



KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN PENDIDIKAN WILAYAH PERSEKUTUAN KUALA LUMPUR

MODUL SMART CHEM 122 WPKL



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Makes
Perfect!*

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CHEMISTRY!

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MODUL SMART CHEM 122 WPKL

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KANDUNGAN MODUL KIMIA SPM WPKL 2020

MODUL SMART CHEM 122

SET	TAJUK TINGKATAN 4	KERTAS 2			KERTAS 3		JUMLAH SOALAN
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SET	TAJUK TINGKATAN 5	KERTAS 2			KERTAS 3		JUMLAH SOALAN
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Set 1

- 1.1 The Structure of The Atom
Struktur Atom
- 1.2 Chemical Formulae &
Equations
*Formula Kimia Dan
Persamaan*
- 1.3 Periodic Table of The Elements
Jadual Berkala Unsur
- 1.4 Chemical Bonds
Ikatan Kimia

TITLE: STRUCTURE OF ATOM

TAJUK: STRUKTUR ATOM

PAPER 2 SECTION A
KERTAS 2 BAHAGIAN A

1. Table 1 shows four substances with their chemical formula and molar mass

Jadual 1 menunjukkan empat bahan dengan formula kimia dan jisim molarnya.

Substances <i>Bahan</i>	Chemical formula <i>Formula Kimia</i>
Oxygen gas <i>Gas Nitrogen</i>	N_2
Magnesium <i>Magnesium</i>	Mg
Copper (II) carbonate <i>Kuprum (II) karbonat</i>	$CuCO_3$
Sulphuric acid <i>Asid sulfurik</i>	H_2SO_4

Table/Jadual 1

Based on Table 1:

Berdasarkan Jadual 1:

- (a) What type of particle is found in
Apakah jenis zarah yang terdapat dalam
Nitrogen gas
Gas nitrogen: _____
Magnesium
Magnesium: _____

[2 marks/markah]

(b) Calculate

Hitungkan

[Relative atomic mass: Cu = 64, O = 16, C = 12, S = 32]

[Jisim atom relatif: Cu = 64, O = 16, C = 12]

(i) the molar mass for sulphuric acid.

jisim molar asid sulfurik.

(ii) the molar mass for copper (II) carbonate.

jisim molar kuprum (II) karbonat

[2 marks/markah]

(c) When zinc nitrate is heated, it decomposes to form zinc oxide, nitrogen dioxide and oxygen.

Apabila zink nitrat dipanaskan, zink nitrat terurai membentuk zink oksida, nitrogen dioksida dan oksigen.

(i) Write a balanced chemical equation for the decomposition of zinc nitrate upon heating.

Tulis satu persamaan kimia yang seimbang bagi penguraian zink nitrat apabila dipanaskan.

[2 marks/markah]

(ii) State three qualitative aspects that can be obtained from the chemical equation.

Nyatakan tiga aspek kualitatif yang dapat diperolehi daripada persamaan kimia tersebut.

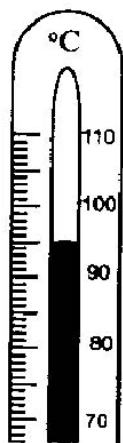
[3 marks/markah]

PAPER 3 STRUCTURED QUESTION

KERTAS 3 SOALAN STRUKTUR

1. An experiment was carried out to determine the freezing point of liquid Z. A boiling tube containing molten Z at 95°C was allowed to cool in a conical flask to room temperature. The temperature of Z was recorded every 30 seconds intervals. Figure 2 shows the reading of the thermometer for this experiment.

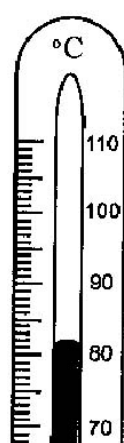
Satu eksperimen telah dijalankan untuk menentukan takat beku cecair Z. Satu tabung didih yang mengandungi leburan Z pada suhu 95°C diletakkan kelalang kon dan dibiarkan menyejuk dalam keadaan suhu bilik. Suhu Z direkod setiap 30 saat. Rajah 2 dibawah menunjukkan bacaan thermometer bagi eksperimen ini.



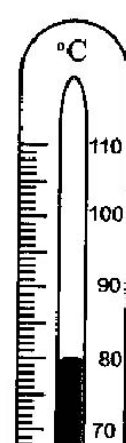
Initial temperature:
.....



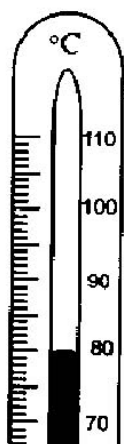
Temperature at
30 s:.....



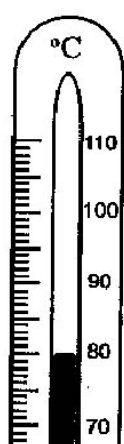
Temperature at
60 s:.....



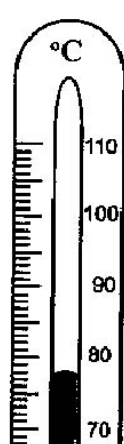
Temperature at
90 s:.....



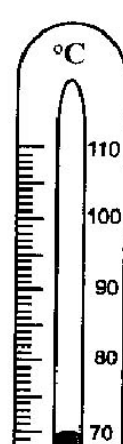
Temperature at
120 s:.....



Temperature at
150 s:.....



Temperature at
180 s:.....



Temperature at
210 s:.....

Diagram/Rajah 2

- (a) Record the temperature at each time interval in the spaces provided in Diagram 2.

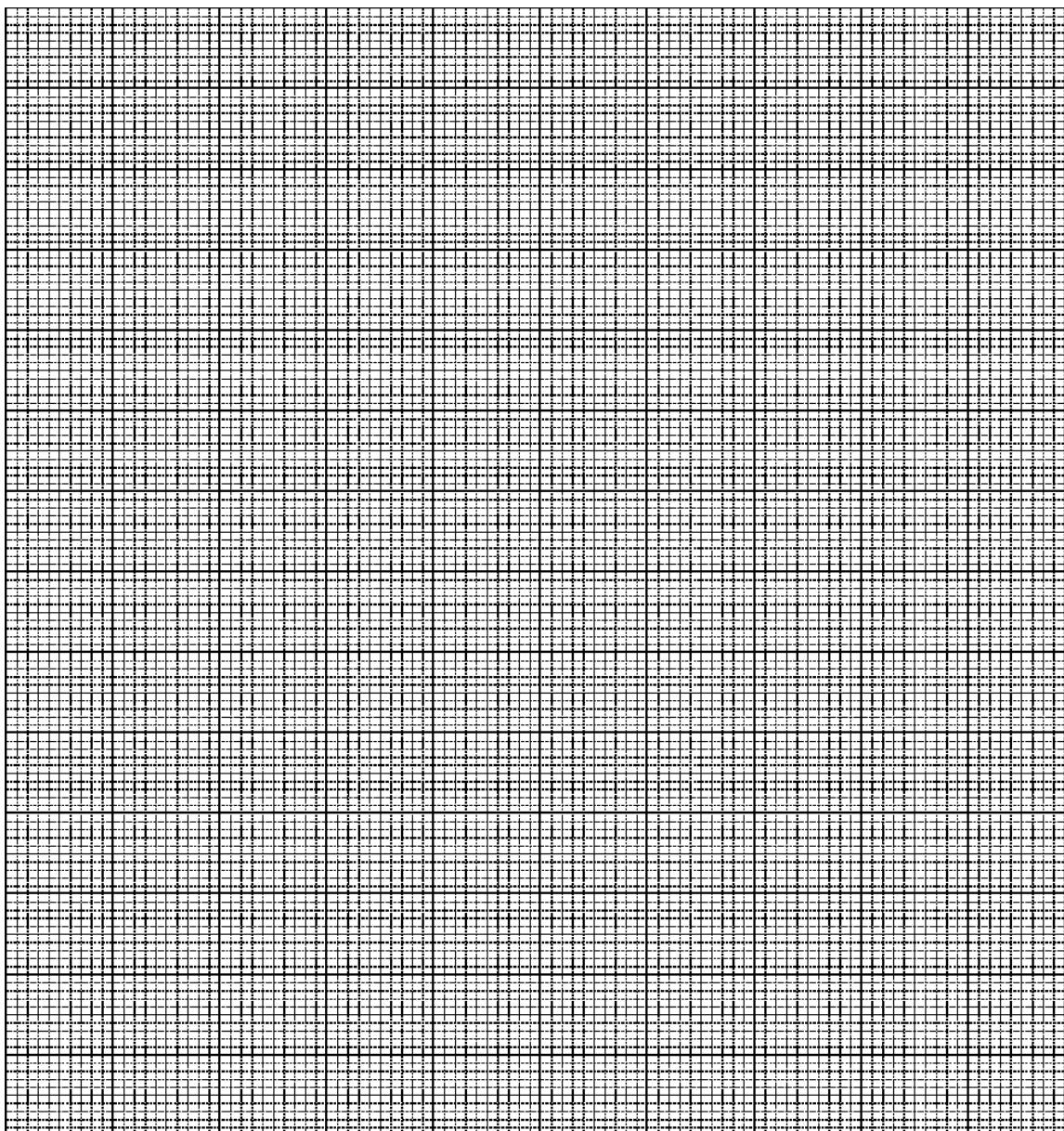
Catatkan bacaan suhu bagi setiap sela masa dalam ruangan yang disediakan dalam Rajah 2.

[3 marks]

- (b) On the graph paper below, draw the graph of temperature against time for the cooling of Z.

Pada kertas graf di bawah, lukiskan graf suhu melawan masa bagi penyejukan Z

[3 marks]



- (c) Show on the graph how you determine this freezing point.

Pada graf di (b) tentukan takat beku Z. Tunjukkan pada graf bagaimana anda tentukan takat beku.

[3 marks]

- (d) State the changes of physical state of naphthalene during the cooling process.

Nyatakan perubahan keadaan fizikal naftalena semasa proses penyejukan.

[3 marks]

- (e) Why was the boiling tube placed in the conical flask during the cooling process?

Mengapakah tabung didih diletakkan dalam kelalang kon semasa proses penyejukan?

[3 marks]

- (f) State the operational definition for the melting point in this experiment.

Nyatakan definisi secara operasi untuk takat lebur dalam eksperimen ini.

[3 marks]

TITLE: CHEMICAL FORMULAE AND EQUATIONS

TAJUK: FORMULA KIMIA DAN PERSAMAAN KIMIA

PAPER 2 SECTION A
KERTAS 2 BAHAGIAN A

1. Diagram 1 shows the set-up of the apparatus for an experiment to determine the empirical formula of an oxide of copper.

Rajah 1 menunjukkan susunan radas bagi satu eksperimen bagi menentukan formula empirik oksida bagi kuprum.

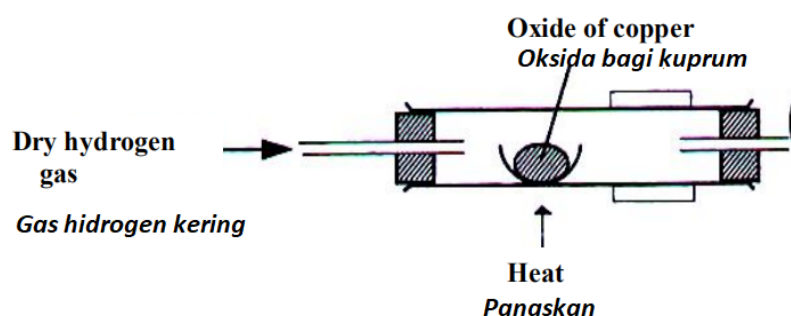


Diagram 1/Rajah 1

Table below shows the results of an experiment after heating, cooling and weighing are repeated until a constant weight is obtained.

Jadual dibawah menunjukkan keputusan eksperimen selepas pemanasan, penyejukan dan penimbangan diulang sehingga jisim tetap diperolehi.

Substance <i>Bahan</i>	Mass(g) <i>Jisim(g)</i>
Mass of combustion tube + porcelain dish <i>Jisim tiub pembakaran + mangkuk pijar</i>	18.75 g
Mass of combustion tube + porcelain dish + oxide of copper <i>Jisim tiub pembakaran + mangkuk pijar + oksida bagi kuprum</i>	20.75 g
Mass of combustion tube + porcelain dish + copper <i>Jisim tiub pembakaran + mangkuk pijar + kuprum</i>	20.35 g

- (a) What is meant by empirical formula?

Apakah yang dimaksudkan dengan formula empirik?

[1 mark]

- (b) Based on results in the table,

Berdasarkan keputusan dalam Jadual

- (i) Calculate the mass of copper and the mass of oxygen used in the experiment.

Tentukan jisim kuprum dan jisim oksigen yang digunakan dalam eksperimen.

[2 marks]

- (ii) Calculate the mole ratio of copper atoms to oxygen atoms.

Tentukan nisbah mol bagi atom kuprum dan atom oksigen.

[Relative atomic mass: Cu = 64; O = 16]

[Jisim atom relatif: Cu = 64; O = 16]

[2 marks]

(iii) State the empirical formula of this oxide of copper.

Nyatakan formula empirik bagi oksida bagi kuprum ini.

[1 mark]

(iv) Write the chemical equation for the reaction in this experiment.

Tuliskan persamaan kimia bagi tindak balas bagi eksperimen ini.

[1 mark]

(c) Describe the steps that should be taken to ensure that all the air in the combustion tube has been expelled, before any heating is carried out.

Terangkan langkah yang perlu diambil bagi memastikan semua udara di dalam tiub pembakaran telah disingkirkan sebelum pemanasan dijalankan.

[3 marks]

2. (a) Calculate the relative molecular or formula masses of the following substances.

Tentukan jisim molekul relatif atau jisim formula bahan-bahan yang berikut.

- (i) Ethanol, C_2H_5OH .

Etanol, C_2H_5OH .

[Relative atomic mass of H = 1, C = 12, O = 16.]

[Jisim atom relatif H = 1, C = 12, O = 16.]

[1 mark]

- (ii) Zinc nitrate, $Zn(NO_3)_2$

Zink nitrat, $Zn(NO_3)_2$

[Relative atomic mass of O = 16, N = 14, Zn = 65]

[Jisim atom relatif O = 16, N = 14, Zn = 65].

[1 mark]

- (b) A closed glass bottle contains 4 mol molecules of oxygen, O_2 .

Satu botol kaca yang bertutup mengandungi 4 mol molekul oksigen, O_2 .

- (i) What is the number of oxygen molecules in the bottle?

Berapakan bilangan molekul oksigen di dalam botol?

[1 mark]

- (ii) How many oxygen atoms are there in the bottle?

Berapakan atom oksigen yang terdapat di dalam botol?

[1 mark]

- (c) Find the number of moles of atoms in a sample containing 9.03×10^{20} atoms of copper.

Tentukan bilangan mol bagi atom di dalam satu sampel yang mengandungi 9.03×10^{20} atom kuprum.

[1 mark]

- (d) Calculate the mass, in gram, of 0.35 moles of copper(II) carbonate, CuCO_3 .

Given that relative formula mass of $\text{CuCO}_3 = 124$

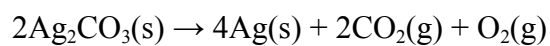
Tentukan jisim dalam gram, 0.35 mol kuprum(ii) karbonat, CuCO_3 .

Diberikan jisim formula bagi $\text{CuCO}_3 = 124$

[1 mark]

- (e) When silver carbonate, Ag_2CO_3 is heated, it will decompose to produce silver metal, carbon dioxide gas and oxygen gas as shown in the equation below.

Apabila argentums karbonat, Ag_2CO_3 dipanaskan dan akan terurai menghasilkan logam argentums, gas karbon dioksida dan gas oksigen seperti yang ditunjukkan dalam persamaan dibawah.



A student heats 8.28 g silver carbonate. Calculate the volume of carbon dioxide gas, CO_2 collected at room temperature.

Given that relative atomic mass of C = 12, O =16, Ag = 108.

Seorang pelajar memanaskan 8.28 g argentum karbonat. Tentukan isipadu gas karbon dioksida yang dikumpul pada suhu bilik.

Diberi jisim atof relatif bagi C = 12, O =16, Ag = 108.

[3 marks]

PAPER 2 SECTION C
KERTAS 2 BAHAGIAN C

1. (a) The information below is regarding substance X

Maklumat dibawah adalah berkaitan dengan bahan X

Carbon 85.70%
<i>Karbon</i>
Hydrogen 14.30%
<i>Hidrogen</i>
Relative molecular mass = 56
<i>Jisim molekul relatif</i>

- (i) Determine the empirical formula of substance X.
Tentukan formula empirik bagi bahan X.
[Relative atomic mass of C = 12, H = 1]
[*Jisim atom relatif* C = 12, H = 1].
- (ii) Determine the molecular formula of substance X.
Tentukan formula molekul bagi bahan X
- (iii) Based on the answers in (a)(i) and (a)(ii) , compare and contrast the empirical formula and the molecular formula.
Berdasarkan jawapan dalam (a)(i) dan (a)(ii), banding dan bezakan di antara formula empirik dengan formula molekul.

[8 marks]

- (b) Magnesium can react actively with oxygen to form magnesium oxide.

Describe an activity that can be carried out in the laboratory to determine the empirical formula of magnesium oxide. Include the calculations involved in your answer.

Magnesium boleh bertindak balas dengan oksigen untuk membentuk magnesium oksida. Jelaskan satu aktiviti yang boleh dijalankan di makmal bagi menentukan formula empirik bagi magnesium oksida. Sertakan sekali pengiraan yang terlibat di dalam jawapan anda.

[Relative atomic mass of O = 16, Mg = 24]

[*Jisim atom relatif* O = 16, Mg = 24].

[11 marks]

TITLE: PERIODIC TABLE OF ELEMENTS
TAJUK: JADUAL BERKALA UNSUR

PAPER 2 SECTION A
KERTAS 2 BAHAGIAN A

1. Diagram 1 shows the incomplete Periodic Table of elements. Based on the diagram, answer the following questions.
Rajah 1 menunjukkan Jadual berkala unsur yang tidak lengkap. Berdasarkan rajah, jawab soalan yang berikut.

1																		18
	2												13	14	15	16	17	
	T																	
	U	3	4	5	6	7	8	9	10	11	12	V					X	
					U												Y	

Diagram 1
Rajah 1

- (a) In Diagram 1, which element is transition metal?
Dalam Rajah 1, yang manakah adalah unsur peralihan?

[1 mark]

- (b) State **two** specific characteristics of transition elements.
*Nyatakan **dua** ciri unsur peralihan.*

[2 marks]

- (c) (i) State which elements have the same chemical properties.
Nyatakan unsur-unsur yang mempunyai sifat kimia yang sama.

[1 mark]

- (ii) Give the reason for the answer of (c)(i).
Berikan sebab bagi jawapan soalan (c)(i).

[1 mark]

- (d) (i) X is a halogen gas. State the type of particle of elements X.
X ialah gas halogen. Nyatakan jenis zarah unsur X.

[1 mark]

- (ii) X reacts with water to form an acidic solution and bleaching agent. Write the balanced chemical equation for the reaction between element X and water.
X bertindak balas dengan air membentuk larutan berasid dan agen peluntur. Tuliskan persamaan kimia yang seimbang untuk tindak balas antara unsur X dengan air

[1 mark]

- (e) (i) To conduct the experiment of reactivity halogens react with water, state how chlorine gas can be produced in the laboratory.
Untuk menjalankan eksperimen kereaktifan halogen terhadap air, nyatakan bagaimana gas klorin dihasilkan di makmal.

[1 mark]

- (ii) Write the balanced chemical equation for the reaction in (e)(i)
Tuliskan persamaan kimia yang seimbang untuk tindak balas di (e)(i)

[2 marks]

2. Table 2 shows some properties of the elements in the Period 3
Jadual 2 menunjukkan sifat bagi unsur dalam kala 3.

Elements Unsur	Na	Mg	Al	Si	P	S	Cl	Ar
Proton number Nombor proton	11	12	13	14	15	16	17	18
Radius of atom (nm) Jejari atom (nm)	0.186	0.160	0.143	0.118	0.110	0.104	0.100	0.094
Physical state Keadaan fizikal	Solid <i>Pepejal</i>	Solid <i>Pepejal</i>	Solid <i>Pepejal</i>	Solid <i>Pepejal</i>	Solid <i>Pepejal</i>	Solid <i>Pepejal</i>	gas	gas
Elektronegativity keelektronegatifan	0.9	1.2	1.5	1.8	2.1	2.5	3.0	-

Table 2/Jadual 2

- (a) Why are all the elements placed in period 3?
Mengapakah unsur-unsur di atas diletakkan dalam kala 3?

[1 mark]

- (b) Explain why Ar does not have electronegativity.
Terangkan mengapa Ar tidak mempunyai keelektronegatifan.

[1 mark]

- (c) State an element that exists as a diatomic molecule.
Nama satu unsur yang wujud sebagai molekul dwiatom.

[1 mark]

- (d) Elements in Period 3 can react with oxygen to form acidic oxide, basic oxide or amphoteric oxide except argon.
Unsur-unsur Kala 3 bertindak balas dengan oksigen untuk membentuk oksida asid, oksida bes atau oksida amfoterik kecuali Argon, Ar.

- (i) State the element that formed amphoteric acid.
Nyatakan unsur yang membentuk oksida amfoterik.

[1 mark]

- (ii) Write the chemical formula of the amphoteric oxide in (d)(i).
Tuliskan formula kimia bagi oksida amfoterik di (d)(i).

[1 mark]

- (e) (i) How does the electronegativity of elements change across period 3?
Bagaimanakah keelektronegatifan unsur berubah apabila merentasi Kala 3?

[1 mark]

- (ii) Give the reasons for your answer in e (i).
Berikan alasan bagi jawapan anda di (e)(I)

[2 marks]

- (f) Explain the changes in sizes of atoms when across a period 3
Terangkan perubahan saiz atom apabila merentasi Kala 3

[3 marks]

PAPER 2 SECTION C
KERTAS 2 BAHAGIAN C

1. Table 1 shows the result when three oxides of elements in period 3 are added to sodium hydroxide solution and hydrochloric acid.

Jadual 1 menunjukkan keputusan apabila tiga oksida unsur kala 3 ditambah kepada larutan natrium hidroksida dan asid hidroklorik.

Oxide oksida	Added to sodium hydroxide Ditambah kepada natrium hidroksida	Added to hydrochloric acid Ditambah kepada asid hidroklorik
Oxide of X <i>Oksida bagi X</i>	Reaction occurs <i>Tindak balas berlaku</i>	Reaction occurs <i>Tindak balas berlaku</i>
Oxide of Y <i>Oksida bagi Y</i>	No Reaction occurs <i>Tiada Tindak balas berlaku</i>	Reaction occurs <i>Tindak balas berlaku</i>
Oxide of Z <i>Oksida bagi Z</i>	Reaction occurs <i>Tindak balas berlaku</i>	No Reaction occurs <i>Tiada Tindak balas berlaku</i>

Table/Jadual 1

- (a) Based on Table 1, arrange X, Y and Z in increasing order of atomic size.
State the oxide of X, oxide of Y, and oxide of Z.
Then, write a balanced chemical equation for the reaction between oxide of Y and hydrochloric acid.

Berdasarkan Jadual 1, susun X, Y dan Z dalam tertib menaik saiz atom.

Nyatakan oksida bagi X, oksida bagi Y dan oksida bagi Z.

Kemudian, tulis persamaan kimia seimbang bagi tindak balas antara oksida bagi Y dan asid hidroklorik.

[6 marks]

- (b) Sodium reacts with oxygen to produce sodium oxide.
Write a balanced chemical equation and calculate the mass of the product formed when 0.2 mol of sodium reacted completely.

[relative atomic mass : Na = 23, O = 16]

Natrium bertindak balas dengan oksigen untuk menghasilkan natrium oksida.

Tulis persamaan kimia seimbang dan hitung jisim hasil yang terbentuk apabila 0.2 mol natrium bertindak balas lengkap.

[jisim atom relatif : Na = 23, O = 16]

[4 marks]

(c)

The reactivity of Group 1 elements towards water increase when going down the group.

Kereaktifan unsur kumpulan 1 dengan air bertambah apabila menuruni kumpulan.

Describe an experiment to verify the above statement. In your answer include :

Huraikan satu eksperimen untuk menentusahkan pernyataan di atas. Sertakan dalam jawapan anda

- Procedure
Prosedur
- Observation
Pemerhatian
- Chemical equation
Persamaan kimia

[10 marks]

PAPER 3 STRUCTURED QUESTION

KERTAS 3 SOALAN STRUKTUR

1. The reactivity of elements in Group 1 towards water depends on the position of the elements in the group of the periodic table of elements.

Diagram 1 shows the set-up of apparatus for an experiment to determine the reactivity of the group 1 elements towards water

Kereaktifan unsur-unsur Kumpulan 1 terhadap air bergantung kepada kedudukan unsur tersebut dalam Jadual Berkala Unsur.

Rajah 1 menunjukkan susunan radas bagi satu eksperimen untuk menentukan kereaktifan unsur kumpulan 1 terhadap air.

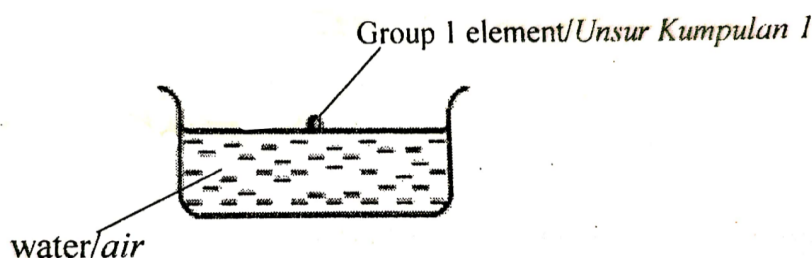


Diagram 1/Rajah 1

The experiment is carried out using lithium, sodium and potassium react with water respectively.

Eksperimen itu dijalankan dengan menggunakan lithium, natrium dan kalium bertindak balas dengan air masing-masing.

- (a) Table 1.1 shows the result of the experiment. Complete the table below by stating the observation for the reaction between potassium and water.

Jadual 1.1 menunjukkan keputusan eksperimen. Lengkapkan jadual di bawah dengan menyatakan pemerhatian tindak balas antara kalium dan air.

Experiment <i>Eksperimen</i>	Observation <i>Pemerhatian</i>
Sodium with water <i>Natrium dengan air</i>	Sodium moves fast with yellow flame on the surface of water and dissolves in water. 'Hissing' sound produced <i>Natrium bergerak cepat di atas permukaan air dan larut dalam air. Bunyi 'hiss' terhasil.</i>
Lithium with water <i>Litium dengan air</i>	Lithium moves slowly with red flame on the surface of water and dissolves in water <i>Lithium bergerak perlahan dengan nyalaan merah di atas permukaan air dan larut dalam air</i>
Potassium with water <i>Kalium dengan air</i>	

Table/Jadual 1.1

[3 marks]

- (b) Based on the observation of the reaction between lithium and water, state **two** inferences

*Berdasarkan kepada pemerhatian bagi tindak balas antara litium dan air, nyatakan **dua** inferens*

[3 marks]

- (c) Based on this experiment, state
Berdasarkan eksperimen ini, nyatakan

(i) the manipulated variable
pembolehubah dimanipulasikan : _____

(ii) the responding variable
pembolehubah bergerak balas : _____

(iii) the constant variable
pembolehubah dimalarkan : _____

[3 marks]

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen tersebut.

[3 marks]

- (e) Give the operational definition for the reactivity of reaction that takes place for the Group 1 elements.

Berikan definisi secara operasi untuk kereaktifan tindak balas yang telah berlaku bagi unsur-unsur Kumpulan 1.

[3 marks]

- (f) Based on the experiment, arrange sodium, lithium, and potassium ascending order of their reactivity.

Berdasarkan experiment, susun natrium, litium dan potassium dalam susunan menaik kereaktifan.

→ →

[3 marks]

- (g) State the relationship between the proton number of Group 1 elements and the rate of reaction between the elements and water.

Nyatakan hubungan antara nombor proton unsur-unsur Kumpulan 1 dengan kadar tindak balas antara unsur-unsur tersebut dengan air.

[3 marks]

- (h) Time taken of the complete reaction of alkali metal, group 1 with water are recorded below.

Masa yang diambil oleh logam alkali kumpulan 1 bertindak balas dengan air direkodkan

Alkali metal <i>Logam alkali</i>	Time taken for complete reaction <i>Masa yang diambil untuk tindak balas lengkap</i>
Lithium <i>Litium</i>	2 minute 20 seconds <i>2 minit 20 saat</i>
Sodium <i>Natrium</i>	1 minute 20 seconds <i>1 minit 20 saat</i>
Potassium <i>Kalium</i>	50 seconds <i>50 saat</i>

State the relationship between reactivity of alkali metal with time taken for the complete reaction.

Nyatakan hubungan di antara kereaktifan unsur halogen dengan masa yang diambil untuk bertindak balas lengkap.

[3 marks]

- (i) If the experiment is repeated by using rubidium metal, predict the observation.
Jika experiment ini diulang dengan menggunakan logam rubidium, ramalkan pemerhatian.

[3 marks]

- (i) If the solution in the basin is tested with red litmus paper after, state the observation.
Jika larutan dalam bekas diuji dengan kertas litmus merah, nyatakan pemerhatian.

[3 marks]

- (j) In Experiment 3, the reaction between alkali metal water with water produces an electrolyte. Classify the ions that exist in the solution into positive ions and negative ions.
Dalam Eksperimen 3, tindak balas antara logam alkali dengan air menghasilkan elektrolit. Kelaskan ion-ion yang hadir dalam larutan tersebut kepada ion positif dan ion negatif.

Positive ion <i>Ion positif</i>	Negative ion <i>Ion negatif</i>

[3 marks]

PAPER 3: PLANNING OF EXPERIMENT

KERTAS 3: MERANCANG EKSPERIMEN

- 1** Chlorine, bromine and iodine **react with water** to form acidic solutions. Apart from acidic solution, chlorine and bromine formed bleaching agents.
Solubility decreases from chlorine to iodine.
*Klorin, bromin dan iodin **bertindak balas dengan air** membentuk larutan berasid. Selain larutan berasid, klorin dan bromin juga membentuk bahan peluntur.
Keterlarutan berkurang dari klorin ke bromin.*

Using suitable substance and apparatus, plan **one** laboratory experiment to investigate the reactivity of chlorine, bromine and iodine react with

*Dengan menggunakan bahan dan radas yang sesuai, rancangkan **satu** eksperimen makmal untuk mengkaji kereaktifan klorin, bromin dan iodin terhadap air.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

- 2 The three statements below describe the observations made when three elements react with oxygen. The elements are in group 1 of the periodic table.

Tiga pernyataan di bawah menghuraikan pemerhatian yang dibuat apabila tiga unsur bertindak balas dengan oksigen. Unsur-unsur ini adalah Kumpulan 1 dalam Jadual Berkala Unsur.

Statement 1/ Pernyataan 1

Lithium burns slowly with a red flame to produce white solid. The white solid dissolves in water to form colourless a solution. The solution turns the green universal indicator to purple.
Litium terbakar perlahan dengan nyalaan merah menghasilkan pepejal putih. Pepejal putih larut dalam air membentuk larutan tidak berwarna. Larutan ini menukarkan warna penunjuk universal dari hijau kepada ungu.

Statement 2/Pernyataan 2

Sodium burns brightly with a yellow flame to produce white solid. The white solid dissolves in water to form a colourless solution. The solution turns the green universal indicator to purple.
Natrium terbakar terang dengan nyalaan kuning menghasilkan pepejal putih. Pepejal putih larut dalam air membentuk larutan tidak berwarna. Larutan ini menukarkan warna penunjuk universal dari hijau kepada ungu.

Statement 3 /Pernyataan 3

Potassium burns very brightly with a yellow flame to produce white solid. The white solid dissolves in water to form a colourless solution. The solution turns the green universal indicator to purple
Kalium terbakar sangat terang dengan ungu menghasilkan putih. Pepejal putih larut dalam air membentuk larutan tidak berwarna. Larutan ini menukarkan warna penunjuk universal dari hijau kepada ungu.

Using suitable substance and apparatus, plan **one** laboratory experiment to investigate reactivity of lithium, sodium and potassium towards oxygen

*Dengan menggunakan bahan dan radas yang sesuai, rancangkan **satu** eksperimen makmal untuk menyiasat kereaktifan logam litium, natrium, kalium terhadap oksigen.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

TITLE: CHEMICAL BONDS

TAJUK: IKATAN KIMIA

PAPER 2 SECTION A
KERTAS 2 BAHAGIAN A

- 1 (a) The proton number of helium is 2.

Why is this element not forming compounds with other atoms?

Nombor proton helium ialah 2.

Mengapakah unsur ini tidak membentuk sebatian dengan atom-atom lain?

[1 mark/markah]

- (b) Atoms of both sodium and chlorine are unstable.

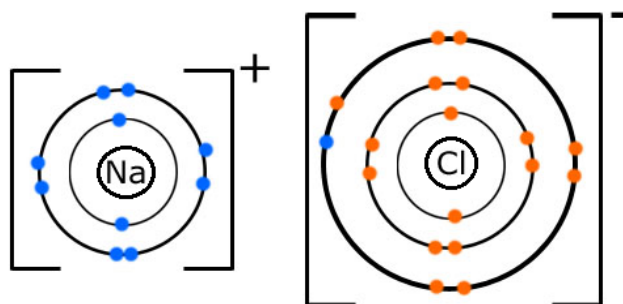
They react to form a compound which is more stable.

Diagram 1(b) below shows a sodium chloride compound, NaCl, that is produced by the formation of a bond between sodium ion, Na^+ , and a chloride ion, Cl^- .

Atom bagi natrium dan klorin adalah tidak stabil.

Mereka bertindak balas membentuk sebatian yang lebih stabil.

Rajah 1(b) di bawah menunjukkan sebatian natrium klorida, NaCl yang terbentuk daripada ikatan antara ion natrium, Na^+ , dan ion klorida, Cl^- .



Diagram/Rajah 1(b)

- (i) How are a sodium ion and a chloride ion formed from their respective atoms?
Bagaimanakah ion natrium dan ion klorida terbentuk daripada atom masing-masing?

Sodium ions/ion natrium:

Chloride ions/ion klorida:

[2 marks/markah]

- (ii) The compound formed melts at 801°C . Explain why the compound has a high melting point.

Sebatian yang terbentuk melebur pada 801°C . Terangkan mengapa sebatian ini mempunyai takat lebur yang tinggi.

[2 marks/markah]

- (iii) Give **one** physical characteristic of the sodium chloride other than melting point and boiling point.

*Berikan **satu** sifat fizik natrium klorida selain takat lebur dan takat didih.*

[1 mark/markah]

- (iv) Sodium chloride can be used as table salt.

Justify the use of this compound in our everyday life.

Natrium klorida boleh digunakan sebagai garam dapur.

Wajarkan penggunaan sebatian ini dalam kehidupan harian kita.

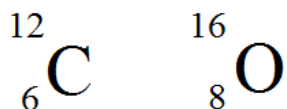
[3 marks/markah]

- (c) Atoms of both carbon and oxygen are unstable too. They react to form a compound.

Diagram 1(c) shows the symbols for carbon and oxygen.

Atom bagi karbon dan oksigen juga tidak stabil. Mereka juga bertindak balas untuk membentuk sebatian.

Rajah 1(c) menunjukkan simbol bagi karbon dan oksigen.



Diagram/Rajah 1(c)

Based on Diagram, draw the compound formed when carbon reacts with oxygen in a complete combustion.

Berdasarkan Rajah, lukis sebatian yang terbentuk apabila karbon bertindak balas dengan oksigen dalam pembakaran lengkap.

[2 marks/markah]

PAPER 2 SECTION B
KERTAS 2 BAHAGIAN B

- 1 (a) Table 1(a) shows the physical properties of compound X and compound Y.

Jadual 1(a) menunjukkan sifat fizik bagi sebatian X dan sebatian Y.

Compound <i>Sebatian</i>	Melting point <i>Takat lebur</i> (⁰ C)	Boiling point <i>Takat didih</i> (⁰ C)	<i>Electrical conductivity</i> <i>Kekonduksian elektrik</i>	
			Solid <i>Pepejal</i>	Molten <i>Leburan</i>
X	-114.5	78.5	Cannot <i>Tidak boleh</i>	Cannot <i>Tidak boleh</i>
Y	770	1420	Cannot <i>Tidak boleh</i>	Can <i>Boleh</i>

Table/Jadual 1(a)

Based on table,

Berdasarkan jadual,

- (i) Identify the type of particles present in compound X and compound Y.

Kenalpasti jenis zarah yang wujud dalam sebatian X dan sebatian Y.

[2 marks/markah]

- (ii) Explain the difference in melting point of compound X and compound Y.

Jelaskan perbezaan dalam takat lebur sebatian X dan sebatian Y.

[4 marks/markah]

- (iii) Explain the difference in electrical conductivity of compound X and compound Y in molten state.

Jelaskan perbezaan dalam kekonduksian elektrik sebatian X dan sebatian Y dalam keadaan leburan.

[4 marks/markah]

- (b) Table 1(b) shows the proton number of elements J, K, L and M.

Jadual 1(b) menunjukkan nombor proton bagi unsur J, K, L dan M.

Element <i>Unsur</i>	J	K	L	M
Proton number <i>Nombor proton</i>	1	6	12	17

Table/Jadual 1(b)

- (i) Explain the position of element L in the Periodic Table of Elements.

Terangkan kedudukan unsur L dalam Jadual Berkala Unsur.

[4 marks/markah]

- (ii) Based on the table, choose two elements that form a compound with low melting point and boiling point which can ionise in water to form electrolyte.

Explain how the compound is formed and draw the electron arrangement for the compound.

Berdasarkan jadual di atas, pilih dua unsur yang membentuk sebatian dengan takat lebur dan takat didih rendah dan boleh mengion dalam air membentuk elektrolit.

Terangkan bagaimana sebatian ini terbentuk dan lukis susunan elektron sebatian ini.

[6 marks/markah]

PAPER 2 SECTION C
KERTAS 2 BAHAGIAN C

- 1 (a) A student carried out an experiment to study the electrical conductivity of covalent compound and ionic compound.

Table 1(a) shows the observations for two sets of experiments.

Seorang murid telah menjalankan satu eksperimen untuk mengkaji kekonduksian elektrik bagi sebatian kovalen dan sebatian ion.

Jadual 1(a) menunjukkan pemerhatian bagi dua set eksperimen.

Experiment <i>Eksperimen</i>	Substance X <i>Bahan X</i>	Substance Y <i>Bahan Y</i>
Set I	Light bulb lights up <i>Mentol menyala</i>	Light bulb does not light up <i>Mentol tidak menyala</i>
Set II	Light bulb does not light up <i>Mentol tidak menyala</i>	Light bulb lights up <i>Mentol menyala</i>

Table/Jadual 1(a)

By using suitable substance, describe an experiment that can be carried out to obtain the observation as in table.

Your description should include the following:

- (i) A labelled diagram to show the apparatus set-up
- (ii) Procedure of the experiment

Dengan menggunakan bahan yang sesuai, huraikan satu eksperimen yang dapat dijalankan bagi memperoleh pemerhatian seperti dalam jadual.

- (i) *Rajah berlabel untuk menunjukkan susunan alat radas*
- (ii) *Prosedur eksperimen*

[10 marks/markah]

PAPER 3: STRUCTURED QUESTION

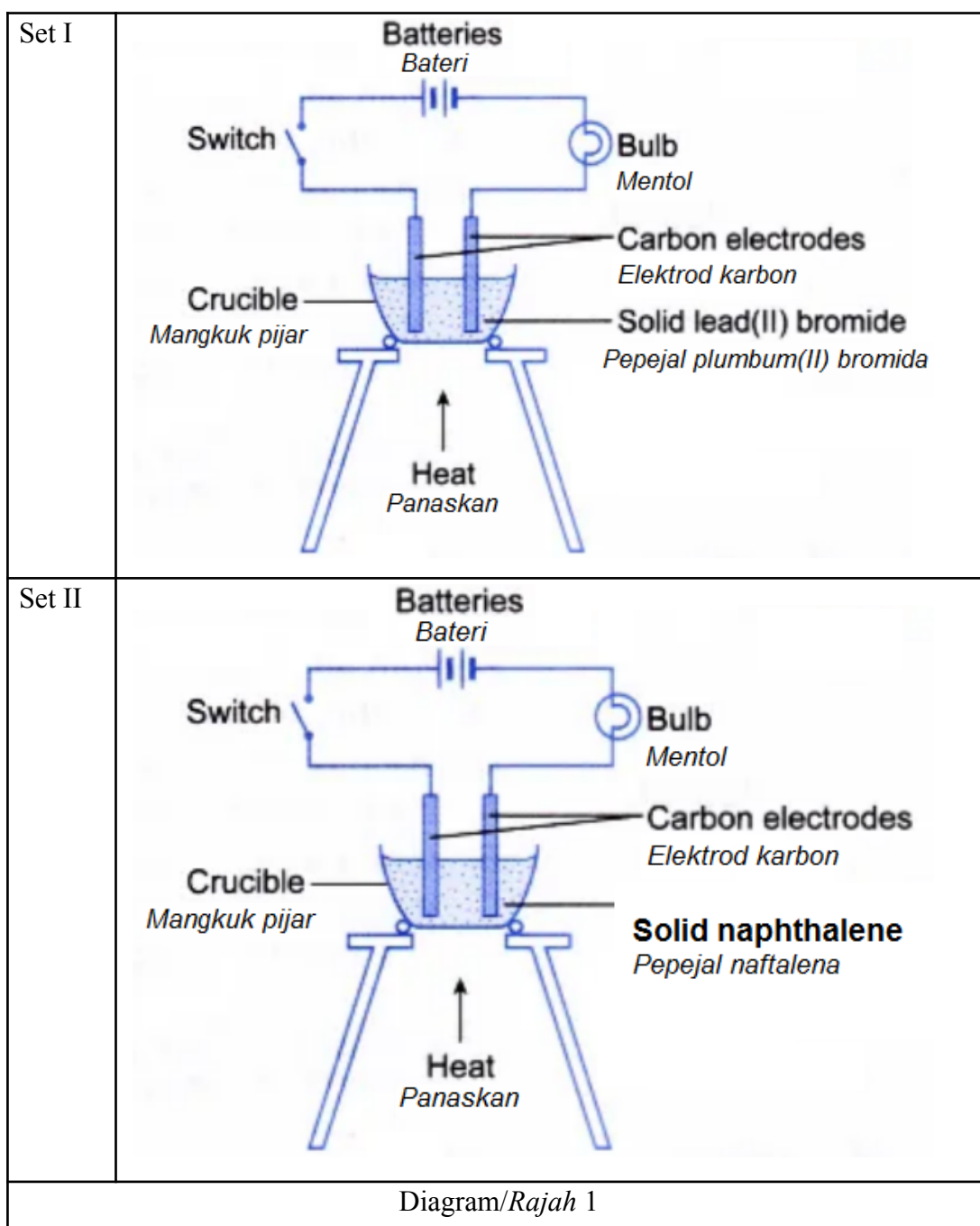
KERTAS 3: SOALAN STRUKTUR

QUESTION 1

SOALAN 1

- 1 Diagram 1 shows an experiment to investigate the electrical conductivity of different compounds.

Rajah 1 menunjukkan satu eksperimen untuk menyiasat kekonduksian elektrik sebatian berbeza.



- (a) State **three** different observations and the corresponding inference in table.

*Nyatakan **tiga** pemerhatian yang berbeza dan inferens yang sepadan dalam jadual.*

Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>
1.	
2.	
3.	

[6 marks/markah]

- (b) State **one** hypothesis for this experiment.

*Nyatakan **satu** hipotesis bagi eksperimen ini.*

[3 marks/markah]

- (c) For this experiment, state:

Bagi eksperimen ini, nyatakan:

- (i) The manipulated variable
Pembolehubah dimanipulasi

- (ii) The responding variable
Pembolehubah bergerak balas

- (iii) The constant variable
Pembelehubah dimalarkan

[3 marks/markah]

- (d) Based on the experiment, state the operational definition of the electrical conductivity of the compound.

Berdasarkan eksperimen ini, nyatakan definisi secara operasi bagi kekonduksian elektrik sebatian.

[3 marks/markah]

- (e) Explain the electrical conductivity of lead(II) bromide in molten state.

Terangkan kekonduksian elektrik leburan plumbum(II) bromida.

[3 marks/markah]

- (f) Lead(II) bromide melts at higher melting point compared to naphthalene. Explain why.

Plumbum(II) bromide melebur pada takat lebur yang lebih tinggi berbanding naftalena. Terangkan mengapa.

[3 marks/markah]

- (g) Classify the following compounds that can dissolve in water and cannot dissolve in water.

Kelaskan sebatian berikut kepada sebatian yang boleh larut dalam air dan tidak boleh larut dalam air.

Potassium carbonate <i>Kalium karbonat</i>	Ethanoic acid <i>Asid ethanoic</i>
Chlorofluorocarbon <i>Klorofluorokarbon</i>	Glycerol <i>Gliserol</i>

Dissolve in water <i>Larut dalam air</i>	Does not dissolve in water <i>Tidak larut dalam air</i>

[3 marks/markah]

PAPER 3: PLANNING OF EXPERIMENT
KERTAS 3: MERANCANG EKSPERIMEN

QUESTION 2

SOALAN 2

The dialogue below shows part of a conversation between a chemistry teacher and her students on an experiment about the solubility of ionic compounds and covalent compounds in different solvents.

Dialog di bawah menunjukkan sebahagian daripada perbualan di antara guru dan muridnya berkaitan eksperimen keterlarutan sebatian ion dan sebatian kovalen dalam pelarut berbeza.

Teacher : Kelly, what is your observation from this experiment?

Cikgu : Kelly, apakah pemerhatian anda daripada eksperimen ini?

Kelly : I found that substance P dissolves in water but does not dissolve
in toluene.

*Saya dapati bahawa bahan P larut dalam air tetapi tidak larut
dalam toluene.*

Teacher : Amirul, how about observation of substance Q?

Cikgu : Amirul, bagaimana dengan pemerhatian bagi bahan Q?

Amirul : Miss Alisha, I found that substance Q does not dissolve in water but
dissolve in toluene.

: Cik Alisha, saya dapati bahawa bahan Q tidak larut dalam air

Based on the conversation, plan a laboratory experiment to compare the solubility of substance P and substance Q.

Give **one** suitable example for substance P and substance Q.

Berdasarkan perbualan tersebut, rancang satu eksperimen makmal untuk membandingkan kekonduksian elektrik bahan P dan bahan Q.

*Berikan **satu** contoh yang sesuai bagi bahan P dan bahan Q.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Problem statement

Pernyataan masalah

(b) All the variables

Semua pemboleh ubah

(c) Statement of hypothesis

Pernyataan hipotesis

(d) List of materials and apparatus

Senarai bahan dan radas

(e) Procedure for the experiment

Prosedur eksperimen

(f) Tabulation of data

Penjadualan data

[17 marks/markah]

SKEMA

SET 1: THE STRUCTURE OF ATOM, CHEMICAL FORMULAE & EQUATION

STRUKTUR ATOM, FORMULA KIMIA & PERSAMAAN

KERTAS 2

Question/Soalan			Answer/Jawapan	Score Markah
1	(a)		Molecule , Atom <i>Molekul, Atom</i>	1 + 1
	(b)		Molar mass H_2SO_4 <i>Jisim molar $\text{H}_2\text{SO}_4 = 98 \text{ g mol}^{-1}$</i> Molar mass CuCO_3 <i>Jisim molar $\text{CuCO}_3 = 124 \text{ g mol}^{-1}$</i>	1 1
	(c)	i	Brown gas <i>Gas perang</i>	1
		ii	$2\text{Zn}(\text{NO}_3)_2 \rightarrow 2\text{ZnO} + 4\text{NO}_2 + \text{O}_2$ Correct formulae/Formula yang betul <i>Balanced equation/Persamaan seimbang</i>	1 1
		iii	Quantitative aspect/ <i>Aspek kuantitatif</i> : 2 mol $\text{Zn}(\text{NO}_3)_2$ produce 2 mol ZnO , 4 mol NO_2 and 1 mol O_2 <i>2 mol $\text{Zn}(\text{NO}_3)_2$ menghasilkan 2 mol ZnO, 4 mol NO_2 dan 1 mol O_2</i> Qualitative aspect/ <i>Aspek kualitatif</i> : $\text{Zn}(\text{NO}_3)_2$ is reactant while ZnO , NO_2 and O_2 are products <i>$\text{Zn}(\text{NO}_3)_2$ ialah bahan tindak balas manakala ZnO , NO_2 dan O_2 adalah hasil tindak balas.</i>	1 1
TOTAL/JUMLAH				9

Question Soalan	Rubric/Rubrik	Score Markah
2(a)	<i>Able to record all temperatures with units and one decimal place accurately</i> <i>Boleh merekod semua suhu dengan unit betul dan satu tempat perpuluhan</i> <u>Sample answer/Samepl jawapan:</u> 95.0°C, 85.0 °C, 82.0 °C, 80.0 °C, 80.0 °C, 80.0 °C, 78.0 °C, 75.0 °C	3
	<i>Able to record any four temperature accurately with one decimal place // All temperature correctly without one decimal place</i> <i>Boleh merekod mana-mana empat suhu yang betul dengan satu tempat perpuluhan//Semua suhu betul tanpa satu tempat perpuluhan</i>	2
	<i>Able to record two temperature correctly without unit</i> <i>Boleh merekod dua suhu betul tanpa unit</i>	1
	<i>No response or wrong response</i> <i>Tidak ada respons atau respons salah</i>	0

Question Soalan	Rubric Rubrik	Score Markah
2(b)	<i>Able to draw the graph correctly and completely</i> <i>The graph consist of:</i> i. Both axis are labelled and with units - y axis, temperature/°C , x axis, time /s ii. All points are transferred correctly iii. Uniform scale iv. Best fit curve of graph and more than ½ size of graph paper <i>Boleh melukis graf dengan betul dan lengkap</i> <i>Graf itu mengandungi:</i> <i>Kedua-dua axis dilabel dengan unit</i>	3

Question Soalan	Rubric Rubrik	Score Markah
	- paksi y, suhu /^oC, paksi x/s Semua titik dipindahkan dengan betul Skala sekata Lengkung graf yang melalui kesemua titik dan melebihi 50% saiz kertas graf	
	Able to plot a graph of temperature against time of the experiment with at least 3 item less accurately i. Both axis are labelled and without units ii. All points are transferred correctly iii. Uniform scale but not suitable iv. Best fit curve of graph Boleh melukis graf suhu melawan masa bagi eksperimen sekurang-kurangnya tidak perkara tetapi kurang tepat. Kedua-dua axis dilabel dengan unit Semua titik dipindahkan dengan betul Skala sekata tetapi tidak sesuai Graf yang baik	2
	Able to show an idea of plotting a graph with at least 2 items Boleh menunjukkan idea melukis graf dengan sekurang-kurangnya memenuhi dua perkara.	1
	No response or wrong response Tidak ada respons atau respons salah	0

Question Soalan	Rubric Rubrik	Score Markah
2(c)	Able to show the freezing point on the graph accurately and stating the freezing point of Z with unit <i>Boleh menunjukkan takat beku pada graf dengan tepat dan menyatakan takat beku Z dengan unit</i> The freezing point is marked accurately on the graph <i>Takat beku ditanda dengan tepat pada graf</i> Stating 80°C <i>Menyatakan 80°C</i>	3
	Able to show the freezing point on the graph less accurately and stating the freezing point of Z without unit <i>Boleh menunjukkan takat beku pada graf dengan kurang tepat dan menyatakan takat beku Z tanpa unit</i>	2
	Able to show an idea how to determine the freezing point on the graph <i>Boleh menunjukkan idea bagaimana menentukan takat beku pada graf</i>	1
	No response or wrong response <i>Tidak ada respons atau respons salah</i>	0

Question Soalan	Rubric Rubrik	Score Markah
2(d)	Able to state the changes of physical state during cooling process with following items: <i>Memberi perbuahan sifat fizik semasa proses pembekuan berdasarkan perkara berikut:</i> Liquid until 90 s <i>Cecair sehingga 90 s</i> Liquid and solid from 90 s till 150 s <i>Cecair dan pepejal daripada 90 s hingga 150 s</i> Solid from 150 s till 210 s <i>Pepejal daripada 150 s sehingga 210 s</i>	3

Question Soalan	Rubric Rubrik	Score Markah
	Able to state the changes of physical state during cooling process with at least two items: <i>Boleh memberi perubahan sifat fizik semasa proses pembekuan sekurang-kurangnya dua perkara berikut:</i>	2
	Able to give an idea of changes of physical state <i>Boleh memberi idea perubahan sifat fizik</i> <u>Sample answer/Sampel jawapan:</u> <i>Liquid to solid/Cecair kepada pepejal</i>	1
	No response or wrong response <i>Tidak ada respons atau respons salah</i>	0

Question Soalan	Rubric Rubrik	Score Markah
2(e)	Able to state an accurate reason correctly <i>Boleh memberi sebab yang tepat dengan betul.</i> Example Contoh: Minimize heat loss to surroundings to ensure uniform cooling <i>Mengurangkan kehilangan haba ke persekitaran supaya pemanasan sekata berlaku</i>	3
	Able to state reason correct <i>Boleh memberi sebab yang betul</i>	2
	Able to state idea only <i>Boleh memberi idea sahaja</i>	1
	No response or wrong response <i>Tidak ada respons atau respons salah</i>	0

Question Soalan	Rubric Rubrik	Score Markah
2(f)	Able to state the operational definition correctly. <i>Boleh mendefinisikan secara operasi dengan betul.</i> Example/Contoh: When solid Z is heated in the water bath, a constant temperature is recorded. <i>Apabila pepejal Z dipanaskan dalam kukus air, satu suhu malar diperolehi.</i>	3
	Able to state the operational definition <i>Boleh memberi definisi secara operasi</i>	2
	Able to state idea only <i>Boleh memberi idea sahaja</i>	1
	No response or wrong response <i>Tidak ada respons atau respons salah</i>	0

Question			Answer	Score
3	(a)		Chemical formula that shows the simplest whole ratio of atom of each elements in the compound. <i>Formula kimia yang menunjukkan nisbah mol teringkas bagi setiap atom dalam satu sebatian.</i>	1
	(b)	i	Mass of Cu = $20.35 - 18.75 = 1.6$ g <i>Jisim Cu</i> Mass of O = $20.75 - 20.35 = 0.4$ g <i>Jisim O</i>	1 1

Question			Answer	Score
		ii	Mol of Cu = $1.6 / 64 = 0.025$ mol <i>Mol Cu</i> Mol of O = $0.4 / 16 = 0.025$ mol <i>Mol O</i> Mol ratio : Cu : O = $0.025 : 0.025 = 1 : 1$ <i>Nisbah mol</i>	1
		iii	Empirical formula CuO <i>Formula Empirik</i>	1
		iv	$\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$	1
	(c)		1.flow dry hydrogen <i>Alirkan gas hidrogen kering</i> 2.collect the gas <i>Kumpulkan gas</i> 3. Place lighted splinter at the mouth of the test tube. <i>Dekatkan kayu uji menyala ke mulut tabung uji</i>	1 1 1
		TOTAL		10

Question			Answer	Score
4	(a)	i	46	1
		ii	189	1
	(b)	i	2.408×10^{24} molecules	1
		ii	4.816×10^{24} atoms	1
	(c)		0.0015 mol	1
	(d)		43.4 g	1
	(e)		$8.28/276 = 0.03 \text{ mol Ag}_2\text{CO}_3$ 2 mol of Ag_2CO_3 produce 2 mol of CO_2 0.03 mol of Ag_2CO_3 produce 0.03 mol of CO_2 $0.03 \times 24 \text{ dm}^3 = 0.72 \text{ dm}^3$. <i>$8.28/276 = 0.03 \text{ mol Ag}_2\text{CO}_3$</i> <i>2 mol of Ag_2CO_3 menghasilkan 2 mol of CO_2</i> <i>0.03 mol of Ag_2CO_3 menghasilkan 0.03 mol of CO_2</i> $0.03 \times 24 \text{ dm}^3 = 0.72 \text{ dm}^3$.	1 1 1
			TOTAL	10

Question			Answer	Score															
5	(a)	i	<table><tr><td></td><td>C</td><td>H</td></tr><tr><td>Mol</td><td>$\frac{85.70}{12}$</td><td>$\frac{14.30}{1}$</td></tr><tr><td></td><td>7.14</td><td>14.30</td></tr><tr><td>ratio</td><td>1</td><td>: 2</td></tr><tr><td colspan="3">The empirical formula CH₂ <i>Formula empirik</i></td></tr></table>		C	H	Mol	$\frac{85.70}{12}$	$\frac{14.30}{1}$		7.14	14.30	ratio	1	: 2	The empirical formula CH ₂ <i>Formula empirik</i>			1
	C	H																	
Mol	$\frac{85.70}{12}$	$\frac{14.30}{1}$																	
	7.14	14.30																	
ratio	1	: 2																	
The empirical formula CH ₂ <i>Formula empirik</i>																			

Question		Answer	Score
(b)		1. An empty crucible and its lid are weighed and the mass are recorded. <i>Satu mangkuk pijar dan penutupnya ditimbang dan jisimnya direkodkan.</i>	1
		2. Magnesium ribbon is cleaned with sandpaper, placed in crucible and weighed again. The mass are recorded. <i>Pita magnesium dibersihkan dengan kertas pasir dan letakkanya ke dalam mangkuk pijar dan ditimbang sekali lagi. Jisim direkodkan.</i>	1
		3. The crucible and its contents are heated over a strong flame. <i>Mangkuk pijar bersama kandunganya dipanaskan dengan api yang kuat.</i>	1
		4. The crucible lid opened once in a while during the experiment <i>Penutup mangkuk pijar dibuka sekali-sekala semasa eksperimen.</i>	1
		5. When the magnesium does not burn anymore, the crucible and its contents are cooled in room temperature, <i>Apabila magnesium tidak lagi terbakar, mangkuk pijar dan kandungan disejukkan kepada suhu bilik.</i>	1
		6. and then weighed. The mass is recorded <i>dan kemudiannya ditimbang. Jisim direkodkan.</i>	1
		7 The heating, cooling and weighing is repeated until the final mass becomes constant <i>Pemanasan, penyejukan dan penimbangan diulang sehingga jisim akhir menjadi tetap.</i>	1
		8 Result Mass of crucible + lid = a g <i>Jisim mangkuk pijar + penutup = a g</i>	1
		Mass of crucible + lid + magnesium ribbon = b g <i>Jisim mangkuk pijar + penutup + pita magnesium = b g</i>	1
		Mass of crucible + lid + magnesium oxide = c g <i>Jisim mangkuk pijar + penutup + magnesium oksida = c g</i>	1
		9. Mass of magnesium = (b – a) g	

Question			Answer	Score
			<i>Jisim magnesium = $(b - a)$ g</i> Mass of oxygen = $(b - c)$ g <i>Jisim oksigen = $(b - c)$ g</i>	1
			10. Mol of magnesium atom = $b - a / 24$ <i>Mol atom magnesium = $b - a / 24$</i> Mol of oxygen atom = $b - c / 16$ <i>Mol atom oksigen = $b - c / 16$</i>	1
			11. Simplest ratio mol of magnesium atom to mol of oxygen atom = $x:y / 1:1$ <i>Nisbah mol atom magnesium kepada atom oksigen = $x:y / 1:1$</i>	
			12. Empirical formula : Mg_xO_y / MgO <i>Formula empirik:</i>	
				1
			TOTAL	20

SKEMA: PERIODIC TABLE OF ELEMENT/ JADUAL BERKALA UNSUR

KERTAS 2

Section A

Bahagian A

Questions			Rubrics	Marks
1	a		W	1
	b		Able to form coloured compound/ able to form complex ions/ability to form compound in variable oxidation numbers/ act as catalyst in certain reaction. (choose any two) <i>Boleh membentuk sebatian berwarna/ boleh membentuk ion kompleks/ boleh membentuk sebatian yang mempunyai 2 atau lebih nombor pengoksidaan/ bertindak sebagai pemangkin dalam beberapa tindak balas.(pilih mana-mana 2)</i>	2
	c	i	T dan U/ X dan Y	1
		ii	Atom T and atom U/ X and Y have the same numbers of electron valens // <i>Atom T dan atom U / X dan Y mempunyai bilangan elektron valens yang sama</i>	1
	d	i	Molecule dwiatom/ <i>molekul dwiatom</i>	1
		ii	$X_2 + H_2O \rightarrow HX + HOX$	1
	e	i	Reaction between potassium permanganate (VII) with saturated hydrochloride acid// <i>tindak balas antara kalium permanganat (VII) dengan asid hidroklorik pekat</i>	1
		ii	$2 KMnO_4 + 16 HCl \rightarrow 2KCl + 2MnCl_2 + 5Cl_2 + 8H_2O$	2
			TOTAL MARKS	10

Questions			Rubrics	Marks
2	a		Have 3 shell filled with electron <i>Mempunyai 3 petala terisi dengan elektron</i>	1
	b		Ar has achieved the stable octet electron arrangement./ Ar atom no need to donate, receive or share electron <i>Ar telah mencapai susunan elektron oktet dan stabil./ Atom Ar tidak perlu menderma, menerima atau berkongsi elektron.</i>	1
	c		Cl/ klorin	1
	d	i	Al / Aluminium	1
		ii	Al_2O_3	1
	e	i	Increases / meningkat	1
		ii	It is because the atomic size decreases while the positive charge of the nucleus increases. Atom will easily accept electrons to achieve stability <i>Ini kerana saiz atom semakin mengecil, bilangan cas positif dalam nukleus bertambah.</i>	1 1

			<i>Atom lebih mudah menerima elektron untuk mencapai kestabilan.</i>	
f			Decrease The proton number increases by one unit from sodium to chlorine so, positive charge of the nucleus increase. The strength of attraction from the proton in the nucleus to the electrons in the shells increases <i>Menurun</i> <i>Nombor proton bertambah satu unit dari natrium kepada klorin menyebabkan bilangan cas positif pada nukleus bertambah.</i> <i>Daya tarikan proton dalam nukleus terhadap elektron dalam petala bertambah.</i>	1 1 1
TOTAL MARKS				11

Section C

Bahagian C

Questions			Rubrics	Marks
1	a		Z,X,Y X : aluminium oxide // <i>aluminium oksida</i> Y : Magnesium oxide // <i>magnesium oksida</i> Z : silicone oxide // <i>silikon oksida</i> Correct formula of reactant and product Balanced equation <i>Formula bahan dan hasil betul.</i> <i>Persamaan seimbang.</i> $MgO + 2HCl \rightarrow MgCl_2 + H_2O$	1 1 1 1 1 1
	b		Correct formula of reactant s and product Balanced equation $4Na + O_2 \rightarrow 2Na_2O$ No of mole $Na_2O = 0.1 \text{ mol}$ Mass of $Na_2O = 0.1 \times 62 \text{ gmol}^{-1}$ $= 6.2g$	
	c		Procedure// prosedur Fill the water trough with water <i>Isikan besen dengan air</i> A small size of lithium is cut by using knife and forceps. <i>Potong secebis kecil litium menggunakan pisau dan forsep</i> Dry the paraffin oil it with filter paper <i>Keringkan minyak parafin menqqunakan kertas turas.</i>	1 1

		Lithium is placed carefully on the surface of water by using a forceps <i>Letakkan litium dengan perlahan di atas permukaan air menggunakan forseps</i> Observation is recorded. <i>Pemerhatian direkodkan</i> Experiment is repeated using sodium and potassium <i>Experiment diulang menggunakan natrium dan kalium</i> Observation <table><tr><th>Metal</th><th>Observation</th></tr><tr><td>Lithium <i>Litium</i></td><td>Moves slowly Burns with red flame <i>Bergerak perlahan</i> <i>Terbakar dengan nyalaan merah.</i></td></tr><tr><td>Sodium <i>Natrium</i></td><td>Moves quickly Burns with a bright yellow flame <i>Bergerak dengan cepat.</i> <i>Terbakar dengan nyalaan kuning .</i></td></tr><tr><td>Potassium <i>Kalium</i></td><td>Moves vigorously Burns with purple flame <i>Bergerak dengan cepat.</i> <i>Terbakar dengan nyalaan ungu.</i></td></tr></table> Correct formula of reactants and products <i>Formula bahan tindak balas dan hasil tindak balas yang betul.</i> Balanced equation <i>Persamaan yang seimbang</i> $2K + 2H_2O \rightarrow 2KOH + H_2$ $2Na + 2H_2O \rightarrow 2NaOH + H_2$ $2Li + 2H_2O \rightarrow 2NaOH + H_2$	Metal	Observation	Lithium <i>Litium</i>	Moves slowly Burns with red flame <i>Bergerak perlahan</i> <i>Terbakar dengan nyalaan merah.</i>	Sodium <i>Natrium</i>	Moves quickly Burns with a bright yellow flame <i>Bergerak dengan cepat.</i> <i>Terbakar dengan nyalaan kuning .</i>	Potassium <i>Kalium</i>	Moves vigorously Burns with purple flame <i>Bergerak dengan cepat.</i> <i>Terbakar dengan nyalaan ungu.</i>	1 1 1 1 1 1 1
Metal	Observation										
Lithium <i>Litium</i>	Moves slowly Burns with red flame <i>Bergerak perlahan</i> <i>Terbakar dengan nyalaan merah.</i>										
Sodium <i>Natrium</i>	Moves quickly Burns with a bright yellow flame <i>Bergerak dengan cepat.</i> <i>Terbakar dengan nyalaan kuning .</i>										
Potassium <i>Kalium</i>	Moves vigorously Burns with purple flame <i>Bergerak dengan cepat.</i> <i>Terbakar dengan nyalaan ungu.</i>										
TOTAL MARKS			20								

SKEMA PERIODIC TABLE OF ELEMENT/ JADUAL BERKALA UNSUR

KERTAS 3

SOALAN STRUKTUR

SOALAN 1

Questions		Rubrics	Marks
a		Potassium moves very fast with purple flame on the surface of water Dissolves in water Hissing sound produced <i>Kalium bergerak sangat cepat dengan nyalaan ungu di atas permukaan air</i> <i>Larut dalam air</i> <i>Bunyi Hiss di hasilkan</i>	3
b		lithium reacts with water To produce lithium hydroxide <i>Litium bertindak balas dengan air</i> <i>Menghasilkan litium hidroksida.</i>	3
c		i) type of alkali metal <i>jenis logam alkali</i> ii) the reactivity of alkali metal towards water <i>Kereaktifan logam alkali terhadap air.</i> ii) the size of alkali metal <i>Saiz logam alkali</i>	3
d		The lower position of metal In group 1, the more reactive metal in reaction with water <i>Semakin rendah kedudukan logam dalam kumpulan 1, semakin reaktif logam itu bertindak balas dengan air.</i>	3
e		An alkali metal that reacts more vigorously with water is more reactive metal <i>Logam alkali yang bertindak balas lebih cepat dengan air ialah logam yang lebih reaktif.</i>	3
f		Lithium → sodium →potassium <i>Litium → Natrium → kalium</i>	3
g		When the proton number of group 1 increase,the rate of reaction between these elements and water increases. <i>Apabila nombor proton dalam kumpulan 1 bertambah, kadar tindak balas antara logam kumpulan 1 dengan air meningkat.</i>	3
h		When the time taken to complete the reaction is decrease, the reactivity of alkali metal increase. <i>Semakin berkurang masa tindak balas lengkap, semakin meningkat kereaktifan logam kumpulan 1</i>	3
i		rubidium moves very fastest with purple bright flame on the surface of water Dissolves in water	

		Hissing sound produced <i>Rubidium bergerak terlalu cepat di atas permukaan air dengan nyalaan ungu terang,</i> <i>Larut dalam air</i> <i>Bunyi Hiss di hasilkan</i>		
j		The red litmus paper change to blue <i>Kertas litmus merah bertukar biru</i>		3
k				3
		Positive ion <i>Ion positif</i>	Negative ion <i>Ion negatif</i>	
		K ⁺ H ⁺	OH ⁻	
TOTAL MARKS				33

MERANCANG EKSPERIMEN

SOALAN 1

Rubrics		Marks								
a	To study reactivity of chlorine, bromine and iodine with water <i>Untuk mengkaji kereaktifan klorin, bromin dan iodin dengan air.</i>	3								
b	Manipulated variable :chlorine, bromine, iodine Pemboleh ubah manipulasi : <i>chlorine, bromin, iodin</i> Responding variable : the rate at which halogen dissolves in water <i>Pembolehubah bergerakbalas : kadar dimana halogen melarut dalam air</i> Constant variable : temperature of water Pembolehubah dimalarkan : suhu air	3								
c	Down the group 17 from chlorine to iodine, the reactivity of halogens react with water is decrease <i>Menuruni kumpulan 17 dari klorin kepada iodin, kreaktifan halogen bertindak balas dengan air semakin berkurang</i>	3								
e	Chlorine gas, liquid bromine, iodine crystal, test tube, rubber stopper, test tube holder, delivery tube and pipet <i>Gas klorin, cecair bromin, hablur iodin, tabung uji, penyumbat getah, pemegang tabung uji, tiub penghantar dan pipet</i>	3								
D	The reaction of chlorine/ tindak balas klorin - Chlorine gas is passed into a test tube containing water <i>Gas klorin dialirkan kedalam air</i> - The solution produced is tested with blue litmus paper <i>Larutan yang terhasil diuji dengan kertas litmus biru .</i> Reaction of bromine/ tindak balas bromin - A few drop of bromine are added to some water in a test tube <i>Beberapa titis bromin ditambah kedalam sedikit air dalam tabung uji</i> - The test tube is tightly closed with rubber stopper and shaken <i>Tabung uji ditutup dengan ketat dengan penyumbat getah dan digoncang</i> - The solution produced is tested with blue litmus paper <i>Larutan yang terhasil diuji dengan kertas litmus biru</i> Reaction of iodine/ tindak balas iodin - Some iodine crystal are added to some water in a test tube <i>Sedikit hablur ditambah kedalam sedikit air dalam tabung uji</i> - The test tube is tightly closed with rubber stopper and shaken <i>Tabung uji ditutup dengan ketat dengan penyumbat getah dan digoncang</i> - The solution produced is tested with blue litmus paper <i>Larutan yang terhasil diuji dengan kertas litmus biru</i>	3								
e	<table><tr><th>Halogens /Halogen</th><th>Observation/Pemerhatian</th></tr><tr><td>Chlorine <i>Klorin</i></td><td></td></tr><tr><td>Bromine <i>Bromin</i></td><td></td></tr><tr><td>Iodine <i>Iodin</i></td><td></td></tr></table>	Halogens /Halogen	Observation/Pemerhatian	Chlorine <i>Klorin</i>		Bromine <i>Bromin</i>		Iodine <i>Iodin</i>		2
Halogens /Halogen	Observation/Pemerhatian									
Chlorine <i>Klorin</i>										
Bromine <i>Bromin</i>										
Iodine <i>Iodin</i>										
TOTAL MARKS		17								

Soalan 2

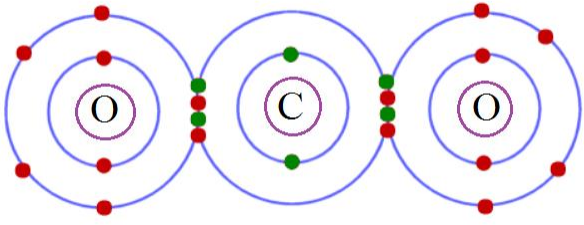
Rubrics		Marks								
a	How does reactivity of alkali metals change when react with oxygen? Bagaimanakah kereaktifan kumpulan berubah apabila bertindak balas dengan oksigen?	3								
b	Manipulated variable : elements of group 1 Pemboleh ubah manipulasi : unsur-unsur kumpulan 1 Responding variable : reactivity of alkali metal/the brightness of flame Pemboleh ubah bergerakbalas : kereaktifan logam alkali/ kecerahan nyalaan Constant variable : size of alkali metal/ Pemboleh ubah dimalarkan : saiz logam alkali	3								
c	The lower position of metal In group 1, the more reactive metal in reaction with oxygen <i>Semakin rendah kedudukan logam dalam kumpulan 1, semakin reaktif logam itu bertindak balas dengan oxygen</i>	3								
d	Lithium, sodium, potassium, oxygen gas, knife, forceps, gas jar, gas jar spoon, filter paper <i>Litium, natrium, kalium, gas oksigen, pisau, forsep, balang gas ,sudu balang gas, kertas turas</i>	3								
e	A small size of lithium is cut by using knife and forceps. <i>Potong secebis kecil litium menggunakan pisau dan forsep</i> Dry paraffin oil it with filter paper <i>Keringkan minyak parafin menggunakan kertas turas.</i> Lithium is placed carefully in the gas jar spoon by using a forceps <i>Letakkan litium dengan perlahan di atas sudu pembakaran menggunakan forseps</i> Heat the lithium until its start to burn <i>Panaskan litium sehingga terbakar</i> Put the burning lithium quickly into a gas jar filled with oxygen\ <i>N Letakkan litium yang terbakar dengan cepat kedalam balang gas y yang mengandungi oksigen</i> Observation is recorded. <i>Pemerhatian direkodkan</i> Experiment is repeated using sodium and potassium <i>Eksperimen diulang menggunakan natrium dan kalium</i>	3								
f	<table><tr><td>Elements <i>Unsur</i></td><td>Observation <i>Pemerhatian</i></td></tr><tr><td>Lithium <i>Litium</i></td><td></td></tr><tr><td>Sodium <i>Natrium</i></td><td></td></tr><tr><td>Potassium <i>Kalium</i></td><td></td></tr></table>	Elements <i>Unsur</i>	Observation <i>Pemerhatian</i>	Lithium <i>Litium</i>		Sodium <i>Natrium</i>		Potassium <i>Kalium</i>		2
Elements <i>Unsur</i>	Observation <i>Pemerhatian</i>									
Lithium <i>Litium</i>										
Sodium <i>Natrium</i>										
Potassium <i>Kalium</i>										
TOTAL MARKS		17								

**Answers Scheme
SKEMA KERTAS 2**

**CHEMICAL BONDS
IKATAN KIMIA**

**SECTION A
BAHAGIAN A**

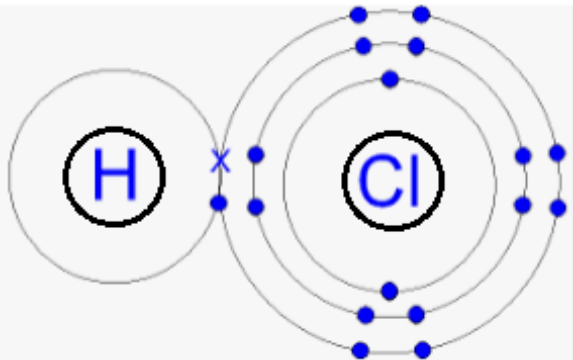
Questions Soalan			Rubrics Rubrik	Marks Markah
1	(a)		Helium atom achieve stable duplet electron arrangement. <i>Atom helium mencapai susunan elektron duplet yang stabil</i>	1
	(b)	(i)	Sodium atom donates one valence electron. <i>Atom natrium menderma satu elektron valens.</i> Chlorine atom receives one valence electron. <i>Atom klorin menerima satu elektron valens.</i>	1 1
		(ii)	Sodium ion and chloride ion are attracted by strong electrostatic forces. <i>Ion natrium dan ion klorida ditarik oleh daya tarikan elektrostatik yang kuat.</i> A lot of heat is needed to overcome the forces. <i>Tenaga haba yang banyak diperlukan untuk mengatasi daya tersebut.</i>	1 1
		(iii)	Soluble in water <i>Larut dalam air</i> /Conduct electricity in molten and aqueous states <i>Mengkonduksikan elektrik dalam keadaan leburan dan akueus.</i>	1
		(iv)	Sodium chloride is suitable to be used in our everyday life. <i>Natrium klorida wajar digunakan dalam kehidupan harian.</i> Acts as flavouring agent to give salty taste in food. <i>Bertindak sebagai perisa untuk memberi rasa masin dalam makanan.</i>	1 1
			It is important to maintain blood pressure in body. <i>Ia penting untuk mengekalkan tekanan darah dalam badan.</i> We should reduce the use of sodium chloride in everyday life. <i>Kita perlu mengurangkan penggunaan natrium klorida dalam kehidupan harian.</i>	1 1
			Excessive consumption of sodium chloride can cause high blood pressure. <i>Penggunaan natrium klorida berlebihan boleh menyebabkan tekanan darah tinggi.</i>	1
			It increases the risk of heart disease and kidney disease. <i>Ia meningkatkan kadar sakit jantung dan sakit ginjal.</i>	1
	(c)		Number of electron shells <i>Bilangan petala elektron</i> Number of electrons	1

Questions Soalan			Rubrics Rubrik	Marks Markah
			<i>Bilangan elektron</i> 	1
TOTAL MARKS/JUMLAH MARKAH				11

Section B
Bahagian B

Questions Soalan			Rubrics Rubrik	Marks Markah
1	(a)	(i)	X: Covalent compound/ <i>sebatian kovalen</i> Y: Ionic compound/ <i>sebatian ion</i>	1 1
		(ii)		

Questions Soalan			Rubrics Rubrik	Marks Markah						
		(iii)	<table><tr><th>X</th><th>Y</th></tr><tr><td>X consists of charged ions <i>X mengandungi ion bercas</i></td><td>Y consists of neutral molecules <i>Y mengndungi molekul neutral</i></td></tr><tr><td>Ions are free to move in molten state to conduct electricity <i>Ion bebas bergerak dalam keadaan leburan untuk mengkonduksikan elektrik</i></td><td>Molecules do not have charge to conduct electricity in molten state <i>Molekul tidak mempunyai cas untuk mengkonduksikan elektrik dalam keadaan leburan</i></td></tr></table>	X	Y	X consists of charged ions <i>X mengandungi ion bercas</i>	Y consists of neutral molecules <i>Y mengndungi molekul neutral</i>	Ions are free to move in molten state to conduct electricity <i>Ion bebas bergerak dalam keadaan leburan untuk mengkonduksikan elektrik</i>	Molecules do not have charge to conduct electricity in molten state <i>Molekul tidak mempunyai cas untuk mengkonduksikan elektrik dalam keadaan leburan</i>	
X	Y									
X consists of charged ions <i>X mengandungi ion bercas</i>	Y consists of neutral molecules <i>Y mengndungi molekul neutral</i>									
Ions are free to move in molten state to conduct electricity <i>Ion bebas bergerak dalam keadaan leburan untuk mengkonduksikan elektrik</i>	Molecules do not have charge to conduct electricity in molten state <i>Molekul tidak mempunyai cas untuk mengkonduksikan elektrik dalam keadaan leburan</i>									
(b)	(i)	L is placed in Group 2 because atom L has 2 valence electrons. <i>L berada di Kumpulan 2 kerana atom L kerana mempunyai 2 elektron valens.</i> L is placed in Period 3 because atom L has 3 shells occupied with electrons. <i>L berada di Kala 3 kerana L mempunyai 3 petala diisi dengan elektron.</i>	1+1 1+1							
	(ii)	Atom J has one valence electron, atom M has seven valence electron. <i>Atom J mempunyai satu elektron valens, atom M mempunyai tujuh elektron valens.</i> Atom J shares one valence electron to achieve stable duplet electron arrangement. <i>Atom J berkongsi satu elektron valens untuk mencapai susunan elektron duplet yang stabil.</i> Atom M shares one valence electron to achieve stable octet electron arrangement. <i>Atom M berkongsi satu elektron untuk mencapai susunan elektron oktet yang stabil.</i> Both atoms share one pair of electrons to a single covalent bond. <i>Kedua-dua atom berkongsi satu pasang elektron untuk membentuk satu ikatan kovalen tunggal.</i> The covalent compound, JM is formed.	1 1 1							

Questions Soalan			Rubrics Rubrik	Marks Markah
			Sebatian kovalen, JM terbentuk. 	1 1 1
TOTAL MARKS/JUMLAH MARKAH				20

Section C
Bahagian C

Questions			Rubrics	Marks
1	(a)	(i)	Functional diagram <i>Rajah berfungsi</i> Correct label of apparatus and material <i>Melabel bahan dan alat radas dengan betul</i>	1 1
		(ii)	Substance X: lead(II) bromide <i>Bahan X: plumbum(II) bromida</i> Substance Y: naphthalene <i>Bahan Y: naftalena</i> Procedure/<i>Prosedur</i> 5 spatulaful of substance X is placed in a crucible. <i>5 spatula bahan X dimasukkan dalam sebuah mangkuk pijar.</i> The crucible is placed on pipe clay triangle on tripod stand. <i>Mangkuk pijar diletakkan di atas segitiga tanah liat atas kaki tungku tiga.</i> Two carbon electrodes are dipped in the substance X. <i>Dua elektrod karbon dimasukkan dalam bahan X.</i> The carbon electrodes are connected to bulb, batteries and switch. <i>Elektrod karbon disambung kepada mentol, bateri dan switch.</i> The switch is turned on and the bulb is observed. <i>Switch ditutup dan mentol diperhatikan.</i> Substance X is heated in crucible until become molten. <i>Bahan X dipanaskan sehingga menjadi leburan.</i> The bulb is observed again. <i>Mentol diperhatikan sekali lagi.</i> Experiment is repeated by replacing substance X with substance Y. <i>Eksperimen diulangi dengan menggantikan bahan X dengan bahan Y.</i>	1 1 1 1 1 1 1

Questions			Rubrics	Marks
			Conclusion/Kesimpulan Lead(II) bromide is an ionic compound that can conduct electricity in molten state but not in solid state. <i>Plumbum(II) bromida adalah sebatian ion yang boleh mengkonduksikan elektrik dalam keadaan leburan tetapi bukan dalam keadaan pepejal.</i> Naphthalene is a covalent compound that cannot conduct electricity in solid and molten state. <i>Naftalena adalah sebatian kovalen yang tidak boleh mengkonduksikan elektrik dalam keadaan pepejal dan leburan.</i>	1 1 1
TOTAL MARKS				10

Paper 3
Kertas 3

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>								
1(a)	Able to state all observations and corresponding inference correctly. <i>Menyatakan kesemua pemerhatian dan inferens yang betul.</i> <u>Answer/Jawapan:</u> <table><tr><th>Observation <i>Pemerhatian</i></th><th>Inference <i>Inferens</i></th></tr><tr><td>Bulb in Set I lights up <i>Mentol dalam Set I menyala</i></td><td>Molten lead(II) bromide conduct electricity. <i>Leburan plumbum(II) bromide tidak mengkonduksikan elektrik.</i></td></tr><tr><td>Bulb in Set II does not light up. <i>Mentol dalam Set II tidak menyala</i></td><td>Molten naphthalene does not conduct electricity. <i>Leburan naftalena tidak mengkonduksikan elektrik</i></td></tr><tr><td>Grey solid formed at cathode in Set I.</td><td>Lead is formed. <i>Plumbum terbentuk.</i></td></tr></table>	Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>	Bulb in Set I lights up <i>Mentol dalam Set I menyala</i>	Molten lead(II) bromide conduct electricity. <i>Leburan plumbum(II) bromide tidak mengkonduksikan elektrik.</i>	Bulb in Set II does not light up. <i>Mentol dalam Set II tidak menyala</i>	Molten naphthalene does not conduct electricity. <i>Leburan naftalena tidak mengkonduksikan elektrik</i>	Grey solid formed at cathode in Set I.	Lead is formed. <i>Plumbum terbentuk.</i>	3
Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>									
Bulb in Set I lights up <i>Mentol dalam Set I menyala</i>	Molten lead(II) bromide conduct electricity. <i>Leburan plumbum(II) bromide tidak mengkonduksikan elektrik.</i>									
Bulb in Set II does not light up. <i>Mentol dalam Set II tidak menyala</i>	Molten naphthalene does not conduct electricity. <i>Leburan naftalena tidak mengkonduksikan elektrik</i>									
Grey solid formed at cathode in Set I.	Lead is formed. <i>Plumbum terbentuk.</i>									

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
	Pepejal kelabu terbentuk di katod dalam Set I.	
	Able to state all observations and corresponding inference correctly. <i>Menyatakan kesemua pemerhatian dan inferens yang betul.</i>	2
	Able to state all observations and corresponding inference correctly. <i>Menyatakan kesemua pemerhatian dan inferens yang betul.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
1(b)	Able to state the relationship between the manipulated variable and the responding variable with direction. <i>Boleh menyatakan perhubungan antara pembolehubah manipulasi dan bergerak balas yang dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Molten lead(II) bromide conduct electricity but molten naphthalene does not conduct electricity. <i>Leburan plumbum(II) bromida mengkonduksikan elektrik tetapi leburan naftalena tidak mengkonduksikan elektrik.</i>	3
	Able to state the relationship between the manipulated variable and the responding variable but less accurately. <i>Boleh menyatakan perhubungan antara pembolehubah manipulasi dan bergerak balas yang kurang tepat.</i> <u>Sample answer/Sampel jawapan:</u> Molten lead(II) bromide conduct electricity// Molten naphthalene does not conduct electricity.	2

	<i>Leburan plumbum(II) bromida mengkonduksikan elektrik//</i> <i>Leburan naftalena tidak mengkonduksikan elektrik.</i>	
	Able to state an idea of hypothesis. <i>Boleh menyatakan idea hipotesis</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) bromide is an ionic compound <i>Plumbum(II) bromida adalah sebatian ion.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
1(c)	Able to state all the variables correctly. <i>Boleh menyatakan semua pembolehubah dengan betul</i> <u>Sample answer/Sampel jawapan:</u> Manipulated variable: Type of compound Pembolehubah manipulasi: Jenis sebatian Responding variable: Electrical conductivity Pembolehubah bergerak balas: Kekonduksian elektrik Fixed variable: carbon electrode Pembolehubah dimalarkan: elektrod karbon	3
	Able to state any two variables correctly. <i>Boleh menyatakan dua pembolehubah dengan betul.</i>	2
	Able to state any one variable correctly. <i>Boleh menyatakan satu pembolehubah dengan betul.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
1(d)	Able to state the operational definition correctly. <i>Boleh menyatakan definisi secara operasi dengan betul.</i> <u>Sample answer/Sampel jawapan:</u> When the compound is heated until molten, the bulb will light up. <i>Apabila sebatian dipanaskan sehingga melebur, mentol menyala.</i>	3
	Able to state part of the operational definition correctly <i>Boleh menyatakan sebahagian definisi dengan betul.</i> <u>Sample answer/Sampel jawapan:</u> The compound is heated until molten// The bulb will light up. <i>Sebatian dipanaskan sehingga melebur// Mentol menyala.</i>	2
	Able to state an idea <i>Boleh memberi idea</i> <u>Sample answer/Sampel jawapan:</u> Ionic compound conducts electricity. <i>Sebatian ionik mengkondusikan elektrik.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
1(e)	Able to state the explanation correctly. <i>Boleh menyatakan penerangan dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) ions and bromide ions are charged particles which are free to move in molten state to conduct electricity. <i>Plumbum(II) ions dan bromida ions adalah zarah bercas yang boleh bebas bergerak dalam keadaan leburan untuk mengkondusikan elektrik.</i>	3
	Able to explain part of the explanation correctly. <i>Menerangkan sebahagian pemerhatian dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) ions and bromide ions are charged particles// Lead(II) ions are free to move in molten state <i>Plumbum(II) ions dan bromida ions adalah zarah bercas//</i> <i>Plumbum(II) ions yang boleh bebas bergerak dalam keadaan leburan.</i>	2
	Able to give an idea. <i>Boleh memberi idea.</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) bromide contains charges and free to move. <i>Plumbum(II) bromide mempunyai cas dan bebas bergerak.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
1(f)	Able to state the inference correctly. <i>Memberi inferens dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) ions and bromide ions are attracted by strong electrostatic forces. A lot of heat is needed to overcome the forces. <i>Plumbum(II) ions dan bromida ions ditarik kuat oleh daya elektrostatik. Tenaga haba yang banyak diperlukan untuk mengatasi daya tarikan tersebut.</i>	3
	Able to explain part of the inference correctly. <i>Menerangkan sebahagian inferens dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) ions and bromide ions are attracted by strong electrostatic forces//A lot of heat is needed to overcome the forces. <i>Plumbum(II) ions dan bromida ions ditarik kuat oleh daya elektrostatik//Tenaga haba yang banyak diperlukan untuk mengatasi daya tarikan tersebut.</i>	2
	Able to give an idea. <i>Boleh memberi idea.</i> <u>Sample answer/Sampel jawapan:</u> Lead(II) bromide is stronger than naphthalene. <i>Plumbum(II) bromida lebih kuat daripada naftalena.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>				
1(g)	Able to classify all the compounds correctly. <i>Mengelaskan semua sebatian dengan betul.</i> <u>Answer/Jawapan:</u> <table><tr><td>Dissolve in water <i>Larut dalam air</i></td><td>Does not dissolve in water <i>Tidak larut dalam air</i></td></tr><tr><td>Potassium carbonate <i>Kalium karbonat</i> Ethanoic acid <i>Asid ethanoic</i> Glycerol <i>Gliserol</i></td><td>Chlorofluorocarbon <i>Klorofluorokarbon</i></td></tr></table>	Dissolve in water <i>Larut dalam air</i>	Does not dissolve in water <i>Tidak larut dalam air</i>	Potassium carbonate <i>Kalium karbonat</i> Ethanoic acid <i>Asid ethanoic</i> Glycerol <i>Gliserol</i>	Chlorofluorocarbon <i>Klorofluorokarbon</i>	3
Dissolve in water <i>Larut dalam air</i>	Does not dissolve in water <i>Tidak larut dalam air</i>					
Potassium carbonate <i>Kalium karbonat</i> Ethanoic acid <i>Asid ethanoic</i> Glycerol <i>Gliserol</i>	Chlorofluorocarbon <i>Klorofluorokarbon</i>					
	Able to classify three the compounds correctly. <i>Mengelaskan tiga sebatian dengan betul.</i>	2				
	Able to classify two compounds correctly. <i>Mengelaskan dua sebatian dengan betul./</i> Reverse answers <i>Jawapan terbalik.</i>	1				
	No response or wrong response <i>Tiada respons atau respons salah</i>	0				

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
2(a)	Able to state the problem statement correctly. <i>Boleh menyatakan pernyataan masalah dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Is sodium chloride and naphthalene dissolve in water and toluene? <i>Adakah natrium klorida dan naftalena boleh larut dalam air dan toluene/.</i>	3
	Able to state the problem statement less accurately. <i>Boleh menyatakan pernyataan masalah yang kurang tepat.</i> <u>Sample answer/Sampel jawapan:</u> Is covalent and ionic compound dissolve in water? <i>Adalah sebatian kovalen dan ionik larut dalam air?</i> To investigate the solubility of covalent and ionic compound in water and toluene. <i>Untuk menyiasat keterlarutan sebatian kovalen dan ionik dalam air dan toluene.</i>	2
	Able to state an idea of problem statement <i>Boleh memberi idea tentang pernyataan masalah</i> <u>Sample answer/Sampel jawapan:</u> Is substance P and Q dissolve in water? <i>Adakah bahan P dan Q larut dalam air?</i> To investigate the solubility of covalent and ionic compound. <i>Untuk menyiasat keterlarutan sebatian kovalen dan ionik.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
2(b)	Able to state all the variables correctly. <i>Boleh menyatakan semua pembolehubah dengan betul</i> <u>Sample answer/Sampel jawapan:</u> Manipulated variable: Type of compound Pembolehubah manipulasi: Jenis sebatian Responding variable: Solubility of compound Pembolehubah bergerak balas: Keterlarutan sebatian Fixed variable: water and toluene. Pembolehubah dimalarkan: air dan toluena	3
	Able to state any two variables correctly. <i>Boleh menyatakan dua pembolehubah dengan betul.</i>	2
	Able to state any one variable correctly. <i>Boleh menyatakan satu pembolehubah dengan betul.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
2(c)	Able to state the relationship between the manipulated variable and the responding variable with direction. <i>Boleh menyatakan perhubungan antara pembolehubah manipulasi dan bergerak balas yang dengan tepat.</i> <u>Sample answer/Sampel jawapan:</u> Sodium chloride dissolves in water but not in toluene. <i>Naphthalene dissolves in toluene but not in water.</i>	3
	Able to state the relationship between the manipulated variable and the responding variable but less accurately. <i>Boleh menyatakan perhubungan antara pembolehubah manipulasi dan bergerak balas yang kurang tepat.</i> <u>Sample answer/Sampel jawapan:</u> Sodium chloride dissolves in water but naphthalene dissolves in toluene. <i>Natrium klorida larut dalam air tetapi naftalena larut dalam toluena.</i>	2
	Able to state an idea of hypothesis. <i>Boleh menyatakan idea hipotesis</i> <u>Sample answer/Sampel jawapan:</u> The solubility of sodium chloride and naphthalene is different. <i>Keterlarutan natrium klorida dan naftalene berbeza.</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
2(d)	Able to give a complete list of materials and apparatus that involves the following: <i>Boleh memberi senarai bahan dan alat radas yang berikut seperti berikut:</i> <u>Sample answer/Sampel jawapan:</u> Boiling tube, measuring cylinder, spatula, water, toluene, glass rod, sodium chloride, naphthalene. <i>Tabung didih, silinder penyukat, spatula, air, toluena, rod kaca, natrium klorida, naftalena.</i>	3
	Able to give a list of materials and apparatus that involves the following but less accurately: <i>Boleh memberi senarai bahan dan alat radas dengan kurang tepat seperti berikut:</i> <u>Sample answer/Sampel jawapan:</u> Boiling tube, water, toluene, glass rod, sodium chloride, naphthalene. <i>Tabung didih, air, toluena, rod kaca, natrium klorida, naftalena.</i>	2
	Able to give an idea of the materials and apparatus that involves the following: <i>Boleh memberi idea tentang bahan dan alat radas seperti berikut:</i> <u>Sample answer/Sampel jawapan:</u> Boiling tube, organic solvent, water, covalent compound, ionic compound. <i>Tabung didih, pelarut organik, air, sebatian kovalen, sebatian ionik</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
2(e)	Able to state all the following 6 steps correctly: <i>Boleh menyatakan kesemua 6 langkah dengan tepat:</i> <u>Sample answer:</u> 1. Fill a boiling tube with 5 ml of water. 2. Add one spatula of sodium chloride powder into the boiling tube. 3. Stir the mixture and observe the solubility of sodium chloride in water. 4. Repeat steps 1 to 3 by replacing sodium chloride with naphthalene. 5. Repeat steps 1 to 4 by replacing water with toluene. 6. Record the results of experiment in a table. <u>Sampel jawapan:</u> <i>Isi sebuah tabung didih dengan 5 ml air.</i> <i>Tambah satu spatula serbuk natrium klorida ke dalam tabung didih.</i> <i>Kacau campuran dan memerhati keterlarutan natrium klorida dalam air.</i> <i>Ulang langkah 1 hingga 3 untuk menggantikan natrium klorida dengan naftalena.</i> <i>Ulang langkah 1 hingga 4 untuk menggantikan air dengan toluene.</i> <i>Rekod keputusan eksperimen dalam jadual.</i>	3
	Steps 1, 2, 4, 5 <i>Langkah 1, 2, 4, 5</i>	2
	Steps 1, 2, 5 <i>Langkah 1, 2, 5</i>	1
	No response or wrong response <i>Tiada respons atau respons salah</i>	0

Question <i>Soalan</i>	Rubrics <i>Rubrik</i>	Marks <i>Markah</i>									
2(f)	Able to exhibit the tabulation of data that includes the following information: <i>Boleh membina jadual yang mengandungi perkara berikut</i> Heading for manipulated variable : <i>Pembolehubah manipulasi</i> Heading for responding variable : <i>Pembolehubah bergerak balas</i> 3 x 3 table/<i>Jadual</i> <u>Sample answer/Sampel jawapan:</u> <table><tr><td>Substance <i>Bahan</i></td><td>Water <i>Air</i></td><td>Toluene <i>Toluena</i></td></tr><tr><td>Sodium chloride <i>Natrium klorida</i></td><td></td><td></td></tr><tr><td>Naphthalene <i>Naftalena</i></td><td></td><td></td></tr></table>	Substance <i>Bahan</i>	Water <i>Air</i>	Toluene <i>Toluena</i>	Sodium chloride <i>Natrium klorida</i>			Naphthalene <i>Naftalena</i>			
Substance <i>Bahan</i>	Water <i>Air</i>	Toluene <i>Toluena</i>									
Sodium chloride <i>Natrium klorida</i>											
Naphthalene <i>Naftalena</i>											
	Able to exhibit the tabulation of data that includes the following information <i>Boleh membina jadual yang mengandungi perkara berikut</i> 1. Heading for manipulated/ responding variable <i>Pembolehubah manipulasi dan bergerak balas</i> 2. 2 x 2 table/<i>Jadual</i> <u>Sample answer/sampel jawapan:</u> <table><tr><td>Substance <i>Bahan</i></td><td>Observation <i>Pemerhatian</i></td></tr><tr><td></td><td></td></tr></table>	Substance <i>Bahan</i>	Observation <i>Pemerhatian</i>			1					
Substance <i>Bahan</i>	Observation <i>Pemerhatian</i>										
	No response or wrong response <i>Tiada respons atau respons salah</i>	0									

Set 2

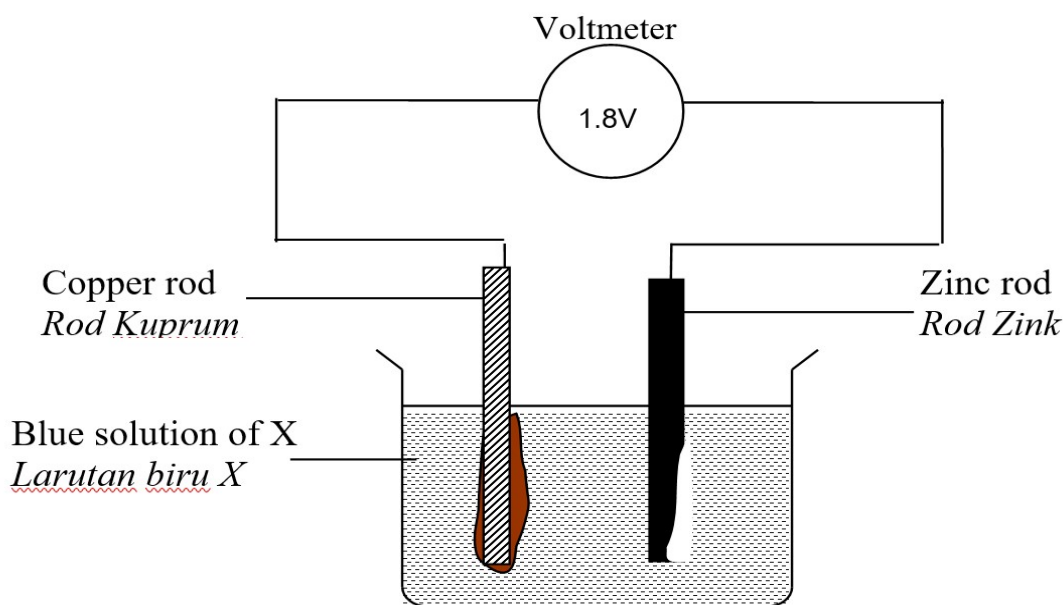
Electrochemistry
Elektrokimia

TAJUK: ELECTROCHEMISTRY / ELEKTROKIMIA

Section A
Bahagian A

1. Diagram 1 shows a simple cell using zinc and copper as the electrodes and blue solution of X as the electrolyte. The reading of the voltmeter is 1.8V.

Rajah 1 menunjukkan satu sel ringkas menggunakan zink dan kuprum sebagai elektrod dan larutan biru X sebagai elektrolit. Bacaan voltmeter ialah 1.8V.



Diagram/ Rajah 1

- (a) In Diagram 1, show the direction of the flow of electrons.
Dalam Rajah 1, tandakan arah aliran elektron.

[1 mark]

- (b) Which metal reacts as the negative terminal?
Logam yang manakah bertindak sebagai terminal negatif ?

[1 mark]

- (c) What is the energy change in the cell above?

Apakah perubahan tenaga di dalam sel di atas?

[1 mark]

- (d) Name the ion that gives the blue colour of solution X.

Namakan ion yang memberikan warna biru larutan X.

[1 mark]

- (e) (i) After a few minutes, the copper rod becomes thicker. Give a reason.

Selepas beberapa minit, rod kuprum menjadi tebal. Berikan satu sebab.

[1 mark]

- (ii) Write a half equation for your answer in (e)(i).

Tuliskan setengah persamaan bagi jawapan anda di (e)(i).

[1 mark]

- (f) (i) State the change in the reading of the voltmeter if zinc rod is replaced by magnesium rod.

Nyatakan perubahan yang berlaku kepada bacaan voltmeter jika rod zink diganti dengan rod magnesium?

[1 mark]

- (ii) Explain your answer in (f)(i).
Jelaskan jawapan anda di (f)(i).

[2 marks]

- (g) Write the overall ionic equation for the cell.
Tuliskan persamaan ion keseluruhan bagi sel.

[1 mark]

- 2 Diagram 2 shows the combination between a chemical cell and an electrolytic cell.
Rajah 2 menunjukkan gabungan satu sel kimia dengan satu sel elektrolisis.

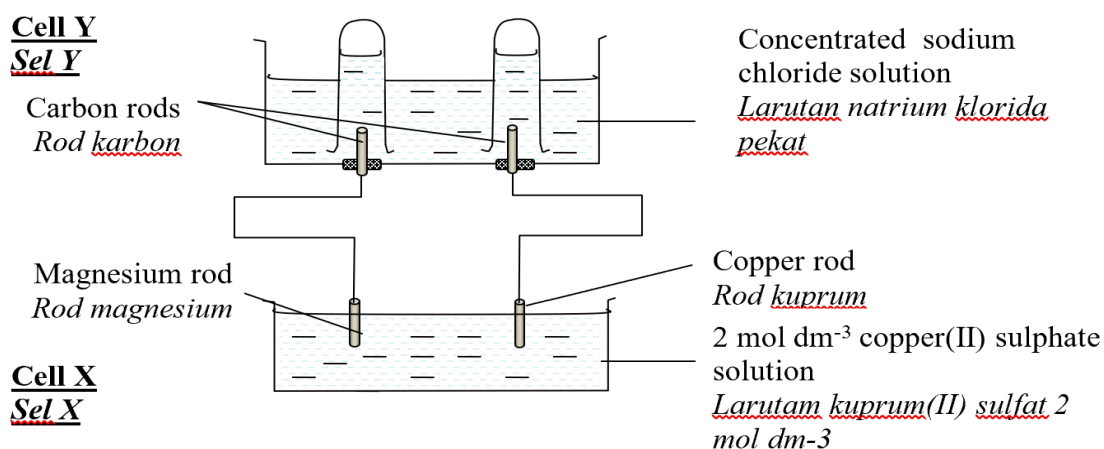


Diagram / Rajah 2

Referring to Cell X,
Merujuk kepada Sel X,

- (a) (i) State the energy change occurred in cell X.
Nyatakan perubahan tenaga yang berlaku dalam sel X.

[1 mark]

- (ii) State the negative terminal. Give your reason.

Nyatakan terminal negative. Berikan sebab.

[2 marks]

- (iii) State the change observed at the copper electrode.

Nyatakan perubahan yang diperhatikan pada elektrod kuprum.

[1 mark]

Referring to Cell Y,

Merujuk kepada Sel Y,

- (b) (i) State all the ions present in concentrated sodium chloride solution.

Nyatakan semua ion yang terdapat dalam larutan natrium klorida pekat.

[1 mark]

- (ii) Name the gas collected at the anode.

Namakan gas yang terkumpul di anod.

[1 mark]

- 3 Diagram 3 shows two beakers containing copper plates immersed in different solutions.

Rajah 3 menunjukkan dua buah bikar yang mengandungi logam kuprum dicelupkan ke dalam dua larutan yang berbeza.

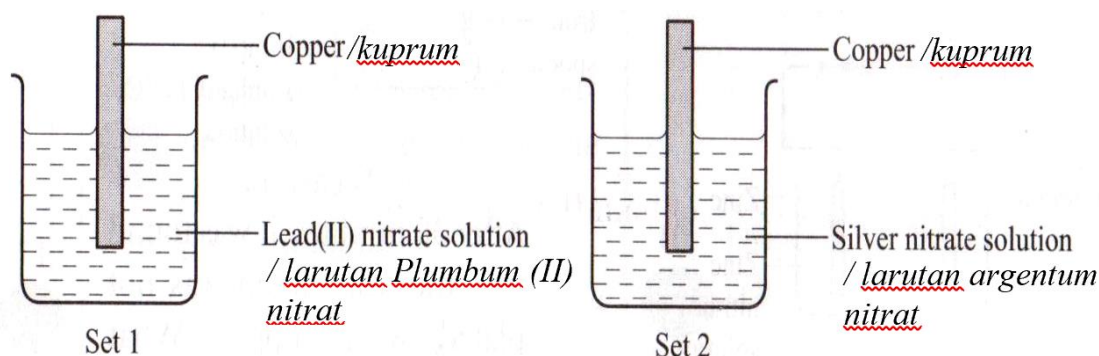


Diagram 3/Rajah 3

- (a) (i) Predict whether displacement reaction occurs in Set 1 and Set 2.

Ramalkan sama ada tindak balas penyesaran berlaku dalam Set 1 dan Set 2.

Set 1 : _____

Set 2 : _____

[2 marks]

- (ii) State one observation for the displacement reaction that occurs in (a)(i).

Nyatakan satu pemerhatian bagi tindak balas penyesaran yang berlaku di (a)(i).

[1 marks]

- (iii) Write the ionic equation for the displacement reaction that occurs in (a)(i).

Tuliskan persamaan ion bagi tindak balas penyesaran yang berlaku di (a)(i).

[1 marks]

- (b) Based on your answer in (a)(i), arrange copper, lead and silver in the order of increasing electropositivity.

Berdasarkan jawapan anda di (a)(i), susunkan kuprum, plumbum, dan argentum dalam tertib penambahan keelektropositifan.

[1 mark]

- (c) If copper is replaced with zinc in Set I, state whether zinc can displaced lead from lead(II) nitrate solution. Explain your answer.

Jika kuprum digantikan dengan zink, nyatakan sama ada zink boleh menyesarkan plumbum daripada larutan plumbum(II) nitrat. Jelaskan jawapan anda.

[2 marks]

- (d) State two uses of the electrochemical series.

Nyatakan dua kegunaan siri elektrokimia.

[2 marks]

- 4 When concentrated aqueous sodium chloride solution is electrolysed using carbon electrodes, gases are collected at the electrodes.

Apabila larutan akueus pekat natrium klorida dielektrolisiskan menggunakan elektrod karbon, gas-gas terhasil dikumpulkan pada elektrod.

- (a) Draw a labelled diagram for the set-up of apparatus to carry out the electrolysis.
Lukiskan satu gambar rajah berlabel susunan radas untuk menjalankan elektrolisis.

[2 marks]

- (b) Name the gases collected at the anode and cathode.

Namakan gas yang terkumpul pada anod dan katod.

Anode/anod:

Cathode/katod:

[2 marks]

- (c) Write the half equation for the reaction that occurs at the anode and cathode.

Tulis setengah persamaan untuk tindak balas yang berlaku di anod dan katod.

Anode/anod:

Cathode/katod:

[2 marks]

- (d) Suggest a chemical test to identify the gas produced at the anode.

Cadangkan satu ujian kimia untuk mengenalpasti gas yang terhasil di anod.

[2 marks]

- (e) Why is concentrated hydrochloric acid not used for the manufacture of chlorine gas by electrolysis?

Mengapakah asid hidroklorik pekat tidak digunakan dalam pembuatan gas klorin melalui elektrolisis?

[2 marks]

- 5 Table 3 shows the descriptions and observations for two experiments I and II.

Jadual 3 menunjukkan penerangan dan pemerhatian untuk dua eksperimen I dan II.

Experiment <i>Eksperimen</i>	Description <i>Penerangan</i>	Observation <i>Pemerhatian</i>
I	Electrolysis of 1 mol dm ⁻³ copper(II) sulphate solution using carbon electrodes <i>Elektrolisis 1 mol dm⁻³ larutan kuprum(II) sulfat menggunakan elektrod karbon</i>	Brown deposits are formed at the cathode and gas bubbles are released at the anode. <i>Enapan perang terbentuk pada katod dan gelembung-gelembung gas dibebaskan di anod.</i>
II	Electrolysis of 1 mol dm ⁻³ copper(II) sulphate solution using copper electrodes	Mass of anode decreases and mass of cathode increases <i>Jisim anod berkurang dan jisim katod bertambah</i>

	<i>Elektrolisis 1 mol dm⁻³ larutan kuprum(II) sulfat menggunakan elektrod kuprum</i>	
--	---	--

Table 5/Jadual 5

(a) Based on Experiment I:

Berdasarkan Eksperimen I:

(i) What is the formula of the ion that is selectively discharged at the anode?

Apakah formula bagi ion yang dipilih untuk nyahcas di anod?

[1 mark]

(ii) State the reason for your answer in (a)(i).

Nyatakan sebab untuk jawapan anda di (a)(i).

[1 mark]

(iii) Write the half equation for the reaction that occurs at the anode.

Tulis setengah persamaan untuk tindak balas yang berlaku di anod.

[1 mark]

(iv) Describe briefly the chemical test to confirm the product at the anode.

Huraikan secara ringkas ujian kimia untuk mengesahkan hasil di anod.

[2 marks]

- (v) How does the intensity of the blue colour copper(II) sulphate change?

Explain your answer.

Bagaimanakah keamatan warna biru larutan kuprum(II) sulfat berubah.

Jelaskan jawapan anda.

[2 marks]

- (b) Based on Experiment II:

Berdasarkan Eksperimen II:

- (i) Write the half equation for the reaction that occurs at the anode.

Tulis setengah persamaan untuk tindak balas yang berlaku di anod.

[1 mark]

- (ii) How does the intensity of the blue colour copper(II) sulphate change?

Explain your answer.

Bagaimanakah keamatan warna biru larutan kuprum(II) sulfat berubah.

Jelaskan jawapan anda.

[2 marks]

Section B
Bahagian B

6. (a) A student has carried out an electrolysis process using dilute ethanoic acid and carbon as electrodes. What is produced at the cathode? Write a half equation for the reaction.

Seorang pelajar telah menjalankan proses elektrolisis dengan menggunakan larutan asid etanoik dan karbon sebagai elektrod. Apakah yang terhasil di katod? Tuliskan persamaan setengah bagi tindak balas tersebut.

[2 marks]

- (b) Diagram 6 shows two types of cells.
Rajah 6 menunjukkan dua jenis sel.

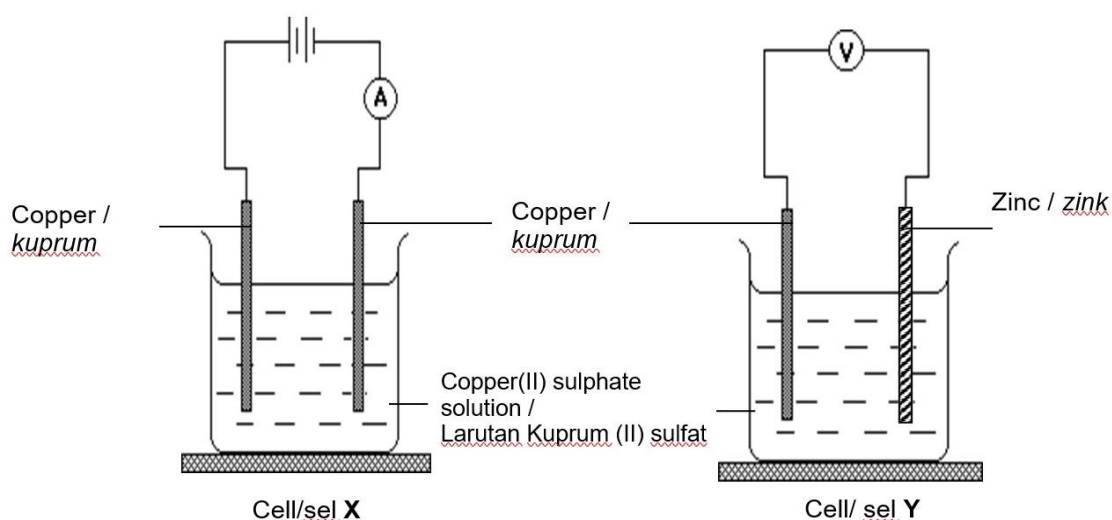


Diagram 6 / Rajah 6

Compare and contrast cell X and cell Y. Include the observations and half equations for reactions at the electrodes in both cells in your answers .

Banding dan bezakan sel X dan sel Y. Sertakan pemerhatian dan persamaan setengah bagi tindak balas di elektrod kedua-dua sel di dalam jawapan anda.

[8 marks]

- (c) Table 6 shows the observation at the anode and cathode when the dilute hydrochloric acid is electrolysed using carbon electrodes.

Jadual 6 menunjukkan pemerhatian pada anod dan katod apabila asid hidroklorik cair dielektrolisiskan menggunakan karbon.

Electrode <i>Elektrod</i>	Observation <i>Pemerhatian</i>
Anode <i>Anod</i>	A colourless gas is released and relights a glowing splinter <i>Gas tidak berwarna dibebaskan dan menyalakan kayu uji berbara</i>
Cathode <i>Katod</i>	A colourless gas is released and gives a 'pop' sound when tested with a lighted wooden splinter <i>Gas tidak berwarna dibebaskan dan menghasilkan bunyi 'pop' apabila diuji dengan kayu uji bernyala</i>

Table 6 / *Jadual 6*

- (i) Identify the products formed at the anode and cathode.

Write the half-equation for the reactions that occur.

Kenalpasti hasil yang terbentuk di anod dan katod

Tulis setengah persamaan bagi tindak balas yang berlaku.

[4 marks/markah]

- (ii) What happens to the dilute hydrochloric acid at the end of the electrolysis?

Give one reason for your answer.

Apakah yang berlaku kepada asid hidroklorik cair pada akhir elektrolisis?

Berikan satu sebab bagi jawapan anda.

[4 marks/markah]

- (iii) State the factor that determines the products formed at the electrodes in this experiment.

Nyatakan faktor yang menentukan hasil yang terbentuk di elektrod dalam eksperimen ini.

[2 marks/markah]

7. Diagram 7.1 shows the set-up of the apparatus to study the electrolysis of sodium chloride solution using carbon electrodes.

Rajah 7.1 menunjukkan susunan radas untuk mengkaji elektrolisis larutan natrium Klorida menggunakan elektrod-elektrod karbon.

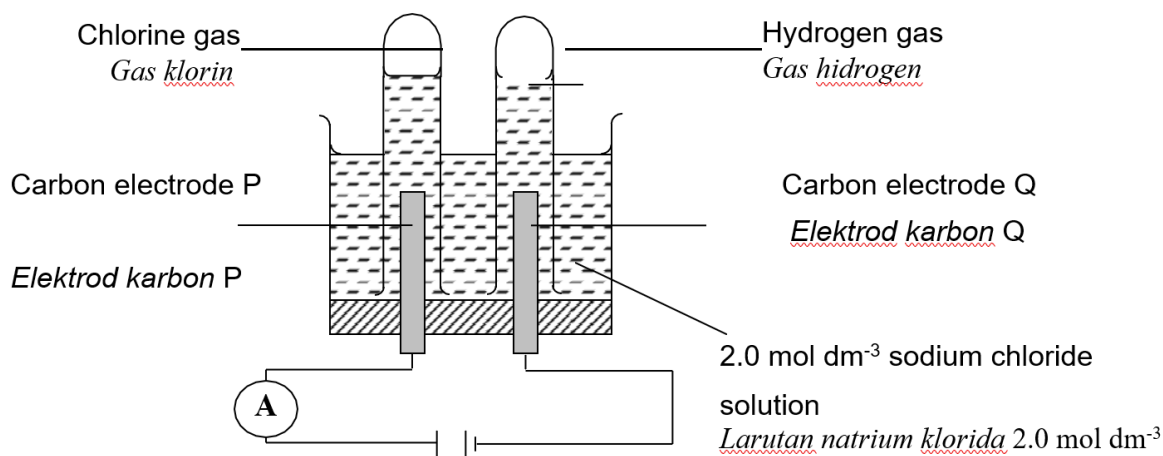


Diagram 7.1 / *Rajah 7.1*

- (a) Based on Diagram 7.1, state the factors that determine the products formed at electrode P and electrode Q.

Berdasarkan Rajah 7.1, nyatakan faktor yang menentukan hasil yang terbentuk pada elektrod P dan elektrod Q.

[2 marks]

- (b) Explain the reaction at electrodes; P and Q. Include the following in your explanation :

Terangkan tindak balas pada elektrod, P dan Q. Sertakan perkara berikut dalam penerangan :

- List of ions attracted to each of electrodes, P and Q
Senarai ion-ion yang tertarik ke setiap elektrod, P dan Q
- Names of the ions selectively discharged at each electrode
Nama ion-ion yang dipilih untuk dinyahcas di setiap elektrod
- The reason why the ions are selectively discharged
Sebab ion-ion dipilih untuk dinyahcas
- Observation for each electrodes
Pemerhatian bagi setiap elektrod

[8 marks]

(c) Diagram 7.2 shows two types of cell.

Rajah 7.2 menunjukkan dua jenis sel.

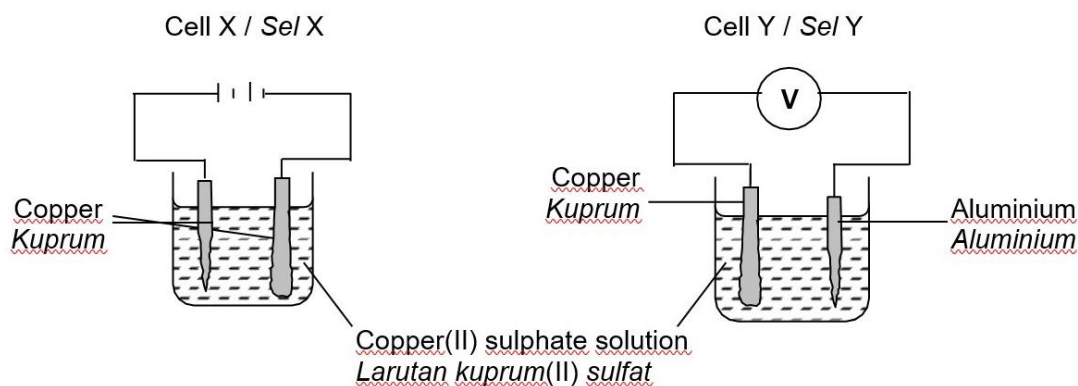


Diagram 7.2 / Rajah 7.2

Compare and contrast cell X and cell Y in term of :

Banding dan beza sel X dan sel Y dari segi :

- Type of cell
Jenis sel
- The energy change
Perubahan tenaga
- The terminals of the cells
Terminal bagi kedua-dua sel
- Ions presence in the electrolyte
Ion-ion yang hadir dalam elektrolit
- Observation
Pemerhatian
- Half equation for both electrodes
Setengah persamaan bagi kedua-dua elektrod
- Name of the processes occurred at the positive terminal of each cell
Nama proses yang berlaku pada terminal positif kedua-dua sel

[10 marks]

Section C
Bahagian C

8. (a) Salman intends to electroplate an iron spoon with nickel.

Salman ingin menyadur satu sudu besi dengan nikel.

Nickel ,Ni is a transition element with oxidation number of +2 and +3.
Nikel ,Ni adalah unsur peralihan dengan nombor pengoksidaan +2 dan +3

Draw a labeled diagram to show how he can set up the apparatus.

Write the half equations at anode and cathode.

Lukiskan rajah berlabel untuk menunjukkan bagaimana dia dapat menyediakan susunan radas tersebut.

Tuliskan persamaan setengah pada anod dan katod.

[4 marks]

- (b) Two sets of experiment are carried out to investigate the factors affecting the discharged of ions at the anode.

Dua set eksperimen dijalankan untuk mengkaji faktor yang mempengaruhi nyahcas ion-ion pada anod.

Table 8 shows information about both experiment.

Jadual 8 menunjukkan maklumat tentang kedua-dua eksperimen.

Experiment <i>Eksperimen</i>	Electrolyte <i>Elektrolit</i>	Type of anode <i>Jenis anod</i>	Observation at anode <i>Pemerhatian pada anod</i>
I	0.0001 mol dm ⁻³ MI solution <i>Larutan MI</i> 0.0001 mol dm ⁻³	Carbon <i>karbon</i>	Bubble of gas produced light up a glowing splinter. <i>Gelembung gas terhasil dan menyalakan kayu uji berbara.</i>
II	1.0 mol dm ⁻³ MI solution <i>Larutan MI</i> 1.0 mol dm ⁻³	Carbon <i>karbon</i>	The solution turns brown and turns dark blue when starch solution is added. <i>Larutan bertukar perang dan</i>

			<i>bertukar ke biru gelap apabila larutan kanji ditambah.</i>
--	--	--	---

Table 8/Jadual 8

Name the product formed at the anode in set I and set II. Explain how the products are formed.

Namakan hasil yang terbentuk di anod dalam setI dan set II.Terangkan bagaimana hasil-hasil tersebut terbentuk.

[6 marks]

(c)

Chemical cell produces electrical energy through chemical reaction.
Sel kimia menghasilkan tenaga elektrik melalui tindak balas kimia.

By using two suitable metal electrodes and an electrolyte,describe an experiment to verify the above statement.

Dengan menggunakan dua elektrod logam yang sesuai dan satu elektrolit ,huraikan suatu eksperimen untuk mengesahkan pernyataan di atas.

[10 marks]

- 9 (a) A group of students carry out an electrolysis of ethanoic acid solution, CH_3COOH by using carbon electrodes.

Sekumpulan pelajar menjalankan suatu elektrolisis larutan asid etanoik, CH_3COOH , menggunakan elektrod karbon.

By using your knowledge of factors affecting the selective discharge of ions at the electrodes,

Dengan menggunakan pengetahuan anda tentang faktor-faktor yang mempengaruhi pemilihan ion untuk dinyahcas di elektrod,

- (i) Identify the ion that is selectively discharge at anode and cathode.

Kenal pasti ion yang dipilih menyahcas di anod dan katod.

- (ii) Write half equation for the reactions occurred at anode and cathode.

Tuliskan persamaan setengah yang berlaku di anod dan katod.

- (iii) Describe a chemical test to verify the product formed at cathode. *Huraikan satu ujian kimia bagi mengesahkan hasil yang terbentuk di katod.*

[6 marks]

- (b) Table 9.1 shows the apparatus set-up to electroplate iron spoon.

Jadual 9.1 menunjukkan susunan radas bagi menyadurkan sudu besi.

Set Set	Apparatus set up <i>Susunan radas</i>	Observation on iron spoon <i>Pemerhatian terhadap sudu besi</i>
I		A shiny grey solid deposited <i>Pepejal kelabu berkilat terenap</i>
II		No changes <i>Tiada perubahan</i>

Table / *Jadual 9.1*

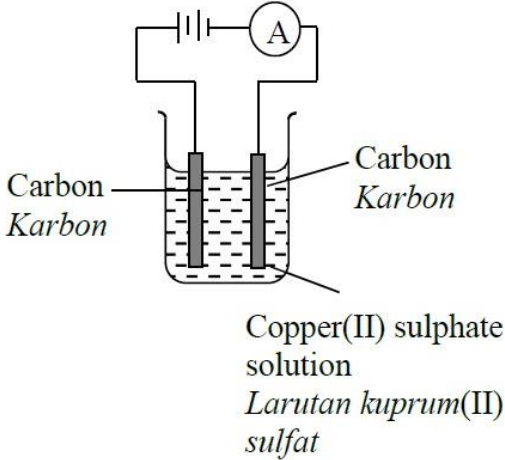
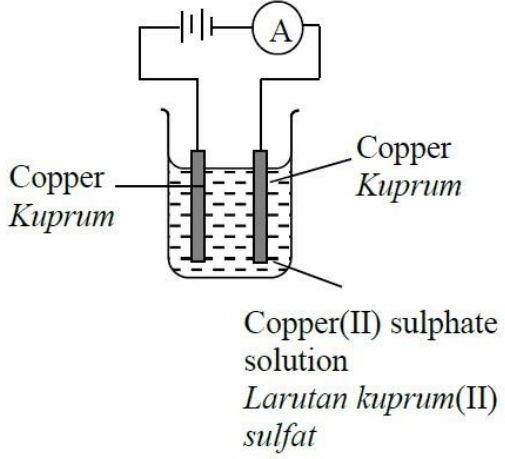
Based on the observation in Table 9.1, explain the differences in Set I and Set II.

Berdasarkan pemerhatian dalam Jadual 9.1, terangkan mengapa terdapat perbezaan dalam Set I dan Set II.

[4 marks]

- (c) Table 9.2 shows the apparatus set-up and observation for four different of cells using 1.0 mol dm^{-3} copper(II) sulphate solution

Jadual 9.2 menunjukkan susunan radas dan pemerhatian bagi empat sel yang berbeza menggunakan larutan kuprum(II) sulfat 1.0 mol dm^{-3} .

Set Set	Apparatus set up <i>Susunan radas</i>	Observation on iron spoon <i>Pemerhatian terhadap sudu besi</i>
I	 Carbon <i>Karbon</i> Carbon <i>Karbon</i> Copper(II) sulphate solution <i>Larutan kuprum(II) sulfat</i>	Anode : <i>Anod :</i> Bubbles gas released <i>Gelembung udara terbebas</i> Electrolyte : <i>Elektrolit :</i> The intensity of blue colour of copper (II) sulphate solution decreased <i>Keamatan warna biru larutan Kuprum (II) sulfat berkurang</i>
II	 Copper <i>Kuprum</i> Copper <i>Kuprum</i> Copper(II) sulphate solution <i>Larutan kuprum(II) sulfat</i>	Anode: <i>Anod:</i> Copper plate become thinner <i>Kepingan kuprum menipis</i> Electrolyte: <i>Electrolit:</i> The intensity of blue colour of copper (II) sulphate solution remain <i>Keamatan warna biru larutan Kuprum (II) sulfat kekal</i>

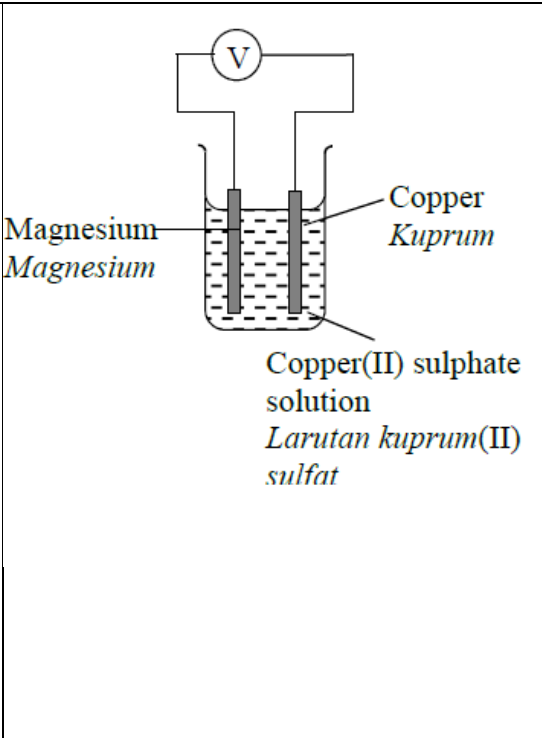
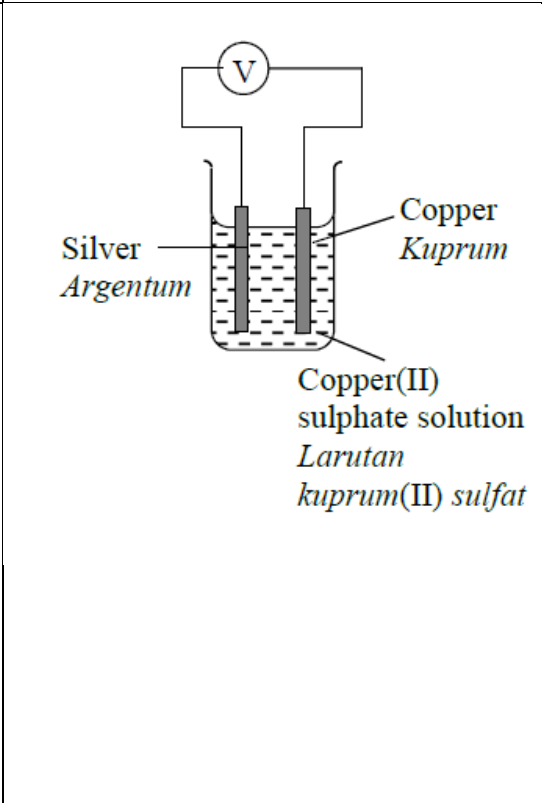
III	 The diagram shows a beaker containing a solution of Copper(II) sulphate. Two electrodes are immersed in the solution: a Magnesium electrode on the left and a Copper electrode on the right. The electrodes are connected by a wire passing through a voltmeter (V). Labels point to the Magnesium electrode, the Copper electrode, and the solution. Magnesium <i>Magnesium</i> Copper <i>Kuprum</i> Copper(II) sulphate solution <i>Larutan kuprum(II) sulfat</i>	Anode : <i>Anod :</i> Magnesium plate become thinner <i>Kepingan magnesium menipis</i> Electrolyte : <i>Elektrolit :</i> The intensity of blue colour of copper (II) sulphate solution decreased <i>Keamatan warna biru larutan Kuprum (II) sulfat berkurang</i>
IV	 The diagram shows a beaker containing a solution of Copper(II) sulphate. Two electrodes are immersed in the solution: a Silver electrode on the left and a Copper electrode on the right. The electrodes are connected by a wire passing through a voltmeter (V). Labels point to the Silver electrode, the Copper electrode, and the solution. Silver <i>Argentum</i> Copper <i>Kuprum</i> Copper(II) sulphate solution <i>Larutan kuprum(II) sulfat</i>	Anode : <i>Anod :</i> Copper plate become thinner <i>Kepingan kuprum menipis</i> Electrolyte : <i>Elektrolit :</i> The intensity of blue colour of copper (II) sulphate solution increased <i>Keamatan warna biru larutan Kuprum (II) sulfat bertambah</i>

Table / Jadual 9.2

Based on Table 9.2:

Berdasarkan Jadual 9.2:

Explain why there are differences in the observation between

Terangkan mengapa terdapat perbezaan pemerhatian di antara

(i) Cell I and Cell II

Sel I dan Sel II

(ii) Cell III and Cell IV

Sel III dan Sell IV

[10 marks]

KERTAS 3 SOALAN STRUKTUR

1. Diagram 1.1 shows the set-up of apparatus for an experiment of Set I, Set II and Set III to construct the electrochemical series based on the potential difference between two different metals in a voltaic cell. Metal X acts as a positive terminal.

Rajah 1.1 menunjukkan susunan radas satu eksperimen bagi Set I, Set II dan Set III untuk membina siri elektrokimia berdasarkan beza keupayaan antara dua logam berbeza dalam sel voltan. Logam X bertindak sebagai terminal positif.

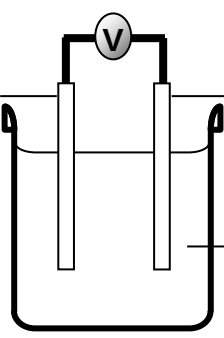
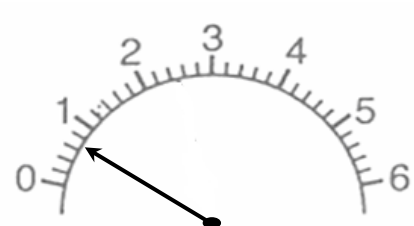
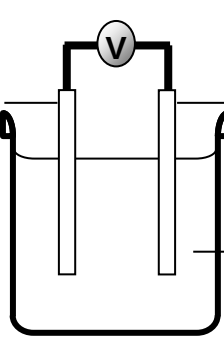
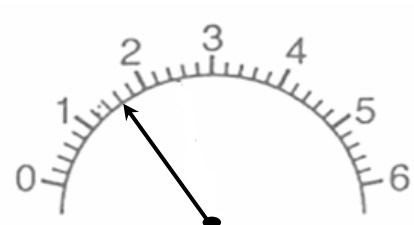
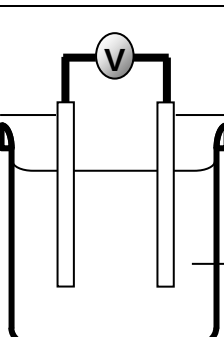
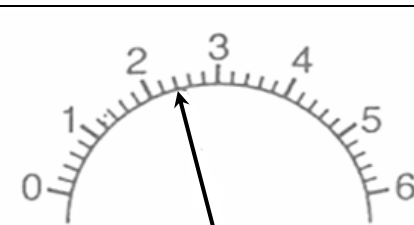
Set Set	Set-up of apparatus Susunan radas
I	Metal X Logam X  Tin Stanum Sodium chloride solution Larutan natrium klorida  Voltmeter reading Bacaan voltmeter :
II	Metal X Logam X  Zinc Zink Sodium chloride solution Larutan natrium klorida  Voltmeter reading Bacaan voltmeter :
III	Metal X Logam X  Magnesium Magnesium Sodium chloride solution Larutan natrium klorida  Voltmeter reading Bacaan voltmeter :

Diagram 1.1/ rajah 1.1

- (a) Record the voltmeter readings in the spaces provided in Diagram 1.1.
Rekod bacaan voltmeter pada ruang yang disediakan dalam Rajah 1.1.

[3 marks]

- (b) For this experiment, state the :
Bagi eksperimen ini, nyatakan:

- (i) manipulated variable
pembolehubah dimanipulasikan

- (ii) responding variable
pembolehubah bergerak balas

- (iii) fixed variable
pembolehubah dimalarkan

[3 marks]

- (c) State one hypothesis for this experiment.
Nyatakan satu hipotesis bagi eksperimen ini.

[3 marks]

- (d) Based on the voltmeter readings in Diagram 1.1, arrange metal X, zinc, magnesium and tin in ascending order of electropositivity of metals in electrochemical series.

Berdasarkan bacaan voltmeter dalam Rajah 1.1, susunkan logam X, zink, magnesium dan stanum dalam tertib menaik keelektropositifan logam dalam siri elektrokimia.

[3 marks]

- (e) State the operational definition for potential difference of metals.

Nyatakan definisi secara operasi bagi beza keupayaan logam.

[3 marks]

- (f) Diagram 1.2 shows the result of the experiment for Set II after 40 minutes.

Rajah 1.2 menunjukkan keputusan eksperimen bagi Set II selepas 40 minit.

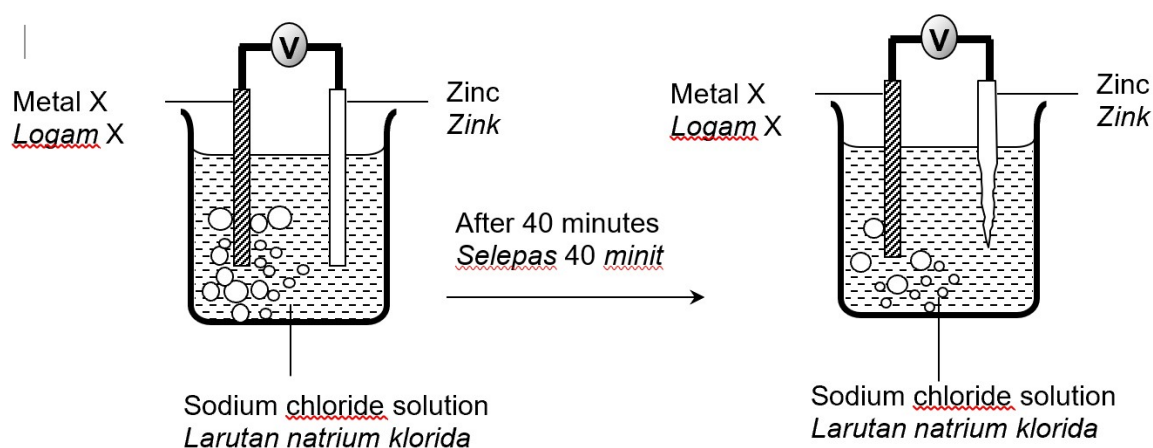


Diagram 1.2 / Rajah 1.2

- (i) State one observation at negative terminal in Diagram 1.2 after 40 minutes.
Nyatakan satu pemerhatian pada terminal negatif dalam Rajah 1.2 selepas 40 minit.

[3 marks]

- (ii) State the inference based on your answer in 1(f)(i).
Nyatakan inferens berdasarkan jawapan anda dalam 1(f)(i).

[3 marks]

- (iii) State the relationship between the number of gas bubbles released at metal X with time.
Nyatakan hubungan antara bilangan gelembung gas terbebas pada logam X dengan masa.

[3 marks]

- (g) Metal Q is placed between tin and metal X in the electrochemical series.
Predict the voltage produced and positive terminal if metal X in Set I is replaced by metal Q.
Logam Q terletak di antara stanum dan logam X dalam siri elektrokimia. Ramalkan voltan yang terhasil dan terminal positif apabila logam X dalam Set I digantikan dengan logam Q.

Voltan / *voltage*

Positive terminal / *terminal*
positif

[3 marks]

- (h) Write half equation for the reaction occurs at negative terminal and positive terminal in Set III.

Tulis setengah persamaan bagi tindak balas yang berlaku pada terminal negatif dan terminal positif dalam Set III.

At negative terminal

Pada terminal negative

At positive terminal

Pada terminal positif

[3 marks]

- (i) Classify all the ions present in sodium chloride solution into cations and anions.

Kelaskan semua ion yang hadir di dalam larutan natrium klorida kepada kation dan anion.

Cation <i>Kation</i>	Anion <i>Anion</i>

[3 marks]

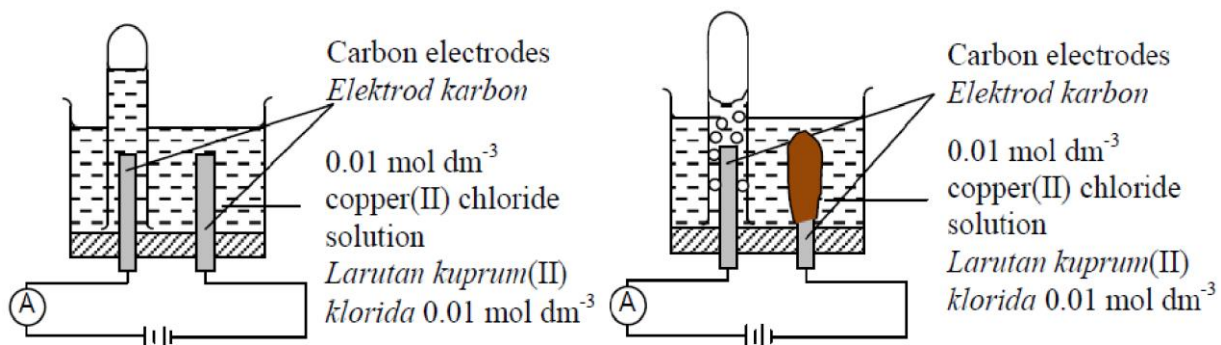
2. Rajah 2.1 dan Rajah 2.2 menunjukkan susunan radas bagi dua eksperimen.

Diagram 2.1 and Diagram 2.2 show the set-up of the apparatus for two experiments.

Electrolytic cell I /Sel elektrolisis I

Beginning of experiment /Awal eksperimen

After 30 minutes/ Selepas 30 minit

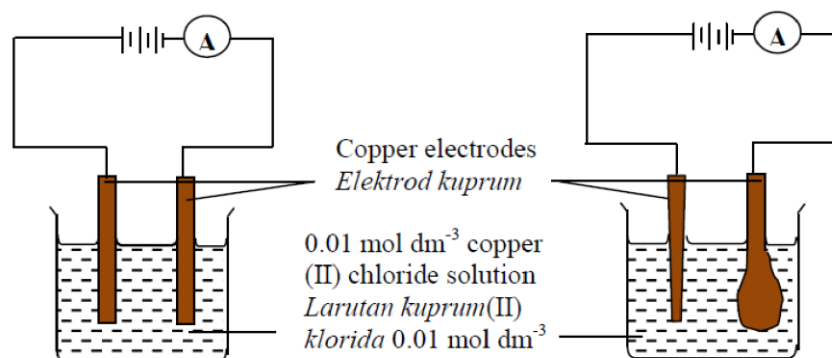


Rajah 2.1/ Diagram 2.1

Sel elektrolisis II/ Electrolytic cell II

Beginning of experiment /Awal eksperimen

After 30 minutes/ Selepas 30 minit



Rajah 2.2/ Diagram 2.2

Electrolytic cell I using carbon electrodes and 0.01 mol dm^{-3} copper(II) chloride solution is used as an electrolyte and Electrolytic cell II using copper electrodes and 0.01 mol dm^{-3} copper(II) chloride solution is used as an electrolyte.

Sel elektrolisis I menggunakan elektrod karbon dan larutan kuprum(II) klorida, 0.01 mol dm^{-3} digunakan sebagai elektrolit manakala Sel elektrolisis II menggunakan elektrod kuprum dan larutan kuprum(II) klorida, 0.01 mol dm^{-3} digunakan sebagai elektrolit.

- (a) State observation at anode in Table 1

Nyatakan pemerhatian di anod dalam Jadual 1.

Electrolytic cell <i>Sel elektrolisis</i>	Observation <i>Pemerhatian</i>
I	
II	

[3 marks]

- (b) Based on the answer at (a), write the half equation for the reaction happen in both cell.

Berdasarkan jawapan di (a), tuliskan persamaan setengah bagi tindak balas yang berlaku dalam kedua-dua sel tersebut.

Electrolytic cell <i>Sel elektrolisis</i>	Half equation <i>Persamaan setengah</i>
I	
II	

[3 marks]

- (c) Based on the half equations in (b), name the products.

Berdasarkan setengah persamaan di (b), namakan hasil-hasil tersebut

Electrolytic cell <i>Sel elektrolisis</i>	Name of products <i>Nama hasil-hasil</i>
I	
II	

[3 marks]

- (d) State an inference for Electrolytic cell II based on observation in 1(a).

Nyatakan inferens bagi Sel elektrolisis II berdasarkan pemerhatian dalam 1(a).

[3 marks]

- (e) For this experiment, state:

Bagi eksperimen ini, nyatakan:

- (i) The manipulated variable:

Pemboleh ubah yang dimanipulasikan :

- (ii) The responding variable:

Pemboleh ubah bergerak balas :

- (iii) The constant variable:

Pemboleh ubah yang ditetapkan :

[3 marks]

- (f) State the hypothesis for this experiment
.Nyatakan hipotesis bagi eksperimen ini.

[3 marks]

- (g) State the operational definition for the factor of electrode type.
Nyatakan definisi secara operasi bagi faktor jenis elektrod.

[3 marks]

- (h) The experiment of Electrolytic cell I repeated by replace 0.01 mol dm^{-3} copper(II) chloride solution to 1.0 mol dm^{-3} copper(II) chloride solution. Predict the name of product formed at anode.
Eksperimen Sel elektrolisis I diulangi dengan menggantikan larutan kuprum(II) klorida 0.01 mol dm^{-3} dengan larutan kuprum(II) klorida 1.0 mol dm^{-3} . Nama hasil yang akan terbentuk di anod.

[3 marks]

- (i) The following are example of chemical substances.

Berikut adalah beberapa contoh bahan kimia

Benzene	Molten lead(II) chloride <i>Leburan</i>	Molten naphthalene
<i>Benzena</i>	<i>Plumbum(II) klorida</i>	<i>Leburan naftalena</i>
Potassium carbonate solution		Glucose solution
<i>Larutan kalium karbonat</i>		<i>Larutan glukosa</i>

Classify the chemical substances into electrolyte and non-electrolyte

Kelaskan bahan-bahan kimia tersebut kepada elektrolit dan bukan elektrolit.

[3 marks]

- (j) (i) Draw a labelled diagram to show the electroplating of an iron key with silver using silver nitrate solution as the electrolyte.

Lukis satu rajah berlabel untuk menunjukkan penyaduran kunci besi dengan argentum menggunakan larutan argentum nitrat sebagai elektrolit.

[3 marks]

- (ii) What will happen to the iron key after electrolysed for 20 minutes?
Apakah yang akan berlaku kepada kunci besi itu selepas 20 minit dielektrolisiskan?

[3 marks]

3. Diagram 3.1 shows the apparatus set-up used in an experiment to construct the electrochemical series by measuring the voltage of copper and metal L in a simple voltaic cell .

The experiment is repeated by replacing metal L with metal M, metal N, metal Q and metal R.

Rajah 3.1 menunjukkan susunan radas yang digunakan dalam satu eksperimen untuk membina siri elektrokimia dengan mengukur voltan antara logam kuprum dengan logam L dalam sebuah sel kimia ringkas

Eksperimen ini diulang dengan menggantikan logam L dengan logam M, logam N, logam Q dan logam R.

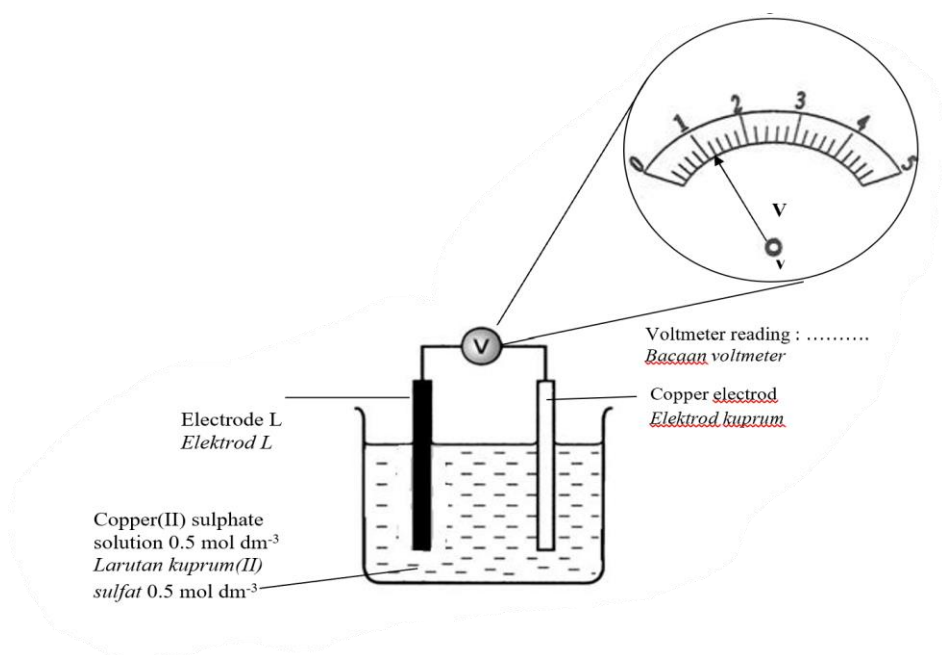


Diagram 3.1 / Rajah 3.1

Diagram 3.2 shows the voltmeter readings of all the experiments.
Rajah 3.2 menunjukkan bacaan voltmeter bagi semua eksperimen.

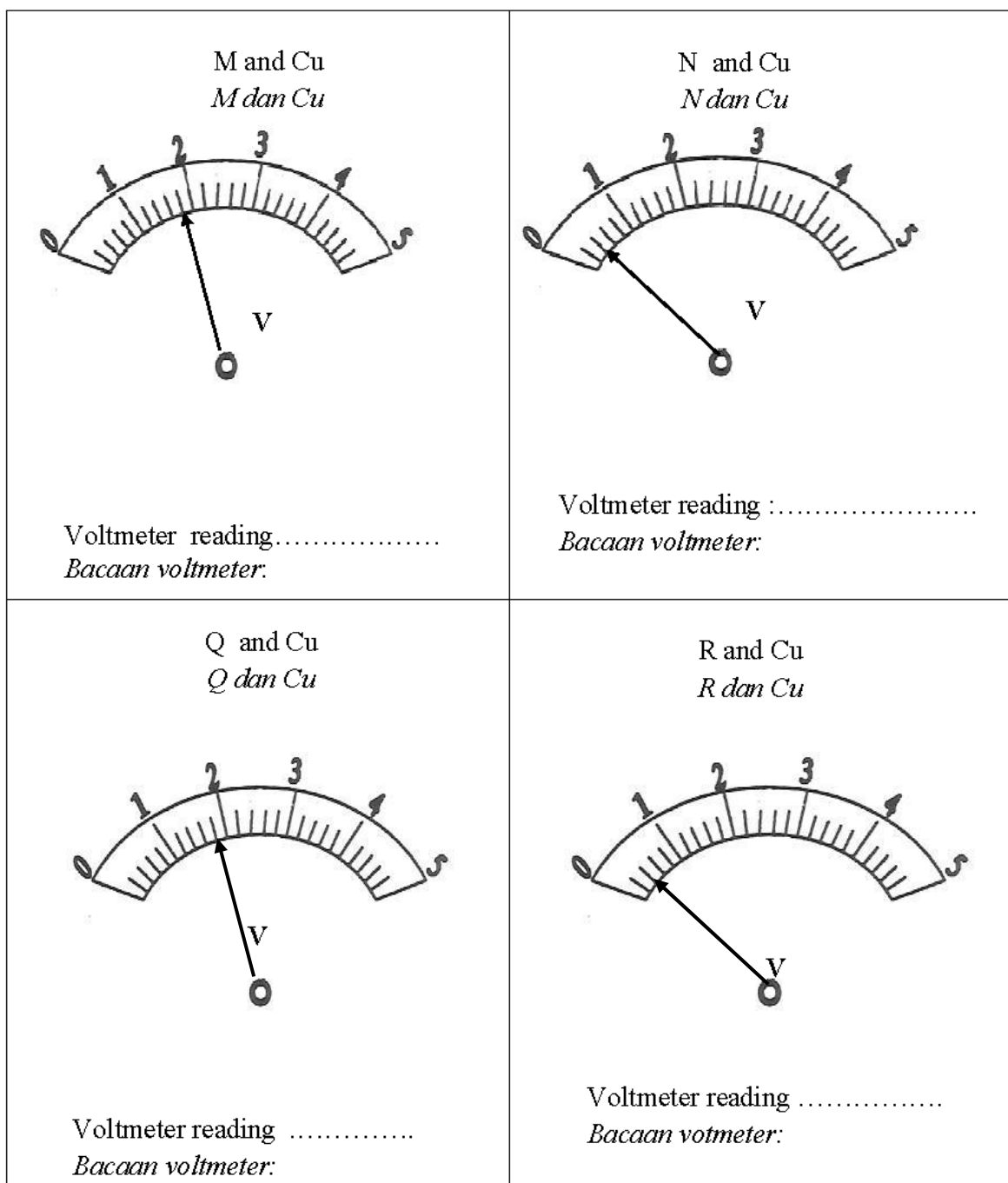


Diagram 3.2 / *raja*h 3.2

- (a) Record the voltmeter readings in the spaces provided in Diagram 3.1 and Diagram 3.2.
Catatkan bacaan voltmeter pada ruang yang disediakan dalam Rajah 3.1 dan Rajah 3.2.

[3 marks]

- (b) Construct a table to record all the voltmeter reading for the different pairs of metals.
Bina satu jadual untuk merekod semua bacaan voltmeter untuk pasangan logam yang berlainan.

[3 marks]

- (c) For this experiment, state:

Bagi eksperimen ini, nyatakan:

- (i) The manipulated variable:

Pemboleh ubah yang dimanipulasikan :

- (ii) The responding variable:

Pemboleh ubah bergerak balas :

- (iii) The constant variable:

Pemboleh ubah yang dimalarkan :

[3 marks]

- (d) State the hypothesis for this experiment
.Nyatakan hipotesis bagi eksperimen ini.

[3 marks]

- (e) Based on the voltmeter readings, arrange all the metals according to the electropositivity in ascending order.

Berdasarkan bacaan voltmeter, susunkan semua logam tersebut mengikut keelektropositifan dalam susunan menaik.

[3 marks]

- (f) Predict the voltage value for each of the following pair of metals:

Ramalkan nilai voltan bagi setiap pasangan logam berikut:

Pair of metals <i>Pasangan logam</i>	Voltage/V <i>Voltan /V</i>
M and R <i>M dan R</i>	
M and L <i>M dan L</i>	
N and Q <i>N dan Q</i>	

[3 marks]

(g) Below is a list of chemical substances solution:

Di bawah ialah senarai beberapa larutan bahan kimia:

- | | | |
|------------------------|-------------------------|-----------------|
| • Sodium chloride | *tetrachlorometane | * chloroform |
| <i>Natrium klorida</i> | <i>tetraklorometana</i> | <i>klorofom</i> |
| ▪ Silver nitrate | * Hydrochloric acid | * Glucose |
| <i>Argentum nitrat</i> | <i>Asid hidroklorik</i> | <i>Glukosa</i> |

Classify these substances into electrolyte and non-electrolyte.

Kelaskan bahan-bahan ini kepada elektrolit dan bukan elektrolit

Electrolyte <i>Elektrolit</i>	Non-electrolyte <i>Bukan elektrolit</i>

[3 marks]

KERTAS 3 MERANCANG EKSPERIMEN

- 1 Diagram 1 shows a group of students present their finding after they have carried out one experiment in the laboratory.

Rajah 1 menunjukkan satu kumpulan murid membentangkan dapatan mereka selepas menjalankan eksperiment di makmal.

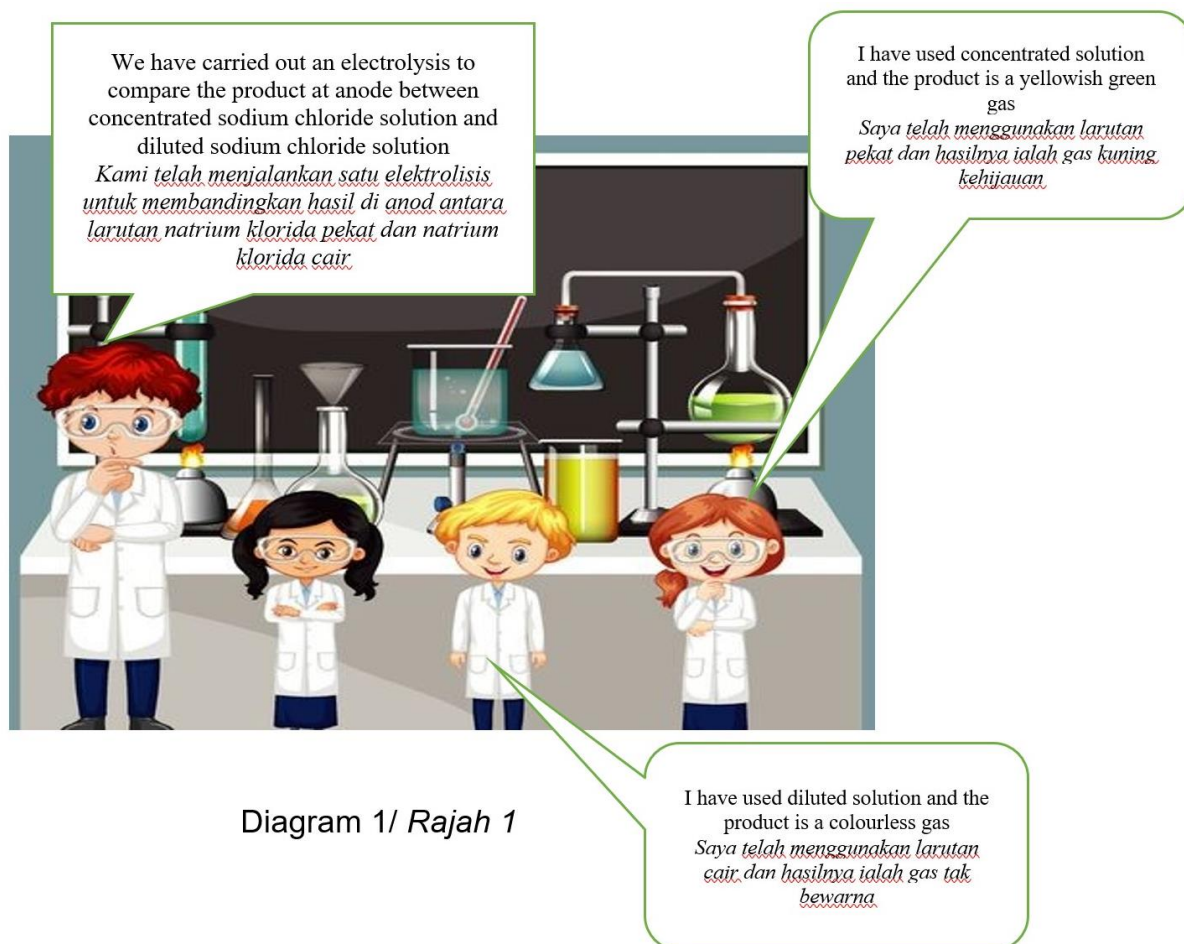


Diagram 1/ Rajah 1

Based on situation above, plan an experiment to study the effect of concentration to the product of electrolysis at anode.

Berdasarkan situasi tersebut, rancang satu eksperimen makmal untuk mengkaji kesan kepekatan elektrolit terhadap hasil elektrolisis pada elektrod anod.

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of the hypothesis
Pernyataan hipotesis
- (d) List of substances and apparatus
Senarai bahan dan radas
- (e) Procedure of the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

- 2 Diagram 2 shows the conversation between two students about the electrolysis experiment.
Rajah 2 menunjukkan perbualan antara dua orang pelajar tentang eksperimen elektrolisis

Chan Siew : I carried out an experiment of electrolysis copper(II) chloride solution using carbon electrodes. I observed the gas bubbles are released at anode.

Saya telah menjalankan eksperimen elektrolisis larutan kuprum(II) klorida dengan menggunakan elektrod karbon. Saya perhatikan gelembong gas dibebaskan di anod.

Amina: But why when I used copper as electrodes, I observed the anode become thinner?

Tapi mengapa apabila saya menggunakan kuprum sebagai elektrod, saya perhatikan anod semakin nipis?

Diagram 2/ Rajah 2

Referring to the conversation above, plan a laboratory experiment to investigate the effect of the type of electrode to the product at anode.

Merujuk kepada perbualan di atas ,rancang satu eksperimen untuk mengkaji kesan jenis elektrod ke atas hasil di anod.

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of the hypothesis
Pernyataan hipotesis
- (d) List of substances and apparatus
Senarai bahan dan radas
- (e) Procedure of the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

3

The voltage of simple chemical cell built using two different metals depends on the position of both metals in Electrochemical Series

Nilai voltan bagi sel kimia ringkas yang dibina menggunakan dua logam yang berbeza bergantung kepada kedudukan kedua-dua logam itu dalam Siri Elektrokimia

Referring to the statement above, plan a laboratory experiment to compare the voltage of two simple chemical cell

Merujuk kepada pernyataan di atas ,rancang satu eksperimen untuk membezakan nilai voltan bagi dua sel kimia ringkas

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of the hypothesis
Pernyataan hipotesis
- (d) List of substances and apparatus
Senarai bahan dan radas
- (e) Procedure of the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

SKEMA KERTAS 2 : ELECTROCHEMISTRY / ELEKTROKIMIA

Section A

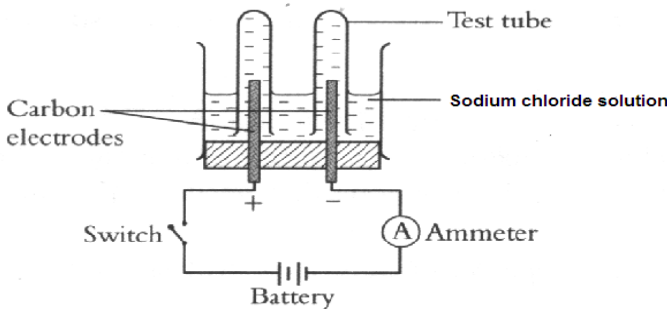
Bahagian A

Questions			Rubrics	Marks
1	(a)		Draw an arrow from zinc to copper / <i>ada anak panah dari zink ke kuprum pada rajah.</i>	1
	(b)		Zinc / <i>zink // Zn</i>	1
	(c)		Chemical energy to electrical energy / <i>tenaga kimia kepada tenaga elektrik</i>	1
	(d)		Copper (II) ion / <i>ion kuprum(II)</i>	1
	(e)	(i)	copper is deposited on the cathode / <i>kuprum terenalap di katod</i>	1
		(ii)	$\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$	1
	(f)	(i)	The voltmeter reading increases.// accept any suitable figure <i>Bacaan voltmeter meningkat // terima nilai yang sesuai</i>	1
		(ii)	In electrochemical series, magnesium is located higher than zinc. The distance between magnesium and copper is further compare to the distance between zinc and copper, so the voltage increases / <i>Kedudukan magnesium dalam siri elektrokimia adalah lebih tinggi daripada zink</i> <i>Jarak antara magnesium dan kuprum adalah lebih jauh berbanding zink dan kuprum, oleh itu bacaan voltmeter meningkat.</i>	1 1
	(g)		$\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$ - Correct formulae of reactants and products <i>-Formula kimia betul bagi bahan tindak balas dan produk</i>	1
TOTAL MARKS				10

Questions			Rubrics	Marks
2	(a)	(i)	Chemical to Electrical / <i>tenaga kimia kepada tenaga elektrik</i>	1
		(ii)	Magnesium / Mg Magnesium / Mg is more electropositive // higher position in Electrochemical Series // higher tendency to release electron / <i>Mg lebih elektropositif // kedudukan yang lebih tinggi dalam siri elektrokimia // lebih cenderung melepaskan elektron</i>	1 1
		(iii)	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	1
		(iv)	Brown solid deposited // copper electrode becomes thicker / <i>enapan perang terbentuk // elektrod kuprum menjadi tebal</i>	1
	(b)	(i)	$\text{Na}^+, \text{Cl}^-, \text{H}^+, \text{OH}^-$	1
		(ii)	Chlorine / <i>klorin</i>	1
TOTAL MARKS				7

Questions			Rubrics	Marks
3	(a)	(i)	Set 1 : No displacement / <i>tiada penyesaran</i> Set 2 : Displacement occur / <i>berlaku penyesaran</i>	1 1
		(ii)	Colorless silver nitrate solution turn to blue // Grey solid deposited // Copper rode become thinner / <i>Larutan tidak berwarna argentum nitrat menjadi biru // pepejal kelabu terbentuk // rod kuprum semakin menipis.</i>	1
		(iii)	$\text{Cu (s)} + \text{Ag}^+ (\text{aq}) \rightarrow \text{Cu}^{2+} (\text{aq}) + \text{Ag (s)}$	1 1
	(b)		Silver, copper, lead // Ag, Cu, Pb / <i>Argentum, kuprum, plumbum</i>	1
	(c)		Occur / <i>berlaku</i>	1

		Zinc more electropositive than lead in ES // higher position than lead in ES // tendency to release electron / <i>zink lebih elektropositif daripada plumbum dalam SE // kedudukan zink yang lebih tinggi daripada plumbum // cenderung melepaskan elektron</i>	1
	(d)	To determine the positive or negative terminals in voltaic cell / <i>untuk menentukan terminal dalam sel kimia</i> To determine the displacement process / <i>untuk menentukan tindakbalas penyesaran</i>	1 1
TOTAL MARKS			10

Questions		Rubrics	Marks
4	(a)	 Functional / <i>radas berfungsi</i> Label diagram / <i>raja berlabel</i>	1 1
	(b)	Anode: chlorine gas / gas klorin Cathode: hydrogen gas / gas hidrogen	1 1
	(c)	Anode: $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ Cathode: $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	2
	(d)	Put a moist blue litmus paper into the test tube containing the gas, the blue litmus paper turns red then to decolourise <i>Letakkan kertas litmus biru lembap pada tabung uji yang mengandungi gas, warna biru bertukar menjadi merah dan kemudian luntur</i>	2
	(e)	Not cheap and highly volatile/ <i>mahal dan sangat beracun</i>	1
TOTAL MARKS			9
Questions		Rubrics	Marks

5	(a)	(i)	OH^-	1
		(ii)	position of ions in the electrochemical series/ <i>kedudukan ion dalam siri elektrokimia</i>	1
		(iii)	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}$	1
		(iv)	Place a glowing wooden splinter into a test tube containing the gas, it rekindles Oxygen gas <i>Letakkan kayu uji berbara pada mulut tabung uji, ia menyala. Gas oksigen</i>	1 1
		(v)	Colour intensity decreases Concentration of copper(II) ions decreases / <i>Keamatan warna biru berkurangan Kepekatan ion kuprum menurun.</i>	1 1
	(b)	(i)	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$	1
		(ii)	Blue intensity remains unchanged The rate of formation of Cu^{2+} at the anode is the same as the rate of discharge of Cu^{2+} at the cathode / <i>Warna biru kekal Kadar pembentukan ion kuprum di anod adalah sama dengan kadar nyahcas ion kuprum di katod</i>	1 1
TOTAL MARKS				10

Section B
Bahagian B

Questions			Rubrics	Marks																					
6	(a)		Hydrogen gas / <i>gas hidrogen</i> $2\text{H}^{+} + 2\text{e} \rightarrow \text{H}_2$	1 1																					
	(b)																								
			<table><tr><td>Cell/ sel</td><td>Y</td><td>X</td></tr><tr><td>Name of the cell/ <i>nama sel</i></td><td>Chemical cell/ <i>sel kimia</i></td><td>Electrolytic cell/ <i>sel elektrolisis</i></td></tr><tr><td>Energy change/ <i>perubahan tenaga</i></td><td>Chemical energy to electrical energy/ <i>Tenaga kimia kepada tenaga elektrik</i></td><td>Electrical energy to chemical energy/ <i>Tenaga elektrik kepada tenaga kimia</i></td></tr><tr><td>Electrodes/ elektrod</td><td>Negative terminal : Zinc Positive terminal: Copper</td><td>Anode: Copper Cathode: Copper</td></tr><tr><td>Ion in Solutions/ <i>Ion dalam larutan</i></td><td>Cu^{2+}, SO_4^{2-}, H^{+}, OH^{-}</td><td>Cu^{2+}, SO_4^{2-}, H^{+}, OH^{-}</td></tr><tr><td>Half equations/ <i>Setengah persamaan</i></td><td>Negative terminal: $\text{Zn} \rightarrow$ $\text{Zn}^{2+} + 2\text{e}$ Positive terminal: $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$</td><td>Anode: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$ Cathode: $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$</td></tr><tr><td>Observation/ <i>pemerhatian</i></td><td>Negative terminal:</td><td>Anode: The electrode</td></tr></table>	Cell/ sel	Y	X	Name of the cell/ <i>nama sel</i>	Chemical cell/ <i>sel kimia</i>	Electrolytic cell/ <i>sel elektrolisis</i>	Energy change/ <i>perubahan tenaga</i>	Chemical energy to electrical energy/ <i>Tenaga kimia kepada tenaga elektrik</i>	Electrical energy to chemical energy/ <i>Tenaga elektrik kepada tenaga kimia</i>	Electrodes/ elektrod	Negative terminal : Zinc Positive terminal: Copper	Anode: Copper Cathode: Copper	Ion in Solutions/ <i>Ion dalam larutan</i>	Cu^{2+} , SO_4^{2-} , H^{+} , OH^{-}	Cu^{2+} , SO_4^{2-} , H^{+} , OH^{-}	Half equations/ <i>Setengah persamaan</i>	Negative terminal: $\text{Zn} \rightarrow$ $\text{Zn}^{2+} + 2\text{e}$ Positive terminal: $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$	Anode: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$ Cathode: $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$	Observation/ <i>pemerhatian</i>	Negative terminal:	Anode: The electrode	1+1 1+1 1+1 1+1 1+1
	Cell/ sel	Y	X																						
	Name of the cell/ <i>nama sel</i>	Chemical cell/ <i>sel kimia</i>	Electrolytic cell/ <i>sel elektrolisis</i>																						
	Energy change/ <i>perubahan tenaga</i>	Chemical energy to electrical energy/ <i>Tenaga kimia kepada tenaga elektrik</i>	Electrical energy to chemical energy/ <i>Tenaga elektrik kepada tenaga kimia</i>																						
	Electrodes/ elektrod	Negative terminal : Zinc Positive terminal: Copper	Anode: Copper Cathode: Copper																						
	Ion in Solutions/ <i>Ion dalam larutan</i>	Cu^{2+} , SO_4^{2-} , H^{+} , OH^{-}	Cu^{2+} , SO_4^{2-} , H^{+} , OH^{-}																						
	Half equations/ <i>Setengah persamaan</i>	Negative terminal: $\text{Zn} \rightarrow$ $\text{Zn}^{2+} + 2\text{e}$ Positive terminal: $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$	Anode: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$ Cathode: $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$																						
	Observation/ <i>pemerhatian</i>	Negative terminal:	Anode: The electrode																						

		<table><tr><td>Zinc electrode become thinner / <i>elektrod zink menjadi semakin nipis</i></td><td>becomes thinner / <i>elektrod menipis</i></td></tr><tr><td>Positive terminal: Copper electrode becomes thicker/ <i>elektrod kuprum menebal</i></td><td>Cathode: The electrode becomes thicker / <i>elektrod menebal</i></td></tr></table>	Zinc electrode become thinner / <i>elektrod zink menjadi semakin nipis</i>	becomes thinner / <i>elektrod menipis</i>	Positive terminal: Copper electrode becomes thicker/ <i>elektrod kuprum menebal</i>	Cathode: The electrode becomes thicker / <i>elektrod menebal</i>	1+1 Max 8					
Zinc electrode become thinner / <i>elektrod zink menjadi semakin nipis</i>	becomes thinner / <i>elektrod menipis</i>											
Positive terminal: Copper electrode becomes thicker/ <i>elektrod kuprum menebal</i>	Cathode: The electrode becomes thicker / <i>elektrod menebal</i>											
(c)	(i)	<table><tr><th>Electrodes</th><th>Anode</th><th>Cathode</th></tr><tr><td>Product/ <i>hasil</i></td><td>Oxygen gas/ <i>gas oksigen</i></td><td>Hydrogen gas / <i>gas hidrogen</i></td></tr><tr><td>Half-equation / <i>setengah persamaan</i></td><td>$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$</td><td>$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$</td></tr></table>	Electrodes	Anode	Cathode	Product/ <i>hasil</i>	Oxygen gas/ <i>gas oksigen</i>	Hydrogen gas / <i>gas hidrogen</i>	Half-equation / <i>setengah persamaan</i>	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	1+1 1+1
Electrodes	Anode	Cathode										
Product/ <i>hasil</i>	Oxygen gas/ <i>gas oksigen</i>	Hydrogen gas / <i>gas hidrogen</i>										
Half-equation / <i>setengah persamaan</i>	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$										
	(ii)	Concentration of hydrochloric acid increases Cl ⁻ and OH ⁻ ions attracted to the anode OH ⁻ ions selectively discharged because lower position in the electrochemical series H ⁺ ions attracted to the anode H ⁺ ions are discharged – one type of ions only Therefore only left with H ⁺ and Cl ⁻ ions <i>Kepekatan asid hidroklorik meningkat</i> <i>Ion klorida dan hidroksida tertarik ke anod</i> <i>Ion hidroksida dinyahcas di anod kerana kedudukan yang rendah dalam siri elektrokimia</i>	1 1 1 1 1 1									

		<i>Ion hidrogen tertarik ke katod</i> <i>Ion hidrogen dinyahcas – terdapat satu ion sahaja</i> <i>Oleh itu, yang tinggal hanya ion hidrogen dan ion ion klorida.</i>	max =4
	(iii)	Anode: Position of ions in the electrochemical series Cathode: Position of ions in the electrochemical series <i>Anod : kedudukan ion dalam siri elektrokimia</i> <i>Katod : kedudukan ion dalam siri elektrokimia</i>	1 1
TOTAL MARKS			20

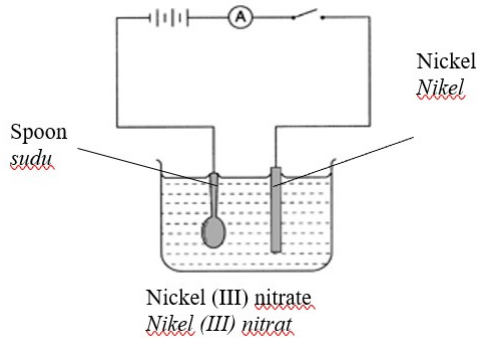
Questions			Rubrics	Marks											
7	(a)		Electrode P : Concentration of electrolyte	1											
			Electrode Q : Position of the ions in the electrochemical series	1											
			<i>Elektrod P : kepekatan elektrolit</i>												
			<i>Elektrod Q : kedudukan ion dalam siri elektrokimia</i>												
	(b)		<table><tr><td></td><td>Electrode P</td><td>Electrode Q</td></tr><tr><td>Ions attracted to/ <i>Ion yang tertarik</i></td><td>Cl⁻ , OH⁻</td><td>Na⁺ , H⁺</td></tr><tr><td>Names the ions selectively Discharged/ <i>ion yang dinyahcas</i></td><td>Cl⁻</td><td>H⁺</td></tr><tr><td>Reason why the ions are selectively</td><td>Concentration of Cl⁻ is higher than</td><td>H⁺ ion is placed lower than Na⁺ in the</td></tr></table>		Electrode P	Electrode Q	Ions attracted to/ <i>Ion yang tertarik</i>	Cl ⁻ , OH ⁻	Na ⁺ , H ⁺	Names the ions selectively Discharged/ <i>ion yang dinyahcas</i>	Cl ⁻	H ⁺	Reason why the ions are selectively	Concentration of Cl ⁻ is higher than	H ⁺ ion is placed lower than Na ⁺ in the
	Electrode P	Electrode Q													
Ions attracted to/ <i>Ion yang tertarik</i>	Cl ⁻ , OH ⁻	Na ⁺ , H ⁺													
Names the ions selectively Discharged/ <i>ion yang dinyahcas</i>	Cl ⁻	H ⁺													
Reason why the ions are selectively	Concentration of Cl ⁻ is higher than	H ⁺ ion is placed lower than Na ⁺ in the													

			discharged/ <i>penerangan</i> <i>pemilihan ion</i>	OH ⁻ / <i>Kepekatan ion</i> <i>Cl⁻ lebih</i> <i>tinggi</i> <i>daripada ion</i> <i>H⁺</i>	electrochemic al Series/ <i>Kedudukan ion</i> <i>H⁺ lebih rendah</i> <i>daripada ion ion</i> <i>Na⁺ dalam siri</i> <i>elektrokimia</i>	1+1
			Observation/ <i>pemerhatian</i>	Greenish yellow gas is released/ <i>gas</i> <i>kuning</i> <i>kehijauan</i> <i>dibebaskan</i>	Colourless gas is released/ <i>gelembung</i> <i>gas tidak</i> <i>berwarna</i> <i>dibebaskan.</i>	
(c)						1
				Cell X	Cell Y	
			Type of cell/ <i>Jenis sel</i>	Electrolytic cell/ <i>Sel elektrolisis</i>	Voltaic cell/ <i>sel kimia</i>	
			The energy change/ <i>Perubahan</i> <i>tenaga</i>	Electrical energy to chemical energy/ <i>Tenaga elektrik</i> <i>kepada tenaga</i> <i>kimia</i>	Chemical energy to electrical energy/ <i>Tenaga kimia</i> <i>kepada tenaga</i> <i>elektrik</i>	
			The terminal of the cell/ <i>Terminal sel</i>	Positive terminal / anode: Copper Negative terminal / cathode: copper	Positive terminal / cathode: copper Negative terminal / anode: aluminium	
			Ions present in the electrolyte/ <i>Ion dalam</i>	Cu ²⁺ , H ⁺ SO ₄ ²⁻ , OH ⁻		1

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			<i>yang berlaku pada elektrod atau terminal</i>		1
					max =10
TOTAL MARKS					20

Section C
Bahagian C

Questions		Rubrics	Marks
8.	(a)	 1.functional diagram : anode and cathode correct,solution shaded,whole spoon immersed 2.label : nickel,spoon,nickel(III) nitrate solution 1.gambarajah berfungsi : anod dan katod betul,larutan dilorek,sudu direndam sepenuhnya 2.label : Nikel,sudu ,larutan nikel(III) nitrat [a:any solution with nickel(II) /nickel(III) ion] 3.anode : $\text{Ni} \rightarrow \text{Ni}^{2+} + 2\text{e}^-$ // $\text{Ni} \rightarrow \text{Ni}^{3+} + 3\text{e}^-$ [refer solution] 4.cathode : $\text{Ni}^{2+} + 2\text{e}^- \rightarrow \text{Ni}$ // $\text{Ni}^{3+} + 3\text{e}^- \rightarrow \text{Ni}$ [rujuk larutan]	1 1 1 1 1
	(b)	Experiment I 1.product = oxygen Hasil =oksigen 2.hydroxide ion is discharged Ion hidroksida dinyahcaskan 3.hydroxide ion is lower than iodide ion in the electrochemical series	1 1 1

		<i>Ion hidroksida di bawah ion iodida dalam siri elektrokimia.</i> Experiment II 4. product = iodine <i>Hasil =iodin</i> 5.iodide ion is discharged <i>Ion iodida dinyahcaskan</i> 6.iodide ion is more concentrated <i>Ion iodide lebih pekat.</i>	1 1 1
(c)		1.Zn 2.Cu 3.CuSO₄ solution Procedure : 4. Zinc strip and copper strip are cleaned with sand paper <i>jalur zink dan jalur kuprum digosok dengan kertas pasir</i> 5.A beaker is filled with 0.1 mol dm⁻³ of copper(II) sulphate solution until half full <i>Sebuah bikar diisi dengan larutan kuprum(II) sulfat 0.1 mol dm⁻³ sehingga separuh bikar</i> 6.Zinc strip and copper strip are dipped into the solution <i>jalur zink dan kuprum dicelup ke dalam larutan</i> 7.both strips are connected to voltmeter via connecting wire <i>kedua-dua jalur disambungkan ke voltmeter melalui wayar penyambung</i> 8.Zinc release electron to form zinc ion <i>zink menderma elektron dan membentuk ion zink</i> 9. copper(II) ion receive electron to form copper <i>ion kuprum(II) menerima elektron dan membentuk kuprum</i> 10.when electron move from zinc to copper pointer of voltmeter deflect <i>apabila elektron bergerak dari zink ke kuprum jarum voltmeter terpesong</i>	1 1 1 1 1 1 1 1 1 1
TOTAL MARKS			20

Question 9		Rubric	MARKS
(a)	(i)	Anode: OH^- Cathode: H^+	1 1
	(ii)	Anode : $4\text{OH}^- \rightarrow \text{O}_2 + \text{H}_2\text{O} + 4\text{e}$ Cathode : $2\text{H}^+ + 2\text{e} \rightarrow \text{H}_2$	1 1
	(iii)	Insert a lighted wooden splinter at the mouth of the test tube, A pop sound is produced <i>masukkan kayu uji bernyala pada mulut tabung uji, bunyi pop terhasil</i>	1 1
(b)		In Set I : Iron spoon is placed at cathode Ag^+ is discharged and formed silver atom because the position Ag^+ is lower than H^+ in ECS// $\text{Ag}^+ + \text{e} \rightarrow \text{Ag}$ <i>sudu besi terletak di katod</i> <i>Ag^+ dinyahcas dan atom argentum terbentuk kerana</i> <i>kedudukan ion argentum lebih rendah dalam SE</i> <i>$\text{Ag}^+ + \text{e} \rightarrow \text{Ag}$</i> In Set II : Iron spoon is placed at anode No silver atom formed <i>sudu besi diletakkan di anod</i> <i>tiada pembentukan atom argentum.</i>	1 1 1 1
(c)	(i)	In Cell I OH^- is discharged at anode and formed oxygen gas // $4\text{OH}^- \rightarrow \text{O}_2 + \text{H}_2\text{O} + 4\text{e}$ because the position of OH^- is lower than NO_3^- in ECS The concentration of Cu^{2+} decreases// Cu^{2+} is discharged to form copper atom at cathode// $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$ In Cell II copper atom (anode) ionises to form Cu^{2+} // $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$ because the factor is type of electrodes The concentration of Cu^{2+} unchanged// concentration for Cu^{2+} formed at anode // $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$	1 1 1 1 1 1
	(ii)	In Cell III Magnesium is more electropositive than copper Magnesium atom ionises to form Mg^{2+} // $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}$	1 1

	The concentration of Cu^{2+} decreases// Cu^{2+} discharge to form copper atom at cathode// $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$ <i>Mg lebih elektropositif daripada kuprum atom magnesium mengion menjadi ion Mg. $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}$ kepekatan ion kuprum</i> In Cell IV Copper is more electropositive than silver Copper atom ionises to form Cu^{2+} // $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$ The concentration of Cu^{2+} increases// Copper ionises to form Cu^{2+} at cathode // $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$	1 1 1 1
	TOTAL MARKS	20

SKEMA KERTAS 3 : ELECTROCHEMISTRY / ELEKTROKIMIA

SOALAN STRUKTUR

SOALAN 1

QUESTION	Rubric	Score
(a)	Able to state all the voltmeter readings accurately with correct unit and one decimal point. <i>Dapat menyatakan semua bacaan voltmeter dengan tepat beserta unit dan satu titik perpuluhan</i> <u>Answer:</u> Set I : 0.7 V Set II : 1.6 V Set III : 2.4 V	3
(b)	Able to state all the three variables correctly <i>Dapat menyatakan semua ketiga-tiga pembolehubah dengan betul</i> <u>Sample answer:</u> Manipulated variable: Pair of metal // Negative terminal <i>Pasangan logam // Terminal negatif</i> Responding variable: Voltmeter reading// potential difference/Voltage <i>Bacaan voltmeter// Beza keupayaan // Voltan</i> Fixed variable : Metal X // Positive terminal// Sodium chloride solution// Type of electrolyte <i>Logam X // Terminal positif // Larutan natrium klorida // Jenis elektrolit</i>	3

(c)		Able to state the relationship between the manipulated variable and the responding variable with direction <i>Dapat menyatakan hubungan antara PU manipulasi dengan PU bergerak balas beserta arah</i> <u>Sample answer:</u> The further/nearer the distance between two metals in the electrochemical series, the higher/lower (the potential difference) / (the voltmeter reading) / voltage <i>Semakin jauh/dekat jarak antara dua logam dalam siri elektrokimia, semakin tinggi/rendah (beza keupayaan)/(bacaan voltmeter)/ voltan</i>	3
(d)		Able to arrange the four metals correctly <u>Sample answer:</u> Metal X, tin, zinc, magnesium // X, Sn, Zn, Mg <i>Logam X, stanum, zink, magnesium // X, Sn, Zn, Mg</i>	3
(e)		Able to give the operational definition for potential difference accurately with the following aspects: 1. what should be done and 2. what should be observed <u>Sample answer:</u> When two different metals are dipped into sodium chloride solution, (the needle of voltmeter deflects)/(voltmeter gives a reading) <i>Apabila dua logam berlainan dicelup ke dalam larutan natrium klorida, (jarum voltmeter terpesong)/(voltmeter menunjukkan bacaan)</i>	3
(f)	(i)	Able to state an observation at negative terminal correctly <u>Sample answer:</u> Zinc becomes thinner // Zinc dissolved // Size of zinc is smaller // Mass of zinc decreases <i>Zink menipis // Zink melarut // Saiz zink mengecil // Jisim zink Berkurang</i>	3

(f)	(ii)	Able to make inference correctly Zinc ionised // Zinc ion produced // Zinc undergoes oxidation // Zinc released electron <i>Zink mengion // Ion zink terhasil // Zink mengalami pengoksidaan // Zinc melepaskan elektron</i>	3
(f)	(iii)	Able to state the relationship between the number of gas bubbles released at metal X with time correctly <u>Sample answer:</u> The number of gas bubbles released at metal X decreases with time // The longer the time, the lesser the number of gas bubbles released at metal X <i>Bilangan gelembung gas terbebas pada logam X berkurang dengan masa //</i> <i>Semakin bertambah masa, semakin berkurang bilangan gelembung gas terbebas pada logam X</i>	3
(g)		Able to predict the voltage value and positive terminal correctly <u>Sample answer:</u> Voltage : [0.0 V < Voltage value < 0.7 V] with unit <i>Voltan [0.0 V < Nilai voltan < 0.7 V] dengan unit</i> Positive terminal : Metal Q <i>Terminal positif : Logam Q</i>	3
(h)		Able to write half equations at negative and positive terminal correctly <u>Sample answer:</u> At negative terminal : $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}$ <i>Pada terminal negatif</i> At positive terminal : $2\text{H}^+ + 2\text{e} \rightarrow \text{H}_2$ <i>Pada terminal positif</i>	3

(i)		Able to classify all the ions correctly <u>Sample answer:</u> <table><tr><th>Cation <i>Kation</i></th><th>Anion <i>Anion</i></th></tr><tr><td>Sodium ion// Na⁺ <i>Ion natrium</i></td><td>Chloride ion// Cl⁻ <i>Ion klorida</i></td></tr><tr><td>Hydrogen ion // H⁺ <i>Ion hidrogen</i></td><td>Hydroxide ion // OH⁻ <i>Ion hidroksida</i></td></tr></table>	Cation <i>Kation</i>	Anion <i>Anion</i>	Sodium ion// Na ⁺ <i>Ion natrium</i>	Chloride ion// Cl ⁻ <i>Ion klorida</i>	Hydrogen ion // H ⁺ <i>Ion hidrogen</i>	Hydroxide ion // OH ⁻ <i>Ion hidroksida</i>	3
Cation <i>Kation</i>	Anion <i>Anion</i>								
Sodium ion// Na ⁺ <i>Ion natrium</i>	Chloride ion// Cl ⁻ <i>Ion klorida</i>								
Hydrogen ion // H ⁺ <i>Ion hidrogen</i>	Hydroxide ion // OH ⁻ <i>Ion hidroksida</i>								

SOALAN 2

QUESTION		Rubric	Score						
(a)		Able to state all observations correctly. <i>Dapat menyatakan pemerhatian dengan betul</i> <u>Sample answer:</u>	3						
		<table><tr><th>Experiment</th><th>Observation at anode</th></tr><tr><td>I</td><td>Bubbles of gas released//effervescence occurs <i>Gelembung gas tidak berwarna terbebas</i></td></tr><tr><td>II</td><td>Copper / anode becomes thinner/ dissolved/ smaller. <i>Kuprum/ anod menjadi nipis/ terlarut/ kecil</i></td></tr></table>		Experiment	Observation at anode	I	Bubbles of gas released//effervescence occurs <i>Gelembung gas tidak berwarna terbebas</i>	II	Copper / anode becomes thinner/ dissolved/ smaller. <i>Kuprum/ anod menjadi nipis/ terlarut/ kecil</i>
		Experiment		Observation at anode					
		I		Bubbles of gas released//effervescence occurs <i>Gelembung gas tidak berwarna terbebas</i>					
		II		Copper / anode becomes thinner/ dissolved/ smaller. <i>Kuprum/ anod menjadi nipis/ terlarut/ kecil</i>					

(b)	The correct half equation <i>Persamaan setengah yang betul</i> <table><tr><th>Experiment t <i>Eksperimen</i></th><th>Observation at anode <i>Pemerhatian di anod</i></th></tr><tr><td>I</td><td>$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}$</td></tr><tr><td>II</td><td>$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$</td></tr></table>	Experiment t <i>Eksperimen</i>	Observation at anode <i>Pemerhatian di anod</i>	I	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}$	II	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$	3
Experiment t <i>Eksperimen</i>	Observation at anode <i>Pemerhatian di anod</i>							
I	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}$							
II	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$							
(c)	Able to state 3 products correctly. <i>Dapat menyatakan 3 hasil dengan betul</i> <u>Sample answer:</u> <table><tr><th>Experiment <i>Eksperimen</i></th><th>Observation at anode <i>Pemerhatian di anod</i></th></tr><tr><td>I</td><td>Oxygen gas and water <i>Gas Oksigen dan air</i></td></tr><tr><td>II</td><td>Copper(II) ion <i>Ion kuprum(II)</i> *[mesti ada (II)]</td></tr></table>	Experiment <i>Eksperimen</i>	Observation at anode <i>Pemerhatian di anod</i>	I	Oxygen gas and water <i>Gas Oksigen dan air</i>	II	Copper(II) ion <i>Ion kuprum(II)</i> *[mesti ada (II)]	3
Experiment <i>Eksperimen</i>	Observation at anode <i>Pemerhatian di anod</i>							
I	Oxygen gas and water <i>Gas Oksigen dan air</i>							
II	Copper(II) ion <i>Ion kuprum(II)</i> *[mesti ada (II)]							
(d)	Able to state the inference correctly based on observation. <i>Dapat menyatakan inferens dengan betul berdasarkan pemerhatian</i> <u>Sample answer:</u> Copper (II) ion / Cu^{2+} produced // Copper ionises // Copper released electron // Copper is oxidised. <i>Ion kuprum(II)/ Cu²⁺ terhasil// kuprum terion// kuprum membebaskan elektron// kuprum teroksida.</i>	3						

(e)		Able to state the three variables correctly <i>Dapat menyatakan 3 pemboleh ubah dengan betul</i> <u>Sample answer:</u> Manipulated: Type of electrode/anode // copper and carbon <i>Manipulasi: Jenis elektrod/ anod// kuprum dan karbon</i> Responding: Product at the anode // Product of electrolysis <i>Bergerak balas: hasil di anod// Hasil elektrolisis</i> Constant: Copper(II) sulphate//CuSO₄// Electrolyte// Concentration of electrolyte <i>Dimalarkan: Kuprum(II) sulfat// Elektrolit// kepekatan elektrolit</i> r: Volume // tolak : Isi padu	3
(f)		Able to state the hypothesis accurately <i>Boleh menyatakan hipotesis dengan betul</i> <u>Sample answer:</u> When copper electrodes are used, copper anode becomes thinner. when carbon electrodes are used, colourless gas is released. <i>Apabila elektrod kuprum digunakan sebagai anod, elektrod kuprum akan menipis manakala elektrod karbon digunakan sebagai anod, gelembung gas tidak berwarna terbebas.</i>	3
(g)		Able to give the OD accurately <i>Menyatakan definisi secara operasi dengan betul</i> <u>Sample answer:</u> When used 2 different electrode/ copper/ carbon Different products/ copper electrode became thinner/ Colourless	3

		bubbles gas released <i>Apabila menggunakan 2 elektrod yang berbeza/ kuprum/ karbon</i> <i>Hasil yang berbeza/ elektrod kuprum menipis/ gelembung gas</i> <i>tidak berwarna terbebas</i>									
(h)		Able to predict the product produce correctly <i>Boleh meramal hasil dengan betul</i> <u>Sample answer:</u> chlorine gas // <i>Gas Klorin</i>	3								
(i)		Able to classify correctly <i>Boleh mengelas dengan betul</i> <u>Sample answer:</u> <table><tr><td>Electrolyte/ <i>Elektrolit</i></td><td>non- electrolyte /<i>Bukan elektrolit</i></td></tr><tr><td>Molten lead(II) chloride <i>Leburan Plumbum(II) klorida</i></td><td>Benzene <i>Benzena</i></td></tr><tr><td>Potassium carbonate solution <i>Larutan kalium karbonat</i></td><td>Glucose solution <i>Larutan glukosa</i></td></tr><tr><td></td><td>Molten naphthalene <i>Leburan naftalena</i></td></tr></table>	Electrolyte/ <i>Elektrolit</i>	non- electrolyte / <i>Bukan elektrolit</i>	Molten lead(II) chloride <i>Leburan Plumbum(II) klorida</i>	Benzene <i>Benzena</i>	Potassium carbonate solution <i>Larutan kalium karbonat</i>	Glucose solution <i>Larutan glukosa</i>		Molten naphthalene <i>Leburan naftalena</i>	3
Electrolyte/ <i>Elektrolit</i>	non- electrolyte / <i>Bukan elektrolit</i>										
Molten lead(II) chloride <i>Leburan Plumbum(II) klorida</i>	Benzene <i>Benzena</i>										
Potassium carbonate solution <i>Larutan kalium karbonat</i>	Glucose solution <i>Larutan glukosa</i>										
	Molten naphthalene <i>Leburan naftalena</i>										
(j)	(i)	Able to drawing and labelling correctly <i>Boleh melukis dan melabel dengan betul</i> <u>Sample answer:</u>									

		silver metal logam argentum iron key / kunci besi silver nitrate solution larutan argentum nitrat	
(j)	(ii)	Able to state the changing correctly <i>Boleh menyatakan perubahan dengan betul</i> <u>Sample answer:</u> Iron key coated with grey metal <i>Kunci besi disadur dengan logam kelabu</i>	

Soalan 3

Question		Rubric	Score
(a)		Able to state all the voltmeter readings accurately with correct unit and 1 decimal place <i>Dapat menyatakan semua bacaan voltmeter dengan tepat beserta unit dan 1 tempat perpuluhan</i> Sample answer: L and Cu : 1.2 V M and Cu : 1.8 V N and Cu : 0.4 V Q and Cu : 1.4 V R and Cu : 2.6 V	3
(b)		Able to construct a table to record the voltmeter reading for each pair of metals that contain: <i>Dapat membina jadual untuk merekod bacaan voltmeter bagi setiap pasangan logam yang mengandungi:</i> 1. Correct titles with unit/<i>Tajuk yang betul dengan unit</i> 2. Readings/<i>Bacaan</i>	3

		<table><tr><td>Pair of metals <i>Pasangan logam</i></td><td>Voltage, V Voltan, V</td></tr><tr><td>L and Cu</td><td>1.2</td></tr><tr><td>M and Cu</td><td>1.8</td></tr><tr><td>N and Cu</td><td>0.4</td></tr><tr><td>Q and Cu</td><td>1.4</td></tr><tr><td>R and Cu</td><td>2.6</td></tr></table>	Pair of metals <i>Pasangan logam</i>	Voltage, V Voltan, V	L and Cu	1.2	M and Cu	1.8	N and Cu	0.4	Q and Cu	1.4	R and Cu	2.6	
Pair of metals <i>Pasangan logam</i>	Voltage, V Voltan, V														
L and Cu	1.2														
M and Cu	1.8														
N and Cu	0.4														
Q and Cu	1.4														
R and Cu	2.6														
(c)		Able to state all the three variables correctly Dapat menyatakan semua tiga pemboleh ubah dengan betul <u>Sample answer:</u> Manipulated variable: Pairs of metals // L, M, N, Q, R and Cu <i>Pemboleh ubah Dimanipulasi : Pasangan logam // L, M, N, Q, R dan Cu</i> Responding variable: Voltmeter / voltage reading//potential difference <i>Pembolehubah bergerak balas : Bacaan voltmeter / bacaan voltan // beza keupayaan</i> Constant variable: copper electrode, copper(II) sulphate Solution//concentration of copper(II) sulphate <i>Pemboleh ubah dimalarkan : Elektrod kuprum, larutan kuprum(II) sulfat // kepekatan larutan kuprum(II) sulfat</i>	3												

(d)	Able to state the relationship between the manipulated Variable and the responding variable with direction. <i>Dapat menyatakan hubungan antara PU manipulasi dan PU bergerak balas dengan arah</i> Sample answer: The further/nearer/closer the distance of the pair of metals/ two metals in the electrochemical series, the voltage/voltmeter reading becomes greater/smaller <i>Semakin jauh/dekat jarak antara pasangan logam dalam Siri Elektrokimia, semakin besar/kecil bacaan voltmeter</i>	3								
(e)	Able to arrange all the metals accurately in ascending order <i>Dapat menyusun semua logam dengan tepat mengikut susunan menaik</i> <u>Sample answer:</u> Cu, N, L, Q, M, R	3								
(f)	Able to predict the voltage of the cells accurately in 1 decimal place <i>Dapat meramal voltan dengan tepat dalam 1 tempat perpuluhan</i> Sample answer: <table><tr><td>Pairs of metals <i>Pasangan logam</i></td><td>Voltage <i>Voltan</i></td></tr><tr><td>M and R</td><td>0.8</td></tr><tr><td>M and L</td><td>0.6</td></tr><tr><td>N and Q</td><td>1.0</td></tr></table>	Pairs of metals <i>Pasangan logam</i>	Voltage <i>Voltan</i>	M and R	0.8	M and L	0.6	N and Q	1.0	3
Pairs of metals <i>Pasangan logam</i>	Voltage <i>Voltan</i>									
M and R	0.8									
M and L	0.6									
N and Q	1.0									
(g)	Able to classify all the substance correctly <i>Dapat mengelas semua bahan dengan betul</i> Sample answer: <table><tr><td>Electrolyte <i>Elektrolit</i></td><td>Non-electrolyte <i>Bukan elektrolit</i></td></tr><tr><td>Sodium chloride</td><td>Tetrachloromethane</td></tr></table>	Electrolyte <i>Elektrolit</i>	Non-electrolyte <i>Bukan elektrolit</i>	Sodium chloride	Tetrachloromethane	3				
Electrolyte <i>Elektrolit</i>	Non-electrolyte <i>Bukan elektrolit</i>									
Sodium chloride	Tetrachloromethane									

		<i>Natrium klorida</i>	<i>Tetraklorometana</i>	
		Silver nitrate <i>Argentum nitrat</i>	Chloroform Klorofom	
		Hydrochloric acid <i>Asid hidroklorik</i>	Glucose <i>Glukosa</i>	

KERTAS 3 MERANCANG EKSPERIMEN

1	(a)	Able to state the problem statement correctly <i>Dapat menyatakan pernyataan masalah dengan betul.</i> Sampel jawapan: Does the concentration of 'named electrolyte' affect the product at anode? Adakah kepekatan 'elektrolit yang dinamakan' mempengaruhi hasil elektrolisis di anod?	3
	(b)	Able to state all the three variables correctly <i>Dapat menyatakan dua pemboleh ubah dengan betul</i> Sampel jawapan Manipulated variable : Concentration of electrolyte <i>Pemboleh ubah dimanipulasi: Kepekatan elektrolit</i> Responding variable : Product at anode <i>Pemboleh ubah bergerak balas: Hasil di anod</i> Constant variable : Type of electrode// <i>Pemboleh ubah dimalarkan : Jenis elektrod</i>	3
	(c)	Able to state the relationship between the manipulated variable and the responding variable with direction. <i>Dapat menyatakan hubungan di antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas dan mempunyai arah</i> Sampel jawapan: If concentrated sodium chloride solution is used, the product at anode is chlorine gas, while if diluted sodium chloride solution is used, the product at anode is oxygen gas <i>Jika larutan natrium klorida pekat digunakan hasil di anod ialah gas klorin manakala jika larutan natrium klorida cair digunakan hasil di anod ialah gas oksigen.</i>	3
	(d)	Able to list all materials and apparatus <i>Dapat menyenaraikan bahan dan radas dengan lengkap</i> Sampel jawapan:	3

		Materials: Sodium chloride solution 0.001mol dm^{-3} , Sodium chloride solution 1.0 mol dm^{-3} <i>Bahan: Larutan natrium klorida 0.001mol dm^{-3} , larutan natrium klorida 1.0 mol dm^{-3}</i> Apparatus: Carbon electrode, Electrolytic cell, connecting wire with crocodile clip, dry cell, test tube <i>Radas: Elektrod karbon, sel elektrolisis, elektrod karbon, wayar penyambung dan klip buaya, sel kering, tabung uji</i>	
	(e)	Able to list all steps of procedure correctly <i>Dapat menyenaraikan semua langkah dengan betul</i> Prosedur/kaedah 1. Pour sodium chloride solution 0.001 mol dm^{-3} half full into an electrolysis cell until half full <i>Masukkan larutan natrium klorida 0.001 mol dm^{-3} ke dalam sel elektrolisis sehingga separuh penuh.</i> 2. Put sodium chloride solution 0.001 mol dm^{-3} into 2 small test tube until full <i>Masukkan larutan natrium klorida 0.001 mol dm^{-3} ke dalam 2 tabung uji kecil sehingga penuh.</i> 3. Inverted the test tube contain the solution to both electrodes <i>Telangkupkan tabung uji yang berisi larutan kepada kedua-dua elektrod</i> 4. Connect both electrodes to dry cell and connecting wire with crocodile clip <i>Sambungkan kedua-dua elektrod kepada sel kering dengan wayar penyambung dan klip buaya.</i> 5. Pemerhatian direkodkan. <i>Rekod the observation</i>	3

		6. Steps 1 to 4 are repeated using sodium chloride solution 1.0 moldm^{-3} <i>Langkah 1 hingga 4 diulang dengan menggunakan larutan natrium klorida 1.0 moldm^{-3}.</i>							
	(f)	Able to construct table with this aspect <i>Dapat membina jadual dengan aspek berikut</i> <table><tr><th>Concentration of electrolyte <i>Kepekatan elektrolit</i> (moldm^{-3})</th><th>Observation at anode <i>Pemerhatian di anod</i></th></tr><tr><td>0.001</td><td></td></tr><tr><td>1.0</td><td></td></tr></table>	Concentration of electrolyte <i>Kepekatan elektrolit</i> (moldm^{-3})	Observation at anode <i>Pemerhatian di anod</i>	0.001		1.0		2'
Concentration of electrolyte <i>Kepekatan elektrolit</i> (moldm^{-3})	Observation at anode <i>Pemerhatian di anod</i>								
0.001									
1.0									

SOALAN 2

2	(a)	Able to state the problem statement correctly <i>Dapat menyatakan pernyataan masalah dengan betul.</i> Sampel jawapan: Does the type of electrode affect the product at anode in electrolysis of 'named electrolyte'? Adakah jenis elektrod mempengaruhi hasil elektrolisis di anod bagi elektrolisis 'elektrolit yang dinamakan' ?	3
	(b)	Able to state all the three variables correctly <i>Dapat menyatakan dua pemboleh ubah dengan betul</i> Sampel jawapan Manipulated variable : Type of electrode <i>Pemboleh ubah dimanipulasi: Jenis elektrod</i> Responding variable : Product at anode <i>Pemboleh ubah bergerak balas: Hasil di anod</i> Constant variable : Concentration of electrolyte <i>Pemboleh ubah dimalarkan : Kepekatan larutan</i>	

	(c)	Able to state the relationship between the manipulated variable and the responding variable with direction. <i>Dapat menyatakan hubungan di antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas dan mempunyai arah</i> Sampel jawapan: If copper electrode is used, the product at anode is copper(II) ion, while if carbon electrode is used, the product at anode is oxygen gas <i>Jika elektrod kuprum digunakan hasil di anod ialah ion kuprum(II) manakala jika elektrod karbon digunakan hasil di anod ialah gas oksigen.</i>	
	(d)	Able to list all materials and apparatus comp[lately <i>[Dapat menyenaraikan bahan dan radas dengan lengkap]</i> Sampel jawapan: Bahan: Larutan kuprum(II) klorida $0.001 \text{ mol dm}^{-3}$ Radas Elektrod karbon, elektrod kuprum, bikar, wayar penyambung dan klip buaya, sel kering, tabung uji	
	(e)	Able to list all steps of procedure correctly <i>Dapat menyenaraikan semua langkah dengan betul</i> Prosedur/kaedah 1. Pour copper(II) chloride solution 0.001 moldm^{-3} half full into a beaker <i>Masukkan larutan natrium klorida 0.001 moldm^{-3} ke dalam bikar sehingga separuh penuh.</i> 2. Put copper(II) chloride solution 0.001 moldm^{-3} into 2 small test tube until full <i>Masukkan larutan natrium klorida 0.001 moldm^{-3} ke dalam 2 tabung uji kecil sehingga penuh.</i>	

		3. Inverted the test tube contain the solution to both electrodes <i>Telangkupkan tabung uji yang berisi larutan kepada kedua-dua elektrod</i> 4. Connect both electrodes to dry cell and connecting wire with crocodile clip <i>Sambungkan kedua-dua elektrod kepada sel kering dengan wayar penyambung dan klip buaya.</i> 5. Pemerhatian direkodkan. <i>Rekod the observation</i> 6. Steps 1 to 4 are repeated using copper electrode <i>Langkah 1 hingga 4 diulang dengan menggunakan elektrod kuprum</i>							
(f)		Able to construct table with this aspect <i>Dapat membina jadual dengan aspek berikut</i> <table><tr><th>Type of electrode <i>Jenis elektrod</i></th><th>Observation at anode <i>Pemerhatian di anod</i></th></tr><tr><td>Carbon Karbon</td><td></td></tr><tr><td>Copper Kuprum</td><td></td></tr></table>	Type of electrode <i>Jenis elektrod</i>	Observation at anode <i>Pemerhatian di anod</i>	Carbon Karbon		Copper Kuprum		
Type of electrode <i>Jenis elektrod</i>	Observation at anode <i>Pemerhatian di anod</i>								
Carbon Karbon									
Copper Kuprum									

SOALAN 3

3	(a)	Able to state the problem statement correctly <i>Dapat menyatakan pernyataan masalah dengan betul.</i> Sampel jawapan: <u>Sample answer</u> How does the distance between two metals in Electrochemical Series affect the voltage?	3
	(b)	Able to state all the three variables correctly <i>Dapat menyatakan dua pemboleh ubah dengan betul</i> Sampel jawapan <u>Manipulated variable</u> Distance of metals in ECS <u>Responding variable</u> Voltage / Potential difference <u>Constant variable</u> Type of electrolyte / metals as positive/negative electrode	3
	(c)	Able to state the relationship between the manipulated variable and the responding variable with direction. <i>Dapat menyatakan hubungan di antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas dan mempunyai arah</i> Sampel jawapan: <u>Sample answer:</u> The further apart the distance of two metals in ECS, the greater the voltage	3
	(d)	Able to list all materials and apparatus completely <i>Dapat menyenaraikan bahan dan radas dengan lengkap</i> Materials: Dilute sulphuric acid, copper strip, lead strip, iron strip, aluminium strip and sand paper <i>Bahan : Asid sulfurik cair, kepingan kuprum, kepingan plumbum, kepingan ferum, kepingan aluminium dan kertas pasir</i> Apparatus : Voltmeter, beaker and connecting wire with crocodile	3

		clip <i>Radas : Voltmeter, bikar dan wayar penyambung dengan klip buaya</i>											
	(e)	Able to list all steps of procedure correctly <i>Dapat menyenaraikan semua langkah dengan betul</i> 1. Pour 100 cm³ dilute sulphuric acid into a beaker Masukkan 100 cm³ asid sulfurik ke dalam bikar 2. Clean all metals strip using sand paper Bersihkan kesemua kepingan logam dengan kertas pasir 3. Dip aluminium strip and copper strip into dilute sulphuric acid Celupkan kepingan aluminium dan kepingan kuprum ke dalam asid sulfurik cair 4. Connect both metals to a voltmeter Sambungkan kedua-dua logam kepada voltmeter 5. Repeat the experiment by substituting aluminium strip with zinc strip, iron strip and lead strip Ulang eksperimen dengan menggantikan kepingan aluminium dengan kepingan zink, kepingan besi dan kepingan plumbum	3										
	(f)	Able to construct table with this aspect <i>Dapat membina jadual dengan aspek berikut</i> <table><tr><td>Pair of metals <i>Pasangan logam</i></td><td>Potential difference, V <i>Beza keupayaan, V</i></td></tr><tr><td>Aluminium and copper</td><td></td></tr><tr><td>Zinc and copper</td><td></td></tr><tr><td>Iron and copper</td><td></td></tr><tr><td>Lead and copper</td><td></td></tr></table>	Pair of metals <i>Pasangan logam</i>	Potential difference, V <i>Beza keupayaan, V</i>	Aluminium and copper		Zinc and copper		Iron and copper		Lead and copper		
Pair of metals <i>Pasangan logam</i>	Potential difference, V <i>Beza keupayaan, V</i>												
Aluminium and copper													
Zinc and copper													
Iron and copper													
Lead and copper													

Set 3

Acids and Bases
Asid dan Bes

Salts
Garam

TAJUK: ACID, BASES AND SALTS

Section A
Bahagian A

1. Table 1 shows the pH value of four solutions P, Q, R and U.
Jadual 1 menunjukkan nilai pH bagi larutan P, Q, R dan U.

Solution <i>Larutan</i>	P	Q	R	U
pH value <i>Nilai pH</i>	7	3	2	13

Table 1
Jadual 1

- (a) What is the meaning of pH value?
Apakah maksud nilai pH?

[1 mark]

- (b) (i) Which solution has the lowest concentration of hydrogen ions?
Larutan manakah mempunyai kepekatan ion hidrogen yang paling rendah?

[1 mark]

- (ii) Give a reason for your answer.
Berikan satu sebab bagi jawapan anda.

[1 mark]

- (c) Which solution represents mineral water?
Larutan manakah mewakili air mineral?

[1 mark]

- (d) Which solution is suitable as one of the reactants in making soap?
Larutan manakah sesuai sebagai bahan tindak balas dalam pembuatan sabun?

[1 mark]

- (e) Solution Q reacts with solution U.

- (i) Name the reaction between Q and U.
Namakan tindak balas antara Q dan U.

[1 mark]

- (ii) What will be produced from this reaction?
Apakah yang akan terhasil daripada tindak balas ini?

[1 mark]

- (f) A piece of marble chips is added into a test tube containing solution R.
Seketul batu marmar ditambah ke dalam sebuah tabung uji berisi larutan R.

- (i) Predict what will be observed in the test tube.
Ramalkan apa yang akan diperhatikan dalam tabung uji tersebut.

[1 mark]

- (ii) Give reasons for your answer.
Berikan sebab bagi jawapan anda.

[2 marks]

2. Table 2 shows the observation of experiment I and experiment II that have been carried out in the chemistry laboratory.

Jadual 2 menunjukkan pemerhatian untuk eksperimen I dan eksperimen II yang telah dijalankan dalam makmal kimia.

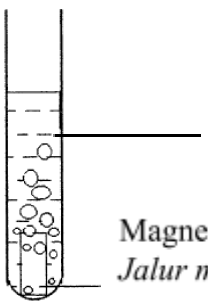
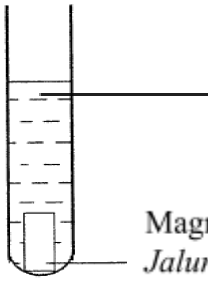
Experiment <i>Eksperimen</i>	Apparatus setup <i>Susunan radas</i>
I	 Hydrogen chloride in solvent A <i>Hidrogen klorida dalam pelarut A</i> Magnesium strip <i>Jalur magnesium</i>
II	 Hydrogen chloride in solvent B <i>Hidrogen klorida dalam pelarut B</i> Magnesium strip <i>Jalur magnesium</i>

Table 2
Jadual 2

- (a) Suggest a name for solvent A dan B.
Cadangkan nama bagi pelarut A dan B.

[2 marks]

- (b) State the type of particles in both experiments.
Nyatakan jenis zarah dalam kedua-dua experiment.

[2 marks]

- (c) Give reason for your answer.
Beri sebab bagi jawapan anda.

[3 marks]

- (d) State the observation when 1 cm^3 of 0.5 mol dm^{-3} silver nitrate solution is added into the test tube in experiment I.
Nyatakan pemerhatian apabila 1 cm^3 larutan argentum nitrat 0.5 mol dm^{-3} ditambah ke dalam tabung uji dalam eksperimen I.

[1 mark]

- (e) Write a chemical equation for the reaction in (d).
Tulis satu persamaan kimia bagi tindak balas di (d).

[2 marks]

3. Diagram 3 shows a flow chart with a series of chemical changes for solid P.
Rajah 3 menunjukkan carta alir tentang perubahan kimia bagi pepejal P.

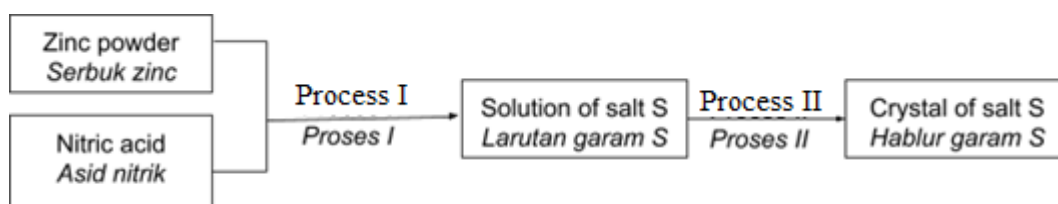


Diagram 3
Rajah 3

- (a) State the name of salt S.
Nyatakan nama garam S terbentuk.

[1 mark]

- (b) Write the equation for reaction in process I?
Tulis persamaan tindak balas dalam proses I?

[2 marks]

- (c) Suggest a suitable chemical substance to replace zinc.
Cadangkan satu bahan kimia yang sesuai untuk menggantikan zink.

[1 mark]

- (d) Describe how crystal of salt S can be obtained through process II.
Terangkan bagaimana hablur garam S boleh didapati melalui proses II.

[2 marks]

- (e) Calculate the mass of zinc that reacted when 50 cm^3 1 mol dm^{-3} nitric acid was used in this experiment.

Hitung jisim zink yang telah bertindak balas apabila 50 cm^3 1 mol dm^{-3} asid nitric digunakan dalam eksperimen ini.

[Relative atomic mass/ Jisim atom relatif: $\text{Zn}=65$]

[3 marks]

4. Table 4 shows the pH values of two different alkali.

Jadual 4 menunjukkan nilai pH bagi dua alkali yang berbeza.

Alkali <i>Alkali</i>	Concentration (mol dm^{-3}) <i>Kepekatan (mol dm^{-3})</i>	pH value <i>Nilai pH</i>
Ammonia solution <i>Larutan amonia</i>	0.1	11
Sodium hydroxide solution <i>Larutan natrium hidroksida</i>	0.1	13

Table 4
Jadual 4

- (a) What is the meaning of alkali?
Apakah yang dimaksudkan dengan alkali?

[1 mark]

- (b) Determine the strength of sodium hydroxide solution. Give your reasons.
Tentukan kekuatan larutan natrium hidroksida. Berikan alasan anda.

[3 marks]

- (c) What is the relationship between the pH value and the concentration of hydroxide ions?
Apakah hubungan di antara nilai pH dan kepekatan ion hidroksida?

[1 mark]

- (d) Compare the concentration of hydroxide ions in both solutions.
Bandingkan kepekatan ion hidroksida dalam kedua-dua larutan tersebut.

[1 mark]

- (e) An alkali reacts with an acid to form a solution with pH value of 7. Explain the concentration of hydrogen ions and hydroxide ions in the solution.
Suatu alkali bertindak balas dengan suatu asid untuk menghasilkan suatu larutan dengan nilai pH 7. Jelaskan kepekatan ion hidrogen dan ion hidroksida dalam larutan tersebut.

[2 marks]

- (f) Name **two** other substances used in daily life which have pH value greater than 7.
*Namakan **dua** bahan lain yang digunakan dalam kehidupan seharian yang mempunyai nilai pH lebih daripada 7.*

[2 marks]

5. A student added portions of an acid, HA to a conical flask containing 25.0 cm^3 of 0.10 mol dm^{-3} potassium hydroxide solution and a few drops of methyl orange. The acid is added until the end point is reached. Diagram 5 shows the results obtained from the experiment.

Seorang pelajar menambahkan asid, HA ke dalam sebuah kelalang kon yang mengandungi 25.0 cm^3 0.10 mol dm^{-3} larutan kalium hidroksida dan beberapa titis metil jingga. Asid ditambah sehingga takat akhir dicapai. Rajah 5 menunjukkan keputusan yang diperolehi daripada eksperimen.

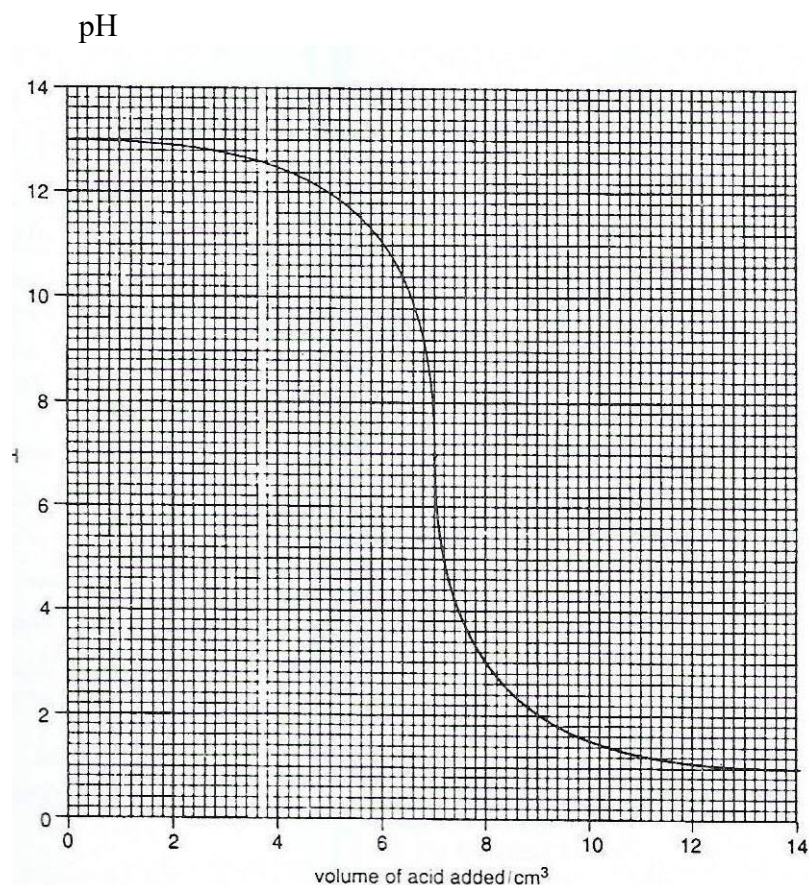


Diagram 5
Rajah 5

- (a) Name the type of reaction occurred in the conical flask.
Namakan jenis tindak balas yang berlaku di dalam kelalang kon.

[1 mark]

- (b) State the change in colour of the mixture at the end of the titration.
Nyatakan perubahan warna bagi campuran pada takat akhir pentitratan.

[1 mark]

- (c) Name a suitable apparatus used to measure 10.0 cm^3 of potassium hydroxide solution.
Namakan satu radas yang sesuai untuk menyukat 10.0 cm^3 larutan kalium hidroksida.

[1 mark]

- (d) Write a chemical equation for the above reaction.
Tuliskan satu persamaan kimia bagi tindak balas di atas.

[2 marks]

- (e) What volume of acid was needed to neutralise the alkali?
Berapakah isi padu asid yang diperlukan untuk meneutralkan alkali tersebut?

[1 mark]

- (f) Calculate the concentration of acid HA in mol dm^{-3} .
Kira kepekatan asid HA dalam mol dm^{-3} .

[3 marks]

- (g) Suggest a way, other than methyl orange, by which the student could follow the pH changes during the reaction.
Cadangkan satu cara, selain daripada metil jingga, yang mana pelajar tersebut boleh mengukur perubahan pH semasa tindak balas berlaku.

[1 mark]

Section B
Bahagian B

1. (a) Diagram 1 shows the flow chart of a series of chemical changes of substance P. Substance P is green before heating. Solid Q formed is black.
Rajah 2 menunjukkan carta alir siri perubahan kimia pepejal P. Bahan P berwarna hijau sebelum pemanasan. Pepejal Q berwarna hitam terbentuk.

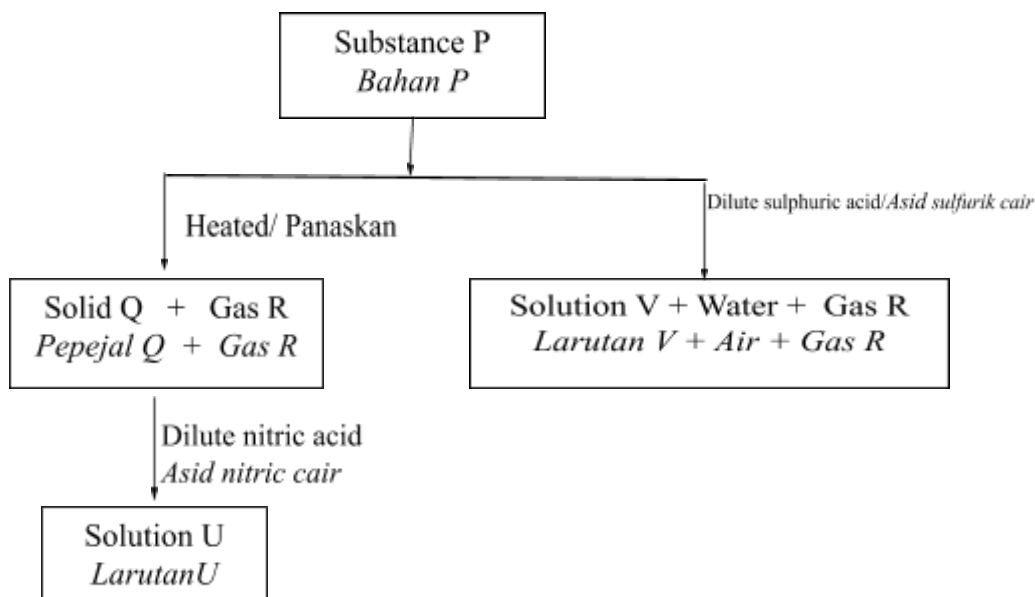


Diagram 1
Rajah 1

- (i) Name substance P, solid Q and gas R. Write a chemical reaction to show the formation of solid Q and gas R.
Namakan bahan P, pepejal Q dan gas R. Tulis persamaan kimia untuk menunjukkan pembentukan pepejal Q dan gas R.

[5 marks]

- (ii) Draw a labelled diagram of the set-up of apparatus for the chemical reaction of converting substance P to solid Q and gas R. In your diagram show how gas R is tested.
Lukis rajah susunan radas berlabel bagi tindak balas kimia penukaran bahan P kepada pepejal Q dan gas R. Tunjukkan bagaimana gas R diuji dalam rajah anda.

[4 marks]

- (b) Solution U and V are the products from reactions in Diagram 1.
Larutan U dan V adalah hasil tindak balas daripada tindak balas dalam Rajah 1.

- (i) Name the possible cation in both solutions.
Namakan kation yang mungkin bagi kedua-dua larutan.

[1 mark]

- (ii) Describe the confirmatory test for the cation mentioned in b(i)
Terangkan ujian pengesahan bagi kation yang dinyatakan dalam b(i).

Your description should include:

- Materials
- Procedure
- Observation

Penerangan anda hendaklah merangkumi:

- *Bahan*
- *Prosedur*
- *Pemerhatian*

[10 marks]

2. (a) Diagram 2 shows two beakers containing pure glacial ethanoic acid and 1 mol dm^{-3} of aqueous ethanoic acid respectively.
Rajah 2 menunjukkan dua bikar yang mengandungi asid etanoik glasial dan akueus asid etanoik 1 mol dm^{-3} .

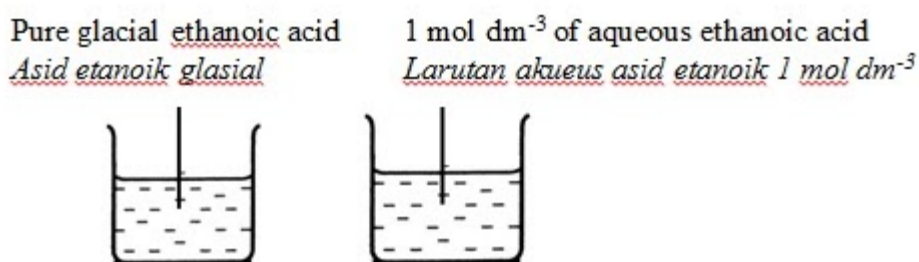


Diagram 2
Rajah 2

Describe a chemical test to differentiate between the two substances.
Terangkan satu ujian kimia untuk membezakan dua bahan tersebut.

[6 marks]

[6 marks]

- (b) In an experiment, 25 cm^3 of 0.2 mol dm^{-3} of sulphuric acid is required to neutralise 25 cm^3 of sodium hydroxide. Write the chemical equation and calculate the concentration of sodium hydroxide used in this experiment.

Dalam satu eksperimen, 25 cm^3 asid sulfurik 0.2 mol dm^{-3} diperlukan untuk meneutralkan 25 cm^3 larutan natrium hidroksida. Tulis persamaan kimia dan hitung kepekatan larutan natrium hidroksida yang digunakan dalam eksperimen ini.

[4 marks]

- (c) (i) Lead(II) carbonate decomposes when heated as shown in the following chemical equation.

Plumbum(II) karbonat terurai apabila dipanaskan seperti persamaan berikut.



Based on the above chemical equation,

- state two observations
- explain how you confirm the presence of gas A

Berdasarkan persamaan di atas,

- nyatakan dua pemerhatian
- terangkan bagaimana anda mengesahkan kehadiran gas A

[6 marks]

- (ii) Write a balanced chemical equation for the reaction in (c)(i). Then, calculate the mass of lead(II) oxide formed when 2.67g of lead(II) carbonate is completely heated.

Tulis satu persamaan kimia seimbang bagi tindak balas di (c)(i). Kemudian, hitung jisim lead(II) oksida terhasil apabila 2.67g plumbum(II) karbonat dipanaskan dengan lengkap.

[Relative atomic mass/ Jisim atom relatif: C, 14; O, 16; Pb 207]

[4 marks]

Section C
Bahagian C

1. (a) You are required to prepare 500 cm^3 of 0.5 mol dm^{-3} standard solution of sodium carbonate.

[Relative atomic mass: C, 12; O, 16; Na, 23]

Anda dikehendaki menyediakan 500 cm^3 0.5 mol dm^{-3} larutan piawai natrium karbonat.

- (i) [Jisim atom relatif: C, 12; O, 16; Na, 23]

What is meant by standard solution?

Apakah yang dimaksudkan dengan larutan piawai?

[1 mark]

- (ii) Describe how you can prepare the 500 cm^3 standard solution in the laboratory. In your description, include the calculation involved.

Terangkan bagaimana anda boleh menyediakan 500 cm^3 larutan piawai tersebut dalam makmal. Dalam huraian anda, sertakan pengiraan yang terlibat.

[12 marks]

- (b)

The pH values of different acidic solutions of the same concentration depend on its degree of ionisation.

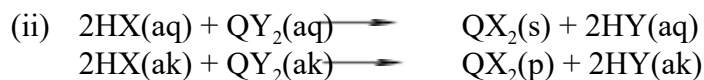
Nilai pH yang berbeza bagi larutan asid yang mempunyai kepekatan asid yang sama bergantung kepada darjah pengionan asid tersebut.

Using two named acids of different degree of ionisation, explain the above statement.

Dengan menggunakan dua asid yang berbeza darjah pengionan, terangkan pernyataan di atas.

[7 marks]

2. (a) (i) What is the meaning of *salt* based on neutralisation reaction?
Apakah yang dimaksudkan dengan garam berdasarkan tindak balas peneutralan?
[1 mark]



Given a chemical equation for the reaction between acid with the formula of HX and ionic compound with the formula of QY₂ as shown above. State **four** statements that could describe the equation. Suggest **one** acid that is represented by HX and **one** ionic compound that is represented by QY₂.

*Diberi persamaan kimia bagi tindak balas antara asid yang berformula HX dan sebatian ion yang berformula QY₂ seperti di atas. Nyatakan **empat** pernyataan yang dapat menghuraikan persamaan itu. Cadangkan **satu** asid yang diwakilkan oleh HX dan **satu** sebatian ion yang diwakili oleh QY₂.*

[6 marks]

- (b) (i) Lead(II) sulphate is insoluble in water. Describe how you can prepare lead(II) sulphate in the laboratory. In your description, include the chemical equation involved.

Plumbum(II) sulfat adalah tidak larut dalam air. Huraikan bagaimana anda boleh menyediakan plumbum(II) sulfat dalam makmal. Dalam huraian anda, sertakan persamaan kimia yang terlibat.

[10 marks]

- (ii) Using the salt you have prepared in (b)(i), describe a chemical test to confirm the presence of the anion present in the salt.

Dengan menggunakan garam yang anda telah sediakan dalam (b)(i), terangkan satu ujian kimia untuk mengesahkan kehadiran anion dalam garam tersebut.

[3 marks]

KERTAS 3 SOALAN STRUKTUR

1. An experiment is carried out to determine the relationship between concentration of hydroxide ion of an alkali and its pH value. The pH values of four sodium hydroxide solutions with concentrations of 0.08 mol dm^{-3} , 0.12 mol dm^{-3} , 0.16 mol dm^{-3} and 0.20 mol dm^{-3} respectively are measured by using a pH meter. Diagram 1 shows the reading of the pH meter in each solution.

Satu eksperimen dijalankan untuk menentukan hubungan antara kepekatan ion hidroksida bagi suatu alkali dan nilai pH. Nilai pH bagi empat larutan natrium hidroksida dengan kepekatan 0.08 mol dm^{-3} , 0.12 mol dm^{-3} , 0.16 mol dm^{-3} and 0.20 mol dm^{-3} masing-masing telah ditentukan dengan menggunakan meter pH. Rajah 1 menunjukkan bacaan meter pH bagi setiap larutan.

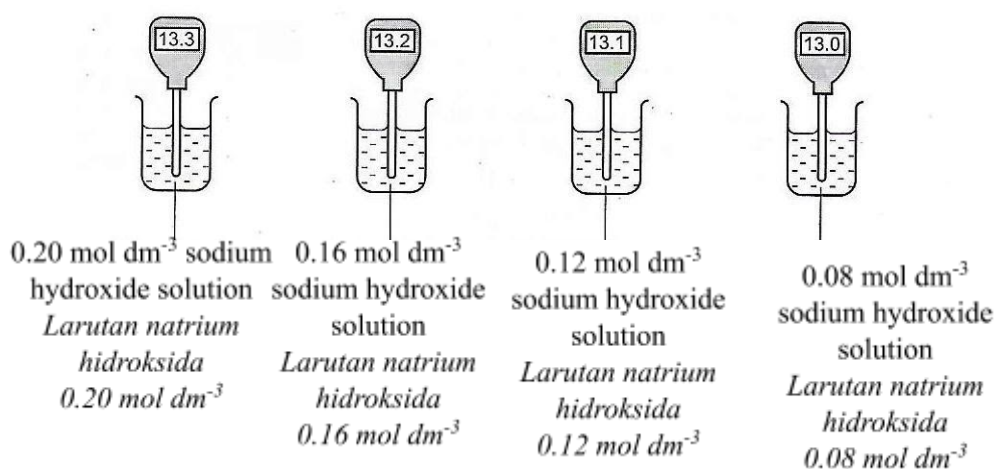


Diagram 1
Rajah 1

- (a) State the variables for this experiment.
Nyatakan pemboleh ubah bagi eksperimen ini.

(i) Manipulated variable:
Pemboleh ubah dimanipulasikan:

(ii) Responding variable:
Pemboleh ubah bergerak balas:

(iii) Constant variable:
Pemboleh ubah dimalarkan:

[3 marks]

- (b) State **one** hypothesis for this experiment.
*Nyatakan **satu** hipotesis bagi eksperimen ini.*

[3 marks]

- (c) Based on Diagram 1, construct a table to record the results of this experiment.
Berdasarkan Rajah 1, bina jadual untuk mencatatkan keputusan bagi eksperimen ini.

[3 marks]

- (d) Based on the results in (d), plot a graph of pH value against concentration of hydroxide ions.
Berdasarkan keputusan di (d), plotkan graf nilai pH melawan kepekatan ion hidroksida.

[3 marks]

- (e) Based on the graph, determine the pH value if the concentration of sodium hydroxide solution used is 0.24 mol dm^{-3} ?
Berdasarkan graf, tentukan nilai pH sekiranya kepekatan larutan natrium hidroksida yang digunakan ialah 0.24 mol dm^{-3} ?

[3 marks]

- (f) Based on the results obtained, how does the pH value change when the concentration of sodium hydroxide solution decreases?
Berdasarkan keputusan yang diperolehi, bagaimana perubahan nilai pH apabila kepekatan larutan kalium hidroksida berkurangan?

[3 marks]

- (g) State the changes in the concentration of hydroxide ions when the concentration of sodium hydroxide solution decreases.

Nyatakan perubahan kepekatan ion hidroksida apabila kepekatan larutan natrium hidroksida berkurangan.

[3 marks]

- (h) What is the relationship between the concentration of the alkali and the pH value?

Apakah hubungan di antara kepekatan alkali dan nilai pH?

[3 marks]

- (i) Predict the pH value of the ammonia solution with the concentration of 0.08 mol dm^{-3} .

Ramalkan nilai pH bagi larutan ammonia yang mempunyai kepekatan 0.08 mol dm^{-3} .

[3 marks]

- (ii) Explain your answer.

Berikan penjelasan bagi jawapan anda.

[3 marks]

- (h) Categorise the ions found in sodium hydroxide solution into positive and negative ions.

Kategorikan ion yang terdapat dalam larutan natrium hidroksida kepada ion positif dan negatif.

[3 marks]

- 2 (a) 25.0 cm^3 of potassium hydroxide solution is transferred into a conical flask. A few drops of phenolphthalein is added and shaken well. Dilute nitric acid, 0.20 mol dm^{-3} is added from a burette into the conical flask until the end point is reached.

The experiment is repeated two times to ensure accurate results are obtained. Diagram 2 shows the initial and final readings of the burette.

25.0 cm^3 larutan kalium hidroksida dipindahkan ke dalam sebuah kelalang kon. Beberapa titis fenolftalein dimasukkan dan digoncang dengan sekata. Asid nitrik cair, 0.20 mol dm^{-3} dimasukkan dari buret ke dalam kelalang kon sehingga mencapai takat akhir.

Eksperimen diulangi sebanyak dua kali untuk memastikan keputusan yang jitu diperolehi. Rajah 2 menunjukkan bacaan awal dan akhir bagi buret.

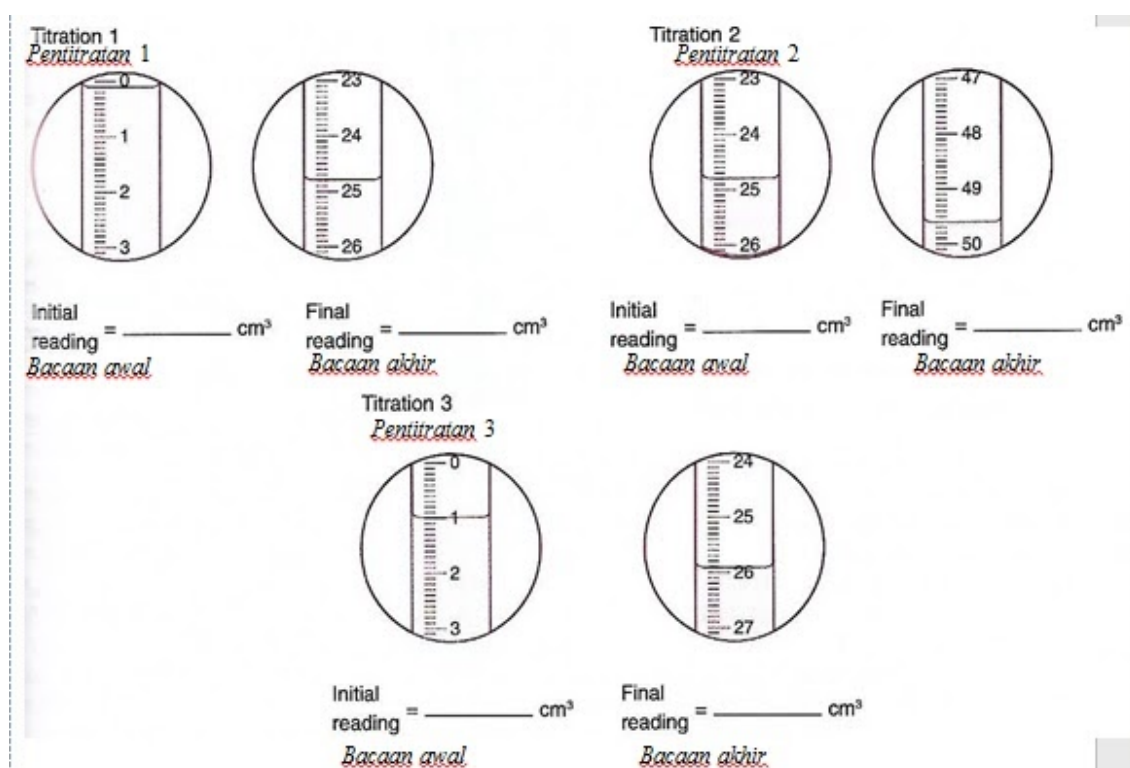


Diagram 2
Rajah 2

Record the initial and final readings of burette for each titration in the spaces provided in the above diagram.

Rekodkan bacaan awal dan bacaan akhir buret bagi setiap pentitratan dalam ruangan yang disediakan dalam rajah di atas.

[3 marks]

- (b) Construct a table and record the initial reading, final reading and the volume of nitric acid used.

Bina sebuah jadual dan rekod bacaan awal, bacaan akhir dan isi padu asid nitrik yang digunakan.

[3 marks]

- (c) State **one** observation when the end point in the titration is reached.

*Nyatakan **satu** pemerhatian apabila takat akhir telah dicapai dalam pentitratan tersebut.*

[3 marks]

- (d) Determine the average volume of nitric acid used for the titration.

Tentukan purata isi padu asid nitrik yang diperlukan dalam pentitratan tersebut.

[3 marks]

- (e) Calculate the concentration in mol dm^{-3} of the potassium hydroxide solution.

Kira kepekatan dalam mol dm^{-3} larutan kalium hidroksida.

[3 marks]

- (f) State the operational definition of end point in this experiment.

Nyatakan definisi operasi takat akhir dalam eksperimen ini.

[3 marks]

- (g) The experiment was repeated using sulphuric acid, 0.2 mol dm^{-3} . Predict the volume of sulphuric acid required for the titration.
- (i) *Eksperimen tersebut diulangi dengan menggunakan asid sulfurik, 0.2 mol dm^{-3} . Ramalkan isi padu asid sulfurik yang diperlukan untuk pentitratan tersebut.*

[3 marks]

- (ii) Explain your answer.
Jelaskan jawapan anda.

[3 marks]

- (h) In another experiment, 20 cm^3 of 0.01 mol dm^{-3} barium hydroxide solution is poured into 15 cm^3 of 0.05 mol dm^{-3} nitric acid in a beaker and stirred well until no further change occurs. State **one** observation when a small amount of magnesium powder is added to the resulting solution.
- (i)

*Dalam eksperimen lain, 20 cm^3 of 0.01 mol dm^{-3} larutan barium hidroksida dituang ke dalam 15 cm^3 of 0.05 mol dm^{-3} asid nitrik dalam sebuah bikar dan dikacau dengan sekata sehingga tiada perubahan yang berlaku. Nyatakan **satu** pemerhatian apabila kuantiti kecil serbuk magnesium ditambah ke dalam larutan yang terhasil.*

[3 marks]

- (ii) Explain your answer.
Jelaskan jawapan anda.

[3 marks]

- (i) Categorise the following acids into strong acid or weak acid.
Kategorikan asid berikut kepada asid kuat atau asid lemah.

Nitric acid <i>Asid nitrik</i>	Hydrochloric acid <i>Asid hidroklorik</i>	Sulphuric acid <i>Asid sulfurik</i>	Ethanoic acid <i>Asid etanoik</i>
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[3 marks]

- 3 (a) An experiment to construct an ionic equation for the formation of precipitate of lead chromate(VI). 5 cm^3 of 0.5 mol dm^{-3} potassium chromate(VI) solution is poured into every tube as shown in Diagram 3.1

Satu eksperimen untuk membina persamaan ion bagi pembentukan mendakan plumbum chromate(VI). 5 cm^3 larutan kalium kromat(VI) 0.5 mol dm^{-3} dituang ke dalam setiap tabung uji seperti yang ditunjukkan dalam Rajah 3.1.

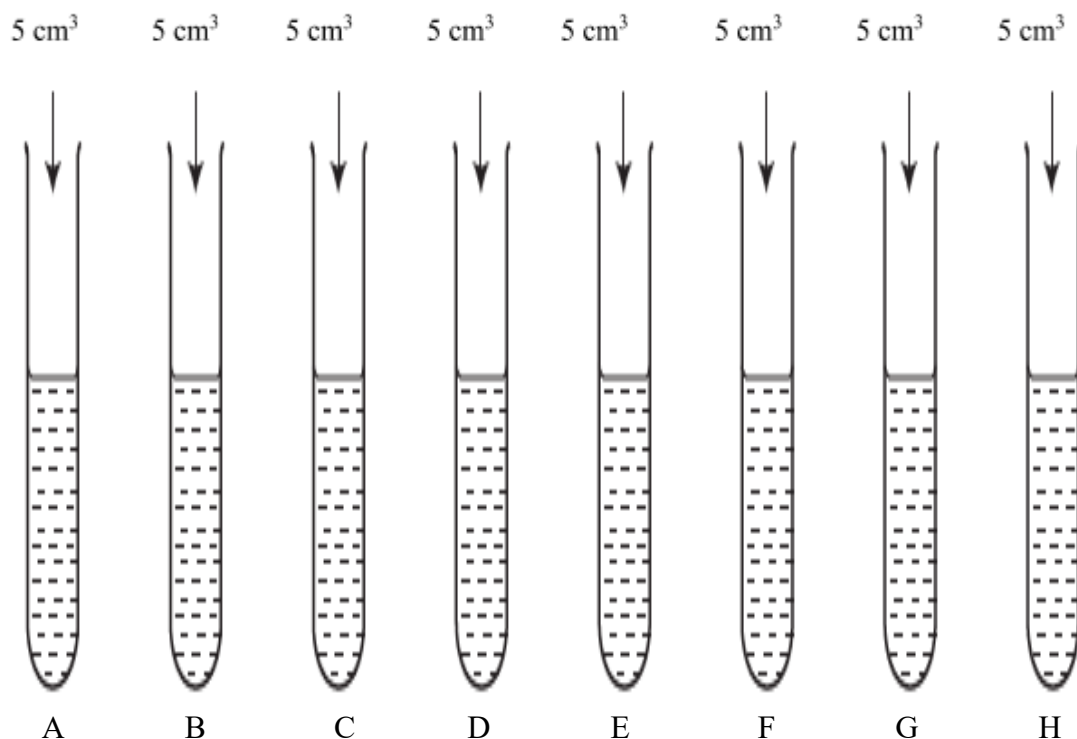


Diagram 3.1
Rajah 3.1

1 cm^3 of 0.5 mol dm^{-3} lead(II) nitrate solution is added to the first test tube, 2 cm^3 to the second test tube and so on until the eighth test tube as shown in Diagram 3.2.

1 cm^3 larutan plumbum(II) nitrat 0.5 mol dm^{-3} ditambah ke dalam tabung uji pertama, 2 cm^3 ke dalam tabung uji kedua dan seterusnya sehingga 8 cm^3 ke dalam tabung uji kelapan seperti yang ditunjukkan dalam Rajah 3.2.

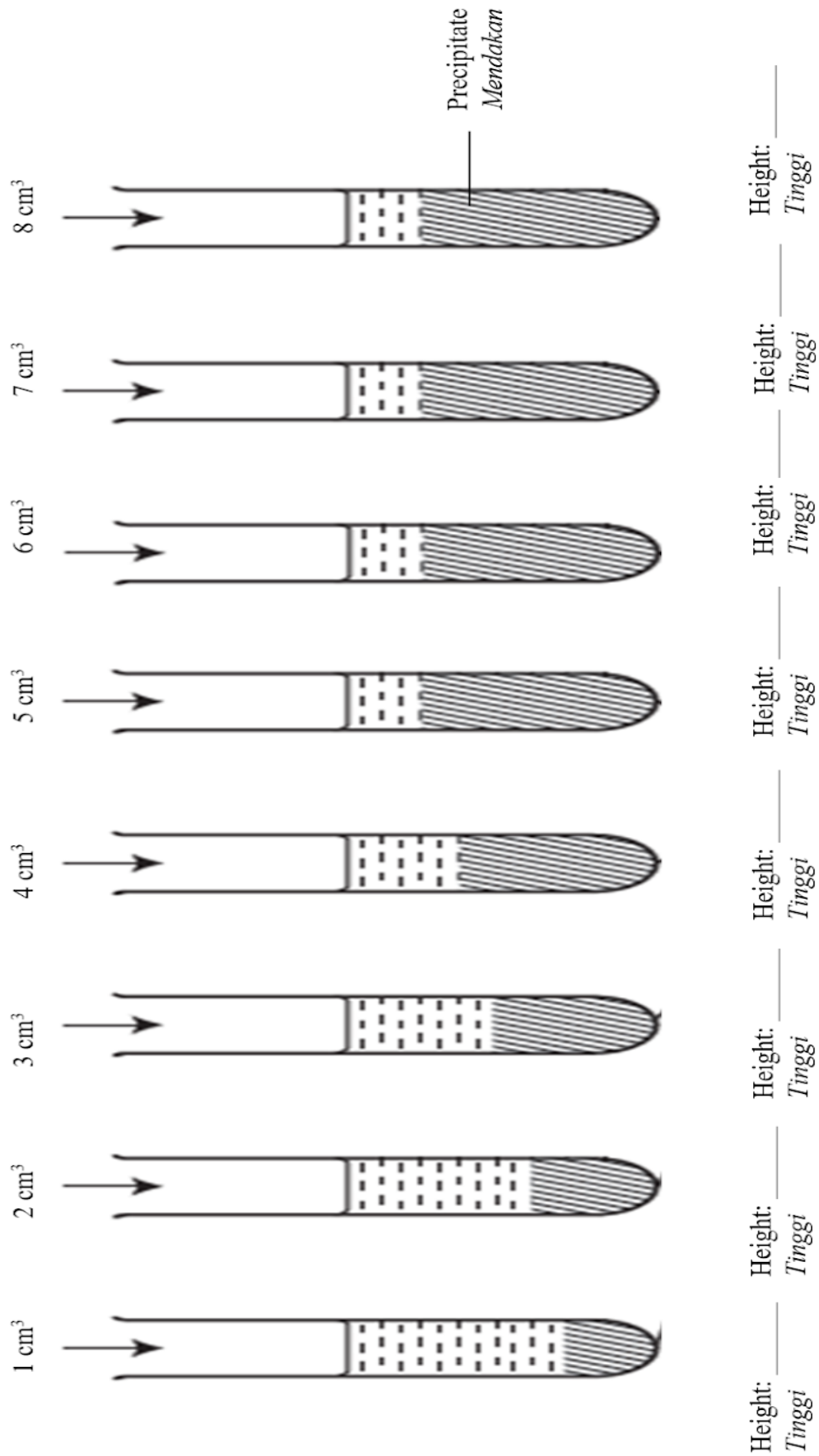


Diagram 3.2
Rajah 3.2

- (a) Diagram 3.2 shows eight test tubes of the above experiment. Measure the height of the precipitate using your own ruler and record the answer in the above diagram.
Rajah 3.2 menunjukkan lapan tabung uji daripada eksperimen di atas. Ukur ketinggian mendakan dengan menggunakan pembaris anda dan rekodkan jawapan dalam rajah di atas.

[3 marks]

- (b) Construct a table to record the volume of 0.5 mol dm^{-3} of potassium chromate(VI) solution added and the height of precipitate produced for all the test tubes.
Bina satu jadual untuk merekod isi padu larutan kalium kromat(VI) 0.5 mol dm^{-3} dan tinggi mendakan yang terbentuk dalam semua tabung uji.

[3 marks]

- (c) State one hypothesis for this experiment.
Nyatakan satu hipotesis bagi eksperimen ini

[3 marks]

- (d) For this experiment, state:
Bagi eksperimen ini, nyatakan:

The manipulated variable
Pembolehubah dimanipulasikan

The responding variable
Pembolehubah bergerak balas

The constant variable
Pembolehubah dimalarkan

[3 marks]

- (e) Using the volume of potassium chromate(VI) solution, K_2CrO_4 in 3(b), calculate the number of moles of lead (II) ions, Pb^{2+} and chromate(VI) ion required for the formation of lead(II) chromate(VI) in a complete reaction.

Dengan menggunakan isi padu larutan kalium kromat(VI), K_2CrO_4 dalam 3(b), hitungkan bilangan mol ion plumbum(II), Pb^{2+} dan ion kromat(VI) yang diperlukan untuk pembentukan plumbum(II) kromat(VI) dalam tindak balas yang lengkap.

[3 marks]

- (f) Based on 3(e), determine the ratio of mol of lead(II) ions, Pb^{2+} and chromate (VI) ion to form 1 mol of lead(II) chromate(VI). Hence, write an ionic equation for the formation of lead(II) chromate(VI).

Berdasarkan 3(e), tentukan nisbah bilangan mol ion plumbum(II), Pb^{2+} dan ion kromat(VI) untuk membentuk 1 mol plumbum(II) kromat(VI). Seterusnya, tulis satu persamaan ion untuk pembentukan plumbum(II) kromat(VI)

[3 marks]

- (g) State the observation in this experiment.
Nyatakan pemerhatian di dalam eksperimen ini.

[3 marks]

- (h) State the inference for the observation.
Nyatakan inferens untuk pemerhatian ini.

[3 marks]

- (i) The precipitate in test tubes A, B, C, D and E are collected and weighed. The mass of precipitate in each test tube is shown in the table below.

Mendakan tabung uji A, B, C, D dan E dikumpulkan dan ditimbang. Jisim mendakan dalam setiap tabung uji diberi dalam jadual seperti di bawah.

Volume of 0.5 mol dm ³ of potassium chromate(VI) solution /cm ³ <i>Isi padu larutan kalium kromat(VI) 0.5 mol dm⁻³</i>	1.00	2.00	3.00	4.00	5.00
Mass of precipitate/ g <i>Jisim mendakan/ g</i>	0.10	0.12	0.14	0.16	0.18

State the relationship between volume of potassium chromate(VI) solution with the mass of precipitate produced.

Nyatakan hubungan di antara isi padu larutan kalium kromat(VI) dengan jisim mendakan.

[3 marks]

- (j) Predict the mass of precipitate if 10 cm³ of 1 mol dm⁻³ of potassium chromate(VI) solution, K₂CrO₄ is poured into test tube H which contain 5.0 cm³ of 1 mol dm⁻³ of lead(II) nitrate solution.

Ramalkan jisim mendakan jika 10 cm³ larutan kalium kromat(VI), K₂CrO₄ 1 mol dm⁻³ di tuangkan ke dalam tabung uji H yang mengandungi 5.0 cm³ larutan plumbum(II) nitrat 1 mol dm⁻³.

[3 marks]

- (k) Given a list of substances as shown below.

Diberi senarai bahan seperti di bawah.

Sodium sulphate	Magnesium carbonate	Lead (II) sulphate	Silver nitrate
<i>Natrium sulfat</i>	<i>Magnesium karbonat</i>	<i>Plumbum (II) sulfat</i>	<i>Argentum nitrat</i>

Classify the compounds into soluble salts and insoluble salts in water.

Kelaskan sebatian tersebut kepada garam larut dan garam tak larut dalam air.

[3 marks]

KERTAS 3: MERANCANG EKSPERIMEN

- 1 Diagram 1 shows the conversation between three students.
Rajah 1 menunjukkan perbualan antara tiga orang murid.

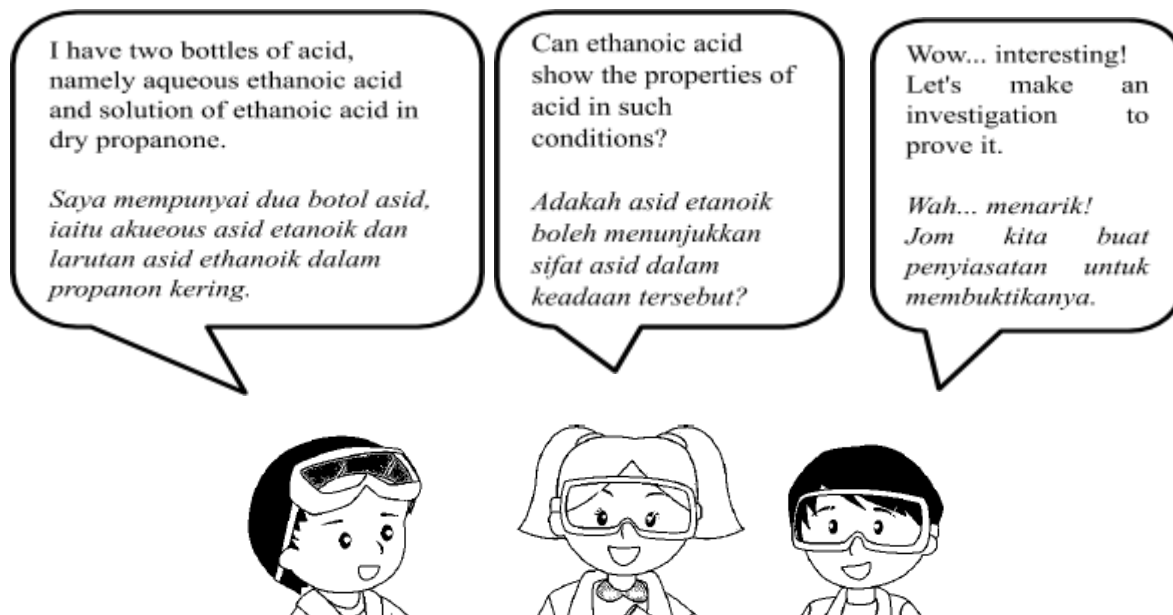


Diagram 1
Rajah 1

Based on Diagram 1, without using pH meter, plan **one** laboratory experiment to determine the role of water to exhibit the properties of acid.

*Berdasarkan Rajah 1, tanpa menggunakan meter pH rancang **satu** eksperimen makmal untuk menentukan fungsi air bagi menunjukkan sifat asid.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

- 2 Acid X and acid Y are monoprotic acids. Diagram 2 shows the pH values of acids X and Y having the same concentration.

Asid X dan asid Y merupakan asid monoprotik. Rajah 2 menunjukkan nilai pH bagi asid X dan Y yang mempunyai kepekatan yang sama.

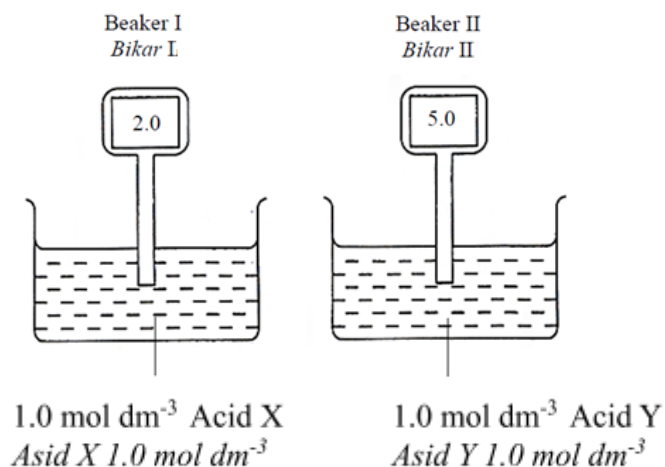


Diagram 2
Rajah 2

Based on Diagram 2, using calcium carbonate and suitable acid to plan **one** laboratory experiment to compare the strength of monoprotic acid.

*Berdasarkan Rajah 2, dengan menggunakan kalsium karbonat dan contoh asid yang sesuai, rancang **satu** eksperimen makmal untuk membandingkan kekuatan bagi asid monoprotik.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

- 3 Diagram 3 shows eight test tubes containing lead(II) chloride precipitate. This precipitate is formed from the reaction between sodium chloride solution and lead(II) nitrate solution. Lead(II) chloride is an insoluble salt.

Rajah 3 menunjukkan lapan tabung uji yang mengandungi mendakan plumbum(II) klorida. Mendakan ini terhasil daripada tindak balas antara larutan natrium klorida dan larutan plumbum(II) nitrat. Plumbum(II) klorida adalah garam tak terlarut.

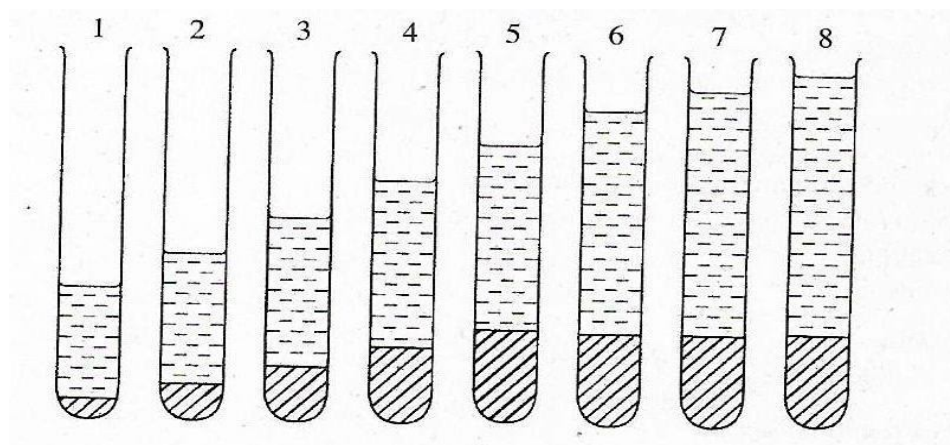


Diagram 3
Rajah 3

Based on Diagram 3, plan **one** laboratory experiment to construct the ionic equation for the formation of lead(II) chloride.

Berdasarkan Rajah 3, rancang satu eksperimen makmal untuk membina persamaan ion bagi pembentukan plumbum(II) klorida .

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

SKEMA

SET 3: ACID, BASES AND SALTS/ ASID, BES DAN GARAM

KERTAS 2

Section A
Bahagian A

Questions			Rubrics	Marks
1	a		The pH value is a measurement of the acidity or alkalinity of a solution. <i>Nilai pH adalah sukatan keasidan atau kealkalian sesuatu larutan.</i>	1
	b	(i)	R	1
		(ii)	The higher the concentration of hydrogen ions, the lower the pH value. <i>Semakin tinggi kepekatan ion hidrogen, semakin rendah nilai pH.</i>	1
	c		P	1
	d		U	1
	e	(i)	Neutralisation <i>Peneutralan</i>	1
		(ii)	Salt and water <i>Garam dan air</i>	1
	f	(i)	Colourless gas bubbles produced. <i>Gelumbung gas tak bewarna terhasil.</i>	1
		(ii)	Solution R is an acid which produces carbon dioxide gas when it reacts with marble chips. <i>Larutan R adalah asid yang akan menghasilkan gas karbon dioksida apabila bertindak balas dengan marmar.</i>	1 +1
TOTAL MARKS				10

Questions			Rubrics	Marks
2	a		A: Water/ <i>Air</i> B : Tetrachlorometane / <i>Tetraklorometana</i> (any suitable organic solvent)	1
	b		A: Ion <i>Ion</i> B: Molecule <i>Molekul</i>	1 1
	c		Hydrogen chloride ionises completely in water to form hydrogen ion Hydrogen chloride does not ionise in tetrachloromethane to form hydrogen ion. It exists as a molecule. <i>Hidrogen klorida mengion secara lengkap dalam air membentuk ion hidrogen.</i> <i>Hidrogen klorida tidak mengion dalam tetraklorometana membentuk ion hidrogen. Ia wujud sebagai molekul.</i>	1 1 1 1 1
	d		White precipitate is formed. <i>Mendakan putih terhasil.</i>	1
	e		$\text{MgCl}_2 + 2\text{AgNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{AgCl}$	2
TOTAL MARKS				10

Questions			Rubrics	Marks
3	a		Zinc nitrate <i>Zink nitrat</i>	1
	b		$\text{Zn} + 2\text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{H}_2$	1
	c		Zinc oxide / Zinc carbonate <i>Zink oksida/ Zink karbonat</i>	1
	d		The solution of S is evaporated until saturated and cooled to room temperature for crystallization. The contents are filtered to obtain crystal S. The crystal S are pressed between filter papers to be dried. <i>Larutan S disejat sehingga tepu dan disejukkan ke suhu bilik untuk penghabluran berlaku.</i> <i>Kandungan dituras untuk mendapatkan hablur S.</i> <i>Hablur S ditekan di antara kertas turas untuk dikeringkan.</i>	1 1 1

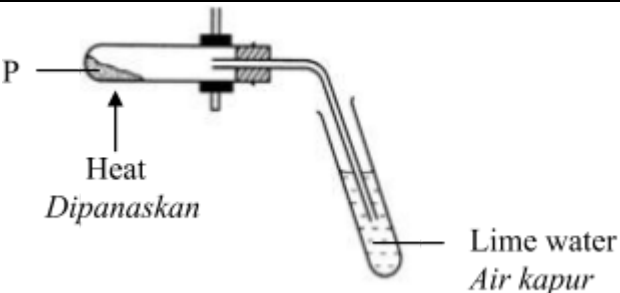
	e		Mole of nitric acid = $\frac{50 \times 1}{1000} = 0.05$ mole <i>Bilangan mol asid nitrik = $\frac{50 \times 1}{1000} = 0.05$ mol</i> 1 mole of zinc reacted completely with 1 mole of nitric acid 0.05 mole of zinc reacted completely with 0.05 mole of nitric acid <i>1 mol zink bertindak balas lengkap dengan 1 mol asid nitrik. 0.05 mol zink bertindak balas lengkap dengan 0.05 mol asid nitrik</i> Mass of zinc = $0.05 \times 65 = 3.25$ g <i>Jisim zink = $0.05 \times 65 = 3.25$ g</i>	1 1 1
TOTAL MARKS				10

Questions			Rubrics	Marks
4	a		An alkali is a chemical substance which ionises completely in water to produce hydroxide ions. <i>Suatu alkali ialah bahan kimia yang mengion secara lengkap dalam air untuk menghasilkan ion hidroksida.</i>	1
	b		Sodium hydroxide solution is a strong alkali. Sodium hydroxide solution ionises completely in water to produce a high concentration of hydroxide ions. <i>Larutan natrium hidroksida ialah alkali kuat.</i> <i>Larutan natrium hidroksida mengion secara lengkap dalam air untuk menghasilkan kepekatan ion hidroksida yang tinggi.</i>	1 1 1
	c		The higher the concentration of hydroxide ions, the higher the pH value. <i>Lebih tinggi kepekatan ion hidroksida, lebih tinggi nilai pH.</i>	1
	d		Ammonia solution has a lower concentration of hydroxide ions compared to sodium hydroxide solution. <i>Larutan ammonia mempunyai kepekatan ion hidroksida yang lebih rendah berbanding dengan larutan natrium hidroksida.</i>	1

	e	1 mole of water molecules undergo partial ionisation to produce 1 mole of hydrogen ions and 1 mole of hydroxide ions. The concentration of hydrogen ions is equal to the concentration of hydroxide ions. <i>Satu molekul air mengion separa untuk menghasilkan satu mol ion hidrogen dan satu mol ion hidroksida.</i> <i>Kepekatan ion hidrogen adalah sama dengan kepekatan ion hidroksida.</i>	1 1
	f	Toothpaste and detergent. Any other suitable answers. <i>Ubat gigi dan detergen.</i> Jawapan lain yang sesuai.	2
TOTAL MARKS			10

Questions			Rubrics	Marks
5	a		Neutralisation <i>Peneutralan</i>	1
	b		Yellow to orange <i>Kuning kepada jingga</i>	1
	c		pipette <i>Pipet</i>	1
	d		$\text{HA} + \text{KOH} \rightarrow \text{H}_2\text{O} + \text{KA}$	2
	e		7 cm ³	1
	f		Number of moles of KOH <i>Bilangan mol KOH =</i> $\frac{MV}{1000} = \frac{0.10(25)}{1000} = 0.0025 \text{ mol}$ From the equation, 1 mole of KOH neutralises 1 mole of HA. <i>Daripada persamaan, 1 mol KOH meneutralkan 1 mol HA.</i> 0.0025 moles of KOH neutralises 0.0025 moles of HA. <i>0.0025 mol KOH meneutralkan 0.0025 mol HA</i> Concentration of HA <i>Kepekatan HA</i> $\frac{0.0025}{7/1000} = 0.36 \text{ mol dm}^{-3}$	1 1 1
	g		pH meter.	1
TOTAL MARKS				10

Section B
Bahagian B

Questions			Rubrics	Marks
1	a	(i)	P: Copper(II) carbonate Q: Copper(II) oxide R: Carbon dioxide <i>P: Kuprum(II) karbonat</i> <i>Q: Kuprum(II) oksida</i> <i>R: Karbon dioksida</i>	1 1 1
		(ii)	 Label P and lime water : 1 + 1 Label Heat : 1 Position of delivery tube correct: 1 Label P dan air kapur: 1 + 1 Label Panaskan : 1 Kedudukan salur penghantar betul - 1	1 1 1 1
	b	(i)	Copper(II) ion Ion kuprum(II)	1
		(ii)	Materials: Sodium hydroxide solution/ aqueous ammonia solution, solution U/V Procedure: 1. 2 cm ³ of solution U/V is measured and poured into a test tube. 2. 3 drops of sodium hydroxide solution are added into the test tube. 3. The mixture is shaken. 4. The changes are recorded. 5. Sodium hydroxide solution is then added drop by drop until in excess. 6. The changes are recorded.	2 1 1 1 1 1

		Observation: Blue precipitate insoluble in excess sodium hydroxide solution Or Blue precipitate soluble in excess aqueous ammonia solution to form a dark blue solution. Note: Can use aqueous ammonia solution,	1 1
		Bahan: Larutan natrium hidroksida/ Larutan akueus ammonia Prosedur; 1. 2 cm ³ larutan U/V disukat dan dituang ke dalam sebuah tabung uji. 2. 3 titik larutan natrium hidroksida/ larutan akueus ammonia ditambah ke dalam tabung uji tersebut. 3. Campuran digoncang. 4. Perubahan dicatatkan. 5. Larutan natrium hidroksida/ larutan akueus ammonia kemudian ditambah setitik demi setitik sehingga berlebihan ke dalam tabung uji. 6. Perubahan dicatatkan. Pemerhatian: Mendakan biru tidak larut dalam larutan natrium hidroksida berlebihan. Atau Mendakan biru larut dalam larutan akueus ammonia berlebihan menghasilkan larutan biru tua.	2 1 1 1 1 1 1 1 1
TOTAL MARKS			20

Questions		Rubrics	Marks
2	a	1. 2 cm^3 of pure glacial ethanoic acid and 1 mol dm^{-3} of aqueous ethanoic acid are poured into two dry test tubes respectively.	1
		2. A small piece of marble/ magnesium/ zinc is put into the test tubes. The changes are recorded.	1
		3. If effervescence occurs, then the substance tested is 1 mol dm^{-3} of aqueous ethanoic acid.	1 + 1
		4. If no effervescence occurs, then the substance tested is pure glacial ethanoic acid.	1 + 1
		1. 2 cm^3 asid etanoik glasial dan akueus asid etanoik 1 mol dm^{-3} masing-masing dituang ke dalam dua tabung uji kering.	1
		2. Sebutir kecil marmar/ magnesium/ zinc dimasukkan dalam tabung uji tersebut. Perubahan direkodkan.	1
		3. Jika pembuakan gas berlaku, maka larutan itu adalah akueus asid etanoik 1 mol dm^{-3} .	1 + 1
		4. Jika pembuakan gas tidak berlaku, maka larutan itu ialah	1 + 1

		<i>asid etanoik glasial.</i>	
b		Chemical equation: $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ 2 moles of NaOH reacted completely with 1 mole of H_2SO_4 <i>2 mol of NaOH reacted completely with 1 mole of H_2SO_4</i> M = concentration/ kepekatan NaOH, $\frac{M \times 25}{0.2 \times 25} = \frac{2}{1}$ $= 0.4 \text{ mol dm}^{-3}$	1 1 1 1
c	(i)	1. Brown solid when it is hot, yellow when it is cold. 2. Colour gas 3. Gas A produced is delivered into a test tube containing lime water. 4. Lime water turns chalky show carbon dioxide gas is formed. <i>1. Pepejal perang semasa panas kepada pepejal kuning semasa sejuk terbentuk.</i> <i>2. Gas tak berwarna terhasil.</i> <i>3. Gas A terhasil disalur ke dalam tabung uji yang mengandungi air kapur.</i> <i>4. Air kapur menjadi keruh menunjukkan gas karbon dioksida terbentuk.</i>	1+1 1 1 1 + 1 1+1 1 1 1 + 1
	(ii)	$2\text{Pb}(\text{NO}_3)_2 \longrightarrow 2\text{PbO} + 4\text{NO}_2 + \text{CO}_2$ Mole of lead(II) nitrate = $\frac{3.31}{331} = 0.01 \text{ mole}$ <i>Bilangan mol plumbum(II) nitrat = $\frac{3.31}{331} = 0.01 \text{ mol}$</i> 2 moles of lead(II) nitrate reacted completely to form 2 moles of lead(II) oxide 0.01 mole of lead(II) nitrate reacted completely to form 0.01 mole of lead(II) oxide <i>2 mol plumbum(II) nitrat bertindak balas lengkap menghasilkan 2 mol plumbum(II) oksida</i> <i>0.01 mol plumbum(II) nitrat bertindak balas lengkap menghasilkan 0.01 mol plumbum(II) oksida</i> Mass of lead(II) oxide = $0.01 \times (207 + 16) = 2.23 \text{ g}$ <i>Jisim plumbum(II) oksida = $0.01 \times (207 + 16) = 2.23 \text{ g}$</i>	1 1 1 1
TOTAL MARKS			20

Section C
Bahagian C

Questions			Rubrics	Marks
1	a	(i)	A solution in which its concentration is accurately known. <i>Suatu larutan di mana kepekataannya diketahui secara tepat.</i>	1
		(ii)	Number of moles of $\text{Na}_2\text{CO}_3 = MV/1000$ $= 0.5 (500/1000)$ $= 0.25 \text{ mol}$ Mass of $\text{Na}_2\text{CO}_3 = 0.25 \times [2(23) + 1(12) + 3(16)]$ $= 0.25 \times 106$ $= 26.5 \text{ g}$ Weigh 26.5 g of solid sodium carbonate using the electronic balance. <i>Timbang 26.5g pepejal natrium karbonat menggunakan penimbang elektronik.</i> Add 100 cm^3 of distilled water to the solid sodium carbonate in a beaker. <i>Tambahkan 100 cm^3 air suling ke dalam pepejal natrium karbonat di dalam sebuah bikar.</i> Stir the mixture with a glass rod until all the solid sodium carbonate has dissolved completely. <i>Kacau campuran tersebut rod kaca sehingga pepejal natrium karbonat larut sepenuhnya.</i> By using a filter funnel, transfer the sodium carbonate solution into a 500 cm^3 volumetric flask. <i>Dengan menggunakan corong turas, pindahkan larutan natrium karbonat ke dalam kelalang volumetrik 500 cm^3.</i>	1 1 1 1 1 1 1

	Rinse the beaker with distilled water. Make sure all the remaining solution is transferred into the volumetric flask. <i>Bilas bikar tersebut dengan air suling. Pastikan kesemua air bilasan dipindahkan ke dalam kelalang volumetrik.</i> Then, rinse the filter funnel with distilled water. All the remaining solution is transferred into the volumetric flask. <i>Kemudian, bilas corong turas dengan air suling. Pastikan semua air bilasan dipindahkan ke dalam kelalang volumetrik.</i> Remove the filter funnel. Add distilled water until it reaches the 500 cm³ calibration mark. <i>Alihkan corong turas tersebut. Tambahkan air suling sehingga mencapai tanda senggatan 500 cm³.</i> Close the volumetric flask with a stopper. Invert the volumetric flask a few times to obtain a homogenous solution. <i>Tutup kelalang volumetrik dengan penutup. Telangkupkan kelalang volumetrik beberapa kali untuk mendapatkan larutan homogen.</i>	1 1 1 1
b	Strong acid: Hydrochloric acid <i>Asid kuat: Asid hidroklorik</i> Weak acid: Ethanoic acid <i>Asid lemah: Asid etanoik</i> Hydrochloric acid is a strong acid. It ionises completely in water to produce a high concentration of hydrogen ions. <i>Asid hidroklorik ialah asid kuat. Ia mengion secara lengkap dalam air untuk menghasilkan kepekatan ion hidrogen yang tinggi.</i> $\text{HCl} \longrightarrow \text{H}^+ + \text{Cl}^-$	1 1 1

		The higher the concentration of hydrogen ions, the lower the pH value. Hence, hydrochloric acid has a lower pH value. <i>Semakin tinggi kepekatan ion hidrogen, semakin rendah nilai pH. Maka, asid hidroklorik mempunyai nilai pH yang lebih rendah.</i>	1
		Ethanoic acid is a weak acid. It ionises partially in water to produce a low concentration of hydrogen ions. <i>Asid etanoik ialah asid lemah. Ia mengion secara separa dalam air untuk menghasilkan kepekatan ion hidrogen yang rendah.</i>	1
		$\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+$	1
		The lower the concentration of hydrogen ion, the higher the pH value. Hence, ethanoic acid has a higher pH value. <i>Semakin rendah kepekatan ion hidrogen, semakin tinggi nilai pH. Maka, asid etanoik mempunyai nilai pH yang lebih tinggi.</i>	1
TOTAL MARKS			20

Questions			Rubrics	Marks
2	a		Salt is an ionic compound formed when hydrogen ion from an acid is being replaced by metal ion or ammonium ion. <i>Garam ialah sebatian ion yang terhasil apabila ion hidrogen daripada asid digantikan oleh ion logam atau ion ammonium.</i>	1
			Double decomposition reaction. <i>Tindak balas penguraian ganda dua.</i>	1
			HX solution reacts with QY_2 solution to produce an insoluble salt, QX_2 and HY solution. <i>Larutan HX bertindak balas dengan larutan QY_2 menghasilkan garam tak terlarutkan QX_2 dan larutan HY.</i>	1
			2 moles of HX reacts with 1 mole QY_2 to produce 1 mole QX_2 and 2 moles of HY. <i>2 mol HX bertindak balas dengan 1 mol QY_2 untuk menghasilkan 1 mol QX_2 dan 2 mol HY.</i>	1
			X^- ion reacts with Q^{2+} ions to produce QX_2 . <i>X^- ion bertindak balas dengan Q^{2+} ions untuk menghasilkan QX_2.</i>	1
			HX is hydrochloric acid. <i>HX ialah asid hidroklorik.</i>	1
			QY_2 is lead(II) nitrate solution. <i>QY_2 adalah larutan plumbum(II) nitrat.</i>	1
b	i		Substances needed are lead(II) nitrate solution and sodium sulphate solution. <i>Bahan yang diperlukan ialah larutan plumbum(II) nitrat dan larutan natrium sulfat.</i>	1
			Apparatus needed are beaker, filter funnel, filter paper and glass rod.	1

		<i>Radas yang diperlukan ialah bikar, corong turas, kertas turas dan rod gelas.</i> Measure 20 cm³ of 0.5 mol dm⁻³ lead(II) nitrate solution and pour into a beaker. <i>Ukur 20 cm³ of 0.5 mol dm⁻³ larutan plumbum(II) nitrat dan tuangkan ke dalam sebuah bikar.</i> Measure 20 cm³ of 0.5 mol dm⁻³ sodium sulphate solution and pour into the beaker containing lead(II) nitrate solution. <i>Ukur 20 cm³ 0.5 mol dm⁻³ larutan natrium sulfat dan tuangkan ke dalam bikar yang mengandungi larutan plumbum(II) nitrat.</i> Stir the mixture using a glass rod. <i>Kacau campuran tersebut dengan menggunakan rod kaca.</i> Filter the mixture. <i>Turaskan campuran tersebut.</i> Wash the residue with distilled water. <i>Cuci baki turasan menggunakan air suling.</i> Dry between sheets of filter paper. <i>Keringkan menggunakan beberapa helaian kertas turas.</i> $\text{Pb}(\text{NO}_3)_2 + \text{Na}_2\text{SO}_4 \longrightarrow \text{PbSO}_4 + 2\text{NaNO}_3$	1 1 1 1 1 1 2
	ii	Excess dilute hydrochloric acid is poured into 2 cm³ of the salt solution in a test tube. <i>Asid hidroklorik cair dituang ke dalam 2 cm³ larutan garam tersebut di dalam sebuah tabung uji.</i> Then, add 2 cm³ of barium chloride solution into the test tube and shake well. <i>Kemudian, tambahkan 2 cm³ larutan barium klorida ke dalam tabung uji tersebut dan goncang dengan sekata.</i> A white precipitate is formed. <i>Mendakan putih terhasil.</i>	1 1 1
TOTAL MARKS			20

SKEMA KERTAS 3 : ACID, BASES AND SALTS**SOALAN STRUKTUR****SOALAN 1**

Questions		Rubrics	Marks										
a	i	Molarity of aqueous alkali <i>Kemolaran alkali akueus</i>	1										
	ii	pH value <i>Nilai pH</i>	1										
	iii	pH meter, volume of sodium hydroxide solution <i>Meter pH, isi padu larutan natrium hidroksida</i>	1										
b		When the molarity of the alkali increases, the pH value of the alkali increases. <i>Apabila kemolaran alkali bertambah, nilai pH bagi suatu alkali bertambah.</i>	3										
c		<table border="1"><thead><tr><th>Molarity of sodium hydroxide solution (mol dm⁻³) <i>Kemolaran larutan natrium hidroksida(mol dm⁻³)</i></th><th>pH value <i>Nilai pH</i></th></tr></thead><tbody><tr><td>0.08</td><td>13.0</td></tr><tr><td>0.12</td><td>13.1</td></tr><tr><td>0.16</td><td>13.2</td></tr><tr><td>0.20</td><td>13.3</td></tr></tbody></table>	Molarity of sodium hydroxide solution (mol dm ⁻³) <i>Kemolaran larutan natrium hidroksida(mol dm⁻³)</i>	pH value <i>Nilai pH</i>	0.08	13.0	0.12	13.1	0.16	13.2	0.20	13.3	3
Molarity of sodium hydroxide solution (mol dm ⁻³) <i>Kemolaran larutan natrium hidroksida(mol dm⁻³)</i>	pH value <i>Nilai pH</i>												
0.08	13.0												
0.12	13.1												
0.16	13.2												
0.20	13.3												
d		pH value <i>Nilai pH</i> Concentration of hydroxide ions (mol dm⁻³) <i>Kepekatan ion hidroksida (mol dm⁻³)</i>	3										
(e)		13.4	3										

(f)		When the concentration of sodium hydroxide solution, NaOH decreases, pH value decreases. <i>Apabila kepekatan larutan natrium hidroksida berkurangan, nilai pH berkurangan.</i>	3						
(g)		When the concentration of sodium hydroxide solution decreases, the concentration of hydroxide ion decreases. <i>Apabila kepekatan larutan natrium hidroksida berkurangan, kepekatan ion hidroksida berkurangan.</i>	3						
(h)		When the concentration of alkali increases, pH value increases. <i>Apabila kepekatan alkali bertambah, nilai pH turut bertambah.</i>	3						
(i)	(i)	11.5 (Accept any answer between 11 and 12). 11.5 (<i>Terima jawapan di antara 11 dan 12</i>).	3						
	(ii)	Ammonia solution is a weak alkali. Ammonia solution ionises partially to form low concentration of hydroxide ions. The concentration of hydroxide ions in ammonia solution is lower than concentration of hydroxide ions in sodium hydroxide solution. The lower the concentration of hydroxide ions, the lower the pH value. <i>Larutan ammonia ialah alkali lemah. Larutan ammonia mengion separa menghasilkan kepekatan ion hidroksida yang rendah. Kepekatan ion hidroksida dalam larutan ammonia adalah lebih rendah berbanding dengan kepekatan ion hidroksida dalam larutan natrium hidroksida. Semakin rendah kepekatan ion hidroksida, semakin rendah nilai pH.</i>	3						
(h)		<table><tr><td>Positive ions <i>Ion positif</i></td><td>Negative ions <i>Ion negatif</i></td></tr><tr><td>Sodium ion <i>Ion natrium</i></td><td>Hydroxide ion <i>Ion hidroksida</i></td></tr><tr><td>Hydrogen ion <i>Ion hidrogen</i></td><td></td></tr></table>	Positive ions <i>Ion positif</i>	Negative ions <i>Ion negatif</i>	Sodium ion <i>Ion natrium</i>	Hydroxide ion <i>Ion hidroksida</i>	Hydrogen ion <i>Ion hidrogen</i>		3
Positive ions <i>Ion positif</i>	Negative ions <i>Ion negatif</i>								
Sodium ion <i>Ion natrium</i>	Hydroxide ion <i>Ion hidroksida</i>								
Hydrogen ion <i>Ion hidrogen</i>									
TOTAL MARKS			33						

SOALAN 2

Questions	Rubrics				Marks																
a		Titration 1: <i>Pentitratan 1:</i> Initial reading = 0.10 cm ³ <i>Bacaan awal</i> = 0.10 cm ³ Final reading = 24.80 cm ³ <i>Bacaan akhir</i> = 24.80 cm ³ Titration 2: <i>Pentitratan 2:</i> Initial reading = 24.80 cm ³ <i>Bacaan awal</i> =24.80 cm ³ Final reading = 49.60 cm ³ <i>Bacaan akhir</i> = 24.80 cm ³ Titration 3: <i>Pentitratan 3</i> Initial reading = 1.00 cm ³ <i>Bacaan awal</i> =1.00 cm ³ Final reading = 25.90 cm ³ <i>Bacaan akhir</i> =25.90 cm ³			3																
b		<table><tr><td> Titration number <i>Bilangan pentitratan</i> Burette readings (cm³) <i>Bacaan buret (cm³)</i> </td><td>1</td><td>2</td><td>3</td></tr><tr><td>Final reading <i>Bacaan akhir</i></td><td>24.80</td><td>49.60</td><td>25.90</td></tr><tr><td>Initial reading <i>Bacaan awal</i></td><td>0.10</td><td>24.80</td><td>1.00</td></tr><tr><td>Volume of nitric acid used <i>Isi padu asid nitrik yang digunakan</i></td><td>24.70</td><td>24.80</td><td>24.90</td></tr></table>			Titration number <i>Bilangan pentitratan</i> Burette readings (cm³) <i>Bacaan buret (cm³)</i>	1	2	3	Final reading <i>Bacaan akhir</i>	24.80	49.60	25.90	Initial reading <i>Bacaan awal</i>	0.10	24.80	1.00	Volume of nitric acid used <i>Isi padu asid nitrik yang digunakan</i>	24.70	24.80	24.90	
Titration number <i>Bilangan pentitratan</i> Burette readings (cm³) <i>Bacaan buret (cm³)</i>	1	2	3																		
Final reading <i>Bacaan akhir</i>	24.80	49.60	25.90																		
Initial reading <i>Bacaan awal</i>	0.10	24.80	1.00																		
Volume of nitric acid used <i>Isi padu asid nitrik yang digunakan</i>	24.70	24.80	24.90																		

c		The pink solution turns colourless. <i>Larutan merah jambu menjadi tanpa warna.</i>	3
d		Average volume of nitric acid = $\frac{24.70 + 24.80 + 24.90}{3}$ <i>Purata isi padu asid nitrik</i> $= 24.80 \text{ cm}^3$	3
e		$\frac{MaVa}{MbVb} = \frac{1}{1}$ $\frac{0.2(24.80)}{Mb(25.0)} = \frac{1}{1}$ $Mb = 0.198 \text{ mol dm}^{-3}$	3
f		A point where the colour of the solution in the conical flask changes from pink to colourless when nitric acid is titrated into the conical flask containing potassium hydroxide solution. <i>Satu titik di mana warna larutan dalam kelalang kon berubah daripada merah jambu kepada tanpa warna apabila asid nitrik dititrat ke dalam kelalang kon yang mengandungi larutan kalium hidroksida.</i>	3
g	i	12.40 cm^3	3
	ii	Sulphuric acid is a strong diprotic acid where nitric acid is a strong monoprotic acid. Hence, the concentration of hydrogen ions in 0.2 mol dm^{-3} sulphuric acid is twice the concentration of hydrogen ions in 0.2 mol dm^{-3} nitric acid. <i>Asid sulfurik ialah asid diprotik yang kuat manakala asid nitrik adalah asid monoprotik yang kuat.</i> <i>Maka, kepekatan ion hidrogen dalam 0.2 mol dm^{-3} asid sulfurik adalah dua kali ganda kepekatan ion hidrogen dalam 0.2 mol dm^{-3} asid nitrik.</i>	3
h	i	Bubbles of colourless gas are liberated. <i>Gelembung gas yang tidak berwarna dibebaskan.</i>	3
	ii	Number of moles of barium hydroxide = $\frac{MV}{1000} = \frac{0.01(20)}{1000} = 0.0002 \text{ mol}$ <i>Bilangan mol barium hidroksida =</i> $\frac{MV}{1000} = \frac{0.01(20)}{1000} = 0.0002 \text{ mol}$ Number of moles of nitric acid = $\frac{MV}{1000} = \frac{0.05(15)}{1000} = 0.00075 \text{ mol}$ <i>Bilangan mol asid nitrik = $MV/1000 =$</i> $\frac{0.05(15)}{1000} = 0.00075 \text{ mol}$ $\text{Ba(OH)}_2 + 2\text{HCl} \longrightarrow \text{BaCl}_2 + 2\text{H}_2\text{O}$	3

		1 mol 2 mol Number of moles of hydrochloric acid required to neutralize 0.0002 mole of barium hydroxide = $\frac{0.0002 \times 2}{1} = 0.0004 \text{ mol}$ <i>Bilangan mol asid hidroklorik yang diperlukan untuk meneutralkan 0.0002 mol barium hidroksida =</i> $\frac{0.0002 \times 2}{1} = 0.0004 \text{ mol}$ Thus, nitric acid is in excess. <i>Jadi, asid nitrik adalah berlebihan.</i> Hence, the addition of magnesium powder to the resulting solution will cause a reaction to occur between magnesium and the excess nitric acid to liberate hydrogen gas. <i>Maka, penambahan serbuk magnesium kepada larutan yang terhasil akan menyebabkan tindak balas berlaku antara magnesium dan asid nitrik yang berlebihan untuk menghasilkan gas hidrogen.</i>					
i		<table><tr><th>Strong acid <i>Asid kuat</i></th><th>Weak acid <i>Asid lemah</i></th></tr><tr><td>Nitric acid <i>Asid nitrik</i> Hydrochloric acid <i>Asid hidroklorik</i> Sulphuric acid <i>Asid sulfurik</i></td><td>Ethanoic acid <i>Asid etanoik</i></td></tr></table>	Strong acid <i>Asid kuat</i>	Weak acid <i>Asid lemah</i>	Nitric acid <i>Asid nitrik</i> Hydrochloric acid <i>Asid hidroklorik</i> Sulphuric acid <i>Asid sulfurik</i>	Ethanoic acid <i>Asid etanoik</i>	3
Strong acid <i>Asid kuat</i>	Weak acid <i>Asid lemah</i>						
Nitric acid <i>Asid nitrik</i> Hydrochloric acid <i>Asid hidroklorik</i> Sulphuric acid <i>Asid sulfurik</i>	Ethanoic acid <i>Asid etanoik</i>						
TOTAL MARKS			33				

SOALAN 3

Questions		Rubrics								Marks																		
(a)		1.6 cm, 2.1 cm, 2.8 cm 3.4 cm, 4.1cm, 4.1cm, 4.1 cm, 4.1 cm								3																		
(b)		<table border="1"><tr><td>Volume of potassium chromate (VI) solution (cm³) <i>Isi padu larutan kalium kromat(VI) (cm³)</i></td><td>1.00</td><td>2.00</td><td>3.00</td><td>4.00</td><td>5.00</td><td>6.00</td><td>7.00</td><td>8.00</td></tr><tr><td>Height of precipitate (cm) <i>Tinggi mendakan (cm)</i></td><td>1.3</td><td>1.9</td><td>2.3</td><td>2.9</td><td>3.4</td><td>3.4</td><td>3.4</td><td>3.4</td></tr></table>								Volume of potassium chromate (VI) solution (cm ³) <i>Isi padu larutan kalium kromat(VI) (cm³)</i>	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	Height of precipitate (cm) <i>Tinggi mendakan (cm)</i>	1.3	1.9	2.3	2.9	3.4	3.4	3.4	3.4	3
Volume of potassium chromate (VI) solution (cm ³) <i>Isi padu larutan kalium kromat(VI) (cm³)</i>	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00																				
Height of precipitate (cm) <i>Tinggi mendakan (cm)</i>	1.3	1.9	2.3	2.9	3.4	3.4	3.4	3.4																				
(c)		As the volume potassium chromate(VI) added to lead(II) nitrate solution increase, the height of precipitate will increase and then constant . <i>Isi padu kalium kromat(VI) ditambah ke dalam larutan plumbum(II) nitrat bertambah, tinggi mendakan meningkat dan kemudian malar.</i>								3																		
(d)		Volume of lead(II) nitrate solution <i>Isi padu larutan plumbum(II) nitrat</i> Height of precipitate <i>Tinggi mendakan</i> Volume and concentration of potassium chromate(VI) solution, concentration of lead(II) nitrate solution, size of test tube <i>Isi padu dan kepekatan larutan kalium kromat(VI), kepekatan larutan plumbum(II) nitrat, saiz tabung uji</i>								3																		
(e)		Number of moles of lead(II) ions, $Pb^{2+} = \frac{5 \times 0.5}{1000} = 0.0025$ mole <i>Bilangan mol ion plumbum(II), Pb^{2+}</i> Number of chromate(VI) ion $= \frac{5 \times 0.5}{1000} = 0.0025$ mole <i>Bilangan mol ion kromat(VI)</i>								3																		
(f)		Ratio of the number of mol of Pb^{2+} ion : chromate(VI) ion <i>Nisbah bilangan mol ion Pb^{2+} ion : ion kromat(VI)</i> $= 0.0205 : 0.0025 = 1:1$ Ionic equation : $Pb^{2+} + Cr_2O_4^{2-} \rightarrow PbCr_2O_4^{2-}$ <i>Persamaan ion</i>								3																		
(g)		The height of yellow precipitate in test tubes 1 to 5 increases, and remains constant in test tubes 6 to 8.								3																		

		<i>Tinggi mendakan kuning dalam tabung uji 1 hingga 5 meningkat dan kekal tidak berubah dalam tabung uji 6 hingga 8.</i> The solution above precipitate is yellow in test tubes 1 to 4, colourless in test tubes 5 to 8. <i>Larutan di atas mendakan kuning dalam tabung uji 1 hingga 4, tanpa warna dalam tabung uji 5 hingga 8.</i>							
(h)		The yellow precipitate is lead(II) chromate(VI). <i>Mendakan kuning ialah plumbum(II) kromat(VI).</i>	3						
(i)		When the volume potassium chromate(VI) solution increases, the mass of precipitate produced increases. <i>Apabila isi padu larutan kalium kromat(VI) bertambah, ketinggian mendakan dihasilkan juga bertambah</i>	3						
(j)		0.36 g	3						
(k)		<table><tr><td>Soluble salts <i>Garam larut</i></td><td>Insoluble salts <i>Garam tak larut</i></td></tr><tr><td>Sodium sulphate Natrium sulfat</td><td>Magnesium carbonate Magnesium karbonat</td></tr><tr><td>Silver nitrate Argentum nitrat</td><td>Lead (II) sulphate Plumbum (II) sulfat</td></tr></table>	Soluble salts <i>Garam larut</i>	Insoluble salts <i>Garam tak larut</i>	Sodium sulphate Natrium sulfat	Magnesium carbonate Magnesium karbonat	Silver nitrate Argentum nitrat	Lead (II) sulphate Plumbum (II) sulfat	3
Soluble salts <i>Garam larut</i>	Insoluble salts <i>Garam tak larut</i>								
Sodium sulphate Natrium sulfat	Magnesium carbonate Magnesium karbonat								
Silver nitrate Argentum nitrat	Lead (II) sulphate Plumbum (II) sulfat								
TOTAL MARKS			33						

MERANCANG EKSPERIMEN

SOALAN 1

Rubrics		Marks						
a	Does an acid need water to show its acidic properties? <i>Adakah asid memerlukan air untuk menunjukkan sifat keasidannya?</i>	3						
b	Manipulated variable: Presence of water <i>Pemboleh ubah dimanipulasi: Kehadiran air</i>	1						
	Responding variable: Change in colour of red litmus paper <i>Pemboleh ubah bergerak balas: Perubahan warna kertas litmus merah</i>	1						
	Constant variable: Litmus paper <i>Pemboleh ubah dimalarkan: Kertas litmus</i>	1						
c	The presence of water shows acidic properties <i>and absence</i> of water does not show acidic properties. <i>Kehadiran air membolehkan asid menunjukkan sifat asidny dan tanpa kehadiran air, asid tidak dapat menunjukkan sifat asidnya.</i>	3						
d	Materials : Glacial ethanoic acid, distilled water, propanone, <i>red litmus paper</i> <i>Bahan: Asid etanoik glasial, air suling, propanon, kertas litmus merah</i> Apparatus: Test tubes <i>Radas: Tabung uji</i>	3						
e	1. Tuang 1 cm ³ glacial ethanoic acid into a test tube. <i>Tuang 1 cm³ asid etanoik glasial ke dalam tabung uji.</i> 2. Add 2 cm ³ of distilled water into the test tube. <i>Tuangkan 2 cm³ air suling ke dalam tabung uji.</i> 3. Add a strip of red litmus paper into the test tube. <i>Masukkan sejalur kertas litmus merah ke dalam tabung uji.</i> 4. <i>Record the colour change on red litmus paper.</i> <i>Rekodkan perubahan warna pada kertas litmus merah.</i> 5. Step 1- 4 are repeated by using propanone. <i>Ulangi langkah 1-4 dengan menggunakan propanon.</i>	3						
f	<table><tr><td>Materials <i>Bahan</i></td><td>Observation <i>Pemerhatian</i></td></tr><tr><td>Ethanoic acid in water <i>Asid etanoik dalam air</i></td><td></td></tr><tr><td>Ethanoic acid in propanon <i>Asid etanoik dalam propanon</i></td><td></td></tr></table>	Materials <i>Bahan</i>	Observation <i>Pemerhatian</i>	Ethanoic acid in water <i>Asid etanoik dalam air</i>		Ethanoic acid in propanon <i>Asid etanoik dalam propanon</i>		2
Materials <i>Bahan</i>	Observation <i>Pemerhatian</i>							
Ethanoic acid in water <i>Asid etanoik dalam air</i>								
Ethanoic acid in propanon <i>Asid etanoik dalam propanon</i>								
TOTAL MARKS		17						

SOALAN 2

Rubrics			Marks						
a	Do all monoprotic acids have the same acid strength? <i>Adakah semua asid monoprotik mempunyai kekuatan asid yang sama?</i>		3						
b	Manipulated variable: Nitric acid/ Hydrochloric acid and ethanoic acid <i>Pemboleh ubah dimanipulasi: Asid nitrik/ asid hidroklorik dan asid etanoik</i>		1						
	Responding variable: Rate of reaction <i>Pemboleh ubah bergerak balas: Kadar tindak balas</i>		1						
	Constant variable: Volume and concentration of acid, calcium carbonate <i>Pemboleh ubah dimalarkan: Isi padu dan kepekatan asid, kalsium karbonat</i>		1						
c	When nitric acid/ hydrochloric acid is used, rate of reaction is higher <i>Apabila asid nitrik/ asid hidroklorik digunakan, kadar tindak balas adalah tinggi</i>		3						
d	Materials : 1.0 mol dm ⁻³ nitric acid/ hydrochloric acid, 1.0 mol dm ⁻³ ethanoic acid, calcium carbonate <i>Bahan: Asid nitrik/ asid hidroklorik 1.0 mol dm⁻³, asid etanoik 1.0 mol dm⁻³, kalsium karbonat</i> Apparatus: Test tube <i>Radas: Tabung uji</i>		3						
e	1. Pour 2 cm ³ of nitric acid solution into a test tube. <i>Tuangkan 2 cm³ larutan asid nitrik ke sebuah tabung uji.</i> 2. Add a piece of calcium carbonate into the test tube. <i>Masukkan sebutir kalsium karbonat ke dalam tabung uji.</i> 3. Observe and record the rate of gas release. <i>Perhatikan dan direkodkan kadar pembebasan gas.</i> 4. Steps 1- 3 are repeated by using ethanoic acid. <i>Ulangi langkah 1-3 dengan menggunakan asid etanoik.</i>		3						
f	<table><tr><td>Materials <i>Bahan</i></td><td>Observation <i>Pemerhatian</i></td></tr><tr><td>1.0 mol dm⁻³ nitric acid/ hydrochloric acid <i>Asid nitrik/ asid hidroklorik 1.0 mol dm⁻³</i></td><td></td></tr><tr><td>1.0 mol dm⁻³ ethanoic acid <i>Asid etanoik 1.0 mol dm⁻³</i></td><td></td></tr></table>		Materials <i>Bahan</i>	Observation <i>Pemerhatian</i>	1.0 mol dm ⁻³ nitric acid/ hydrochloric acid <i>Asid nitrik/ asid hidroklorik 1.0 mol dm⁻³</i>		1.0 mol dm ⁻³ ethanoic acid <i>Asid etanoik 1.0 mol dm⁻³</i>		2
Materials <i>Bahan</i>	Observation <i>Pemerhatian</i>								
1.0 mol dm ⁻³ nitric acid/ hydrochloric acid <i>Asid nitrik/ asid hidroklorik 1.0 mol dm⁻³</i>									
1.0 mol dm ⁻³ ethanoic acid <i>Asid etanoik 1.0 mol dm⁻³</i>									
TOTAL MARKS			17						

SOALAN 3

Rubrics		Marks
a	How to construct an ionic equation for the formation of lead(II) chloride? <i>Bagaimana untuk membina persamaan ion bagi pembentukan plumbum(II) klorida?</i>	3
b	Manipulated variable: Volume of lead(II) nitrate solution <i>Pemboleh ubah dimanipulasi: Isipadu larutan plumbum(II) nitrat</i>	1
	Responding variable: Height of the precipitate <i>Pemboleh ubah bergerak balas: Tinggi mendakan</i>	1
	Constant variable: Volume and concentration of sodium chloride solution/concentration of lead(II) nitrate solution/ size of test tube <i>Pemboleh ubah dimalarkan: Isi padu dan kepekatan larutan natrium klorida/ kepekatan larutan plumbum(II) nitrat/ saiz tabung uji</i>	1
c	When the volume of lead(II) nitrate solution increases, the height of the precipitate increases. <i>Apabila isipadu larutan plumbum(II) nitrat bertambah, tinggi mendakan turut bertambah.</i>	3
d	Materials : lead(II) nitrate solution (1.0 mol dm^{-3}) sodium chloride solution (1.0 mol dm^{-3}) <i>Bahan: larutan plumbum(II) nitrat (1.0 mol dm^{-3}) larutan natrium klorida (1.0 mol dm^{-3})</i> Apparatus: Ruler, test tubes, test tube rack, stopper/glass rod, burette <i>Radas: Pembaris, tabung uji, rak tabung uji, penutup/rod kaca, buret</i>	3
e	1. Label all the test tubes. Put the test tubes on a test tube rack. <i>Label kesemua tabung uji. Letak tabung tersebut pada rak tabung uji.</i> 2. Pour 5 cm^3 of sodium chloride solution into eight test tubes. <i>Tuangkan 5 cm^3 larutan natrium klorida ke dalam kelapan-lapan tabung uji.</i> 3. Pour 1 cm^3 of lead(II) nitrate solution into the first test tube, 2 cm^3 of lead(II) nitrate solution into the second test tube until the 8th test tube with 8 cm^3 of lead(II) nitrate solution. <i>Masukkan 1 cm^3 larutan plumbum(II) nitrat ke dalam tabung uji pertama, 2 cm^3 larutan plumbum(II) nitrat ke dalam tabung uji kedua sehingga tabung uji ke lapan dengan 8 cm^3 larutan plumbum(II) nitrat.</i> 4. Shake the test tube. <i>Goncang tabung uji tersebut.</i> 5. Leave the test tube.	3

	<i>Biarkan tabung uji tersebut.</i> 6. Measure and record the height of precipitate. <i>Ukur dan rekod tinggi mendakan.</i>																										
f	<table><tr><td>Volume of lead(II) nitrate solution (cm³) <i>Isi padu larutan plumbum(II) nitrat (cm³)</i></td><td>1.00</td><td>2.00</td><td>3.00</td><td>4.00</td><td>5.00</td><td>6.00</td><td>7.00</td><td>8.00</td></tr><tr><td>Height of precipitate (cm) <i>Tinggi mendakan (cm)</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>								Volume of lead(II) nitrate solution (cm ³) <i>Isi padu larutan plumbum(II) nitrat (cm³)</i>	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	Height of precipitate (cm) <i>Tinggi mendakan (cm)</i>									2
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Height of precipitate (cm) <i>Tinggi mendakan (cm)</i>																											
TOTAL MARKS								17																			

Set 4

Manufactured
Substances in Industry
*Bahan Buatan Dalam
Industri*

TAJUK : MANUFACTURED SUBSTANCES IN INDUSTRY /
BAHAN BUATAN DALAM INDUSTRI

Section A
Bahagian A

1. Sulphuric acid is produced through Contact Process. Diagram 1 shows the stages in the Contact Process.

Asid sulfurik dihasilkan melalui Proses Sentuh. Rajah 1 menunjukkan peringkat-peringkat dalam Proses Sentuh.

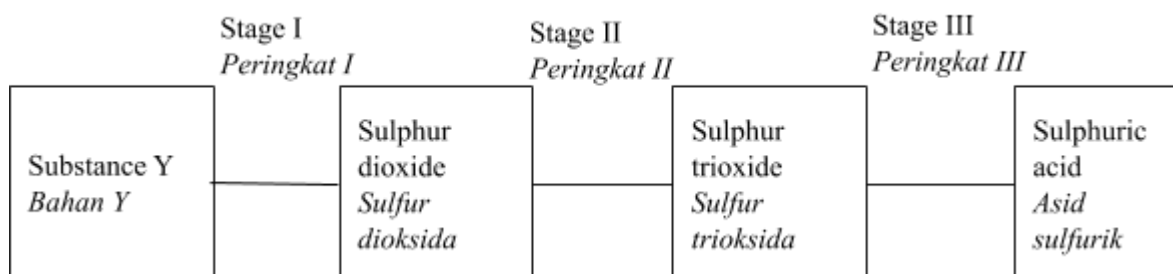


Diagram 1
Rajah 1

- (a) (i) Substance Y is burnt in air to produce sulphur dioxide. Name substance Y.
Bahan Y dibakar di udara untuk menghasilkan sulfur dioksida. Namakan bahan Y.

[1 mark]

- (ii) State the catalyst used at Stage II.
Nyatakan mangkin yang digunakan pada Peringkat II.

[1 mark]

- (iii) At stage III, sulphur trioxide is dissolved in concentrated sulphuric acid to form oleum. Write a balanced chemical equation for this reaction.
Pada peringkat III, sulfur trioksida dilarutkan dalam asid sulfurik pekat untuk menghasilkan oleum. Tuliskan persamaan kimia seimbang untuk tindak balas ini.

[2 marks]

- (b) Acid rain may cause damage to statues and buildings made from marble.
Hujan asid boleh menyebabkan kerosakan kepada tugu dan bangunan yang diperbuat daripada marmar.

- (i) State two effects of acid rain to the environment.
Nyatakan dua kesan hujan asid terhadap alam sekitar.

[2 marks]

- (ii) Name one main source of sulphur dioxide in the air.
Namakan satu punca utama sulfur dioksida dalam udara.

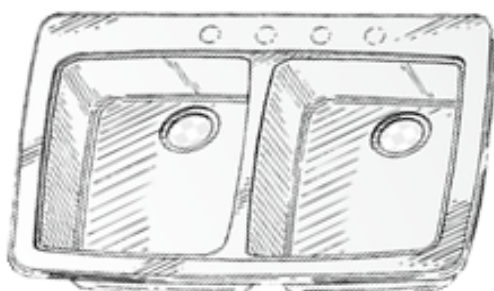
[1 mark]

- (iii) Suggest two ways to control and reduce the production of sulphur dioxide in the air.
Cadangkan dua cara untuk mengawal dan mengurangkan penghasilan sulfur dioksida dalam udara.

[2 marks]

2. Diagram 2 shows two sinks, sink A and sink B, made up of stainless steel and ceramics respectively.

Rajah 2 menunjukkan dua sinki, sinki A dan sinki B, masing-masing diperbuat daripada keluli nirkarat dan seramik.



Sink A / Sinki A



Sink B / Sinki B

Diagram 2
Rajah 2

- (a) Stainless steel is an example of alloy.
Keluli nirkarat merupakan satu contoh aloi.

- (i) What is the meaning of alloy?
Apakah maksud aloi?

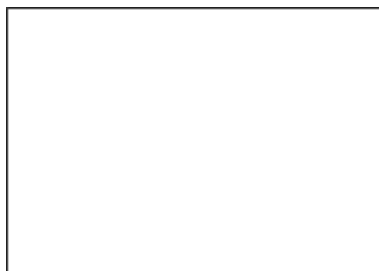
[1 mark]

- (ii) Beside iron, name two elements which are added to form stainless steel.
Selain besi, namakan dua unsur yang ditambahkan untuk membentuk keluli nirkarat.

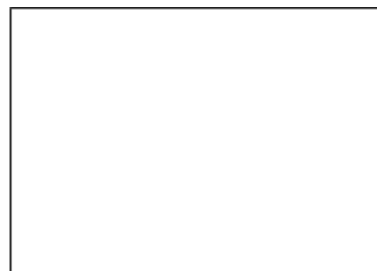
[1 mark]

- (iii) Draw the arrangement of atoms in:
Lukis susunan atom di dalam:

Stainless steel
Keluli nirkarat



Iron
Besi



[2 marks]

- (iv) Explain why stainless steel is harder than iron.
Terangkan mengapa keluli nirkarat lebih keras berbanding besi.

[3 marks]

- (b) Sink B is made from a type of clay.
Sinki B diperbuat daripada sejenis tanah liat.

- (i) Name the clay used to make ceramics.
Namakan tanah liat yang digunakan untuk membuat seramik.

[1 mark]

- (ii) Name one example of an object that has the same properties as Sink B.
Namakan satu contoh objek yang mempunyai sifat yang sama dengan Sink B.

[1 mark]

- (c) Ahmad would like to buy a new sink for his kitchen. Which sink should he choose? Explain your answer.
Ahmad ingin membeli sinki baru untuk dapurnya. Sinki mana yang harus dia pilih? Terangkan jawapan anda.

[2 marks]

3. Table 3 shows three types of manufactured substances in the industry and their respective examples.

Jadual 3 menunjukkan tiga jenis bahan pembuatan dalam industri dan contoh masing-masing.

Type of manufactured substances <i>Jenis bahan buatan</i>	Example <i>Contoh</i>
Ceramic <i>Seramik</i>	Cooking pots <i>Periuk masak</i>
S	Polystyrene <i>Polistirena</i>
Glass <i>Kaca</i>	Glass T <i>Kaca T</i>

Table 3
Jadual 3

- (a) Manufactured substance S is used widely in the plastic industry.
Bahan buatan S digunakan secara meluas dalam industri plastik.
- (i) Name the type of manufactured substance S.
Namakan jenis bahan buatan S.

[1 mark]

- (ii) Draw the structural formula for monomer of polystyrene.
Lukis formula struktur monomer bagi polistirena.

[1 mark]

- (b) Plastic containers which are not properly disposed of will cause environmental pollution problems. Suggest two ways to solve the problems.
Bekas plastik yang tidak dibuang dengan betul akan menyebabkan masalah pencemaran alam sekitar. Cadangkan dua cara bagi mengatasi masalah tersebut.

[2 marks]

- (c) (i) Ceramics are made from clay such as kaolin. State one element found in kaolin.
Seramik diperbuat daripada tanah liat seperti kaolin. Nyatakan satu unsur yang terdapat dalam kaolin.

[1 mark]

- (ii) State one characteristic of ceramic which is suitable to be used as a cooking pot.
Nyatakan satu sifat seramik yang menjadikannya sesuai digunakan sebagai periuk masak.

[1 mark]

- (d) (i) Glass T has a high density and refractive index. Name type of glass T.
Kaca T mempunyai ketumpatan dan indeks biasan yang tinggi. Namakan jenis kaca T.

[1 mark]

- (ii) Name the chemical substance added to glass to produce glass T.
Namakan bahan kimia yang ditambah kepada kaca untuk menghasilkan kaca T.

[1 mark]

- (e) Compare and contrast the properties of glass and ceramic.
Banding dan bezakan ciri-ciri kaca dan seramik.

[2 marks]

Section B
Bahagian B

1. (a) Table 1.1 shows two types of fertilisers.
Jadual 1.1 menunjukkan 2 jenis baja.

Fertiliser <i>Baja</i>	Formula <i>Formula</i>	Relative molecular mass <i>Jisim molekul relatif</i>
Ammonium sulphate <i>Ammonium sulfat</i>	$(\text{NH}_4)_2\text{SO}_4$	
Ammonium nitrate <i>Ammonium nitrat</i>	NH_4NO_3	

Table 1.1
Jadual 1.1

- (i) Complete Table 1 by calculating the relative molecular mass of both the fertilisers.
[Relative atomic mass : H = 1, O = 16, N = 14, S = 32]
Lengkapkan Jadual 1 dengan menghitung jisim molekul relatif bagi kedua-dua baja itu.
[Jisim atom relatif : H = 1, O = 16, N = 14, S = 32]

[2 marks]

- (ii) Encik Rayyan wants to buy fertilisers for his crops. Suggest which fertiliser is better between both fertilisers. Explain your answer by calculating the percentage of nitrogen in the fertilisers.
Encik Rayyan ingin membeli baja untuk tanamannya. Cadangkan baja yang mana lebih baik antara kedua-dua jenis baja itu. Terangkan jawapan anda dengan mengira peratus nitrogen yang terdapat dalam setiap baja itu.

[3 marks]

- (b) In the production of sulphuric acid, 99.5% of gas Z is converted to sulphur trioxide gas. 0.5 % of gas Z is absorbed by limestone and some of them are released to the atmosphere. The gas released can affect health and the environment.
Dalam penghasilan asid sulfurik, 99.5% gas Z ditukarkan menjadi gas sulfur trioksida. 0.5% gas Z diserap oleh batu kapur dan sebahagiannya dibebaskan ke atmosfera. Gas yang terbebas dapat memudaratkan kesihatan dan alam sekitar.

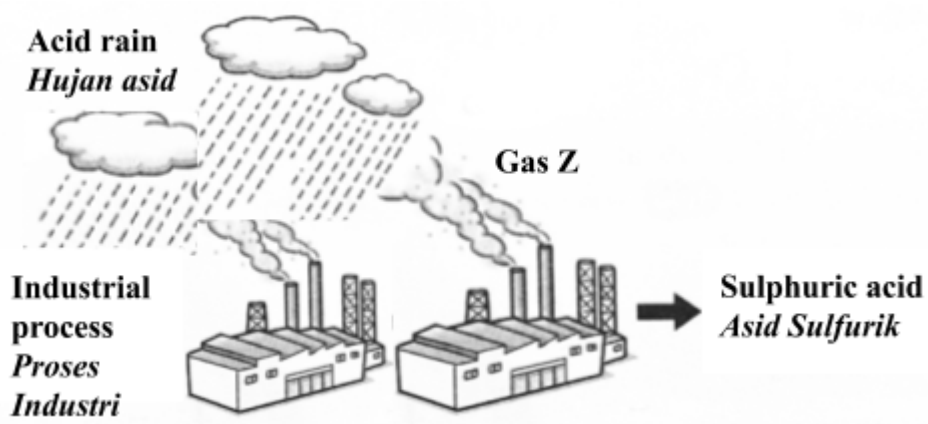


Diagram 1
Rajah 1

Based on Diagram 1, name the process to produce sulphuric acid in industry. Name gas Z and describe how acid rain is formed using relevant equations.

Berdasarkan maklumat dalam Rajah 1, namakan proses untuk menghasilkan asid sulfurik dalam industri. Namakan gas Z dan huraikan bagaimana hujan asid terbentuk dengan menggunakan persamaan yang relevan.

[5 marks]

- (c) Table 1.2 shows five different manufactured substances in industry, J, K, L, M, N and their uses.

Jadual 1.2 menunjukkan lima jenis bahan buatan industri, J, K, L, M, N dan kegunaannya.

Manufactured substances in industry <i>Bahan buatan dalam industri</i>	Uses <i>Kegunaan</i>
J	To make conical flasks <i>Membuat kelalang kon</i>
K	To make badminton rackets <i>Membuat raket badminton</i>
L	To make artificial teeth and bones <i>Membuat gigi dan tulang tiruan</i>
M	To make pipes <i>Membuat paip</i>
N	To make railway tracks <i>Membuat trek kereta api</i>

Table 1.2
Jadual 1.2

Based on Table 1.2, state the names of J, K, L, M and N. Give the specific properties of each of the substances to support your answer.

Berdasarkan Jadual 1.2, nyatakan nama bagi J, K, L, M dan N. Berikan sifat spesifik bagi setiap bahan tersebut untuk menyokong jawapan anda.

[10 marks]

Section C
Bahagian C

1. Safwan bought a saxophone ten years ago. It is made from brass, an alloy of copper, which is hard and strong. Until today, the saxophone is still in good condition and can be used.

Safwan membeli saksofon sepuluh tahun yang lalu. Ia dibuat dari loyang, aloi kuprum, yang keras dan kuat. Sehingga hari ini, saksofon masih dalam keadaan baik dan dapat digunakan.

- (a) By using a labeled diagram of the arrangement of atoms in copper and its alloy brass, explain why brass is harder than copper.

Dengan menggunakan gambarajah berlabel susunan atom dalam kuprum dan aloi loyang, terangkan mengapa loyang lebih keras daripada kuprum.

[7 marks]

- (b) Describe an experiment to compare the hardness of brass and copper. Your answer should include the following aspects :

Huraikan satu eksperimen untuk membandingkan kekerasan loyang dan kuprum.

Jawapan anda perlu merangkumi aspek berikut :

- Materials and apparatus

Bahan dan radas

- Procedure

Prosedur

- Tabulation data

Penjadualan data

- Conclusion

Kesimpulan

[10 marks]

- (c) State three other aims of alloying apart from increasing its hardness.

Nyatakan tiga tujuan lain pengaloiian selain daripada menambahkan kekerasan.

[3 marks]

KERTAS 3: SOALAN STRUKTUR

1. Alloy is harder than its pure metal. To prove the statement, a student carried out an experiment to compare the hardness of brass and copper. Diagram 1 shows the apparatus set-up for the experiment.

Aloi lebih keras daripada logam tulennya. Bagi membuktikan pernyataan tersebut, seorang pelajar melakukan eksperimen untuk membandingkan kekerasan loyang dan kuprum. Rajah 1 menunjukkan susunan radas untuk eksperimen.

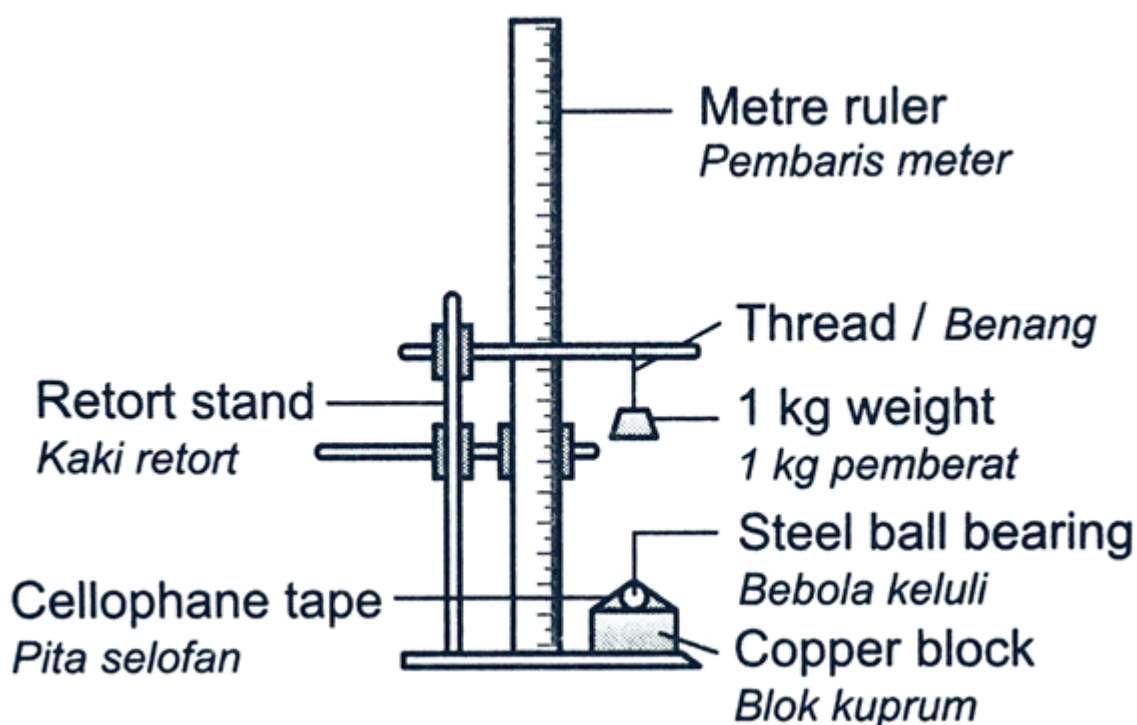


Diagram 1
Rajah 1

A 1 kg weight is dropped from a height of 50 cm onto a steel ball bearing taped to a copper block. The weight is dropped three times on different parts of the same copper block. Three dents have been made on the copper block. The experiment is then repeated using a brass block to replace the copper block.

Pemberat 1 kg dijatuhkan dari ketinggian 50 cm ke atas bebola keluli yang dilekatkan pada blok kuprum. Pemberat dijatuhkan tiga kali pada bahagian yang berlainan pada blok kuprum yang sama. Tiga lekuk terbentuk pada blok kuprum tersebut. Eksperimen kemudian diulang menggunakan blok loyang untuk menggantikan blok kuprum.

Table 1 shows the three dents formed on the brass block and copper block.

Jadual 1 menunjukkan tiga lekuk yang terhasil di atas blok loyang dan blok kuprum.

Block/Blok / Trial/Percubaan	Brass block <i>Blok loyang</i>	Copper block <i>Blok kuprum</i>
1	 Diameter of dent: <i>Diameter lekuk</i> : _____ cm	 Diameter of dent: <i>Diameter lekuk</i> : _____ cm
2	 Diameter of dent: <i>Diameter lekuk</i> : _____ cm	 Diameter of dent: <i>Diameter lekuk</i> : _____ cm
3	 Diameter of dent: <i>Diameter lekuk</i> : _____ cm	 Diameter of dent: <i>Diameter lekuk</i> : _____ cm

Table 1
Jadual 1

- (a) Record the diameter of dents on the space provided in Table 1 by using a meter rule.
Catatkan diameter lekuk pada ruang yang disediakan dalam Jadual 1 dengan menggunakan pembaris meter.

[3 marks]

- (b) Construct a table to record the diameter of dents formed and the average of dents formed on the both blocks.
Bina satu jadual untuk merekodkan diameter lekuk dan purata lekuk yang terbentuk pada kedua-dua bongkah.

[3 marks]

- (c) Explain why the weight is dropped three times on each block.
Terangkan mengapa pemberat dijatuhkan sebanyak tiga kali ke atas setiap blok.

[3 marks]

- (d) State one observation from both experiments.
Nyatakan satu pemerhatian daripada kedua-dua eksperimen.

[3 marks]

- (e) State one inference based on the answer in (d).
Nyatakan satu inferens berdasarkan jawapan di (d).

[3 marks]

- (f) Complete the table below :
Lengkapkan jadual di bawah :

Variables <i>Pemboleh ubah</i>	Action to be taken <i>Tindakan yang perlu diambil</i>
Manipulated variable : <i>Pemboleh ubah dimanipulasikan :</i> 	The way to manipulate variable : <i>Cara memanipulasikan pemboleh ubah :</i>
Responding variable : <i>Pemboleh ubah bergerak balas :</i> 	What to observe in the responding variable : <i>Apa yang diperhatikan pada pemboleh ubah bergerak balas :</i>
Controlled variable : <i>Pemboleh ubah yang dimalarkan :</i> 	How to maintain the controlled variables : <i>Cara untuk mengekalkan pemboleh ubah yang ditetapkan :</i>

[6 marks]

- (g) State one hypothesis for this experiment.
Nyatakan satu hipotesis untuk eksperimen ini.

[3 marks]

- (h) State the operational definition for the hardness of brass in this experiment.
Nyatakan definisi secara operasi bagi kekerasan loyang dalam eksperimen ini.

[3 marks]

- (i) Predict the diameter of dent on the copper block if the experiment is repeated using 1.0 kg of weight that hangs from the height of 1.0 meter and is dropped on the steel ball bearing.

Ramalkan diameter lekuk pada blok kuprum jika eksperimen diulang dengan menggantungkan pemberat 1.0 kg dan dijatuhkan dari ketinggian 1.0 meter ke atas bebola keluli.

[3 marks]

- (j) The following is a list of substances.
Berikut merupakan senarai beberapa bahan.

Pewter <i>Piuter</i>	Iron <i>Besi</i>	Aluminium <i>Aluminium</i>	Tin <i>Timah</i>
Copper <i>Kuprum</i>	Cupro-nickel <i>Kupro-nikel</i>	Steel <i>Keluli</i>	Duralumin <i>Duralumin</i>

Classify these substances into alloy and pure metal.
Kelaskan bahan-bahan ini kepada aloi dan logam tulen.

[3 marks]

KERTAS 3: MERANCANG EKSPERIMEN**1.**

Dania : “How beautiful are your rings!”

“Cantiknya cincin-cincin awak!”

Riani : “Thank you. I bought these two rings last month.”

“Terima kasih. Saya membeli dua cincin ini bulan lepas.”

Dania : “But why is one of the rings bent?”

“Tetapi mengapa salah satu daripada cincin ini bengkok?”

Riani : “This bent ring is made of pure metal, while another one is made of alloy.”

“Cincin yang bengkok ini diperbuat daripada logam tulen, sementara yang satu lagi diperbuat daripada aloi.”

Based on the above conversation, plan **one** laboratory experiment to compare the hardness of alloy and its pure metal.

*Berdasarkan perbualan di atas, rancangkan **satu** eksperimen makmal untuk membandingkan kekerasan aloi dengan logam tulennya.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

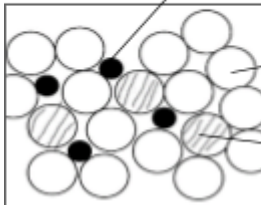
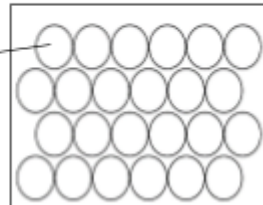
[17 marks]

SKEMA KERTAS 2 : MANUFACTURED SUBSTANCES IN INDUSTRY / BAHAN BUATAN DALAM INDUSTRI

Section A
Bahagian A

Questions			Rubrics	Marks
1	a	i	Sulphur <i>Sulfur</i>	1
		ii	Vanadium(V) oxide / V ₂ O ₅ <i>Vanadium(V) oksida / V₂O₅</i>	1
		iii	SO ₃ + H ₂ SO ₄ → H ₂ S ₂ O ₇	1+1
	b	i	Increases the acidity of water <i>Meningkatkan keasidan air</i>	1
			Increases the acidity of soil <i>Meningkatkan keasidan tanah</i>	1
			Leaches minerals and nutrients in the soil <i>Mengalirkan mineral dan nutrien dalam tanah</i>	
		ii	Burning of fossil fuels from power station <i>Pembakaran bahan api fosil daripada stesen janakuasa</i>	1
		iii	Use low-sulphur fuels <i>Menggunakan bahan api rendah sulfur</i>	1
Gas released from power station and factories are sprayed with powdered limestone (calcium carbonate) <i>Gas yang dibebaskan dari stesen janakuasa dan kilang boleh disembur dengan serbuk batu kapur (kalsium karbonat)</i>	1			
TOTAL MARKS				9

Questions			Rubrics	Marks
2	a	i	Alloy is a mixture of two or more elements with a certain fixed composition in which the major component is a metal. <i>Aloi ialah campuran dua atau lebih unsur dengan komposisi yang tetap yang mana komponen utama adalah logam.</i>	1
		ii	Carbon and chromium <i>Karbon dan kromium</i>	1

		iii	Stainless steel <i>Keluli nirkarat</i> Carbon <i>Karbon</i>  Iron <i>Besi</i> Chromium <i>Kromium</i> 	1+1	
		iv	The presence of carbon atoms and chromium atoms of different size from atoms of iron <i>Kehadiran atom karbon dan atom kromium dengan saiz berbeza daripada atom besi</i>	1	
			Disrupts the orderly and uniform arrangement of iron atoms <i>Mengganggu susunan atom besi yang teratur dan seragam</i>	1	
			This prevents the layers of atoms from sliding over one another easily <i>Ini mengelakkan lapisan atom menggelongsor antara satu sama lain dengan mudah</i>	1	
	b	i	Kaolin <i>Kaolin</i>	1	
		ii	Bathtubs / Toilet bowl <i>Tab mandi / Mangkuk tandas</i>	1	
	c		Sink A <i>Sink A</i>	1	
			Durable / Easy to clean <i>Tahan lama / Mudah dibersihkan</i>	1	
	TOTAL MARKS				11

Questions			Rubrics	Marks
3	a	i	Synthetic polymers <i>Polimer sintetik</i>	1
		ii	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{n} \quad \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{C}_6\text{H}_5 \end{array} $	1

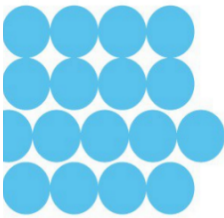
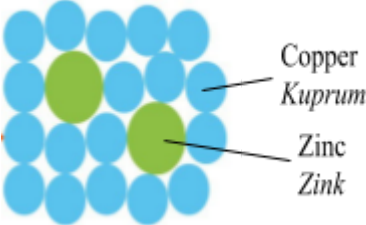
	b	Reuse <i>Guna semula</i>	1	
		Recycle <i>Kitar semula</i>	1	
		Use biodegradable synthetic polymers <i>Menggunakan polimer sintetik terbiodegradasi</i>		
	c	i	Aluminium / Silicon / Oxygen <i>Aluminium / Silikon / Oksigen</i>	1
		ii	Chemically inert / non-corrosive <i>Lengai secara kimia / tidak mengakis</i>	1
	d	i	Lead crystal glass <i>Kaca kristal plumbum</i>	1
		ii	Lead(II) oxide <i>Plumbum(II) oksida</i>	1
	e	Both glass and ceramics are hard / strong / inert to chemicals <i>Kedua-dua kaca dan seramik keras / kuat / lengai terhadap bahan kimia</i>	1	
		Glass can be heated until molten repeatedly but not ceramics / Glass has a lower melting point than ceramics <i>Kaca boleh dipanaskan hingga lebur berulang kali tetapi tidak seramik / Kaca mempunyai takat lebur yang lebih rendah daripada seramik</i>	1	
TOTAL MARKS				10

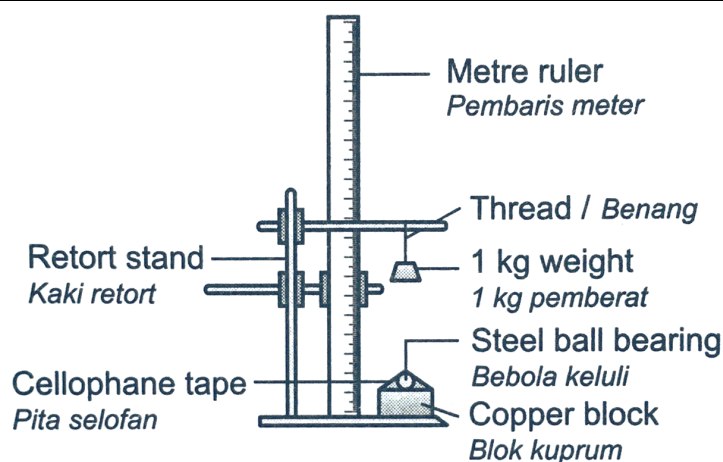
Section B
Bahagian B

Questions			Rubrics	Marks
1	a	i	Relative molecular mass <i>Jisim molekul relatif</i> Ammonium sulphate <i>Ammonium sulfat</i> $(14+4(1)) \times 2 + 32 + 4(16) = 132$ Ammonium nitrate <i>Ammonium nitrat</i> $14 + 4(1) + 14 + 3(16) = 80$	1 1
		ii	% N in Ammonium sulphate <i>% N dalam Ammonium sulfat</i> $= \frac{28}{132} \times 100$ $= 21.21 \%$ % N in Ammonium nitrate <i>% N dalam Ammonium nitrat</i> $= \frac{28}{80} \times 100$ $= 35.00 \%$ Ammonium nitrate is better fertilizer because the percentage of nitrogen by mass is higher <i>Baja ammonium nitrat lebih baik kerana peratus nitrogen mengikut jisim adalah lebih tinggi</i>	1 1 1

	b	Contact process <i>Proses sentuh</i> Gas Z : Sulphur dioxide gas <i>Gas Z : Gas sulfur dioksida</i> Sulphur dioxide gas dissolves in rain water to form sulphurous acid <i>Gas sulfur dioksida larut dalam air hujan untuk membentuk asid sulfurus</i> $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$	1 1 1 1+1
	c	J : Fused glass <i>Kaca silika terlakur</i> Glass does not expand nor contract much when there is large change in heat <i>Kaca tidak mengembang atau mengecut dengan banyak di bawah perubahan suhu yang besar</i> K : Fibre glass <i>Kaca gentian</i> High tensile strength and easily moulded in thin layers <i>Kekuatan regangan tinggi dan mudah dibentuk dalam lapisan nipis</i> L : Ceramics <i>Seramik</i> Inert and non-compressible <i>Lengai dan tidak boleh dimampatkan</i> M : Polyvinyl chloride (PVC) <i>Polivinil klorida</i> Durable and does not rust <i>Tahan lama dan tidak berkarat</i> N : Steel <i>Keluli</i> Hard and strong <i>Keras dan kuat</i>	1 1 1 1 1 1 1 1 1
TOTAL MARKS			20

Section C
Bahagian C

Questions	Rubrics	Marks
1 a	  Atoms of pure copper metal are of the same size. <i>Atom-atom logam kuprum tulen mempunyai saiz yang sama.</i> They are arranged orderly in layers. <i>Atom-atom ini tersusun dalam lapisan.</i> Layers of atoms easily slide over each other when external force is applied on them. <i>Lapisan-lapisan atom lebih senang menggelongsor antara satu sama lain apabila dikenakan daya.</i> The size of zinc atoms which are bigger than copper in brass <i>Saiz atom zink yang lebih besar berbanding atom kuprum dalam loyang</i> disrupt the orderly arrangement of copper atoms. <i>menyebabkan atom-atom kuprum menjadi tidak tersusun.</i> Layers of metal atoms are difficult to slide over each other when external force is applied. <i>Lapisan -lapisan atom sukar menggelongsor di antara satu sama lain apabila dikenakan daya.</i>	1 1 1 1 1 1
b	Experiment to compare the hardness of pure metal (copper) and its alloy (brass) <i>Eksperimen untuk membanding kekerasan logam tulen (kuprum) dan aloi (loyang)</i> Materials and apparatus <i>Bahan dan radas :</i> 1 kg weight, meter rule, retort stand and clamp, thread, steel ball bearing, brass block and copper block. <i>Pemberat 1 kg, pembaris meter, kaki retort dan pemegang, benang, bebola keluli, bongkah loyang dan bongkah kuprum.</i>	1



Procedure :

Prosedur :

1. A steel ball bearing is tapped onto a copper block using cellophane tape.
Satu bebola keluli dilekatkan di atas bongkah kuprum dengan pita selofan.
2. A 1 kg weight is hung at a height of 50 cm above the copper block using thread.
1 kg pemberat digantungkan pada ketinggian 50 cm di atas bongkah kuprum menggunakan benang.
3. The weight is allowed to drop on the steel ball bearing and the diameter of the dent formed on the copper block is measured and recorded.
Pemberat dijatuhkan ke atas bebola keluli dan diameter lekuk yang terbentuk pada bongkah kuprum diukur dan direkodkan.
4. Step 1 to 3 are repeated on two other part of copper block in order to obtain an average value for the diameter of dents formed.
Langkah 1 hingga 3 diulangi di atas dua bahagian lain di permukaan blok kuprum untuk memperoleh nilai purata bagi diameter lekuk yang terhasil.
5. Step 1 to 4 are repeated by replacing the copper block with brass block.
Langkah 1 hingga 4 diulangi dengan menggantikan blok kuprum dengan blok loyang.

		Tabulation of data <i>Penjadualan data :</i> <table><tr><th rowspan="2">Type of block <i>Jenis blok</i></th><th colspan="3">Diameter of dent (cm) <i>Diameter lekuk (cm)</i></th><th rowspan="2">Average diameter of dents (cm) <i>Purata diameter lekuk (cm)</i></th></tr><tr><th>1</th><th>2</th><th>3</th></tr><tr><td>Copper <i>Kuprum</i></td><td></td><td></td><td></td><td></td></tr><tr><td>Brass <i>Loyang</i></td><td></td><td></td><td></td><td></td></tr></table> Conclusion : <i>Kesimpulan :</i> The brass is harder than the copper // Alloy is harder than pure metal. <i>Loyang lebih keras daripada kuprum // Aloi lebih keras daripada logam tulen.</i>	Type of block <i>Jenis blok</i>	Diameter of dent (cm) <i>Diameter lekuk (cm)</i>			Average diameter of dents (cm) <i>Purata diameter lekuk (cm)</i>	1	2	3	Copper <i>Kuprum</i>					Brass <i>Loyang</i>					1+1 1
Type of block <i>Jenis blok</i>	Diameter of dent (cm) <i>Diameter lekuk (cm)</i>			Average diameter of dents (cm) <i>Purata diameter lekuk (cm)</i>																	
	1	2	3																		
Copper <i>Kuprum</i>																					
Brass <i>Loyang</i>																					
	c	To prevent corrosion and rusting. <i>Untuk mencegah kakisan dan pengaratan.</i> To improve the appearance of a pure metal. <i>Untuk memperbaiki rupa bentuk logam tulen.</i>	1+1 1																		
TOTAL MARKS			20																		

SKEMA KERTAS 3 : MANUFACTURED SUBSTANCES IN INDUSTRY / BAHAN BUATAN DALAM INDUSTRI

SOALAN STRUKTUR

SOALAN 1

Questions	Rubrics	Marks																				
a	[Able to measure the diameter of dents correctly and accurately with unit] [<i>Berupaya mengukur diameter lekuk dengan betul dan jitu dengan unit</i>] Sample answer : <i>Contoh jawapan :</i> Brass : 1.2 cm, 1.3 cm, 1.0 cm <i>Loyang : 1.2 cm, 1.3 cm, 1.0 cm</i> Copper : 1.7 cm, 1.5 cm, 1.8 cm <i>Kuprum : 1.7 cm, 1.5 cm, 1.8 cm</i> [Able to measure the diameter of dents without 1 decimal places and unit] [<i>Berupaya mengukur diameter lekuk tanpa dua titik perpuluhan atau unit</i>] [Able to state four diameters of dents] [<i>Berupaya menyatakan empat diameter lekuk dengan betul</i>] [No response or wrong response] [<i>Tiada jawapan atau jawapan salah</i>]	3 2 1 0																				
b	[Able to construct the table to record the diameters and average diameter of dents on brass and copper block with correct: 1. Titles and units 2. Reading] [<i>Berupaya membina jadual untuk merekodkan diameter dan diameter purata blok loyang dan kuprum dengan betul:</i> 1. <i>Tajuk dan unit</i> 2. <i>Bacaan</i>] Sample answer: <i>Contoh jawapan:</i> <table><tr><th>Type of block <i>Jenis blok</i></th><th colspan="3">Diameter of dent (cm) <i>Diameter lekuk (cm)</i></th><th>Average diameter of dents (cm) <i>Purata diameter lekuk (cm)</i></th></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td></td></tr><tr><td>Copper <i>Kuprum</i></td><td>1.2</td><td>1.3</td><td>1.0</td><td>1.2</td></tr><tr><td>Brass <i>Loyang</i></td><td>1.7</td><td>1.5</td><td>1.8</td><td>1.7</td></tr></table> [Able to construct a less accurate the table that contain the following : 1. Titles without unit 2. Reading]	Type of block <i>Jenis blok</i>	Diameter of dent (cm) <i>Diameter lekuk (cm)</i>			Average diameter of dents (cm) <i>Purata diameter lekuk (cm)</i>		1	2	3		Copper <i>Kuprum</i>	1.2	1.3	1.0	1.2	Brass <i>Loyang</i>	1.7	1.5	1.8	1.7	3 2
Type of block <i>Jenis blok</i>	Diameter of dent (cm) <i>Diameter lekuk (cm)</i>			Average diameter of dents (cm) <i>Purata diameter lekuk (cm)</i>																		
	1	2	3																			
Copper <i>Kuprum</i>	1.2	1.3	1.0	1.2																		
Brass <i>Loyang</i>	1.7	1.5	1.8	1.7																		

	<i>[Berupaya membina jadual kurang tepat yang mengandungi yang berikut:</i> <i>1. Tajuk tanpa unit</i> <i>2. Bacaan]</i> <i>[Able to construct the idea of tabulation of data]</i> <i>[Berupaya membina idea penjadualan data]</i> <i>[No response or wrong response]</i> <i>[Tiada jawapan atau jawapan salah]</i>	1 0
c	<i>[Able to state the explanation correctly]</i> <i>[Berupaya menyatakan penerangan dengan betul]</i> Sample answer: <i>Contoh jawapan:</i> To get an average reading for a more accurate result. <i>Untuk memperoleh bacaan purata untuk keputusan yang lebih tepat.</i> <i>[Able to state the explanation less correctly]</i> <i>[Berupaya menyatakan penerangan yang kurang tepat]</i> Sample answer: <i>Contoh jawapan:</i> To obtain an average reading for a correct result. <i>Untuk memperoleh bacaan purata untuk keputusan yang betul.</i> <i>[Able to state the idea of explanation]</i> <i>[Berupaya menyatakan idea bagi penerangan]</i> Sample answer: <i>Contoh jawapan:</i> To obtain an average reading. <i>Untuk memperoleh bacaan purata.</i> <i>[No response or wrong response]</i> <i>[Tiada jawapan atau jawapan salah]</i>	3 2 1 0
d	<i>[Able to state the observation correctly - Must have comparison]</i> <i>[Berupaya menyatakan pemerhatian dengan betul – dalam bentuk perbandingan]</i> Sample answer: <i>Contoh jawapan:</i> The average diameter of dents on brass block is 1.2 cm and the average diameter of dents on copper block is 1.7 cm // The size / diameter of dents on brass block is smaller than the size / diameter of dents on copper block <i>Diameter purata lekuk pada blok loyang adalah 1.2 cm dan diameter purata lekuk pada blok kuprum adalah 1.7 cm //</i> <i>Saiz / diameter lekuk pada blok loyang lebih kecil daripada saiz / diameter pada blok kuprum</i>	3

	[Able to state the incomplete observation] [Berupaya menyatakan pemerhatian yang tidak lengkap] Sample answer: Contoh jawapan: The size / diameter of dents on copper block is bigger // The size / diameter of dents on brass block is smaller Saiz / diameter lekuk pada blok kuprum lebih besar // Saiz / diameter lekuk pada blok loyang lebih kecil	2
	[Able to state the idea of observation] [Berupaya menyatakan idea bagi pemerhatian] Sample answer: Contoh jawapan: The size / diameter of dents on copper block is big // The size / diameter of dents on brass block is small Saiz / diameter lekuk pada blok kuprum besar // Saiz / diameter lekuk pada blok loyang kecil	1
	[No response or wrong response] [Tiada jawapan atau jawapan salah]	0
e	[Able to state the inference correctly] [Berupaya menyatakan inferens dengan betul] Sample answer: Contoh jawapan: Brass is harder than copper // Copper is less harder than brass Loyang lebih keras daripada kuprum // Kuprum kurang keras daripada loyang	3
	[Able to state the incomplete inference] [Berupaya menyatakan inferens kurang lengkap] Sample answer: Contoh jawapan: Brass is harder // Copper is less harder. Loyang lebih keras // Kuprum kurang keras.	2
	[Able to state the idea of inference] [Berupaya menyatakan idea bagi inferens] Sample answer: Contoh jawapan: Brass is hard // Copper is soft. Loyang keras // Kuprum lembut.	1
	[No response or wrong response] [Tiada jawapan atau jawapan salah]	0

f	[Able to state all the variable and action to be taken correctly [Berupaya menyatakan semua pemboleh ubah dan tindakan yang perlu diambil dengan betul] Sample answer: Contoh jawapan: <table><tr><td>Variables <i>Pemboleh ubah</i></td><td>Action to be taken <i>Tindakan yang perlu diambil</i></td></tr><tr><td>Manipulated variable : <i>Pemboleh ubah dimanipulasikan :</i> <u>Type of block //</u> <u>Brass block and copper block</u> <u>Jenis blok //</u> <u>Blok loyang dan blok kuprum</u></td><td>The way to manipulate variable : <i>Cara memanipulasikan pemboleh ubah :</i> <u>Replace brass block with copper block</u> <u>Menggantikan blok loyang dengan blok kuprum</u></td></tr><tr><td>Responding variable : <i>Pemboleh ubah bergerak balas :</i> <u>Diameter of dents // Hardness</u> <u>Diameter lekuk // Kekerasan</u></td><td>What to observe in the responding variable : <i>Apa yang diperhatikan pada pemboleh ubah bergerak balas :</i> <u>The measurement of diameter of dents</u> <u>Pengukuran diameter lekuk</u></td></tr><tr><td>Controlled variable : <i>Pemboleh ubah yang dimalarkan :</i> <u>Height of weight //</u> <u>Mass of weight //</u> <u>Size of stainless steel ball bearing</u> <u>Ketinggian pemberat // Jisim pemberat // Saiz bebola keluli nirkarat</u></td><td>How to maintain the controlled variables : <i>Cara untuk mengekalkan pemboleh ubah yang ditetapkan :</i> <u>Using the same height of weight//</u> <u>Using the same mass of weight //</u> <u>Using the same size of stainless steel ball bearing</u> <u>Gunakan tinggi pemberat yang sama</u> <u>//Gunakan jisim pemberat yang sama</u> <u>//Gunakan saiz bebola keluli nirkarat yang sama</u></td></tr></table>	Variables <i>Pemboleh ubah</i>	Action to be taken <i>Tindakan yang perlu diambil</i>	Manipulated variable : <i>Pemboleh ubah dimanipulasikan :</i> <u>Type of block //</u> <u>Brass block and copper block</u> <u>Jenis blok //</u> <u>Blok loyang dan blok kuprum</u>	The way to manipulate variable : <i>Cara memanipulasikan pemboleh ubah :</i> <u>Replace brass block with copper block</u> <u>Menggantikan blok loyang dengan blok kuprum</u>	Responding variable : <i>Pemboleh ubah bergerak balas :</i> <u>Diameter of dents // Hardness</u> <u>Diameter lekuk // Kekerasan</u>	What to observe in the responding variable : <i>Apa yang diperhatikan pada pemboleh ubah bergerak balas :</i> <u>The measurement of diameter of dents</u> <u>Pengukuran diameter lekuk</u>	Controlled variable : <i>Pemboleh ubah yang dimalarkan :</i> <u>Height of weight //</u> <u>Mass of weight //</u> <u>Size of stainless steel ball bearing</u> <u>Ketinggian pemberat // Jisim pemberat // Saiz bebola keluli nirkarat</u>	How to maintain the controlled variables : <i>Cara untuk mengekalkan pemboleh ubah yang ditetapkan :</i> <u>Using the same height of weight//</u> <u>Using the same mass of weight //</u> <u>Using the same size of stainless steel ball bearing</u> <u>Gunakan tinggi pemberat yang sama</u> <u>//Gunakan jisim pemberat yang sama</u> <u>//Gunakan saiz bebola keluli nirkarat yang sama</u>	6
Variables <i>Pemboleh ubah</i>	Action to be taken <i>Tindakan yang perlu diambil</i>									
Manipulated variable : <i>Pemboleh ubah dimanipulasikan :</i> <u>Type of block //</u> <u>Brass block and copper block</u> <u>Jenis blok //</u> <u>Blok loyang dan blok kuprum</u>	The way to manipulate variable : <i>Cara memanipulasikan pemboleh ubah :</i> <u>Replace brass block with copper block</u> <u>Menggantikan blok loyang dengan blok kuprum</u>									
Responding variable : <i>Pemboleh ubah bergerak balas :</i> <u>Diameter of dents // Hardness</u> <u>Diameter lekuk // Kekerasan</u>	What to observe in the responding variable : <i>Apa yang diperhatikan pada pemboleh ubah bergerak balas :</i> <u>The measurement of diameter of dents</u> <u>Pengukuran diameter lekuk</u>									
Controlled variable : <i>Pemboleh ubah yang dimalarkan :</i> <u>Height of weight //</u> <u>Mass of weight //</u> <u>Size of stainless steel ball bearing</u> <u>Ketinggian pemberat // Jisim pemberat // Saiz bebola keluli nirkarat</u>	How to maintain the controlled variables : <i>Cara untuk mengekalkan pemboleh ubah yang ditetapkan :</i> <u>Using the same height of weight//</u> <u>Using the same mass of weight //</u> <u>Using the same size of stainless steel ball bearing</u> <u>Gunakan tinggi pemberat yang sama</u> <u>//Gunakan jisim pemberat yang sama</u> <u>//Gunakan saiz bebola keluli nirkarat yang sama</u>									
	[Able to state all three variables and at least two corresponding action to be taken correctly] [Berupaya menyatakan semua tiga pemboleh ubah dan sekurang-kurangnya dua tindakan yang perlu diambil pada pemboleh ubah yang berkaitan dengan betul]	5								
	[Able to state at least two variables and at least two corresponding action to be taken correctly]	4								

	<i>[Berupaya menyatakan sekurang-kurangnya dua pemboleh ubah dan sekurang-kurangnya dua tindakan yang perlu diambil pada pemboleh ubah yang berkaitan dengan betul]</i> [Able to state at least two variables and at least one corresponding action to be taken correctly] <i>[Berupaya menyatakan sekurang-kurangnya dua pemboleh ubah dan sekurang-kurangnya satu tindakan yang perlu diambil pada pemboleh ubah yang berkaitan dengan betul]</i> [Able to state at least one variables and at least one corresponding action to be taken correctly] <i>[Berupaya menyatakan sekurang-kurangnya satu pemboleh ubah dan sekurang-kurangnya satu tindakan yang perlu diambil pada pemboleh ubah yang berkaitan dengan betul]</i> [Able to state at least one variables correctly] <i>[Berupaya menyatakan sekurang-kurangnya satu pemboleh ubah dengan betul]</i> [No response or wrong response] <i>[Tiada jawapan atau jawapan salah]</i>	3 2 1 0
g	[Able to state the hypothesis correctly] <i>[Berupaya menyatakan hipotesis dengan betul]</i> Sample answer: Contoh jawapan: Brass block has a smaller size / diameter of dents than copper block // Brass is harder than copper <i>Blok loyang mempunyai saiz / diameter lekuk yang lebih kecil daripada blok kuprum //</i> <i>Loyang lebih keras daripada kuprum</i> [Able to state the hypothesis less correctly] <i>[Berupaya menyatakan hipotesis kurang tepat]</i> Sample answer: Contoh jawapan: Brass is harder // Copper is less harder <i>Loyang lebih keras // Kuprum kurang keras</i> [Able to state the idea of hypothesis] <i>[Berupaya menyatakan idea hipotesis]</i> Sample answer: Contoh jawapan: Brass is hard // Copper is soft <i>Loyang keras // Kuprum lembut</i> [No response or wrong response] <i>[Tiada jawapan atau jawapan salah]</i>	3 2 1 0

h	[Able to state the operational definition correctly] [Berupaya menyatakan mendefinisi secara operasi dengan betul] What should be done: Drop 1.0 kg weight from 0.5 meter height on the material block. What should be observed: Dents formed on the material block. <i>Apa yang perlu dibuat : Jatuhkan pemberat 1.0 kg dari ketinggian 0.5 meter di atas blok bahan.</i> <i>Apa yang diperhatikan : Lekuk terbentuk di atas blok bahan</i> Sample answer: Contoh jawapan: A small dents formed when 1.0 kg weight dropped from 0.5 meter height on the block. <i>Lekuk yang kecil terbentuk apabila pemberat 1.0 kg dijatuhkan dari ketinggian 0.5 meter di atas blok bahan.</i>	3
	[Able to state the operational definition less correctly] [Berupaya menyatakan mendefinisi secara operasi kurang lengkap] What should be done : Drop weight on the material block. What should be observed : Dents formed. <i>Apa yang perlu dibuat : Jatuhkan pemberat di atas blok bahan. Apa yang diperhatikan : Lekuk terbentuk</i> Sample answer: Contoh jawapan: A small dents formed when weight dropped on the block. <i>Lekuk yang kecil terbentuk apabila pemberat dijatuhkan di atas blok bahan.</i>	2
	[Able to state the idea of operational definition] [Berupaya menyatakan idea bagi mendefinisi secara operasi] Sample answer: Contoh jawapan: The harder the material produce a smaller dent <i>Bahan yang lebih keras menghasilkan lekuk yang lebih kecil</i>	1
	[No response or wrong response] [Tiada jawapan atau jawapan salah]	0
i	[Able to predict the diameter of dent correctly] [Berupaya meramalkan diameter lekuk dengan betul] Sample answer: Contoh jawapan: Diameter / size of dents on copper is more than 1.8 cm <i>Diameter /saiz lekuk pada blok kuprum lebih besar daripada 1.8 cm</i>	3

	[Able to predict less correctly] [Berupaya meramal dengan kurang tepat] Sample answer: Contoh jawapan: Diameter become larger / bigger / increase Diameter semakin besar / meningkat [Able to state the idea of prediction] [Berupaya menyatakan idea meramal] Sample answer: Contoh jawapan: Change Berubah [No response or wrong response] [Tiada jawapan atau jawapan salah]	2 1 0										
j	[Able to classify all materials correctly] [Berupaya mengelaskan semua bahan dengan betul] Sample answer: Contoh jawapan: <table border="1"> <tr> <td>Alloy Aloi</td> <td>Pure Metal Logam tulen</td> </tr> <tr> <td>Pewter Piuter</td> <td>Tin Timah</td> </tr> <tr> <td>Cupro-nickel Kupro-nikel</td> <td>Copper Kuprum</td> </tr> <tr> <td>Duralumin Duralumin</td> <td>Aluminium Aluminium</td> </tr> <tr> <td>Steel Keluli</td> <td>Iron Besi</td> </tr> </table> [Able to classify at least six materials correctly] [Berupaya mengelaskan sekurang-kurangnya enam bahan dengan tepat] [Able to classify at least four materials correctly] [Berupaya mengelaskan sekurang-kurangnya empat bahan dengan tepat] [No response or wrong response] [Tiada jawapan atau jawapan salah]	Alloy Aloi	Pure Metal Logam tulen	Pewter Piuter	Tin Timah	Cupro-nickel Kupro-nikel	Copper Kuprum	Duralumin Duralumin	Aluminium Aluminium	Steel Keluli	Iron Besi	3 2 1 0
Alloy Aloi	Pure Metal Logam tulen											
Pewter Piuter	Tin Timah											
Cupro-nickel Kupro-nikel	Copper Kuprum											
Duralumin Duralumin	Aluminium Aluminium											
Steel Keluli	Iron Besi											
TOTAL MARKS		33										

MERANCANG EKSPERIMEN

SOALAN 1

Rubrics		Marks
a	[Able to state the problem statement correctly]: [Berupaya menyatakan pernyataan masalah dengan betul] Suggested answer: Contoh jawapan : Which metals are harder, alloys or pure copper? Logam manakah yang lebih keras, aloi atau logam tulen?	3
	[Able to state the problem statement less correctly] [Berupaya menyatakan pernyataan masalah kurang tepat] Suggested answer: Contoh jawapan : Are alloys are harder than pure metals? Adakah aloi lebih keras daripada logam tulen?	2
	[Able to state the problem statement less correctly] [Berupaya menyatakan pernyataan masalah kurang tepat] Suggested answer: Contoh jawapan : Which metals are harder? Logam manakah yang lebih keras?	1
	[No response given or wrong response] [Tiada jawapan atau jawapan salah]	0
b	[Able to state the variables correctly]: [Berupaya menyatakan pemboleh ubah-pemboleh ubah dengan betul] Suggested answer: Contoh jawapan : (a) Manipulated variable : Type of metals block Pemboleh ubah dimanipulasi : Jenis blok logam (b) Responding variable : Hardness of metals Pemboleh ubah bergerak balas : Kekerasan logam (c) Fixed variable : Size of steel ball bearing /Height of weight Pemboleh ubah dimalarkan : Saiz bebola keluli / Ketinggian pemberat	3

	[Able to state the variables less correctly] <i>[Berupaya menyatakan pemboleh ubah-pemboleh ubah dengan kurang tepat]</i> Suggested answer: <i>Contoh jawapan :</i> One mistake <i>Satu kesalahan</i>	2
	[Able to state the variables less correctly] <i>[Berupaya menyatakan pemboleh ubah-pemboleh ubah dengan kurang tepat]</i> Suggested answer: <i>Contoh jawapan :</i> Two mistakes <i>Dua kesalahan</i>	1
	[No response given or wrong response] <i>[Tiada jawapan atau jawapan salah]</i>	0
c	[Able to state the hypothesis correctly]: <i>[Berupaya menyatakan hipotesis dengan betul]</i> Suggested answer: <i>Contoh jawapan :</i> Alloy is harder than pure metals <i>Aloi lebih keras daripada logam tulen</i>	3
	[Able to state the hypothesis less correctly] <i>[Berupaya menyatakan hipotesis dengan kurang tepat]</i> Suggested answer: <i>Contoh jawapan :</i> Alloy is harder <i>Aloi lebih keras</i>	2
	[Able to state the hypothesis less correctly] <i>[Berupaya menyatakan hipotesis dengan kurang tepat]</i> Suggested answer: <i>Contoh jawapan :</i> Alloy produce smaller dent <i>Aloi menghasilkan lekuk yang lebih kecil</i>	1
	[No response given or wrong response] <i>[Tiada jawapan atau jawapan salah]</i>	0

e	[Able to list the apparatus and materials correctly]: [Berupaya menyenaraikan radas dan bahan dengan betul] Suggested answer: Contoh jawapan : Apparatus : 1 kg of weight, thread, cellophane tape, retort stand and clamp, meter rule, ruler Materials : steel ball bearing, bronze block dan copper block Radas : Pemberat 1 kg, benang, pita selofan, kaki retort dan pemegang, pembaris meter, pembaris Bahan : bebola keluli, bongkah loyang dan bongkah kuprum.	3
	[Able to list the apparatus and materials less correctly] [Berupaya menyenaraikan radas dan bahan dengan kurang tepat] Suggested answer: Contoh jawapan : One mistake Satu kesalahan	2
	[Able to list the apparatus and materials less correctly] [Berupaya menyenaraikan radas dan bahan dengan kurang tepat] Suggested answer: Contoh jawapan : Two mistakes Dua kesalahan	1
	[No response given or wrong response] [Tiada jawapan atau jawapan salah]	0
d	[Able to state the procedure correctly]: [Berupaya menyatakan prosedur dengan betul] Suggested answer: Contoh jawapan : 1. Put a steel ball to a bronze block using cellophane tape. 2. Hang 1 kg weight at a height of 50 cm from the top of the bronze block. 3. Put a bronze block under the weight. 4. Release the weight so that it falls on the steel ball bearing. 5. Measure the diameter of the dent formed on top of the bronze block using meter rule. 6. Record the diameter reading in the table. 7. Repeat the steps 1 to 5 using pure metal block (copper).	3

[Able to draw the table less correctly] <i>[Berupaya membina jadual dengan kurang tepat]</i> Suggested answer: <i>Contoh jawapan :</i> One mistake in table such as 1. Table not properly drawn 2. No unit 3. No type of block mention <i>Satu kesalahan dalam jadual seperti</i> 1. <i>Jadual tidak dilukis dengan betul</i> 2. <i>Tiada unit</i> 3. <i>Jenis blok tidak dinyatakan</i>	1
[No response given or wrong response] <i>[Tiada jawapan atau jawapan salah]</i>	0
TOTAL MARKS	17

Set 5

Rate of Reaction
Kadar Tindak Balas

TAJUK: RATE OF REACTION/ KADAR TINDAK BALAS

Section A
Bahagian A

1. A student conducted an experiment to determine the rate of reaction between 50 cm³ of sulphuric acid, 0.05 mol dm⁻³ and calcium carbonate chips. The gas evolved was collected through water displacement method and the data obtained is shown in Table 1.

Seorang murid menjalankan eksperimen untuk menentukan kadar tindak balas antara 50 cm³ asid sulfurik 0.05 mol dm⁻³ dengan ketulan kalsium karbonat. Gas yang terbebas dikutip melalui kaedah sesaran air dan data yang diperolehi ditunjukkan dalam Jadual 1.

Time (s) <i>Masa (s)</i>	0	30	60	90	120	150	180
Volume of gas (cm ³) <i>Isipadu gas (cm³)</i>	0	16	30	40	45	48	48

Table 1
Jadual 1

- (a) The chemical equation for the reaction above is shown below.
Persamaan kimia yang seimbang bagi tindak balas di atas adalah seperti berikut.



- (i) Calculate the volume of carbon dioxide gas that should be released theoretically if 50 cm³ of sulphuric acid 0.05 mol dm⁻³ reacts with calcium carbonate chips.
[Molar volume of gas at room condition = 24,000 cm³mol⁻¹]
Hitungkan isipadu gas karbon dioksida yang sepatutnya terbebas secara teori apabila 50 cm³ asid sulfurik 0.05 mol dm⁻³ bertindak balas dengan ketulan kalsium karbonat.
[Isipadu molar gas pada keadaan bilik = 24,000 cm³mol⁻¹]

[2 marks]

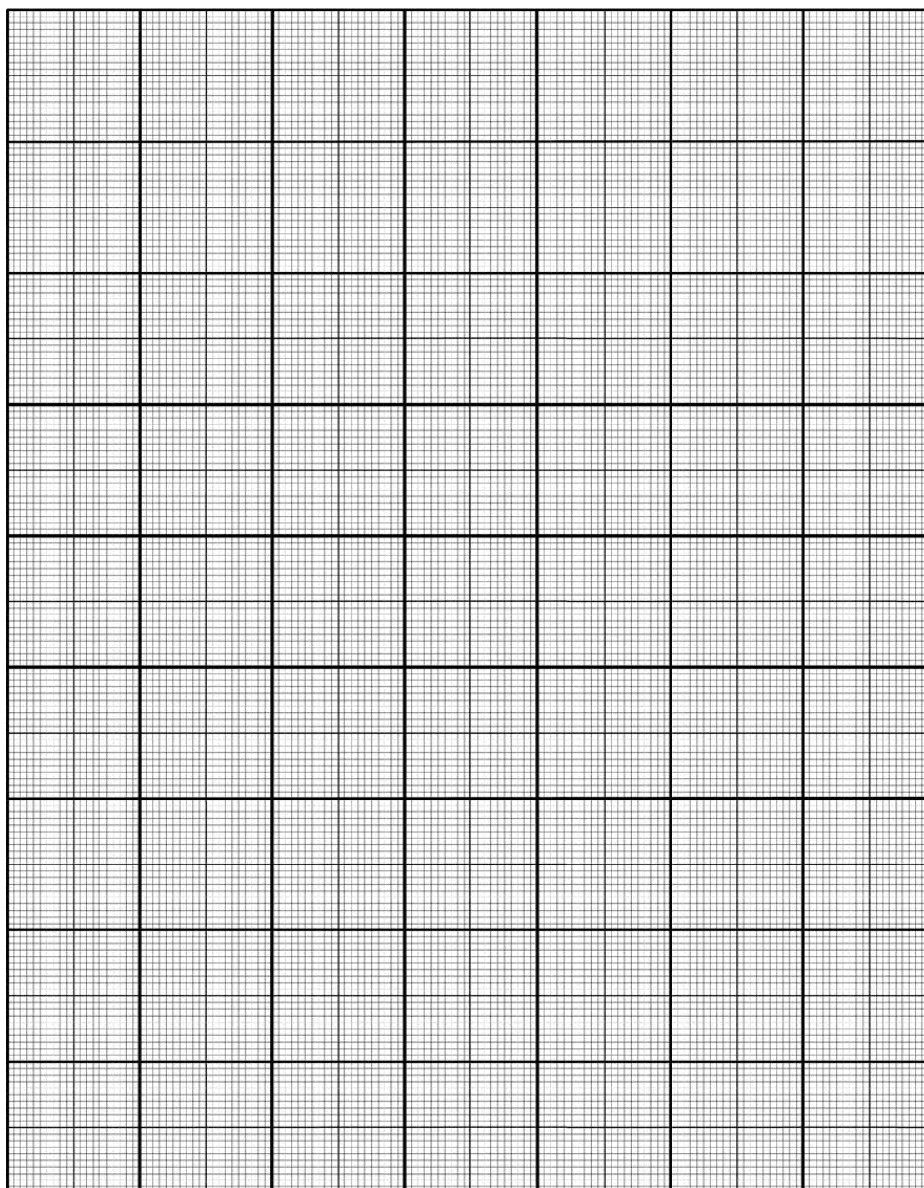
- (ii) Give a reason why the theoretical volume of gas evolved in a(i) is more than the experimental value obtained in Table 1.

Nyatakan satu sebab mengapa nilai teori bagi isipadu gas yang terbebas di a(i) lebih besar daripada nilai eksperimen yang diperolehi dalam Jadual 1.

[1 mark]

- (b) Plot a graph of the volume of carbon dioxide gas against time based on Table 1 above.

Plotkan graf isipadu gas karbon dioksida melawan masa berdasarkan Jadual 1 di atas.



[3 marks]

- (c) Based on the results obtained from the experiment, calculate
Berdasarkan keputusan eksperimen, hitungkan
- (i) The overall average rate of reaction for this reaction
Kadar tindak balas purata bagi tindak balas keseluruhan

[1 mark]

- (ii) The average rate of reaction in the second minute
Kadar tindak balas purata dalam minit kedua

[1 mark]

- (iii) The rate of reaction at the second minute
Kadar tindak balas pada minit kedua

[2 marks]

2. Table 2 shows the data from Experiment I and Experiment II that were carried out to study the rate of reaction of zinc with two acids, X and Y respectively.

Jadual 2 menunjukkan data daripada Eksperimen I dan Eksperimen II yang dijalankan untuk mengkaji kadar tindak balas antara zink dengan dua asid, X dan Y masing-masing.

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	Observation <i>Pemerhatian</i>
I	2.6g of zinc and 50 cm ³ of acid X 2.0 mol dm ⁻³ 2.6g zink dengan 50 cm ³ asid X 2.0 mol dm ⁻³	A few gas bubbles released <i>Sedikit gelembung gas dibebaskan</i>
II	2.6g of zinc and 50 cm ³ of hydrochloric acid 2.0 mol dm ⁻³ 2.6g zink dengan 50 cm ³ asid hidroklorik 2.0 mol dm ⁻³	A lot of gas bubbles released <i>Banyak gelembung gas dibebaskan</i>

Table 2
Jadual 2

- (a) What is the name of the gas released?
Apakah nama gas yang di bebaskan?

[1 mark]

- (b) Draw a labelled diagram of the set-up of apparatus for this experiment. Also show how the volume of gas collected is measured in the experiment.
Lukiskan gambarajah berlabel untuk menunjukkan susunan alat radas bagi eksperimen ini. Juga tunjukkan bagaimana gas yang dibebaskan dalam eksperimen ini diukur.

[2 marks]

- (c) (i) State the name of the acid X in Experiment I.
Nyatakan nama asid X yang digunakan dalam Eksperimen I.

[1 mark]

- (ii) Justify your answer for c(i).
Justifikasikan jawapan anda untuk c(i).

[3 marks]

- (d) Puan Minah took one hour to roast a whole chicken as shown in the diagram below.
Puan Minah mengambil masa satu jam untuk memanggang ayam seperti yang ditunjukkan dalam rajah di bawah.



How can she roast the chicken faster without using higher temperature?
Explain your answer.

*Bagaimanakah dia boleh memanggang ayam lebih cepat tanpa menaikkan suhu?
Jelaskan jawapan anda.*

[3 marks]

- 3 Diagram 3 shows two different conditions of soap water used to wash a soiled shirt. Answer the questions below based on the diagram.
Rajah 3 menunjukkan dua keadaan air sabun yang berbeza untuk mencuci baju yang kotor. Jawab soalan di bawah berdasarkan rajah itu.

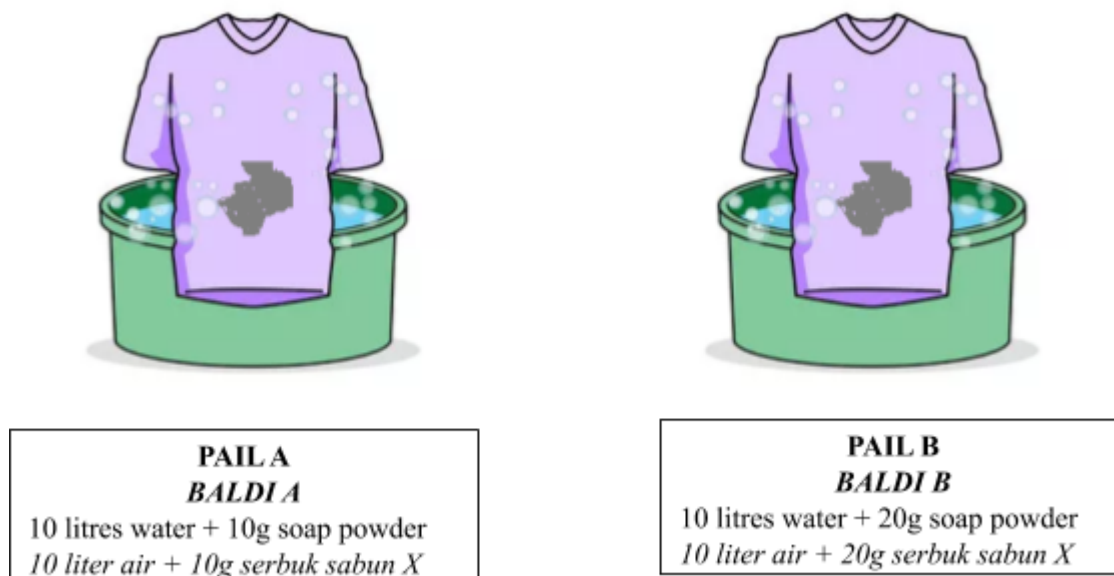


Diagram 3
Rajah 3

- (a) (i) The shirt in which pail will clean faster?
Baju dalam baldi manakah lebih cepat dibersihkan?

[1 mark]

- (ii) Explain your answer in a(i).
Terangkan jawapan anda dalam a(i).

[2 marks]

- (b) In the school laboratory, soap is prepared using palm oil and sodium hydroxide solution.

Two groups of students conducted an experiment to prepare soap in the school laboratory using the following materials.

Group 1: palm oil with sodium hydroxide solution 5 mol dm^{-3} .

Group 2: palm oil with sodium hydroxide solution 7 mol dm^{-3} .

Di dalam makmal, sabun disediakan melalui tindak balas antara minyak kelapa sawit dengan larutan natrium hidroksida. Dua kumpulan pelajar telah menjalankan eksperimen untuk menyediakan sabun di dalam makmal menggunakan bahan-bahan berikut.

Kumpulan 1: minyak kelapa sawit dengan larutan natrium hidroksida 5 mol dm^{-3} .

Kumpulan 2: minyak kelapa sawit dengan larutan natrium hidroksida 7 mol dm^{-3} .

- (i) What is the name of the process above?

Apakah nama proses di atas?

[1 mark]

- (ii) Which group will be able to produce the soap faster?

Kumpulan yang manakah akan dapat menyediakan sabun lebih cepat?

[1 mark]

- (iii) Explain your answer in b(ii) using collision theory.

Terangkan jawapan anda di b(ii) menggunakan teori perlanggaran.

[5 marks]

- 4 Two experiments are conducted to investigate the factor that affects the rate of reaction for Experiment I and Experiment II respectively. In both experiments, 25 cm^3 of 1.0 mol dm^{-3} sodium thiosulphate solution is added to 25 cm^3 of 1.0 mol dm^{-3} hydrochloric acid in a conical flask. Diagram 4 shows the set-up of apparatus and Table 4 shows the results of these experiments.

Dua eksperimen telah dijalankan untuk mengkaji faktor yang mempengaruhi kadar tindak balas masing-masing bagi Eksperimen I dan Eksperimen II. Di dalam kedua-dua eksperimen, 25 cm^3 larutan natrium tiosulfat 1.0 mol dm^{-3} ditambahkan kepada 25 cm^3 asid hidroklorik 1.0 mol dm^{-3} di dalam kelalang kon. Rajah 4 menunjukkan susunan alat radas dan Jadual 4 menunjukkan keputusan eksperimen.

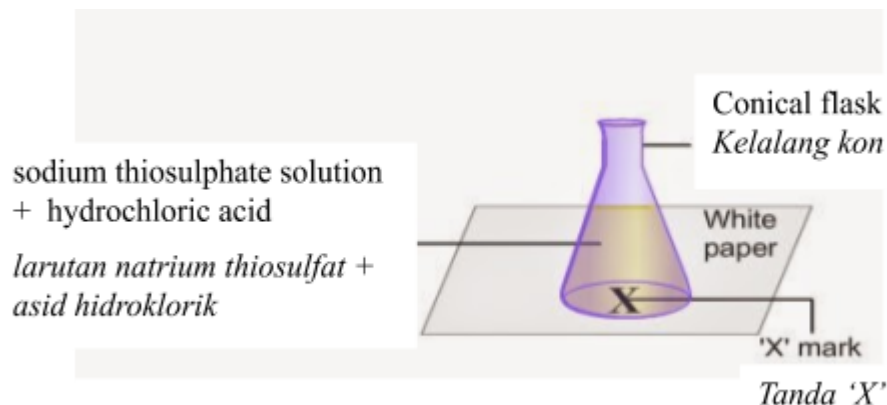


Diagram 4
Rajah 4

Experiment <i>Eksperimen</i>	Temperature / $^{\circ}\text{C}$ <i>Suhu / $^{\circ}\text{C}$</i>	Time taken for 'X' mark to disappear / s <i>Masa untuk tanda 'X' hilang / s</i>
I	30	25
II	50	15

Table 4
Jadual 4

- (a) (i) What is observed at the bottom of the conical flask in both experiments?
Apakah yang diperhatikan di dasar kelalang kon dalam kedua-dua eksperimen?

[1 mark]

- (ii) State the name of the substance formed in a(i).
Nyatakan nama bahan yang terbentuk dalam a(i).

[1 mark]

- (b) Write a balanced chemical equation for the reaction above
Tuliskan persamaan kimia yang seimbang bagi tindak balas di atas

[2 marks]

- (c) (i) Referring to Table 4, compare the rate of reaction of Experiment I and Experiment II.
Merujuk kepada Jadual 4, bandingkan kadar tindak balas bagi Eksperimen I dan Eksperimen II.

[1 mark]

- (ii) Explain your answer in (c) (i) referring to the collision theory.
Terangkan jawapan anda di (c) (i) dengan merujuk teori perlanggaran.

[3 marks]

- (d) Sketch the graph of the volume of gas produced against time for both experiments on the same axis.
Lakarkan graf isipadu gas yang terbebas melawan masa bagi kedua-dua eksperimen pada paksi yang sama.

[2 marks]

- 5 Two experiments have been carried out to study the effect of factors affecting the rate of reaction at room temperature.

Dua eksperimen telah dijalankan untuk mengkaji kesan faktor yang mempengaruhi kadar tindak balas pada suhu bilik.

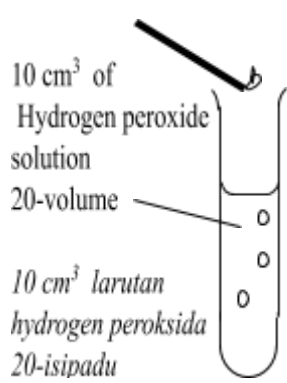
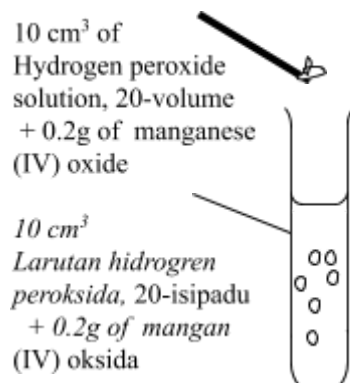
Experiment <i>Eksperimen</i>	I	II
Set-up of apparatus <i>Susunan alat radas</i>	 10 cm³ of Hydrogen peroxide solution 20-volume 10 cm³ larutan hydrogen peroksida 20-isipadu	 10 cm³ of Hydrogen peroxide solution, 20-volume + 0.2g of manganese (IV) oxide 10 cm³ Larutan hidrogen peroksida, 20-isipadu + 0.2g of mangan (IV) oksida
Observation <i>Pemerhatian</i>	The wooden splinter glows dimly <i>Kayu uji berbara dengan malap</i>	The wooden splinter rekindles brightly <i>Kayu uji menyala dengan terang</i>

Table 5
Jadual 5

- (a) (i) Based on the observation in Table 5, compare the rate of reaction between Experiment I and II.

Berdasarkan pemerhatian daripada Jadual 5, bandingkan kadar tindak balas antara Eksperimen I dan II.

[1 mark]

- (ii) Using the collision theory, explain why there is a difference in the rate of reaction for Experiment I and II.

Dengan menggunakan Teori Pelanggaran, jelaskan mengapa terdapat perbezaan pada kadar tindak balas bagi Eksperimen I dan II.

[3 marks]

- (b) The graph in Diagram 5 shows the result of Experiment I.
Graf pada Rajah 5 menunjukkan keputusan bagi Eksperimen I.

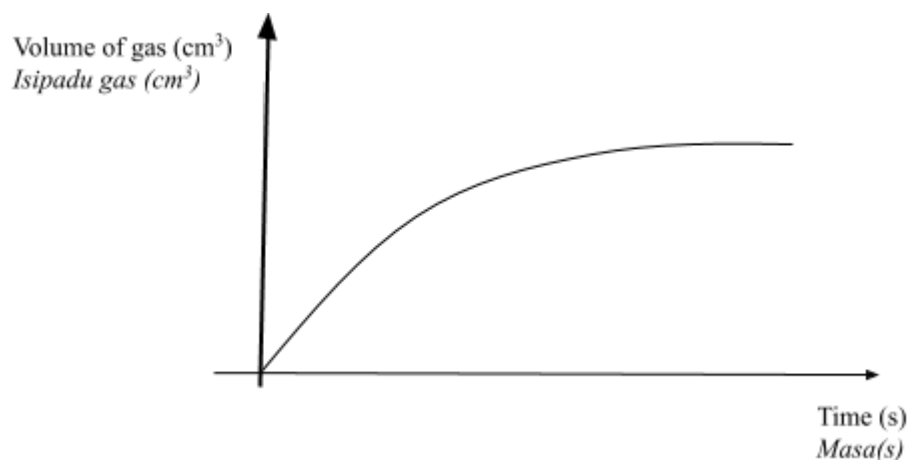


Diagram 5
Rajah 5

On Diagram 5, sketch the curves that you would expect to obtain,

- For experiment II
- Experiment 1 is repeated using 10 cm³ of Hydrogen peroxide solution 10-volume (Other conditions remain the same)

Pada Rajah 5, lakarkan lengkuk yang dijangka

- Untuk eksperimen II*
- Eksperimen 1 diulang menggunakan 10 cm³ larutan hidrogen peroksida 10-isipadu [Keadaan lain tidak berubah]*

[2 marks]

- (c) (i) Write the balanced chemical equation for the decomposition of hydrogen peroxide in both the experiments.

Tuliskan persamaan kimia yang seimbang bagi penguraian hidrogen peroksida di kedua-dua eksperimen tersebut.

[2 marks]

- (ii) Describe a chemical test to verify the gas in (c) (i).
Huraikan satu ujian kimia untuk mengesahkan gas di (c) (i).

[2 marks]

Section B
Bahagian B

1. (a) (i) What is the meaning of the rate of reaction ?
Apakah maksud kadar tindak balas?

[1 mark]

- (ii) State 4 factors that affect the rate of reaction.
Nyatakan 4 faktor yang mempengaruhi kadar tindak balas

[4 marks]

- (b) An experiment was carried out to study the effect of concentration on the rate of reaction. The table below shows the data obtained when different concentrations of sodium thiosulphate solution, $\text{Na}_2\text{S}_2\text{O}_3$ reacts with 1.0 mol dm^{-3} sulphuric acid, H_2SO_4 . The table below shows the results of the experiment.

Satu eksperimen telah dijalankan untuk mengkaji kesan kepekatan ke atas kadar tindak balas. Jadual di bawah menunjukkan data yang diperolehi apabila larutan natrium tiosulfat, $\text{Na}_2\text{S}_2\text{O}_3$ yang berbeza kepekatan bertindak balas dengan 1.0 mol dm^{-3} asid sulfurik, H_2SO_4 . Jadual di bawah menunjukkan keputusan eksperimen.

Experiment <i>Eksperimen</i>	1	2	3	4	5
Concentration of sodium thiosulphate solution/ mol dm^{-3} <i>Kepekatan larutan natrium tiosulfat/ mol dm^{-3}</i>	0.20	0.16	0.12	0.08	0.04
Time / s <i>Masa / s</i>	24	30	42	62	111
$1/\text{time} / \text{s}^{-1}$ <i>1 / masa / s^{-1}</i>					

Copy and complete the table above. Based on the table, plot a graph of concentration of sodium thiosulphate against $1/\text{time}$.

Salin dan lengkapkan jadual di atas. Berdasarkan jadual di atas, plotkan graf kepekatan larutan natrium tiosulfat melawan $1/\text{masa}$

[6 marks]

- (c) Based on your plotted graph, state the relationship between :
Berdasarkan graf yang anda plotkan, nyatakan hubungan di antara :
- (i) the value of $1/\text{time}$ taken and the rate of reaction.
nilai $1/\text{masa}$ dan kadar tindak balas. [1 mark]
- (ii) the rate of reaction and the concentration of sodium thiosulphate solution.
kadar tindak balas dan kepekatan larutan natrium tiosulfat. [1 mark]
- (d) Write the chemical equation for the reaction between sodium thiosulphate solution and sulphuric acid.
Tuliskan persamaan kimia bagi tindak balas antara larutan natrium tiosulfat dengan asid sulfurik. [2 marks]
- (e) (i) What is the effect on the rate of reaction if hydrochloric acid of the same concentration is used to replace sulphuric acid in this experiment?
Apakah kesannya ke atas kadar tindak balas jika asid hidroklorik, yang mempunyai kepekatan yang sama digunakan untuk menggantikan asid sulfurik dalam eksperimen ini? [1 mark]
- (ii) Explain your answer in (e)(i).
Jelaskan jawapan anda dalam (e)(i). [4 marks]

2. The speed of a chemical reaction is called the rate of reaction. Some reactions are fast and some are slow.

Kelajuan sesuatu tindak balas dipanggil kadar tindak balas. Ada beberapa tindak balas yang cepat dan ada beberapa tindak balas yang lambat.

- (a) (i) Based on this statement, what is the relationship between rate of reaction and time?

Berdasarkan kenyataan di atas, apakah hubungan antara kadar tindak balas dengan masa?

[1 mark]

- (ii) Give two examples of a fast and two examples of a slow reaction.

Berikan satu contoh tindak balas yang cepat dan satu contoh tindak balas yang lambat.

[4 marks]

- (b) An experiment was carried out to study the relationship between rate of reaction and time for the reaction of calcium carbonate powder, CaCO_3 , and hydrochloric acid, HCl , 1.0 mol dm^{-3} .

The table below shows the data that was obtained for the reaction.

Satu eksperimen telah dijalankan untuk mengkaji hubungan antara kadar tindak balas dengan masa bagi tindak balas antara serbuk kalsium karbonat, CaCO_3 dengan asid hidroklorik, HCl , 1.0 mol dm^{-3} .

Jadual di bawah menunjukkan data yang diperolehi bagi tindak balas tersebut.

Time / min <i>Masa / min</i>	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Volume of gas collected / cm^3 <i>Isipadu gas yang terkumpul / cm^3</i>	0	12	22	30	36	40	42	43	43

- (i) Based on the table, plot a graph of volume of gas collected against time.
Berdasarkan jadual diatas, plotkan graf isipadu gas yang terkumpul melawan masa.

[3 marks]

- (ii) Based on your plotted graph, calculate the rate of reaction at :
Berdasarkan graf yang anda plotkan, hitung kadar tindak balas pada :

- first minute
minit pertama
- third minute
minit ketiga

Compare the rate of reactions above. Explain the difference between both the rate of reactions.

Bandingkan perbezaan kadar tindak balas di atas. Terangkan perbezaan antara kedua-dua kadar tindak balas tersebut

[6 marks]

- (iii) The experiment above is repeated with calcium carbonate chips. All other conditions remain the same. Sketch a curve that will be obtained on the graph plotted at b(i).

Eksperimen di atas diulangi dengan menggunakan ketulan kalsium karbonat. Keadaan lain kekal sama. Lakarkan lengkung yang akan diperolehi pada graf yang diplot dalam b(i)

[1 mark]

- (iv) Using Collision theory, explain the difference in the rate of reaction for both the experiments above.

Dengan menggunakan teori perlanggaran, terangkan perbezaan antara kadar tindak balas bagi kedua-dua eksperimen.

[5 marks]

Section C
Bahagian C

1. (a) Catalyst is one of the factors affecting the rate of reaction. It is used widely in industrial processes, such as the making of sulfuric acid.

What is a catalyst? Name the industrial process to produce sulphuric acid and the catalysts used.

Mangkin adalah satu faktor yang mempengaruhi kadar tindak balas. Ia digunakan dengan meluas di dalam industri misalnya dalam pembuatan asid sulfurik.

Apakah itu mangkin? Namakan proses pembuatan asid sulfurik dalam industri dan mangkin yang digunakan

[3 marks]

- (b) Catalyst is one of the factors affecting the rate of reaction. Give **four** characteristics of a catalyst.

Mangkin adalah satu faktor yang mempengaruhi kadar tindak balas. Berikan empat ciri-ciri bagi mangkin.

[3 marks]

- (c) Using the collision theory, explain how a catalyst affects the rate of a chemical reaction.

Dengan menggunakan teori perlanggaran, terangkan bagaimana mangkin boleh mempengaruhi kadar tindak balas kimia.

[4 marks]

- (d) With the aid of a labelled diagram, describe an experiment that shows the effect of the catalyst manganese(IV) oxide on the rate of decomposition of hydrogen peroxide solution. Sketch a related graph to show the results of the experiment.

Dengan bantuan gambarajah yang berlabel, huraikan satu eksperimen untuk menunjukkan kesan mangkin mangan(IV) oksida ke atas kadar tindak balas penguraian larutan hidrogen peroksida. Lakarkan graf yang berkaitan bagi menunjukkan keputusan eksperimen.

[10 marks]

2. A student carried out three experiments to investigate the factors affecting the rate of reaction. Table 2 shows the results of the experiments. The reaction between sodium thiosulphate and hydrochloric acid produced sodium chloride, sulphur, sulphur dioxide and water.

Seorang pelajar menjalankan tiga eksperimen untuk mengkaji faktor yang mempengaruhi kadar tindak balas. Jadual 2 menunjukkan keputusan bagi eksperimen itu. Tindak balas antara natrium tiosulfat dan asid hidroklorik menghasilkan natrium klorida, sulfur, sulfur dioksida dan air.

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	Temperature (°C) <i>Suhu</i> (°C)	Time taken for 'X' mark to disappear from sight/s <i>Masa untuk pangkah "X"</i> <i>hilang dari penglihatan/s</i>
I	50 cm ³ of 0.2 mol dm ⁻³ sodium thiosulphate solution + 5 cm ³ of 1 mol dm ⁻³ hydrochloric acid <i>50 cm³ larutan natrium</i> <i>tiosulfat 0.2 mol dm⁻³ +</i> <i>5 cm³ asid hidroklorik 1.0</i> <i>mol dm⁻³</i>	30.0	18.0
II	50 cm ³ of 0.2 mol dm ⁻³ sodium thiosulphate solution + 5 cm ³ of 1 mol dm ⁻³ hydrochloric acid <i>50 cm³ larutan natrium</i> <i>tiosulfat 0.2 mol dm⁻³ +</i> <i>5 cm³ asid hidroklorik 1.0</i> <i>mol dm⁻³</i>	40.0	11.0
III	50 cm ³ of 0.2 mol dm ⁻³ sodium thiosulphate solution + 5 cm ³ of 2 mol dm ⁻³ hydrochloric acid <i>50 cm³ larutan natrium</i> <i>tiosulfat 0.2 mol dm⁻³ +</i> <i>5 cm³ asid hidroklorik 2.0</i> <i>mol dm⁻³</i>	40.0	2.0

Table 2
Jadual 2

- (a) (i) Based on Table 2,
- Arrange the rate of reaction for experiments I, II and III in ascending order.
 - state the factor that affect the rate of reaction between
 - (i) Experiment I and Experiment II
 - (ii) Experiment II and Experiment III
 - write the chemical reaction for Experiment III

Berdasarkan Jadual 2

- *Susunkan kadar tindak balas bagi eksperimen I,II dan III dalam tertib menaik.*
- *Nyatakan faktor yang mempengaruhi kadar tindak balas di antara
 - (i) Eksperimen I dan Eksperimen II
 - (ii) Eksperimen II dan Eksperimen III*
- *Tuliskan persamaan kimia untuk Eksperimen III*

[5 marks]

- (ii) Explain using collision theory the difference in the rate of reaction between Experiment II and Experiment III.

Terangkan dengan menggunakan teori perlanggaran perbezaan kadar tindak balas antara Eksperimen II dan Eksperimen III.

[5 marks]

- (b) Referring to Table 2, describe a laboratory experiment using the factor that affects the rate of reaction between sodium thiosulphate solution and hydrochloric acid in Experiment I and Experiment II . In your description, include an experiment procedure, observation and an ionic equation.

Merujuk kepada Jadual 2, huraikan satu eksperimen yang menggunakan faktor yang mempengaruhi kadar tindak balas di antara larutan natrium tiosulfat dengan larutan asid hidroklorik dalam Eksperimen I dan Eksperimen II. Dalam huraian anda, sertakan kaedah eksperimen, pemerhatian dan persamaan ion.

[10 marks]

Kertas 3

TAJUK : RATE OF REACTION/ KADAR TINDAK BALAS

Structure/ Struktur

- 1 Diagram 1.1 shows the apparatus set-up for an experiment to investigate the effect of temperature on the rate of reaction between sodium thiosulphate solution and sulphuric acid. In each set of the experiment, the size of conical flask used is 250 cm^3 . 50 cm^3 of 0.05 mol dm^{-3} of sodium thiosulphate solution at 30°C is poured into a conical flask and 10 cm^3 of 1.0 mol dm^{-3} of sulphuric acid is added immediately into the sodium thiosulphate solution. The conical flask is shaken and then placed on a white paper with mark 'X' as shown in Diagram 1.1. The time taken for the mark 'X' to disappear from sight is recorded.

Rajah 1.1 menunjukkan susunan radas bagi eksperimen untuk mengkaji kesan suhu ke atas kadar tindak balas antara larutan natrium tiosulfat dan asid sulfurik. Dalam setiap eksperimen, saiz kelalang kon yang digunakan adalah 250 cm^3 . 50 cm^3 larutan natrium tiosulfat 0.05 mol dm^{-3} pada suhu 30°C dimasukkan ke dalam sebuah kelalang kon dan 10 cm^3 asid sulfurik 1.0 mol dm^{-3} ditambah dengan cepat kepada larutan natrium tiosulfat itu. Kelalang kon itu digoncangkan dan kemudian diletakkan di atas kertas putih yang ditanda 'X' seperti yang ditunjukkan pada Rajah 1.1. Masa untuk tanda 'X' hilang dari pandangan dicatatkan.

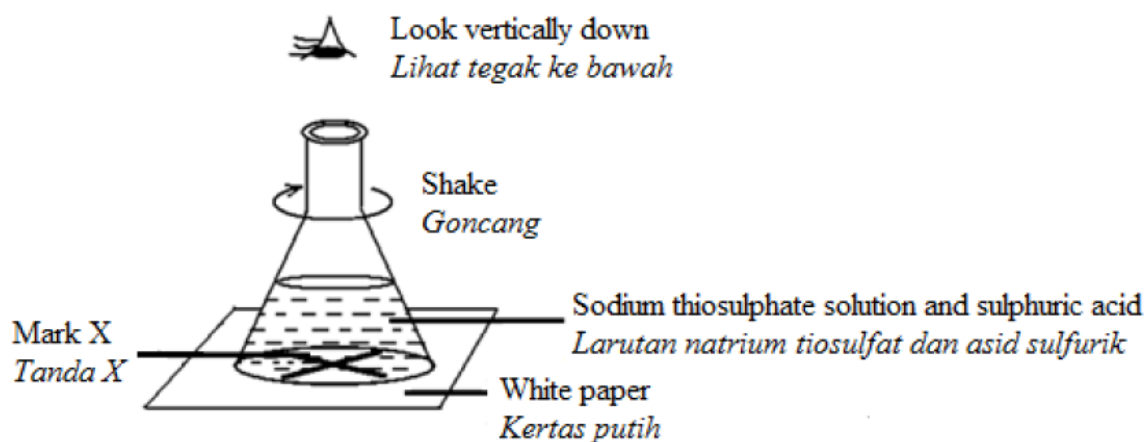
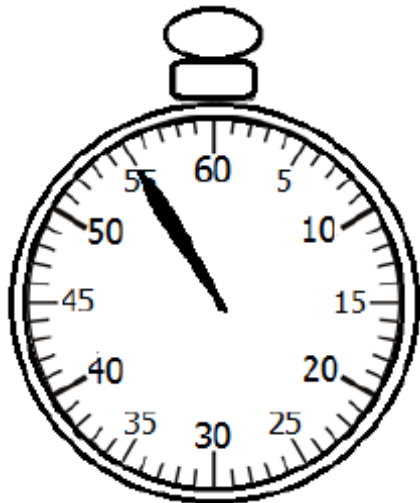
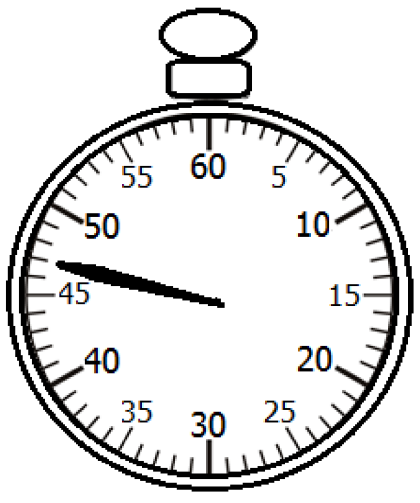
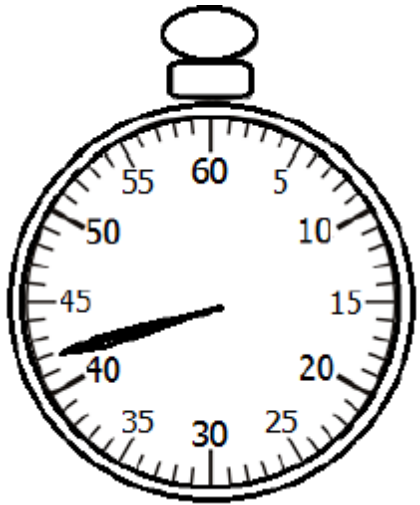
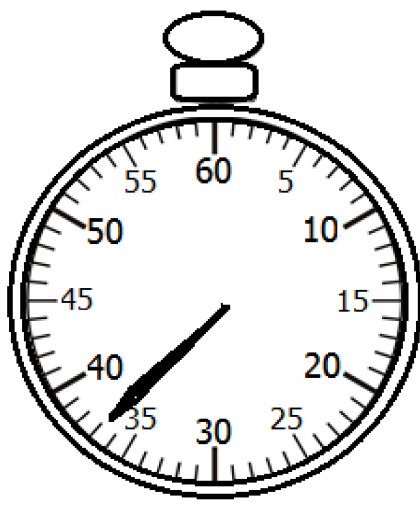


Diagram 1.1
Rajah 1.1

The experiment is repeated by the same volume and concentration of sodium thiosulphate solution which is heated to 35°C , 40°C , 45°C and 50°C . Diagram 1.2 shows the readings of the stopwatch in each experiment.

Eksperimen itu diulangi untuk larutan natrium tiosulfat dengan isipadu dan kepekatan yang sama dipanaskan pada suhu 35°C , 40°C , 45°C dan 50°C . Rajah 1.2 menunjukkan bacaan jam randik bagi setiap eksperimen.

- a(i) Record the stopwatch readings in the space provided in Diagram 1.2 below.
Catatkan bacaan jam randik pada ruang yang disediakan pada Rajah 1.2 di bawah.

Set I <i>Set I</i>	Set II <i>Set II</i>
	
Temperature = 30°C <i>Suhu</i> Time, t_1 = _____ <i>Masa</i>	Temperature = 35°C <i>Suhu</i> Time, t_2 = _____ <i>Masa</i>
Set III <i>Set III</i>	Set IV <i>Set IV</i>
	
Temperature = 40°C <i>Suhu</i> Time, t_3 = _____ <i>Masa</i>	Temperature = 45°C <i>Suhu</i> Time, t_4 = _____ <i>Masa</i>

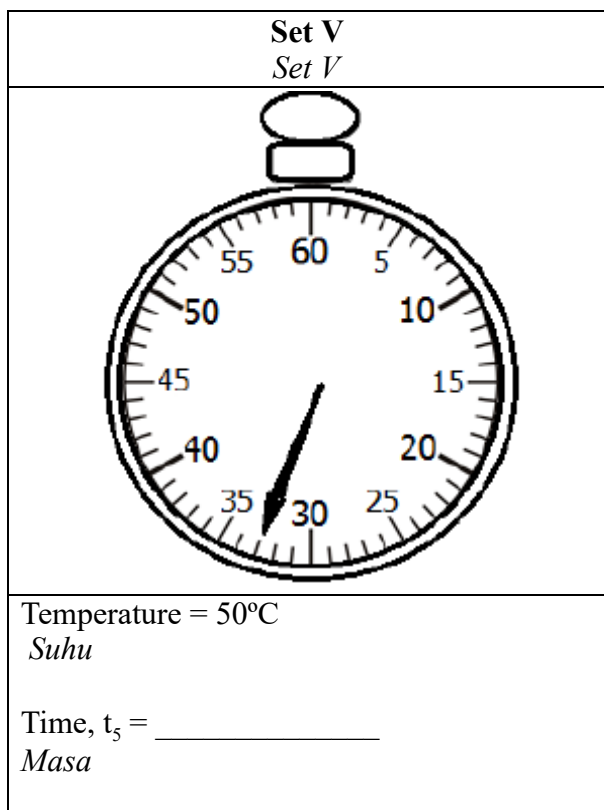


Diagram 1.2

Rajah 1.2

[3 marks / 3 markah]

- (b) Construct a table and record temperature, time and 1/time for this experiment.
Bina satu jadual dan rekodkan suhu, masa dan 1/masa untuk eksperimen ini.

[3 marks / 3 markah]

- (c) Plot a graph of temperature of sodium thiosulphate solution against 1/time on the graph paper provided.
Lukiskan graf kepekatan natrium tiosulfat melawan 1/masa di atas kertas graf yang disediakan.

[3 marks / 3 markah]

- (d) Based on the graph, state the relationship between the temperature of sodium thiosulphate solution and the rate of reaction.

Berdasarkan graf, nyatakan hubungan antara kepekatan larutan natrium tiosulfat dengan kadar tindak balas.

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[3 marks / 3 markah]

- (e) State the operational definition for the rate of reaction based on this experiment.

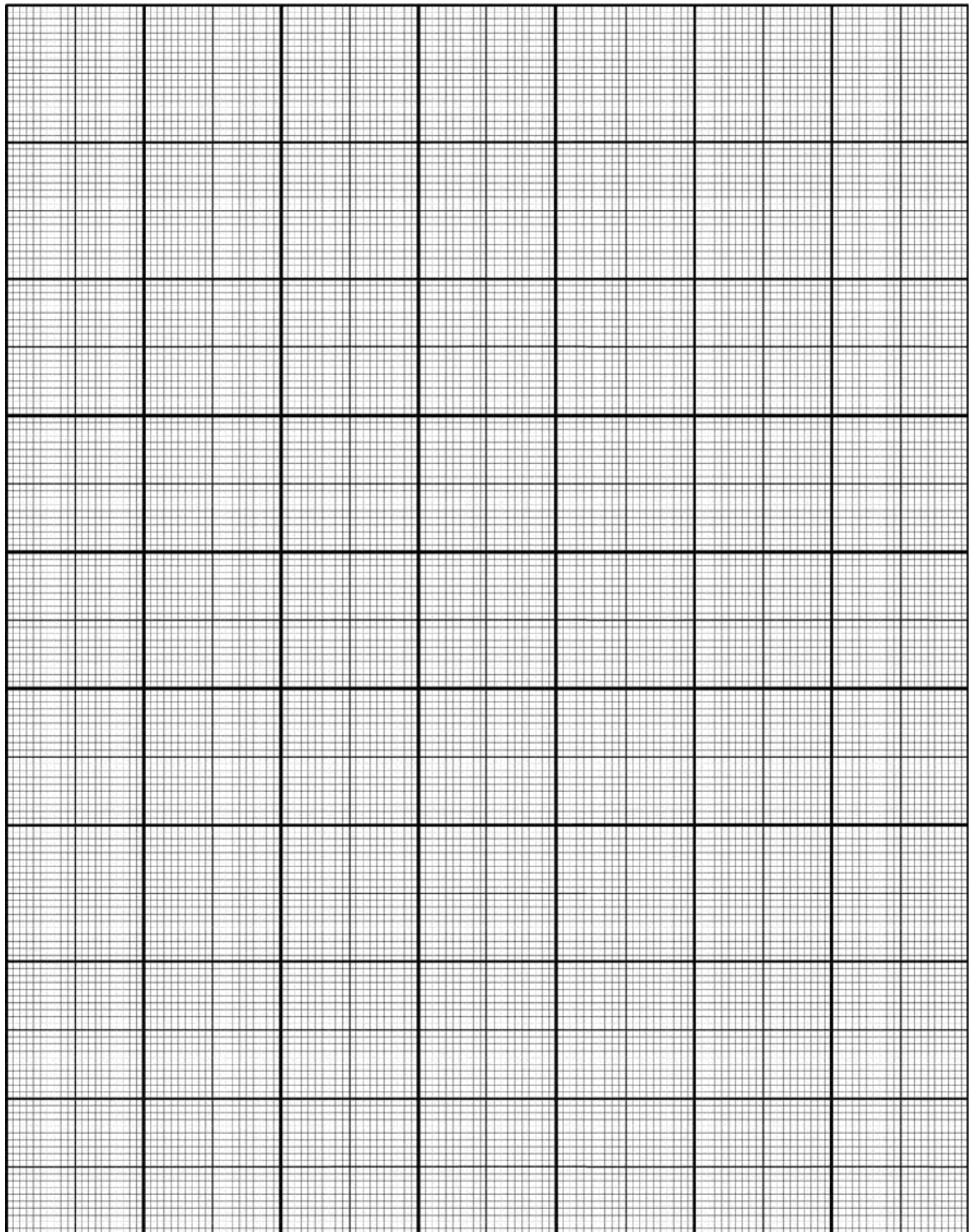
Nyatakan definisi secara operasi bagi kadar tindak balas berdasarkan eksperimen ini.

.....

.....

.....

[3 marks / 3 markah]



2

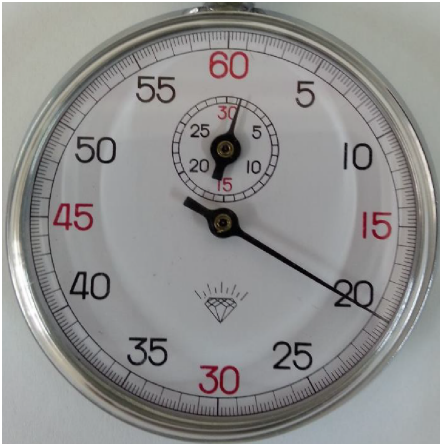
A student carried out an experiment to investigate the effect of temperature on the rate of reaction between excess zinc powder and 25 cm³ of 0.1 mol dm⁻³ hydrochloric acid. The reaction is carried out at different temperatures; 25.0°C, 30.0°C, 40.0°C, 50.0°C and 60.0°C. Time taken to collect 30.00 cm³ of hydrogen gas is recorded.

The stopwatch readings for each temperature are shown in Diagram 2.1.

Seorang pelajar menjalankan suatu eksperimen untuk mengkaji kesan suhu ke atas kadar tindak balas di antara serbuk zink berlebihan dengan 25 cm³ asid hidroklorik 0.1 mol dm⁻³. Tindak balas dijalankan pada suhu yang berbeza; 25.0 °C, 30.0 °C, 40.0 °C, 50.0 °C and 60.0 °C.

Masa yang diambil untuk mengumpulkan 30.00 cm³ gas hidrogen dicatatkan.

Bacaan jam randik bagi setiap suhu ditunjukkan dalam Rajah 2.1.

Temperature/°C <i>Suhu/ °C</i>	Stopwatch reading <i>Bacaan jam randik</i>	Time taken / s <i>Masa yang diambil/s</i>
25.0		
30.0		

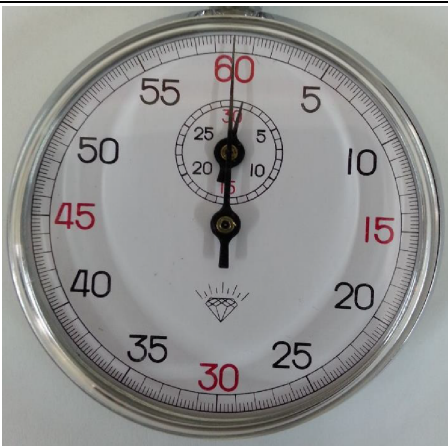
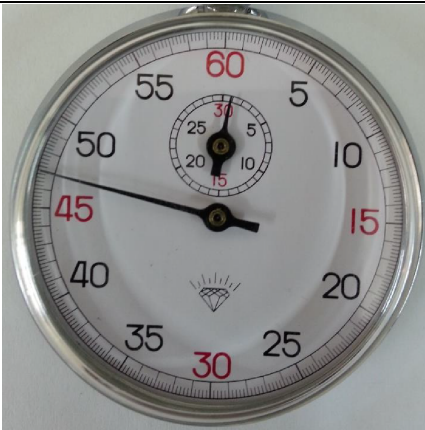
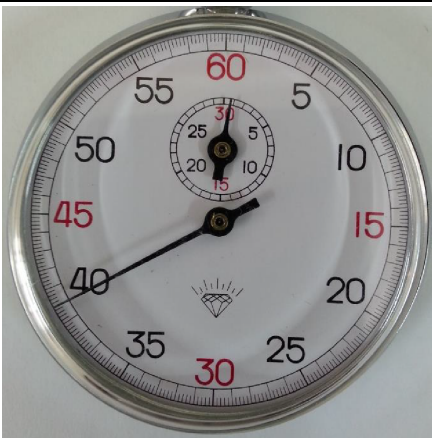
40.0		
50.0		
60.0		

Diagram 2.1
Rajah 2.1

- (a) Record the time for each temperature in Diagram 2.1.
Rekodkan bacaan suhu bagi Diagram 2.1

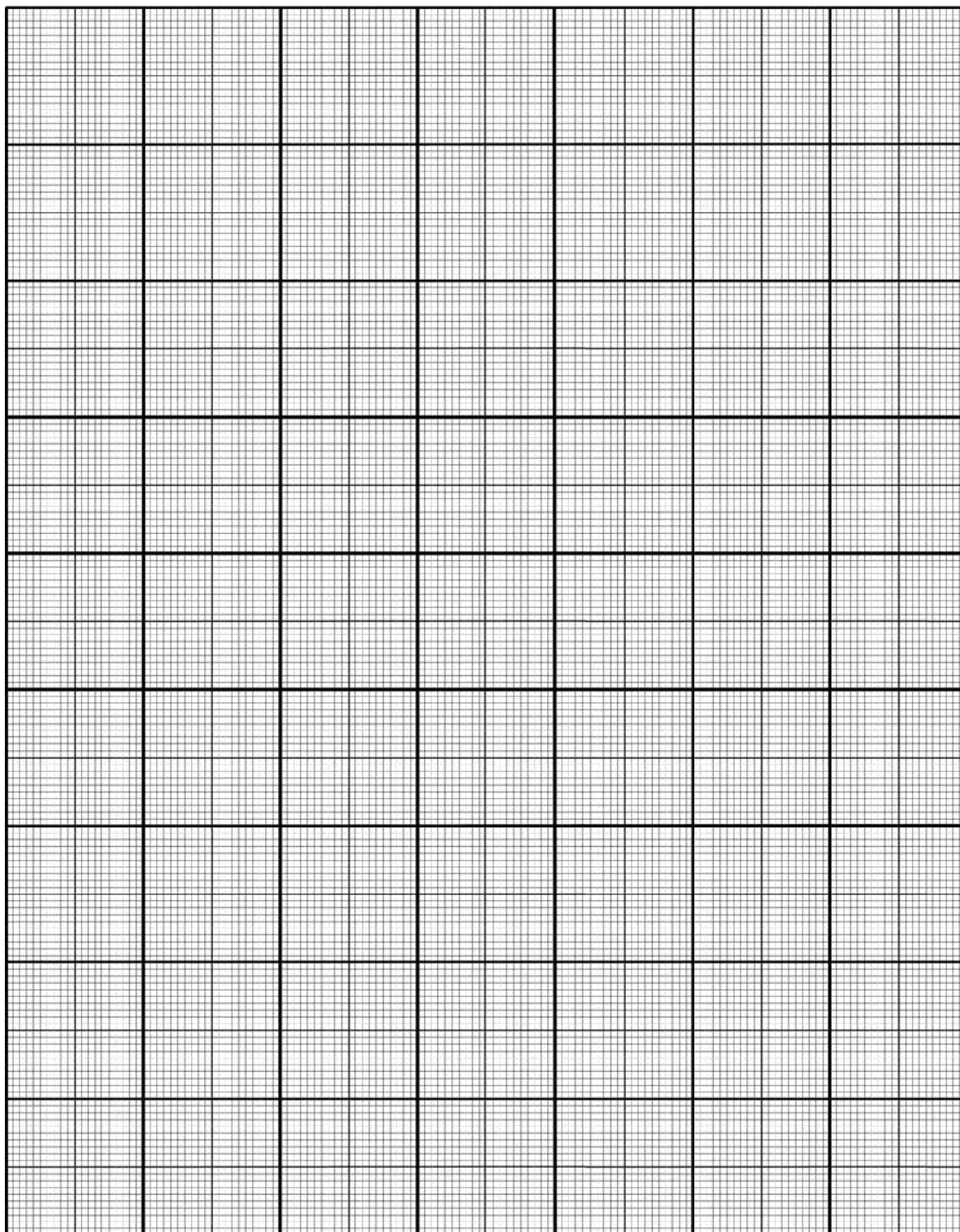
[3 marks / 3 markah]

- (b) Tabulate the reading of temperature, time and $1/\text{time}$ in the space provided.
Jadualkan bacaan suhu, masa dan $1/\text{masa}$ di dalam ruangan yang disediakan.

[3 marks / 3 markah]

- (c)(i) Draw a graph of temperature against $1/\text{time}$ on the graph paper.
Lukiskan graf suhu melawan $1/\text{masa}$ pada kertas graf.

[3 marks / 3 markah]



c(ii) State the relationship between temperature and the rate of reaction.

Nyatakan perhubungan antara suhu dan kadar tindak balas .

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[3 marks/ 3 markah]

- c(iii) Predict the time taken for collecting 30.00 cm^3 of hydrogen gas when the experiment was carried out at 45.0°C .

Show on the graph how you determine the answer.

Ramalkan masa yang diambil untuk mengumpul 30.00 cm^3 gas hidrogen pada 45.0°C .

Tunjukkan pada graf bagaimana anda memperolehi jawapan.

.....
[3 marks/ 3 markah]

- (d) State the operational definition for the rate of reaction in this experiment .

Nyatakan definisi secara operasi bagi kadar tindak balas dalam eksperimen ini

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.....
[3 marks/ 3 markah]

- (e) The experiment at 30.0°C is repeated by using a zinc strip to replace the zinc powder. The time taken for the reaction to be completed is longer. Explain why.

Eksperimen pada suhu 30.0°C diulangi dengan menggunakan kepingan zink untuk menggantikan serbuk zink. Masa yang diambil untuk tindak balas lengkap adalah lebih panjang. Terangkan mengapa.

.....
.....
.....
[3 marks/ 3 markah]

3 Diagram 3.1, 3.2, 3.3, 3.4 and 3.5 shows the apparatus set-up of Set I, Set II, Set III, Set IV and Set V of an experiment to investigate the effect of temperature on the rate of reaction between sodium thiosulphate solution and hydrochloric acid. In each set of the experiment, the size of the conical flask used is 250 cm³.

Rajah 3.1, 3.2, 3.3, 3.4 dan 3.5 menunjukkan susunan radas Set I, Set II, Set III, Set IV dan Set V bagi satu eksperimen untuk mengkaji kesan suhu ke atas kadar tindak balas antara larutan natrium tiosulfat dan asid hidroklorik. Bagi setiap set eksperimen itu, saiz kelalang kon yang digunakan ialah 250 cm³

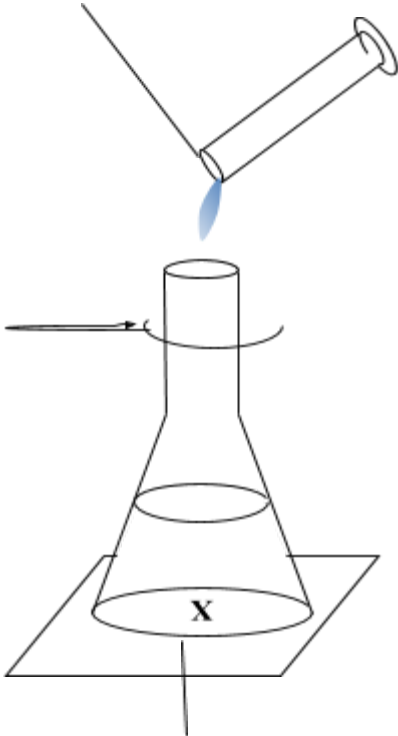
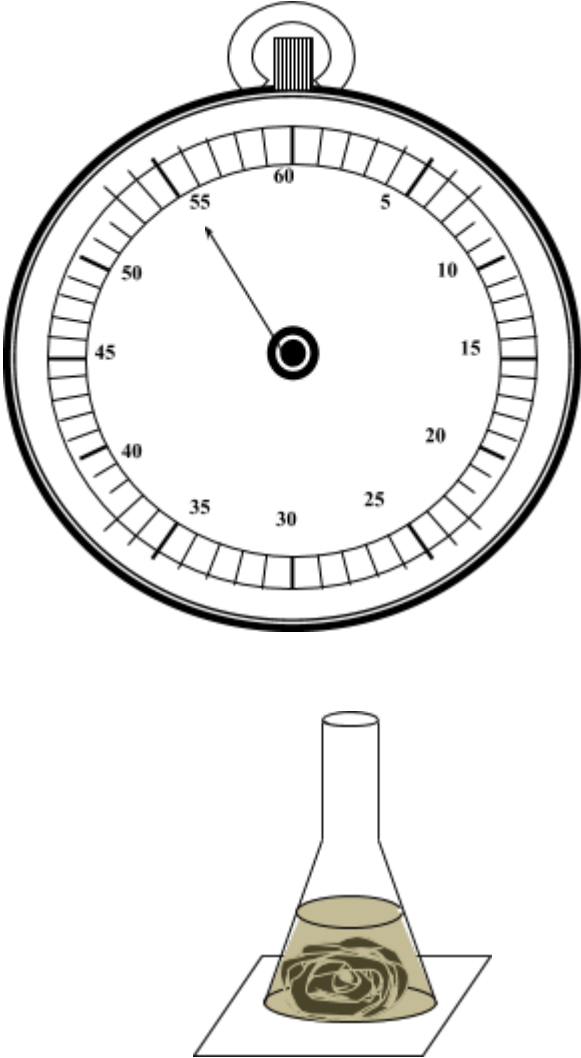
Set	Apparatus set-up <i>Susunan radas</i>	Observation <i>Pemerhatian</i>
I	5 cm³ of 1.0 mol dm⁻³ hydrochloric acid 5 cm³ of 1.0 mol dm⁻³ asid hidroklorik  50 cm³ of 0.2 mol dm⁻³ sodium thiosulphate solution 50 cm³ larutan natrium tiosulfat 0.2 mol dm⁻³	 Temperature of reaction 28°C Suhu tindak balas 28°C

Diagram 3.1
Rajah 3.1

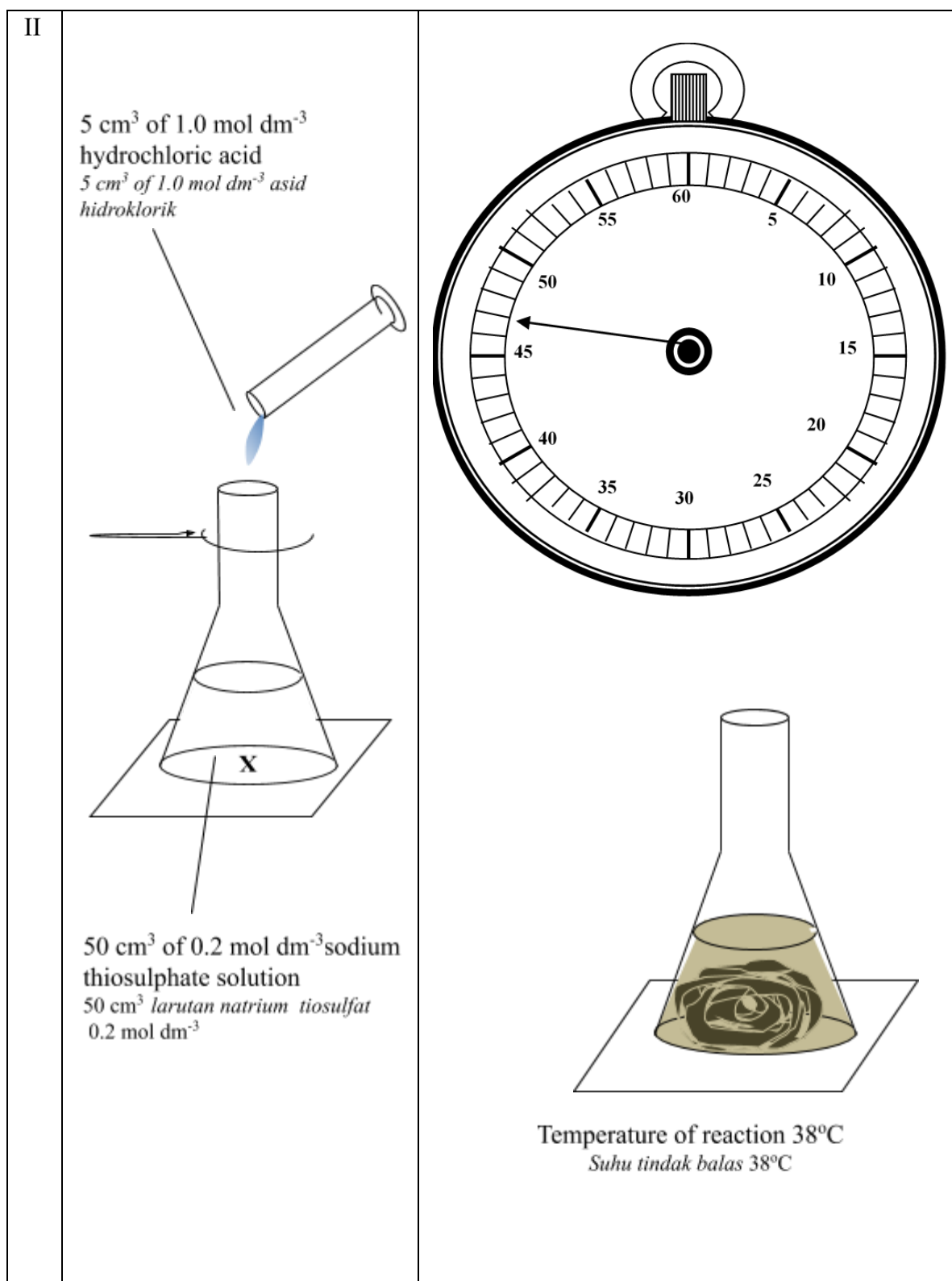


Diagram 3.2
Rajah 3.2

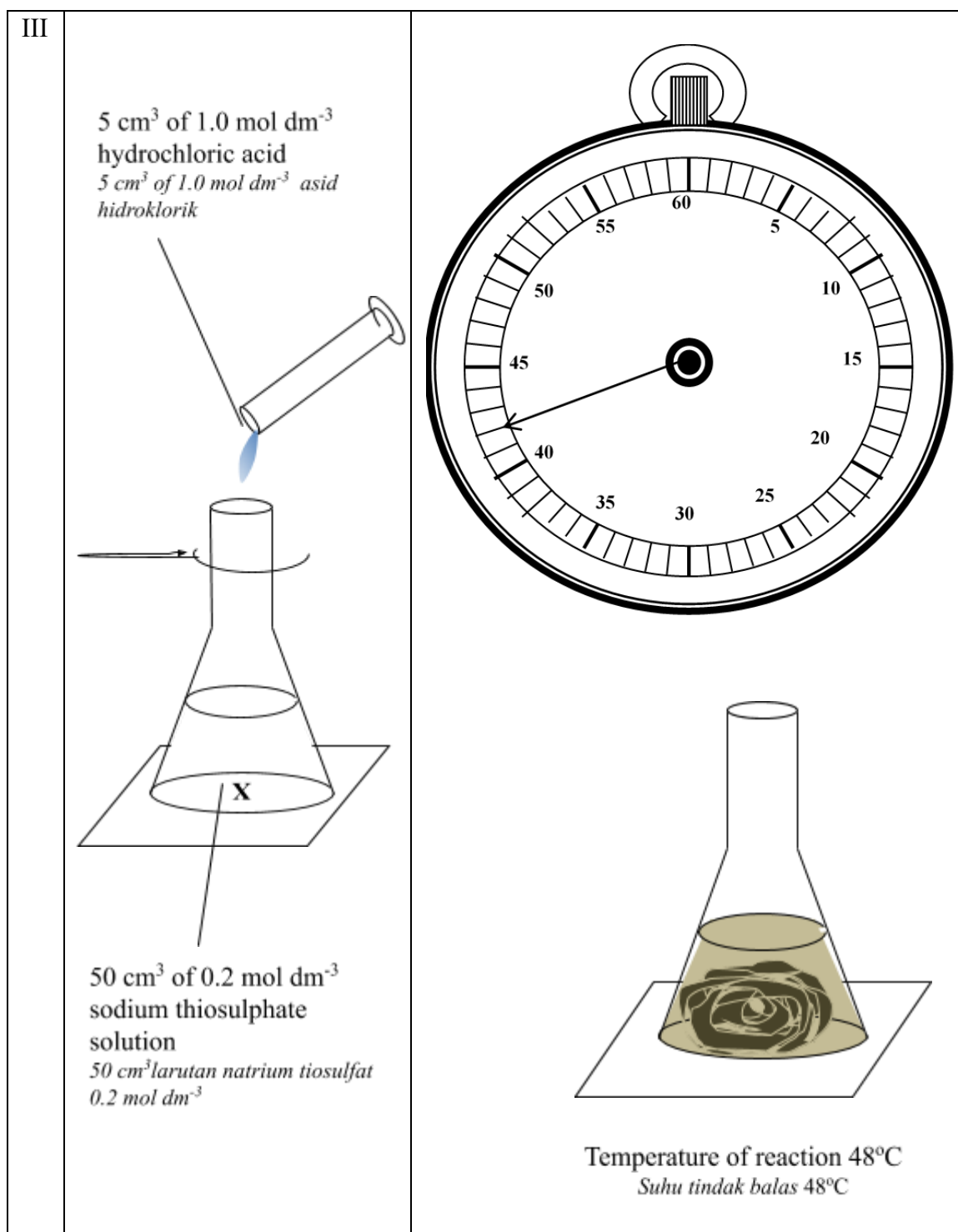
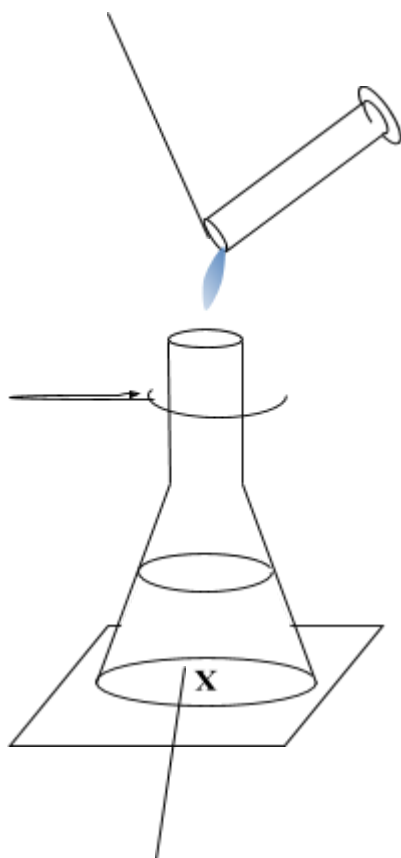


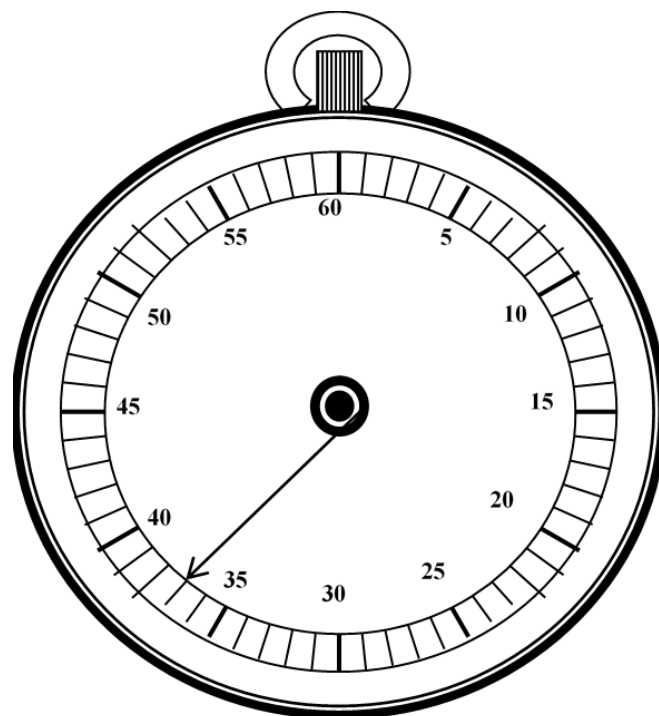
Diagram 3.3
Rajah 3.3

IV

5 cm³ of 1.0 mol dm⁻³
hydrochloric acid
5 cm³ of 1.0 mol dm⁻³ asid
hidroklorik



50 cm³ of 0.2 mol dm⁻³
sodium thiosulphate solution
50 cm³ larutan natrium tiosulfat
0.2 mol dm⁻³



Temperature of reaction 58°C
Suhu tindak balas 58°C

Diagram 3.4
Rajah 3.4

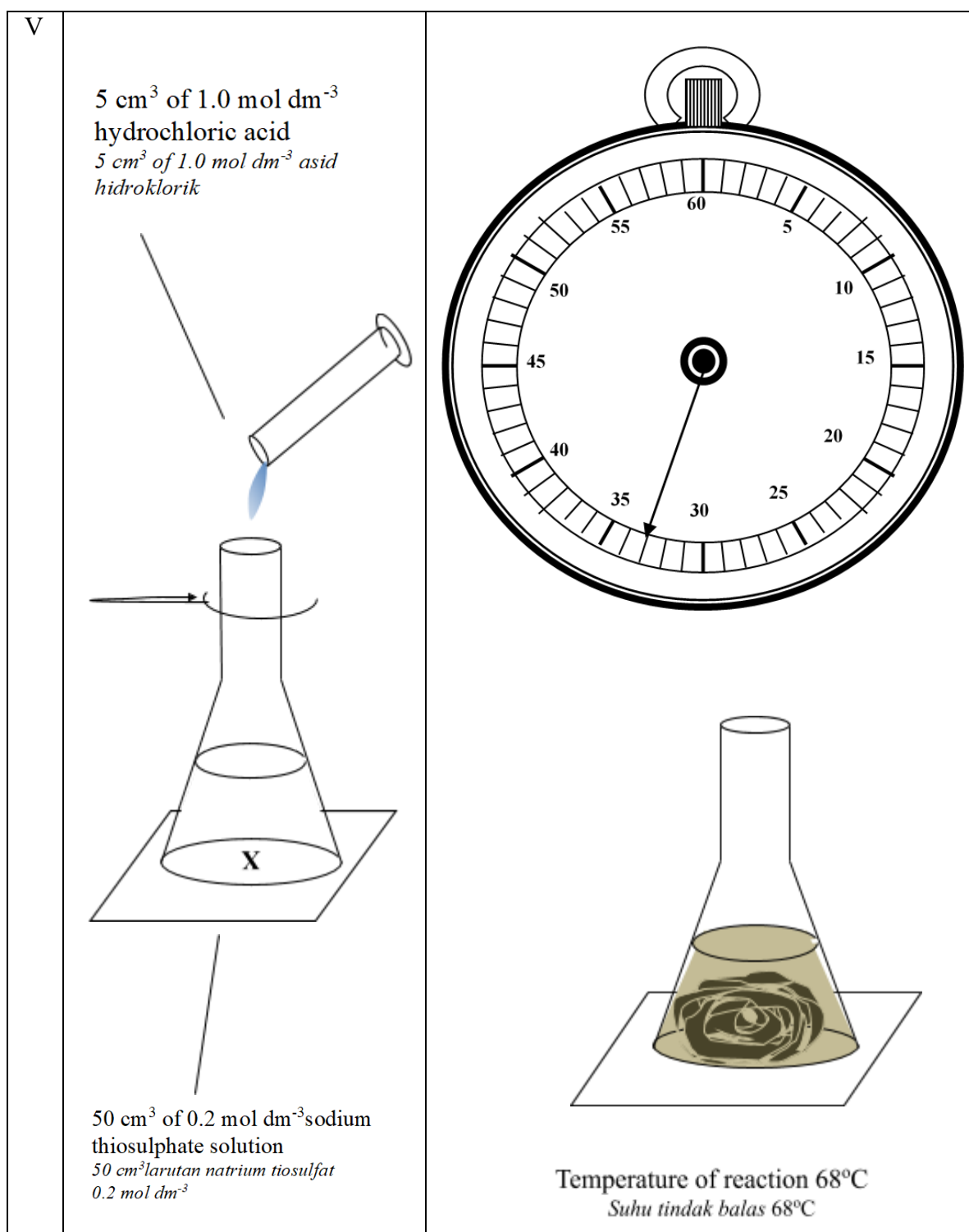


Diagram 3.5
Rajah 3.5

- (a)(i) Based on Diagrams 3.1, 3.2, 3.3, 3.4 and 3.5, state an observation for this experiment.
Berdasarkan Rajah 3.1, 3.2, 3.3, 3.4 dan 3.5, nyatakan satu pemerhatian dalam eksperimen ini.

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.....

[3 marks / 3 markah]

- (ii) Based on the observation in 3(a)(i), state the inference.
Berdasarkan pemerhatian dalam 3(a)(i), nyatakan inferens.

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[3 marks / 3 markah]

- (b) For this experiment, state the:
Bagi eksperimen ini nyatakan :

Manipulated variable:
Pemboleh ubah dimanipulasikan:

.....

Responding variable:
Pemboleh ubah bergerak balas:

.....

Constant variable:
Pemboleh ubah yang dimalarkan:

.....

[3 marks / 3 markah]

- (c) State one hypothesis for this experiment.
Nyatakan satu hipotesis bagi eksperimen ini.

.....

.....

[3 marks / 3 markah]

- (d) State the operational definition for the rate of reaction in this experiment.
Nyatakan definisi secara operasi bagi kadar tindak balas dalam eksperimen ini.

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.....

[3 marks / 3 markah]

- (e)(i) Based on Diagram 3.1, 3.2, 3.3, 3.4 and 3.5, complete Table 3.1.
Berdasarkan Rajah 3.1, 3.2, 3.3, 3.4 dan 3.5 lengkapkan Jadual 3.1.

Set	I	II	III	IV	V
Temperature of sodium thiosulphate solution (°C) <i>Suhu larutan natrium tiosulfat(°C)</i>	28	38	48	58	68
Time(s) <i>Masa(s)</i>					
1/time (s ⁻¹) <i>1/masa (s⁻¹)</i>					

Table 3.1
Jadual 3.1

[3 marks / 3 markah]

- (e)(ii) Based on Table 3.1, plot a graph of temperature of sodium thiosulphate solution against 1/time.
Berdasarkan jadual 3.1, plot graf suhu larutan natrium tiosulfat melawan 1/masa

[3 marks / 3 markah]

- (f)(i) State the relationship between the temperature of sodium thiosulphate solution and the rate of reaction.
Nyatakan hubungan antara suhu larutan natrium tiosulfat dengan kadar tindak balas.

.....
.....

[3 marks / 3 markah]

- (ii) Predict the time taken for the “ X ” mark to disappear from sight if the experiment is carried out at 70°C of sodium thiosulphate solution. Show on the graph how you determine the time taken.

Ramalkan masa yang diambil bagi tanda “ X “ tidak kelihatan lagi jika eksperimen itu dilakukan pada suhu 70°C bagi larutan natrium tiosulfat. Tunjukkan pada graf itu bagaimana anda menentukan masa yang diambil.

Time

Masa:.....s

[3 marks / 3 markah]

- (g) The experiment of Set I is repeated by replacing the 250 cm³ conical flask with a smaller conical flask.

The time taken for the mark “ X ” to disappear from sight is less than 20 seconds.

Explain why.

Eksperimen bagi Set I diulang dengan menggantikan kelalang kon 250 cm³ dengan kelalang kon yang lebih kecil.

Masa yang diambil bagi tanda “ X “ tidak kelihatan lagi adalah kurang daripada 20 saat. Terangkan mengapa.

.....
.....

[3 marks / 3 markah]

- (h) **Classify the ions present in Set II by completing Table 3.2**
Kelaskan ion-ion yang hadir dalam Set II dengan melengkapkan Jadual 3.2

Anions <i>Anion</i>	Cations <i>Kation</i>

Table 3.2
Jadual 3.2

[3 marks / 3 markah]

Kertas 3
Planning Experiment/ Merancang Eksperimen

- 1 **Rate of reaction (Effect of particle size)**
Kadar tindak balas (Kesan Saiz Zarah)



During camping, a group of students discovered that it is easier to start a bonfire using sticks rather than logs. This is due to the difference in size.

Referring to the above situation, plan a laboratory experiment to investigate the effect of size of reactant on the rate of reaction between calcium carbonate and hydrochloric acid. Your planning should include following aspects:

Semasa perkhemahan, sekumpulan pelajar mendapati bahawa lebih mudah untuk memulakan unggun api menggunakan kayu daripada kayu balak. Ini disebabkan oleh perbezaan ukuran. Merujuk kepada situasi di atas, rancang eksperimen makmal untuk menyiasat kesan ukuran bahan tindak balas terhadap kadar tindak balas antara kalsium karbonat dan asid hidroklorik.

Perancangan anda harus merangkumi aspek berikut:

- (a) Problem statement/ *Pernyataan Masalah*
- (b) All the variables/ *Semua Pemboleh ubah*
- (c) Hypothesis/ *Hipotesis*
- (d) List of materials and apparatus/ *Senarai Bahan dan Alat Radas*
- (e) Procedure/ *Prosedur*
- (f) Tabulation of data/ *Penjadualan data*

[17 marks/ markah]

2 **Rate of reaction (Effect of temperature)**
Kadar tindak balas (Kesan Suhu)



Food that is stored in a refrigerator will last longer than that of food stored in the kitchen cabinet.

Makanan yang disimpan di dalam peti sejuk akan bertahan lebih lama daripada makanan yang disimpan di dalam kabinet dapur.

Based on the above statement, plan a laboratory experiment to investigate the effect of temperature on the rate of reaction between sodium thiosulphate solution and dilute sulphuric acid. Your planning should include following aspects:

Berdasarkan pernyataan di atas, rancang eksperimen makmal untuk menyiasat kesan suhu pada kadar tindak balas antara larutan natrium tiosulfat dan asid sulfurik cair. Perancangan anda harus merangkumi aspek berikut:

- (a) Problem statement/ *Pernyataan Masalah*
- (b) All the variables/ *Semua Pemboleh ubah*
- (c) Hypothesis/ *Hipotesis*
- (d) List of materials and apparatus/ *Senarai Bahan dan Alat Radas*
- (e) Procedure/ *Prosedur*
- (f) Tabulation of data/ *Penjadualan data*

[17 marks/ *markah*]

3 **Rate of reaction (Effect of concentration)**
Kadar tindak balas (Kesan Suhu)



Building in industrial areas are more corroded than those in housing areas. This is because the concentration of acid in rainwater is higher in industrial areas.

Bangunan di kawasan perindustrian lebih terhakis daripada bangunan di kawasan perumahan. Ini kerana kepekatan asid dalam air hujan lebih tinggi di kawasan perindustrian.

Referring to the situation above, plan a laboratory experiment to investigate the effect of concentration on the rate of reaction between a named acid and a named metal. Your planning should include following aspects :

Merujuk kepada situasi di atas, rancang eksperimen makmal untuk menyiasat kesan kepekatan pada kadar tindak balas antara asid bernama dan logam bernama. Perancangan anda harus merangkumi aspek berikut :

- (a) Problem statement/ *Pernyataan Masalah*
- (b) All the variables/ *Semua Pemboleh ubah*
- (c) Hypothesis/ *Hipotesis*
- (d) List of materials and apparatus/ *Senarai Bahan dan Alat Radas*
- (e) Procedure/ *Prosedur*
- (f) Tabulation of data/ *Penjadualan data*

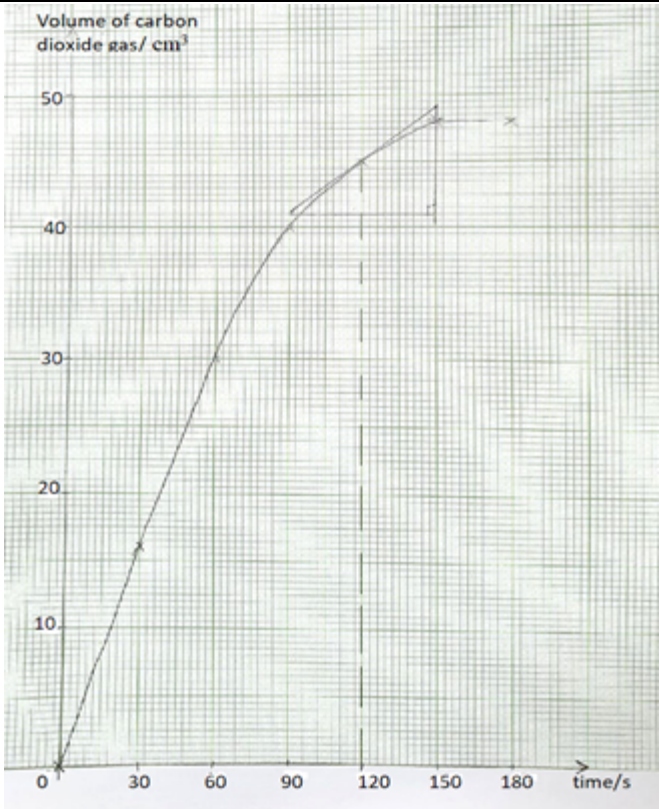
[17 marks/ markah]

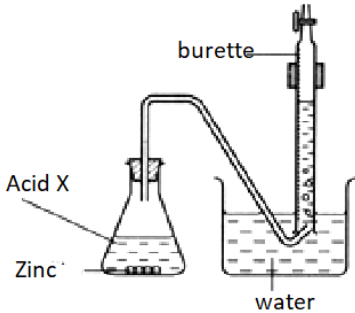
END OF QUESTION PAPER
KERTAS SOALAN TAMAT

SCHEME OF WORK FOR RATE OF REACTION (PAPER 2)

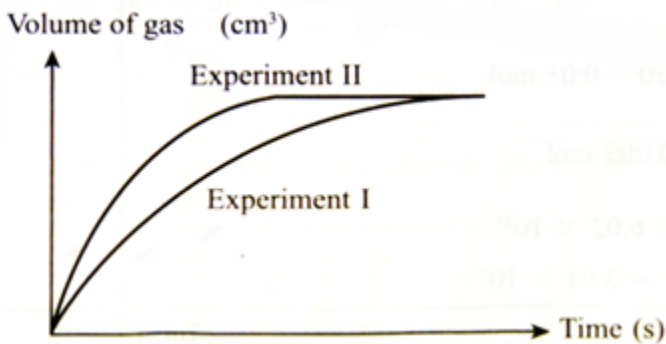
SKEMA JAWAPAN KADAR TINDAK BALAS (KERTAS 2)

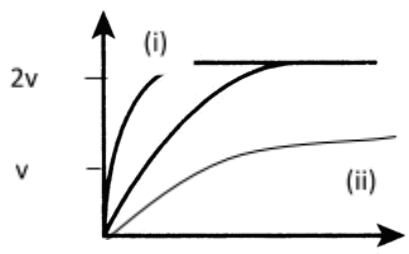
Bahagian A

Questions			Rubrics	Marks
1	a	i	$\text{Mol H}_2\text{SO}_4 = \frac{0.05(50)}{1000} = 0.0025 \text{ mol}$ $\text{Volume} = 0.0025 \times 24000 = 60\text{cm}^3$ <i>Isipadu</i>	1 1
		ii	Some of the CO ₂ has dissolved in water <i>Sedikit gas CO₂ larut dalam air</i>	1
	b			3
	c	i	$48/150 = 0.32 \text{ cm}^3\text{s}^{-1}$	1
		ii	$(45-30)/120-60 = 0.25 \text{ cm}^3\text{s}^{-1}$	1
		iii	$(48-42)/150-90$ $= 0.1 \text{ cm}^3\text{s}^{-1}$	1 1
			total	10

2	a		Hydrogen <i>Hidrogen</i>	1
	b			2
	c	i	Ethanoic acid <i>Asid etanoik</i>	1
		ii	Rate of reaction is higher in experiment II than in experiment I Concentration of hydrogen ions in experiment II is higher than in experiment I Thus experiment II uses strong acid and weak acid used in experiment I <i>Kadar tindak balas eksperimen II lebih tinggi daripada eksperimen I</i> <i>Kepekatan ion hidrogen dalam asid di eksperimen II lebih tinggi daripada asid dalam eksperimen I</i> <i>Maka eksperimen I menggunakan asid lemah manakala eksperimen II menggunakan asid kuat</i>	1 1 1
	d		Cut the chicken to smaller pieces The smaller the size of meat, the larger total exposed surface area Absorb more heat <i>Potong ayam kepada kepingan yang lebih kecil</i> <i>Semakin kecil saiz kepingan ayam, semakin besar jumlah luas permukaan yang terdedah untuk</i> <i>Menyerap lebih banyak haba</i>	1 1 1
			total	10

3	a	i	Pail B <i>Baldi B</i>	1
		ii	The concentration of soap in pail B is higher More anions of soap per unit volume to do cleansing action <i>Kepekatan sabun dalam baldi B lebih banyak.</i> <i>Lebih banyak anion sabun per unit isipadu untuk menjalankan tindakan pencucian</i>	1 1
	b	i	Saponification <i>Saponifikasi</i>	1
		ii	Group 2 <i>Kumpulan 2</i>	1
		iii	Concentration of NaOH in group 2 is higher than in group 1 Thus, the number of ions per unit volume is higher in group 2 than in group 1 Frequency of collision between reacting particles is higher in group 2 than in group 1 Frequency of effective collision between reacting particles is higher in group 2 than in group 1 Rate of reaction is higher in group 2 than in group 1 <i>Kepekatan larutan NaOH bagi kumpulan 2 lebih tinggi daripada kumpulan 1</i> <i>Maka bilangan ion per unit isipadu bagi NaOH dalam kumpulan 2 lebih tinggi daripada kumpulan 1</i> <i>Frekuensi perlanggaran antara zarah-zarah bahan tindak balas dalam kumpulan 2 lebih tinggi daripada kumpulan 1</i> <i>Frekuensi perlanggaran berkesan antara zarah-zarah bahan tindak balas dalam kumpulan 2 lebih tinggi daripada kumpulan 1</i> <i>Kadar tindak balas bagi kumpulan 2 lebih tinggi daripada kumpulan 1</i>	1 1 1 1 1 1
			total	10

4	a	i	Yellow precipitate <i>Mendakan kuning</i>	1
		ii	Sulphur <i>Sulfur</i>	1
	b		$\text{Na}_2\text{S}_2\text{O}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{SO}_2 + \text{H}_2\text{O} + \text{S}$	2
	c	i	Rate of reaction in experiment 2 is higher than 1 <i>Kadar tindak balas eksperimen 2 lebih tinggi daripada eksperimen 1</i>	1
		ii	temperature in experiment 2 is higher than 1 particles move faster in experiment 2 is higher than 1 frequency of collision between reacting particles in experiment 2 is higher than 1 frequency of effective collision between reacting particles in experiment 2 is higher than 1 <i>Kadar tindak balas eksperimen 2 lebih tinggi daripada eksperimen 1</i> <i>Suhu eksperimen 2 lebih tinggi daripada eksperimen 1</i> <i>Frekuensi perlanggaran antara zarah-zarah bahan tindak balas eksperimen 2 lebih tinggi daripada eksperimen 1</i> <i>Frekuensi perlanggaran berkesan antara zarah-zarah bahan tindak balas eksperimen 2 lebih tinggi daripada eksperimen 1</i>	1 1 1 1
	d			2
			total	10

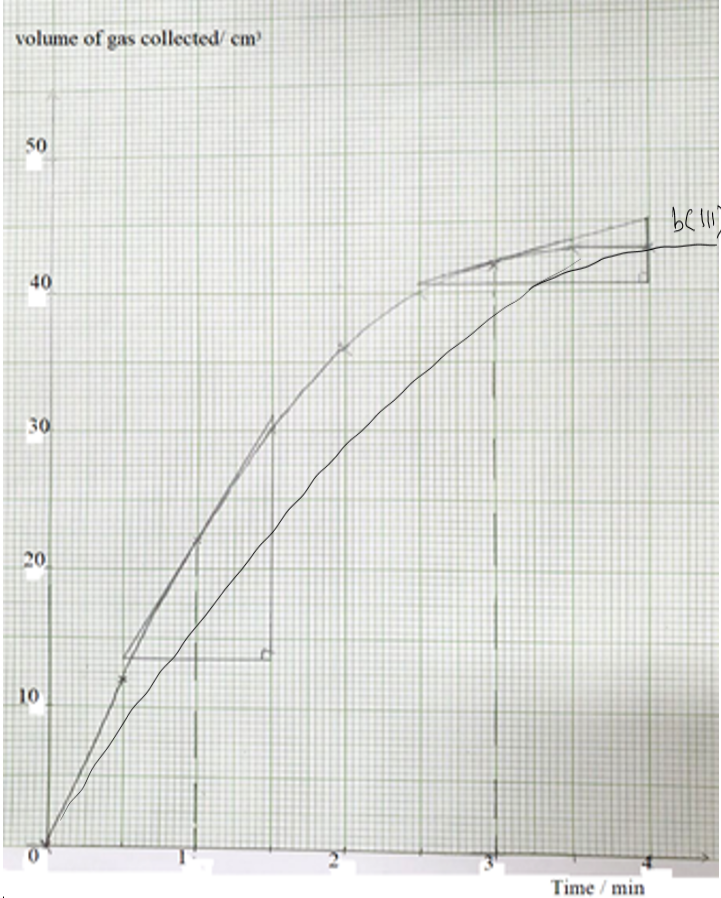
5	a	i	The rate of reaction of Experiment II is higher than Experiment I <i>Kadar tindak balas eksperimen II lebih tinggi daripada eksperimen I</i>	1
		ii	There is a catalyst, manganese (IV) oxide in Experiment II, no catalyst in Experiment I. Catalyst lowers the activation energy. The frequency of effective collision is higher in experiment II compared to experiment I. <i>Terdapat mangkin mangan(IV)oksida dalam eksperimen II tetapi tiada mangkin dalam eksperimen I</i> <i>Mangkin merendahkan tenaga pengaktifan</i> <i>Frekuensi perlanggaran berkesan dalam eksperimen II lebih tinggi daripada eksperimen I</i>	1 1 1
	b		Volume of gas (cm³) <i>Isipadu gas (cm³)</i> 	2
	c	i	$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$	2
		ii	Place a glowing splinter into the test tube. It will rekindle. <i>Masukkan kayu uji berbara ke dalam tabung uji.</i> <i>Ia akan menyala.</i>	1 1
			Total	10

BAHAGIAN B

Questions			Rubrics	Marks												
1	a	(i)	Change in quantity of reactant / product with time <i>Perubahan kuantiti bahan / hasil tindak balas terhadap masa</i>	1												
			Size of reactant Concentration of reactant Temperature of reactant mixture Presence of catalysts <i>Saiz bahan tindak balas</i> <i>Kepekatan larutan</i> <i>Suhu larutan</i> <i>Kehadiran mangkin</i>	1 1 1 1												
	b	(i)	<table border="1"><tr><td>Exp</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>1 /T</td><td>0.042</td><td>0.033</td><td>0.024</td><td>0.016</td><td>0.009</td></tr></table> Concentration (moldm⁻³) <i>Kepekatan (moldm⁻³)</i>  1/T (s⁻¹)	Exp	1	2	3	4	5	1 /T	0.042	0.033	0.024	0.016	0.009	2 4
		Exp	1	2	3	4	5									
		1 /T	0.042	0.033	0.024	0.016	0.009									
		c	i	The value of 1/ Time is directly proportional to rate of reaction. <i>Nilai 1/masa berkadar langsung dengan kadar tindak balas</i>	1											
	ii	The higher the concentration of sodium thiosulphate, the higher the rate of reaction. <i>Semakin tinggi kepekatan natrium tiosulfat, semakin tinggi kadar tindak balas</i>	1													
d		Na ₂ S ₂ O ₃ + H ₂ SO ₄ → S + SO ₂ + H ₂ O + Na ₂ SO ₄	1+1													
e	i	The rate of reaction decreases. <i>Kadar tindak balas menurun</i>	1													

		ii	- HCl is a strong monoprotic acid - sulphuric acid, is a strong diprotic acid. - the concentration of hydrogen ions - in hydrochloric is half of sulphuric acid, <i>HCl adalah asid monoprotik kuat</i> <i>Asid sulfuric adalah asid diprotic kuat</i> <i>Kepekatan ion hidrogen dalam</i> <i>HCl separuh daripada asid sulfurik</i>	1 1 1
			TOTAL MARKS	20

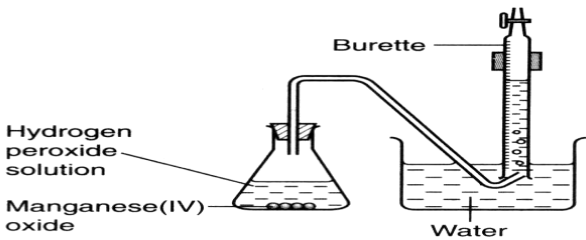
Questions			Rubrics	Marks
2	a	(i)	The shorter the time, the higher the rate of reaction <i>Semakin singkat masa, semakin tinggi kadar tindakbalas</i> The longer the time, the lower the rate of reaction <i>Semakin lama masa, semakin rendah kadar tindakbalas</i> (Either one)	1
			Example of slow reaction: -the rusting of pipes /iron gates - formation of stalagmites and stalactites Example of fast reaction: - combustion -neutralisation <i>Tindak balas perlahan: -Pengaratan paip/ pagar besi</i> - Penghasilan stalatik dan stalagmik <i>Tindak balas cepat: - Pembakaran</i> - Peneutralan	1 + 1 1 + 1

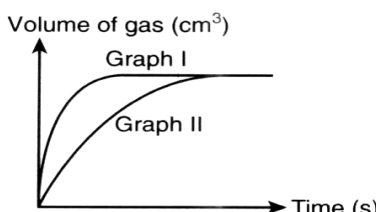
	b	(i)		3
		(ii)	• first minute = $(31-13.5) / (1.5-0.5) = 17.5\text{cm}^3\text{min}^{-1}$ <i>minit pertama</i> • third minute = $(45-40.5) / (4-2.5) = 3\text{cm}^3\text{min}^{-1}$ <i>minit ketiga</i> • The rate of reaction is higher in the first minute compared to the third minute • As time passes, more HCl will react with more CaCO_3. Thus, the concentration of HCl decreases with time <i>.Kadar tindak balas lebih tinggi pada minit pertama berbanding minit ketiga Apabila masa berlalu, lebih banyak CaCO_3 yang bertindak balas Maka, kepekatan HCl berkurang dengan masa</i>	1 1 1 1 1 1
		(iii)	Refer b(i) Rujuk b(i)	1

	iv	• The size of Calcium carbonate powder in the original experiment is smaller than calcium carbonate chips in the new experiment • The total surface area of Calcium carbonate powder is larger than calcium carbonate chips • The frequency of collision between hydrogen ions and Calcium carbonate in the original experiment is higher than in the experiment using calcium carbonate chips • The frequency of effective collision between hydrogen ions and Calcium carbonate in the original experiment is higher than in the experiment using calcium carbonate chips • Hence, rate of reaction in the original experiment is higher than the new one • <i>Saiz serbuk kalsium karbonat dalam eksperimen asal lebih kecil daripada cebisan kalsium karbonat dalam eksperimen baru</i> • <i>Jumlah luas permukaan serbuk kalsium karbonat dalam eksperimen asal lebih besar daripada cebisan kalsium karbonat dalam eksperimen baru</i> • <i>Frekuensi perlanggaran Antara ion hydrogen dengan kalsium karbonat dalam eksperimen asal lebih tinggi daripada dalam eksperimen baru</i> • <i>Frekuensi perlanggaran berkesan antara ion hydrogen dengan kalsium karbonat dalam eksperimen asal lebih tinggi daripada dalam eksperimen baru</i> • <i>Kadar tindak balas dalam eksperimen asal lebih tinggi daripada dalam eksperimen baru</i>	1 1 1 1 1
		TOTAL MARKS	20

BAHAGIAN C

1	a	- a substance that changes the rate of reaction - contact process - vanadium(V)oxide - <i>Bahan yang mengubah kadar tindak balas</i> - <i>proses sentuh</i> - <i>Vanadium(V)oksida</i>	1
	b	-it does not undergo chemical change after the reaction even though its physical property may change.	1
		-Only a small quantity is required.	1
		-It does not alter the amount of products formed. - <i>Tidak mengalami perubahan kimia tetapi mungkin berlaku perubahan fizikal</i> - <i>diperlukan di dalam kuantiti yang sedikit</i> - <i>Tidak mengubah kuantiti hasil tindak balas</i>	1
c		-Catalyst lowers the activation energy.	1
		-More reactant particles are able to overcome the activation energy	1
		-Frequency of effective collisions between reacting particles increases.	1
		-Rate of reaction increases. - <i>mungkin merendahkan tenaga pengaktifan</i> - <i>lebih banyak zarah-zarah bahan tindak balas dapat mengatasi tenaga pengaktifan</i> - <i>frekuensi perlanggaran berkesan Antara zarah-zarah bahan tindak balas bertambah</i>	1

		- kadar tindak balas bertambah	
d		-Procedure:  - Pour 100 cm³ of hydrogen peroxide into a conical flask. <i>Tuang 100cm³ hydrogen peroksida ke dalam kelalang kon</i> -Add a little manganese(IV) oxide to the solution. <i>Tambahkan sedikit mangan(IV)oksida ke dalam larutan tersebut</i> -Start the stopwatch <i>Mulakan jam randik</i> -Collect the gas produced in a burette as shown above <i>Kutip gas yang terbebas ke dalam satu buret seperti di rajah atas</i> -Take the burette reading at every 30-second interval. <i>Ambil bacaan buret setiap 30 saat</i> -Record the data in the table below <i>Catat data dalam jadual di bawah</i> -Repeat the experiment without adding manganese(IV) oxide to the hydrogen peroxide solution. <i>Ulang eksperimen tanpa menggunakan mangan (IV) oksida.</i>	2 5

		Results: <table><tr><td>Time/ Masa (s)</td><td>0</td><td>30</td><td>60</td><td>90</td><td>120</td><td>150</td></tr><tr><td>Burette reading (cm³) <i>Bacaan buret (cm³)</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Volume of gas (cm³) <i>Isipadu gas (cm³)</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> Graph:  graph I is with catalysts and II is without catalysts <i>Graf 1 menggunakan mangkin tetapi graf 2 tidak</i> Gradient of graph I is greater than that of graph II. <i>Kecerunan graf 1 lebih daripada graf 2</i> Rate of reaction in graph 1 is higher than 2 <i>Kadar tindak balas graf 1 lebih tinggi dari[ada graf 2</i>	Time/ Masa (s)	0	30	60	90	120	150	Burette reading (cm ³) <i>Bacaan buret (cm³)</i>							Volume of gas (cm ³) <i>Isipadu gas (cm³)</i>							1
Time/ Masa (s)	0	30	60	90	120	150																		
Burette reading (cm ³) <i>Bacaan buret (cm³)</i>																								
Volume of gas (cm ³) <i>Isipadu gas (cm³)</i>																								
			2																					
			1																					
		TOTAL MARK	20																					

2	a	i	Experiment I, Experiment II, Experiment III <i>Eksperimen I , Eksperimen II , Eksperimen III</i>  Rate of reaction increases/ <i>Kadar tindak balas bertambah</i> Experiment I and Experiment II: temperature <i>Eksperimen I and Eksperimen II: suhu</i> Experiment II and experiment III; Concentration <i>Eksperimen II and Eksperimen III: kepekatan</i> 4. Correct formula / <i>formula betul</i> 5. Balance / <i>seimbang</i> $2 \text{HCl} + \text{Na}_2\text{S}_2\text{O}_3 \rightarrow 2 \text{NaCl} + \text{SO}_2 + \text{S} + \text{H}_2\text{O}$	1 1 1 1 1
		ii	1. The concentration of hydrochloric acid in Experiment III is higher <i>Kepekatan HCl dalam eksperimen III lebih tinggi</i> 2. The number of particles per unit volume in Experiment III is higher compare to Experiment II <i>Bilangan zarah per unit isipadu lebih tinggi dalam eksperimen III berbanding eksperimen II</i> 3. The frequency of collision between hydrogen ions and thiosulphate ions increases in Experiment III. <i>Frekuensi perlanggaran Antara ion hydrogen dan ion tiosulfat</i>	1 1 1

		<i>bertambah dalam eksperimen III</i> 4. The frequency of effective collision between hydrogen ions and thiosulphate ions increases in Experiment III. <i>Frekuensi perlanggaran berkesan antara ion hydrogen dan ion tiosulfat bertambah dalam eksperimen III</i> 5. The rate of reaction increases in Exp III compare to Exp II <i>Kadar tindak balas eksperimen III bertambah berbanding eksperimen II</i>	1 1
		1. 50cm³ of 0.2 moldm⁻³ sodium thiosulphate solution is poured into conical flask <i>50cm³ 0.2 moldm⁻³ larutan natrium tiosulfat di tuang ke dalam kelalang kon</i> 2. The initial temperature of the solution is observed & recorded <i>Suhu awal larutan diambil dan dicatat</i> 3. The conical flask is placed on top of white paper with mark 'X' at the centre <i>Kelalang kon itu diletakkan di atas kertas yang ditanda 'X'</i> 4. 5 cm³ of 0.2 mol dm⁻³ hydrochloric acid is poured quickly into conical flask. <i>50cm³ 0.2 moldm⁻³ asid hidroklorik di tuang ke dalam kelalang kon</i>	

		5. The stopwatch is started immediately <i>Jam randik dimulakan serta merta</i> 6. The conical flask is swirled <i>Kelalang kon dipusarkan</i> 7. The stopwatch is stopped immediately once the mark 'X' disappeared from sight and the time is recorded <i>Jam randik dihentikan sebaik sahaja tanda "X" hilang dari penglihatan</i> 8. The experiment is repeated using 50 cm³ of 0.2 mol dm⁻³ sodium thiosulphate solution using different temperature , 35 °C, 40 °C, 45 °C and 50 °C <i>Eksperimen diulangi menggunakan 50cm³ 0.2 moldm⁻³ larutan natrium tiosulfat pada suhu 35 °C, 40 °C, 45 °C and 50 °C</i> Observation/ <i>pemerhatian</i> 9. Yellow precipitate <i>Mendakan kuning</i> Ionic equation/ <i>Persamaan ion</i>: 10. $2\text{H}^+ + \text{S}_2\text{O}_3^{2-} \rightarrow \text{SO}_2 + \text{S} + \text{H}_2\text{O}$	
		Total	20

SCHEME OF WORK FOR RATE OF REACTION (PAPER 3)**SKEMA JAWAPAN KADAR TINDAK BALAS (KERTAS 3)**

Q No.	Rubric / Sample answers	Score
1(a)	<i>Able to record all reading accurately to one decimal point with unit</i> Answer : Set I = 55.0 s Set II = 47.0 s Set III = 42.0 s Set IV = 37.0 s Set V = 33.0 s	3
	<i>Able to record any 4 reading accurately//</i> <i>Able to record all reading without decimal place//</i> <i>Able to record all reading without unit</i>	2
	<i>Able to record any 3 reading accurately</i>	1
	No response given / wrong answer	0

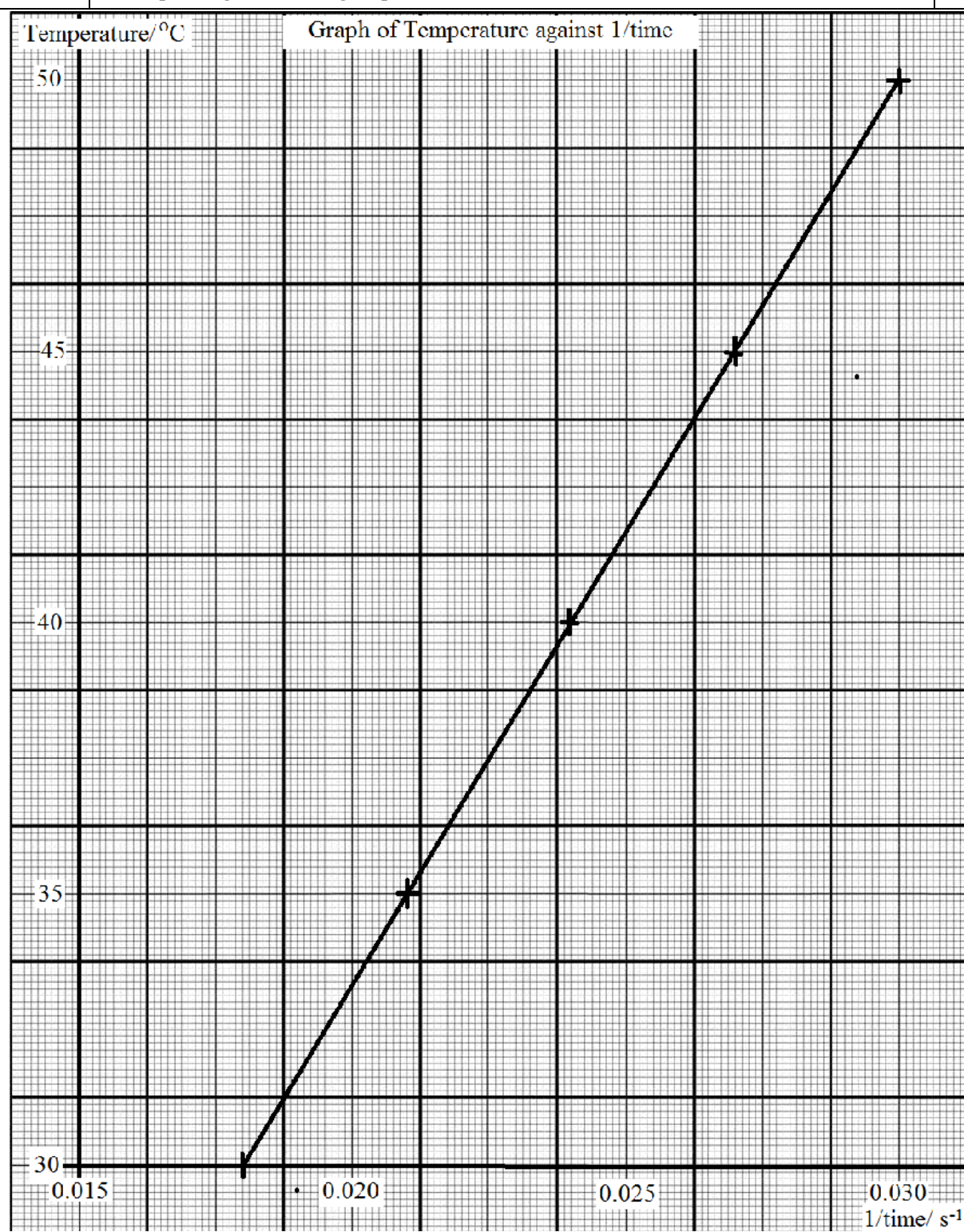
Q No.	Rubric	Score
1(b)	<i>Able to construct a table that contains the following information:</i> 1. Heading in the table : temperature, time and 1/time with unit. 2. Transfer all temperature and time reading from (a) correctly. 3. Value of 1/time is uniform/consistent and with three decimal places.	3

	<table><tr><th>Set</th><th>Temperature, °C</th><th>Time, s</th><th>1/time, s⁻¹</th></tr><tr><td>I</td><td>30</td><td>55.0</td><td>0.018</td></tr><tr><td>II</td><td>35</td><td>47.0</td><td>0.021</td></tr><tr><td>III</td><td>40</td><td>42.0</td><td>0.024</td></tr><tr><td>IV</td><td>45</td><td>37.0</td><td>0.027</td></tr><tr><td>V</td><td>50</td><td>33.0</td><td>0.030</td></tr></table>	Set	Temperature, °C	Time, s	1/time, s ⁻¹	I	30	55.0	0.018	II	35	47.0	0.021	III	40	42.0	0.024	IV	45	37.0	0.027	V	50	33.0	0.030	
Set	Temperature, °C	Time, s	1/time, s ⁻¹																							
I	30	55.0	0.018																							
II	35	47.0	0.021																							
III	40	42.0	0.024																							
IV	45	37.0	0.027																							
V	50	33.0	0.030																							
<i>Able to construct a table that contain following information:</i>																										
1. Heading in the table : temperature, time and 1/time without unit.		2																								
2. Transfer all temperature and time reading from (a) correctly.																										
Able to state an idea to construct a table		1																								
<i>No response given / wrong response</i>		0																								

1(c)	<i>Able to draw a graph correctly</i>	3
	1. Correct axis with unit	
	Vertical axis : temperature / °C, horizontal axis : 1/time / s ⁻¹	
	2. Consistent scale for temperature and 1/time	
	3. The graph at least half of the graph paper	
	4. All the point are transferred correctly	2
	5. Best fit straight line and smooth	
	<i>Able to draw a graph incorrectly</i>	
	1. Correct axis without unit //	
	Inversed axis	
	Vertical axis : temperature , horizontal axis : 1/time	1
	2. Consistent scale for temperature and 1/time	
	3. About 3 point are transferred correctly	
	4. Best fit straight line and smooth	
	<i>Able to state an idea to draw the graph</i>	
	1. Draw the vertical axis and horizontal axis	1
	2. Straight line	

No response given / wrong response

0



Q No.	Rubric / Sample answers	Score
1(d)	<i>Able to state the relationship between temperature and rate of reaction correctly</i> Sample answer: When the temperature of sodium thiosulphate solution is higher, the rate of reaction is higher// When the temperature of sodium thiosulphate solution is lower, the rate of reaction is lower	3
	<i>Able to state the relationship between temperature and rate of reaction incorrectly</i> Sample answer: Different temperature of sodium thiosulphate solution, different the rate of reaction//	2
	<i>Able to give an idea of the relationship between temperature and rate of reaction</i> Sample answer: Temperature affect the rate of reaction// When temperature is higher, rate of reaction is faster// Rate of reaction is directly proportional with temperature	1
	No response given / wrong answer	0

Q No.	Rubric	Score
1(e)	<i>Able to give the operational definition accurately</i> Sample answer: What should be observed : One per time taken for mark 'X' to disappear from sight What should be done : sulphuric acid is added into sodium thiosulphate solution with different temperature.	3

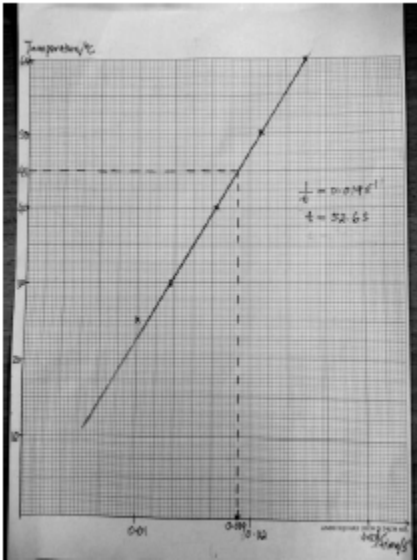
	One per time taken for mark 'X' to disappear from sight when sulphuric acid is added into sodium thiosulphate solution with different temperature.	
	<i>Able to state the meaning of the rate of reaction less accurately</i> Sample answer: Time taken for mark 'X' to disappear from sight when sulphuric acid is added into sodium thiosulphate solution with different temperature.	2
	<i>Able to give an idea for the meaning of the rate of reaction</i> Sample answer: Time taken for mark 'X' to disappear from sight// Sulphuric acid is added into sodium thiosulphate solution with different temperature.	1
	<i>No response given / wrong response</i>	0

Q No.	Rubric / Sample answers	Score
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2(a)	Able to record all the time taken at five different temperatures correctly with one decimal place. <i>Answers:</i> <table><tr><td>Temperature / °C</td><td>25.0</td><td>30.0</td><td>40.0</td><td>50.0</td><td>60.0</td></tr><tr><td>Time /s</td><td>95.0</td><td>80.0</td><td>60.0</td><td>47.0</td><td>40.0</td></tr></table>	Temperature / °C	25.0	30.0	40.0	50.0	60.0	Time /s	95.0	80.0	60.0	47.0	40.0	3
Temperature / °C	25.0	30.0	40.0	50.0	60.0									
Time /s	95.0	80.0	60.0	47.0	40.0									
	Able to record the time taken correctly with no or two decimal places // Able to record the time taken in at least 3 experiments with one decimal place correctly.	2												
	Able to record the time taken in two experiments correctly.	1												
	No response or wrong response	0												

2(b)	Able to construct a table correctly with the following aspects : (i) Three column with correct quantities and units ;Temperature/ $^{\circ}\text{C}$, Time taken / s , 1/time / s^{-1} (ii) Correct all reading of time taken with one decimal place (iii) Correct all reading of 1/ time to 3 decimal places. <i>Suggested answer:</i> <table><tr><td>Temperature / $^{\circ}\text{C}$</td><td>25.0</td><td>30.0</td><td>40.0</td><td>50.0</td><td>60.0</td></tr><tr><td>Time /s</td><td>95.0</td><td>80.0</td><td>60.0</td><td>47.0</td><td>40.0</td></tr><tr><td>$\frac{1}{\text{Time}}$ / s^{-1}</td><td>0.011</td><td>0.013</td><td>0.017</td><td>0.021</td><td>0.025</td></tr></table>	Temperature / $^{\circ}\text{C}$	25.0	30.0	40.0	50.0	60.0	Time /s	95.0	80.0	60.0	47.0	40.0	$\frac{1}{\text{Time}}$ / s^{-1}	0.011	0.013	0.017	0.021	0.025	3
Temperature / $^{\circ}\text{C}$	25.0	30.0	40.0	50.0	60.0															
Time /s	95.0	80.0	60.0	47.0	40.0															
$\frac{1}{\text{Time}}$ / s^{-1}	0.011	0.013	0.017	0.021	0.025															
	Able to construct a table correctly with 2 following aspects #If any of the time taken in 1(a) is wrong but transferred correctly in the table	2																		
	Able to construct a table correctly with 1 following aspect	1																		
	No response or wrong response	0																		

Q No.	Rubric / Sample answers	Score
2(c) (i)	Able to plot the graph with the following criteria : (i) Both axes with correct labels and units Y- axis : Temperature/ $^{\circ}\text{C}$ [#Scale not necessary begin from 0] X-axis : 1/ time / s^{-1} [#Scale must begin from 0] (ii) Correct scale and all points are transferred correctly. # size of the graph at least half of graph paper	3

	#adp data from 1(a) (iii) Best fit line 	
	Able to plot the graph with the following criteria : (i) reverse position of axes (ii) 2 points are transferred correctly (iii) Line	2
	Able to give an idea to plot the graph (i) Label at least one axis without unit (ii) Line	1
	No response or wrong response	0

2(c)(ii)	Able to state the relationship between temperature and the rate of reaction correctly <u>Sample answer</u> When the temperature increases, the rate of reaction increases// The rate of reaction increases when temperature increases.// When the temperature is higher, the rate of reaction is higher	3
	Able to state the relationship between the rate of reaction and temperature less correctly <u>Sample answer</u> The rate of reaction increases // Rate of reaction is directly proportional to temperature// The higher the rate , the higher the temperature	2
	Able to give an idea of rate of reaction <u>Sample answer</u> The rate of reaction changes // increase	1
	No response or wrong response	0

2(c)(iii))	Able to predict the time taken to collect 30 cm³ of hydrogen gas at 45.0 0C correctly with the following aspects : (i) Show on the graph (extrapolate) (ii) Show the calculation step (iii) Time taken with correct unit and one decimal place Answer $1/\text{time} = 0.019 \text{ s}^{-1}$ [value in range $0.018 \leq 0.020 \text{ s}^{-1}$] $\therefore \text{time} = 52.6 \text{ s}$ [value in range $50.0 - 55.6 \text{ s}$]	3
	Able to predict the time taken to collect 30 cm³ of hydrogen gas at 45.0 0C with correct unit Answer Value in range: $0.016 < 1/t < 0.018 \text{ s}^{-1}$ and $0.020 < 1/t < 0.022 \text{ s}^{-1}$, $55.6 < t < 62.5 \text{ s}$ and $45.5 < t < 50.0 \text{ s}$	2
	Able to give an idea in prediction Any value other than Score 3 and Score 2 // more than 48.0 s // less	1
	No response or wrong response	0

2(d)	Able to describe the following criteria :	3
------	--	---

	(i) What should be done : (ii) What should be observed <u>Sample answer</u> Time taken to collect hydrogen gas when hydrochloric acid is reacted with zinc powder // When hydrochloric acid is reacted zinc powder, time taken to collect gas is recorded.	
	Able to describe the either criterion (i) or (ii) <u>Sample answer</u> Time taken to collect hydrogen gas // hydrochloric acid is reacted with zinc powder// The speed at which reactants are converted to products// Rate of reaction = $\frac{\text{change in selected quantity}}{\text{time taken}}$	2
	Able to give an idea for the rate of reaction <u>Sample answer</u> Time taken // Volume of hydrogen gas collected	1
	<i>No response or wrong response</i>	0

2(e)	Able to explain correctly with the following aspects. (i) Zinc strip has bigger size (ii) Smaller total surface area (iii) The rate of reaction is lower <u>Sample answer</u> P1. Zinc strip has bigger size. P2. Smaller total surface area of zinc that exposed P3. The rate of reaction decreases/lower // Reaction is slow	3
	Able to give 2 aspects correctly	2
	Able to give one aspect correctly or an idea <u>Sample answer</u> Big size // Smaller total surface area // Rate of reaction is low	1
	<i>No response or wrong response</i>	0

3(a)(i)	Able to state one observation correctly	3
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	<u>Answer:</u> A yellow precipitate is formed	
	Able to state one observation less correctly <u>Sample Answer:</u> A white precipitate is formed//precipitate	2
	Able to give an idea of observation <u>Sample answer:</u> Residue is formed	1
	<i>No response or wrong response</i>	0

3(a)(ii)	Able to make inference correctly. <u>Answer</u> Sulphur is formed	3
	Able to make inference less correctly <u>Sample answer:</u> Yellow solid is formed	2
	Able to give an idea of inference <u>Sample answer:</u> insoluble	1
	<i>No response or wrong response</i>	0

3(b)(ii)	Able to state the three variables correctly	3
----------	--	---

	<u>Sample answer</u> Manipulated Variable Temperature of sodium thiosulphate solution Responding Variable Rate of reaction// time taken for mark 'X' to disappear Constant variable Concentration and volume of sodium thiosulphate solution// Concentration and volume of hydrochloric acid// size of conical flask	
	Able to state any two variables correctly	2
	Able to state any one variables correctly	1
	<i>No response or wrong response</i>	0

3(c)	Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly <u>Sample answer</u> The higher the temperature of sodium thiosulphate solution, the higher the rate of reaction with hydrochloric acid	3
	Able to state the relationship between the manipulated variable and the responding variable without stating the direction <u>Sample answer</u> The temperature of sodium thiosulphate solution, affects the rate of reaction with hydrochloric acid	2
	Able to give an idea of hypothesis.	1

	<u>Sample answer</u> Different temperature different rate of reaction	
	<i>No response or wrong response</i>	0

3(d)	Able to give the operational definition for the rate of reaction correctly with the following aspects 1. What you do 2. What you observe <u>Sample answer</u> Time taken for the 'X' mark to disappear from sight	3
	Able to give the operational definition for the rate of reaction incompletely with any one of the following aspects 1. What you do 2. What you observe <u>Sample answer</u> Time taken// mark 'X' disappear from sight	2
	Able to give an idea of operational definition for the rate of reaction <u>Sample answer:</u> Formation of precipitate	1
	<i>No response or wrong response</i>	0

3(e)	Able to complete the table correctly	3
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	<u>Sample answer</u> <table><tr><td>Set</td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td></tr><tr><td>Temperature($^{\circ}\text{C}$)</td><td>28</td><td>38</td><td>48</td><td>58</td><td>68</td></tr><tr><td>Time (s)</td><td>55</td><td>36</td><td>23</td><td>17</td><td>13</td></tr><tr><td>1/time(s^{-1})</td><td>0.018</td><td>0.028</td><td>0.043</td><td>0.059</td><td>0.077</td></tr></table>	Set	I	II	III	IV	V	Temperature($^{\circ}\text{C}$)	28	38	48	58	68	Time (s)	55	36	23	17	13	1/time(s^{-1})	0.018	0.028	0.043	0.059	0.077	
Set	I	II	III	IV	V																					
Temperature($^{\circ}\text{C}$)	28	38	48	58	68																					
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Set	I	II	III	IV	V																					
Temperature($^{\circ}\text{C}$)	28	38	48	58	68																					
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	Incomplete table <table><tr><td>Set</td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td></tr><tr><td>Temperature($^{\circ}\text{C}$)</td><td>28</td><td>38</td><td>48</td><td>58</td><td>68</td></tr><tr><td>Time (s)</td><td>55</td><td>36</td><td>23</td><td>17</td><td>13</td></tr><tr><td>1/time(s^{-1})</td><td></td><td></td><td></td><td></td><td></td></tr></table>	Set	I	II	III	IV	V	Temperature($^{\circ}\text{C}$)	28	38	48	58	68	Time (s)	55	36	23	17	13	1/time(s^{-1})						1
Set	I	II	III	IV	V																					
Temperature($^{\circ}\text{C}$)	28	38	48	58	68																					
Time (s)	55	36	23	17	13																					
1/time(s^{-1})																										
	<i>No response or wrong response</i>	0																								

3(ii)	Able to plot graph of temperature against 1/time with the following aspects: 1 Label axis with unit 2 All five points are transferred correctly. Best straight line	3
	Able to plot graph of temperature against 1/time with the following aspects: 1 All three points are transferred correctly. 2. Best straight line	2
	Able to give an idea to sketch a straight line	1
	<i>No response or wrong response</i>	0

3(f)(i)	Able to state the relationship between the temperature of sodium thiosulphate solution and the rate of reaction correctly.	3
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	<u>Sample answer</u> The higher the temperature of sodium thiosulphate solution, the higher is the rate of reaction	
	Able to state the relationship between the temperature of sodium thiosulphate solution and the rate of reaction less correctly. <u>Sample answer</u> The rate of reaction is directly proportional to the temperature of sodium thiosulphate solution	2
	Able to give an idea of the relationship between the temperature of sodium thiosulphate solution and the rate of reaction <u>Sample answer</u> Rate of reaction is higher// temperature increase	1
	<i>No response or wrong response</i>	0

3(f)(ii)	Able to predict the time accurately with unit shown on graph <u>Answer:</u> $1/0.08 = 12.5s$	3
	Able to predict the time accurately without unit <u>Answer</u> 12.5	2
	Able to give an idea of predicting time Able to give an idea of predicting time. <u>Sample answer</u> less than 13s	1

	<i>No response or wrong response</i>	0
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3(g)	Able to explain relationship between base area of conical flask and amount of sulphur formed correctly. <u>Sample answer</u> The smaller conical flask has a smaller base area. Thus the thickness of the sulphur is increased	3
	Able to explain relationship between base area of conical flask and amount of sulphur formed less correctly <u>Sample answer</u> Smaller conical flask, more sulphur formed	2
	Able to give an idea of relationship between base area of conical flask and amount of sulphur formed. <u>Sample answer</u> Thick sulphur formed	1
	<i>No response or wrong response</i>	0

3(h)	Able to classify all the four ions correctly <u>Sample answer</u>	3
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	<table><tr><td>Anions</td><td>Cations</td></tr><tr><td>Chloride ion, Cl⁻</td><td>Hydrogrn ion,H⁺</td></tr><tr><td>Thiosulphate ion, S₂O₃²⁻</td><td>Sodium ion,Na⁺</td></tr></table>	Anions	Cations	Chloride ion, Cl ⁻	Hydrogrn ion,H ⁺	Thiosulphate ion, S ₂ O ₃ ²⁻	Sodium ion,Na ⁺	
Anions	Cations							
Chloride ion, Cl ⁻	Hydrogrn ion,H ⁺							
Thiosulphate ion, S ₂ O ₃ ²⁻	Sodium ion,Na ⁺							
Able to classify three ions correctly		2						
Able to classify two ions correctly		1						
<i>No response or wrong response</i>		0						

Experiment/ Eksperimen

Question 1/ Soalan 1

Problem statement/ <i>Pernyataan masalah</i>	How does the particle size of reactant affect the rate of reaction? <i>Bagaimanakah saiz zarah bahan tindak balas mempengaruhi kadar tindak balas?</i>	3
All the variables/ <i>Semua pemboleh ubah</i>	Manipulated variable/ <i>Pemboleh ubah dimanipulasi</i> : <i>Size of marble chips/ Saiz ketulan marmar</i> Responding variable/ <i>Pemboleh ubah bergerak balas</i> : Rate of reaction / <i>Kadar tindak balas</i> Fixed variable/<i>Pemboleh ubah tetap</i> : Temperature / mass of marble chips /concentration and volume of hydrochloric acid <i>Suhu / jisim ketulan marmar / kepekatan dan isipadu asid hidroklorik</i>	3
Hypothesis/ <i>Hipotesis</i>	When the size of marble chips decreases, the rate of reaction increases/ <i>Apabila saiz ketulan marmar berkurang, kadar tindak balas meningkat</i>	3
List of materials and apparatus / <i>Senarai bahan dan radas</i>	Materials : 0.1 mol dm^{-3} hydrochloric acid, 2 g large marble chip, 2 g small marble chip, water Apparatus : 100 cm^3 measuring cylinder, 150 cm^3 conical flask, stopper with delivery tube, basin, burette, electronic balance, retort stand and clamp, and stopwatch	3

	<i>Bahan: Asid hidroklorik 0.1 mol dm^{-3}, ketulan marmar besar 2 g, ketulan marmar kecil 2 g, air</i> <i>Alat radas: silinder penyukat 100 cm^3, kelalang kon 150 cm^3, penyumbat dengan salur penghantar, basin, buret, keseimbangan elektronik, kaki retod dan pengepit dan jam randik</i>	
Procedure/ Prosedur	1. Fill a burette with water until it is full. 2. Invert the burette in a basin of water and clamp it vertically. 3. Record initial burette reading. 4. Measure 50 cm^3 0.1 mol dm^{-3} hydrochloric acid, HCl using a measuring cylinder. Transfer the acid into a conical flask. 5. Weigh 2 g of large marble chips. Put them into a conical flask. 6. Close the conical flask immediately with a stopper which is joined to the delivery tube and start the stopwatch. 7. Record the burette reading at intervals of 30 seconds until the reaction stops. 8. Repeat the steps 1 to 7 using 2 g of small marble chips to replace 2 g of large marble chips. <i>1. Isi buret dengan air hingga penuh.</i> <i>2. Terbalikkan buret di dalam basin yang berisi air dan letakkannya secara menegak.</i> <i>3. Rekodkan bacaan awal buret.</i> <i>4. Ukur 50 cm^3 0.1 mol dm^{-3} asid hidroklorik, HCl menggunakan silinder penyukat. Pindahkan asid ke dalam kelalang kon.</i> <i>5. Timbang 2 g ketulan marmar besar. Masukkannya ke dalam kelalang kon.</i> <i>6. Tutup kelalang kon segera dengan penyumbat yang disambungkan ke salur penghantar dan mulakan jam randik.</i> <i>7. Catat bacaan buret pada selang 30 saat sehingga tindak balas berhenti.</i> <i>8. Ulangi langkah 1 hingga 7 menggunakan 2 g ketulan marmar kecil untuk menggantikan 2 g ketulan marmar besar.</i>	3

Tabulation of data / Pengumpulan data	Small marble chips / <i>Ketulan marmar kecil</i>					2	
	Times / s	0	30	60	90		120
	Burette reading / cm ³						
	Volume of gas / cm ³						
	Large marble chips / <i>Ketulan marmar besar</i>						
	Times / s	0	30	60	90		120
	Burette reading / cm ³						
	Volume of gas / cm ³						

Question 2/ Soalan 2

Problem statement/ <i>Pernyataan masalah</i>	How does the temperature of reactant affect the rate of reaction/ <i>Bagaimana suhu bahan tindak balas mempengaruhi kadar tindak balas?</i>	3
All the variables/ <i>Semua pemboleh ubah</i>	Manipulated variable/ Pemboleh ubah dimanipulasi : Temperature of reactant (sulphuric acid) / Suhu bahan tindak balas Responding variable/ Pemboleh ubah bergerak balas: Rate of reaction / Kadar tindak balas Fixed variable/ Pemboleh ubah dimalarkan: Mass of zinc / concentration and volume of sulphuric acid / volume of hydrogen gas released / Jisim zink / kepekatan dan isipadu asid sulfurik / isipadu gas hidrogen yang dibebaskan	3
Hypothesis/ <i>Hipotesis</i>	The higher the temperature of reactant, the higher the rate of reaction/ <i>Semakin tinggi suhu bahan tindak balas, semakin tinggi kadar tindak balas</i>	3
List of materials and apparatus / <i>Senarai bahan dan radas</i>	Materials : 0.5mol dm^{-3} sulphuric acid, 2 cm zinc ribbon, water Apparatus : 100cm^3 measuring cylinder, 150cm^3 conical flask, stopper with delivery tube, basin, burette, electronic balance, retort stand and clamp, and stopwatch <i>Bahan: Asid sulfurik 0.5 mol dm^{-3}, pita zink 2 cm, air:</i> <i>Alat radas: Silinder penyukat 100 cm^3, kelalang kon 150 cm^3, penyumbat dengan salur penghantar, basin, buret, keseimbangan elektronik, kaki retord dan pengepit, dan jam randik</i>	3
Procedure/ <i>Prosedur</i>	1. Fill a burette with water until it is full. 2. Invert the burette in a basin of water and clamp it vertically. 3. Record initial burette reading. 4. Measure 50 cm^3 0.1mol dm^{-3} sulphuric acid using a measuring cylinder. Transfer the acid into a conical flask. 5. Heat the sulphuric acid solution until 40°C. Swirl the conical flask. 6. Place 2 cm of zinc ribbon into a conical flask. 7. Close the conical flask immediately with a stopper which is joined to the delivery tube and start the stopwatch. 8. Record the time taken to collect 25cm^3 of hydrogen gas. 9. Repeat the steps 1 to 8 by heating sulphuric acid solution to the temperature of 50°C. <i>1. Isi buret dengan air hingga penuh.</i>	3

	2. Balikkan buret di lembangan air dan pasangkannya secara menegak. 3. Rekodkan bacaan buret awal. 4. Ukur 50 cm^3 asid sulfurik 0.1mol dm^{-3} menggunakan silinder penyukat. Pindahkan asid ke dalam kelalang kon. 5. Panaskan larutan asid sulfurik hingga 40°C. Pusingkan kelalang kon. 6. Letakkan 2 cm pita zink ke dalam kelalang kon. 7. Tutup kelalang kon segera dengan penyumbat yang disambungkan ke tiub penyampaian dan mulakan jam randik. 8. Catat masa yang diambil untuk mengumpulkan 25 cm^3 gas hidrogen. 9. Ulangi langkah 1 hingga 8 dengan memanaskan larutan asid sulfurik hingga suhu 50°C.				
Tabulation of data / Pengumpulan data	Experiment	Temperature / $^\circ\text{C}$	Time / s	Experiment	2
	I	40.0			
	II	50.0			

Question 3/ Soalan 3

Problem statement/ <i>Pernyataan masalah</i>	How does the concentration of acid affect the rate of reaction/ <i>Bagaimana kepekatan asid mempengaruhi kadar tindak balas?</i>	3
All the variables/ <i>Semua pemboleh ubah</i>	Manipulated variable : Concentration of sulphuric acid Responding variable : Rate of reaction Fixed variable : Volume of sulphuric acid / mass of zinc <i>Pemboleh ubah dimanipulasi: Kepekatan asid sulfurik</i> <i>Pemboleh ubah bergerak balas: Kadar tindak balas</i> <i>Pemboleh ubah tetap: Isipadu asid sulfurik / jisim zink</i>	3
Hypothesis/ Hipotesis	The higher the concentration of acid, the higher the rate of reaction/ <i>Semakin tinggi kepekatan asid, semakin tinggi kadar tindak balas</i>	3

List of materials and apparatus / <i>Senarai bahan dan radas</i>	Materials : Zinc powder, 0.1mol dm^{-3} sulphuric acid, 1.0mol dm^{-3} sulphuric acid Apparatus : 100cm^3 measuring cylinder, 150cm^3 conical flask, stopper with delivery tube, basin, burette, electronic balance, retort stand and clamp, and stopwatch <i>Bahan: Serbuk zink, asid sulfurik 0.1mol dm^{-3}, asid sulfurik 1.0mol dm^{-3}</i> <i>Alat Radas: Silinder penyukat 100 cm^3, kelalang kon 150 cm^3, penyumbat dengan salur penghantar, besen, buret, keseimbangan elektronik, pengepit dan kaki retord, dan jam randik</i>	3
Procedure/ Prosedur	1. Fill a burette with water until it is full. 2. Invert the burette in a basin of water and clamp it vertically. 3. Record initial burette reading. 4. Measure 50cm^3 0.1mol dm^{-3} sulphuric acid using a measuring cylinder. Transfer the acid into a conical flask. 5. Place 2g of zinc powder into a conical flask. 6. Close the conical flask immediately with a stopper which is joined to the delivery tube and start the stopwatch. 7. Record the time taken to collect 25cm^3 hydrogen gas. 8. Repeat the steps 1 to 7 using 1.0mol dm^{-3} sulphuric acid to replace 0.1mol dm^{-3} sulphuric acid. <i>1. Isi buret dengan air hingga penuh.</i> <i>2. Terbalikkan buret di dalam basin yang berisi air dan pasangkannya secara menegak.</i> <i>3. Rekodkan bacaan awal buret.</i> <i>4. Ukur 50 cm^3 asid sulfurik 0.1mol dm^{-3} menggunakan silinder penyukat. Pindahkan asid ke dalam kelalang kon.</i> <i>5. Masukkan 2g serbuk zink ke dalam kelalang kon.</i> <i>6. Tutup kelalang kon segera dengan penyumbat yang disambungkan ke salur penghantar dan mulakan jam randik.</i> <i>7. Catat masa yang diambil untuk mengumpul 25cm^3 gas hydrogen.</i> <i>8. Ulangi langkah 1 hingga 7 menggunakan asid sulfurik 1.0mol dm^{-3} untuk menggantikan asid sulfurik 0.1mol dm^{-3}.</i>	3

Tabulation of data / Pengumpulan data	Experiment	Concentration / mol dm⁻³	Time / s	2
	I	0.1		
	II	1.0		

END OF MARKING SCHEME
PERATURAN PEMARKAHAN BERAKHIR

Set 6

Carbon Compounds
Sebatian Karbon

TAJUK: CARBON COMPOUND/ SEBATIAN KARBON

Section A
Bahagian A

1. Diagram 1.1 shows some examples of foods consisting of carbon compounds.
Rajah 1.1 menunjukkan beberapa contoh makanan yang terdiri daripada sebatian karbon.



Diagram 1.1

Rajah 1.1

- a) i) What is the meaning of carbon compound
Apakah maksud sebatian karbon

[1 mark]

- ii) Carbon compounds can be classified into two groups namely organic compounds and inorganic compounds. Give an example of an organic compound and an inorganic compound.

Sebatian karbon boleh dikelaskan kepada dua kumpulan iaitu sebatian organik dan sebatian tak organik. Nyatakan satu contoh sebatian organik dan sebatian tak organik.

Organic compound : _____

Sebatian organik :

Inorganic compound: _____

Sebatian tak organik :

[2 marks]

- b) Diagram 1.2 shows petroleum which is one of the sources of hydrocarbons. Compounds W and X are examples of hydrocarbon compounds that can be obtained from petroleum.

Rajah 1.2 menunjukkan petroleum yang merupakan salah satu sumber hidrokarbon. Sebatian W dan X merupakan contoh sebatian hidrokarbon yang boleh diperolehi daripada petroleum.

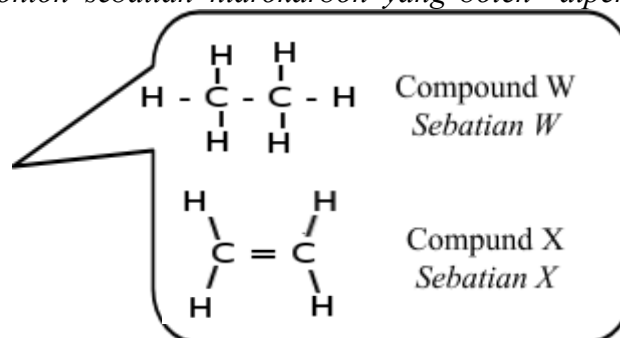


Diagram 1.2

Rajah 1.2

- i) Name the type of hydrocarbon of compound W and X. Give a reason for your choice.
Namakan jenis sebatian hidrokarbon W dan X. Berikan satu sebab untuk pilihan anda.

Compound W : _____

Sebatian W

Reason : _____

Sebab

[2 marks]

Compound X : _____

Sebatian X

Reason : _____

Sebab

[2 marks]

- ii) Compound X can be converted to Compound W through reaction Y and by using reactant Z. Name reaction Y and reactant Z
Sebatian X boleh ditukarkan kepada Sebatian W melalui tindak balas Y dan dengan menggunakan bahan tindak balas Z. Namakan tindak balas Y dan bahan tindak balas Z tersebut.

Reaction Y : _____

Tindak balas Y :

Reactant Z : _____

Bahan tindak balas Z :

[2 marks]

- iii) Exhaust gas from vehicles contain non-combustible hydrocarbons. State one health problem to humans resulting from the release of these non-combustible hydrocarbons.
Gas ekzos daripada kenderaan mengandungi hidrokarbon yang tidak terbakar. Nyatakan satu masalah kesihatan terhadap manusia akibat daripada pembebasan hidrokarbon yang tidak terbakar ini.

[1 mark]

2. Diagram 2.1 shows a gas cylinder containing a mixture of propane gas, C_3H_8 and butane gas, C_4H_{10} .
Rajah 2.1 menunjukkan selinder gas yang mengandungi campuran gas propana, C_3H_8 dan gas butana, C_4H_{10} .



Diagram 2.1

Rajah 2.1

- a) i) State the general formula for the gas mixture contained in this gas cylinder
Nyatakan formula am bagi campuran gas yang terdapat dalam silinder gas ini

[1 mark]

- ii) Butane gas is an isomer. Draw two isomers of butane gas.
Gas butana adalah suatu isomer. Lukis dua isomer bagi gas butana.

[2 marks]

- iii) Liquid X is a substance found in the same homologous series as the gas mixture in a gas cylinder with the number of carbon atoms five. Predict the molecular formula for liquid X and name the liquid X.

*Cecair X merupakan bahan yang terdapat dalam siri homolog yang sama seperti campuran gas di dalam silinder gas dengan bilangan atom karbon lima.
Ramalkan formula molekul bagi cecair X dan namakan cecair X tersebut.*

Molecular formula of liquid X : _____
Formula molekul liquid X

Name of liquid X : _____
Nama cecair X

[2 marks]

- b) Nasrul conducted a fractional distillation experiment in his school laboratory to separate propane gas, butane gas and liquid X. Nasrul found that the three substances were distilled at different boiling points.

Nasrul menjalankan eksperimen penyulingan berperingkat di dalam makmal sekolahnya untuk mengasingkan gas propana, gas butana dan cecair X.

Nasrul mendapati ketiga – tiga bahan tersebut disuling keluar pada takat didih berbeza- beza.

- i) Arrange the substances in the order of increasing boiling point.
Susunkan bahan-bahan tersebut dalam urutan penambahan takat didih.

[1 mark]

- ii) Explain your answer in (b)(i)
Terangkan jawapan anda di (b)(i).

[2 marks]

- c) Write a balanced chemical equation for the combustion of propane gas in excess oxygen gas.

Tuliskan persamaan kimia yang seimbang untuk pembakaran gas propana dalam gas oksigen berlebihan.

[2 marks]

3. Diagram 3.1 shows the flow chart of a series of changes in reaction that occur to alcohol U. Alcohol U contains 3 carbon atoms per unit molecule.

Rajah 3.1 menunjukkan carta alir bagi beberapa siri tindak balas penukaran yang berlaku ke atas alkohol U. Alkohol U mengandungi 3 atom karbon per unit molekul.

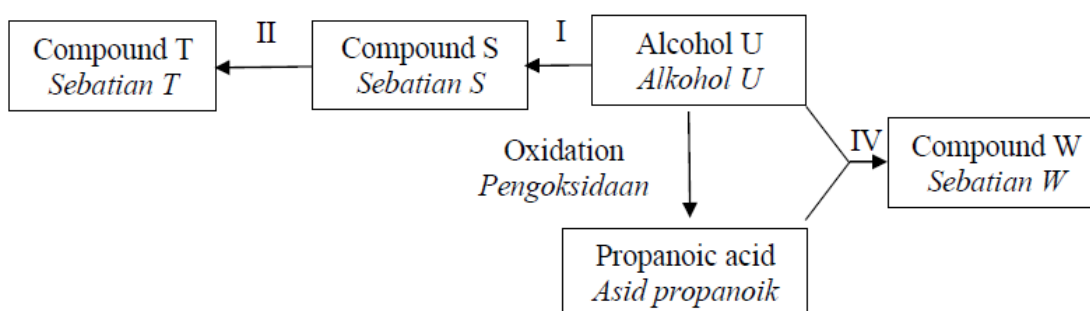


Diagram 3.1
Rajah 3.1

- a) Draw the structural formula of alcohol U
Lukiskan formula struktur bagi alkohol U

[1 mark]

- b) i) Write the chemical equation of the dehydration reaction in reaction I.
Tuliskan persamaan kimia bagi tindak balas pendehidratan dalam tindak balas penukaran I.

[1 mark]

- ii) What can be observed when compound S is shaken with bromine water?
Apakah yang dapat diperhatikan apabila sebatian S digoncang dengan air bromin?

[1 mark]

- iii) Draw the labelled diagram for the apparatus set-up used for reaction I in the laboratory.
Lukiskan rajah berlabel untuk susunan radas bagi tindak balas penukaran I di makmal.

[2 marks]

- c) i) Name the conversion reaction of II
Namakan tindak balas penukaran II

[1 mark]

- ii) Describe a chemical test to distinguish compound S and compound T in the laboratory.
Huraikan satu ujian kimia bagi membezakan sebatian S dan sebatian T di dalam makmal.

[2 mark]

- d) i) Name the reaction to produce compound W.
Nyatakan tindak balas untuk menghasilkan sebatian W.

[1 mark]

- ii) State the name of compound W.
Nyatakan nama bagi sebatian W.

[1 mark]

4. Oils and fats are esters formed from fatty acids and glycerol. Diagram 4.1 shows the structural formula of glyceryl trioleate which is a type of oil.

Minyak dan lemak ialah ester yang terbentuk daripada asid lemak dan gliserol. Rajah 4.1 menunjukkan formula struktur gliseril trioleat iaitu sejenis minyak.

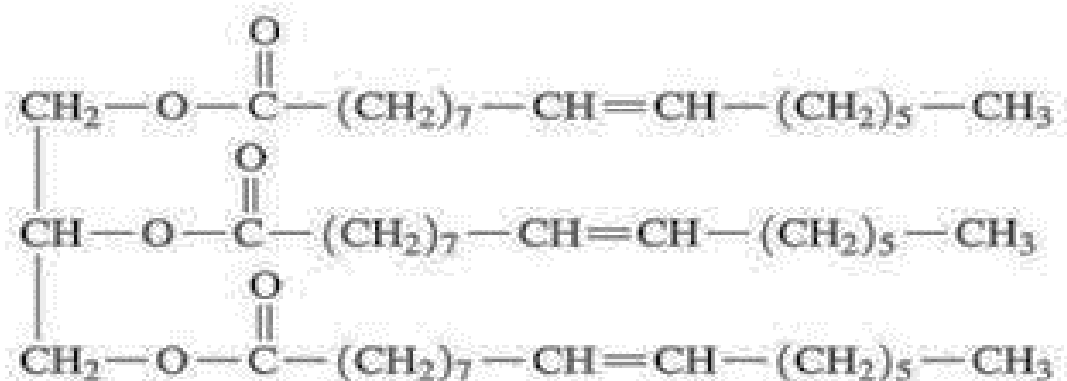


Diagram 4.1

Rajah 4.1

- a) Based on the structural formula in Diagram 4.1,
Berdasarkan formula struktur dalam Rajah 4.1,

- i) Identify whether it is a type of saturated fat or unsaturated fat.
Kenal pasti sama ada ianya sejenis lemak tepu atau lemak tak tepu.

[1 mark]

- ii) Name the two functional groups found in the molecule.
Namakan dua kumpulan berfungsi yang terdapat dalam molekul tersebut.

[2 marks]

- iii) Predict the color change that occurs when this substance is added with a little acidified potassium manganate (VII) solution and shaken vigorously. Explain your answer.

Ramalkan perubahan warna yang berlaku apabila bahan ini ditambahkan dengan sedikit larutan kalium manganat(VII) berasid dan digoncang dengan kuat. Jelaskan jawapan anda.

[2 marks]

- b) Diagram 4.2 shows palm oil fruit which can be used to make margarine and cooking oil

Rajah 4.2 menunjukkan buah kelapa sawit yang boleh digunakan untuk membuat marjerin dan minyak masak.

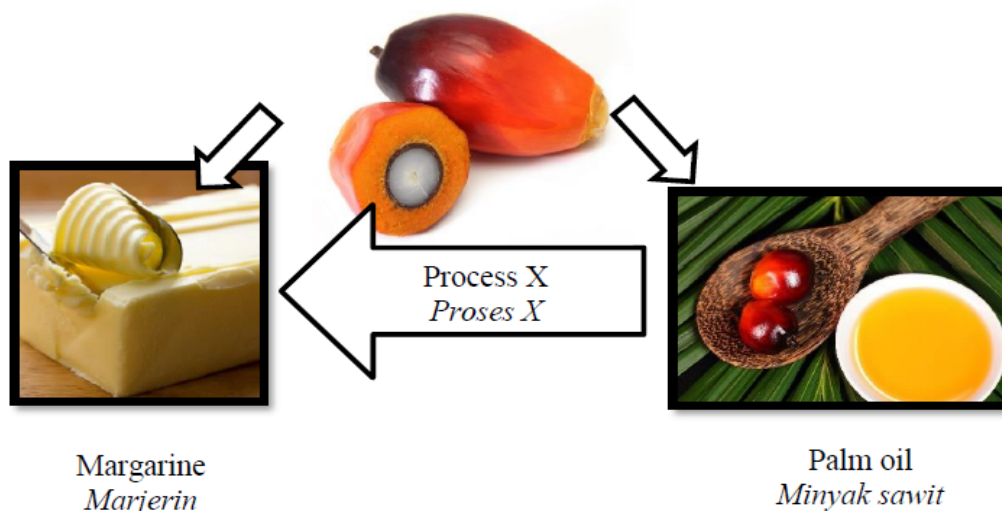


Diagram 4.2
Rajah 4.2

Palm oil can be converted to margarine through process X. Name process X.

Minyak sawit boleh ditukarkan kepada marjerin melalui proses X. Namakan proses X.

[1 mark]

- i) State the temperature and catalyst used for this X process.

Nyatakan suhu dan mangkin yang digunakan untuk proses X ini.

[2 marks]

- ii) Palm oil has many advantages over other vegetable oils. Give two advantages of palm oil.

Minyak sawit mempunyai kelebihan yang banyak berbanding dengan minyak sayuran yang lain. Berikan dua kelebihan minyak sawit.

[2 marks]

5. Diagram 5.1 shows conversations related to the properties and uses of natural rubber.

Rajah 5.1 menunjukkan perubahan berkaitan sifat dan kegunaan getah asli.

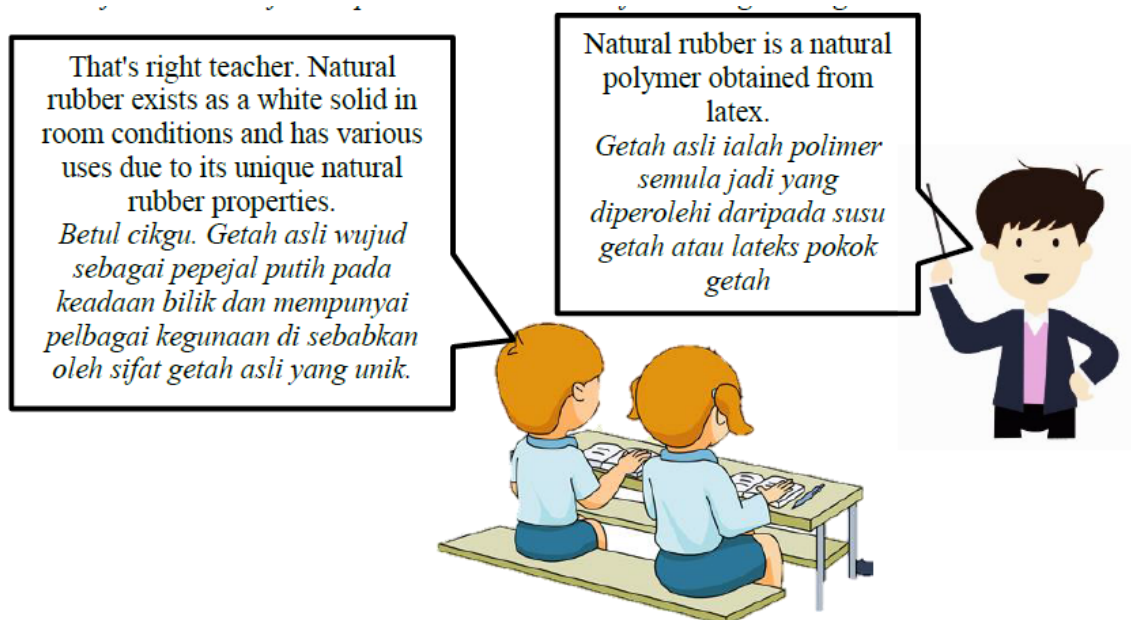
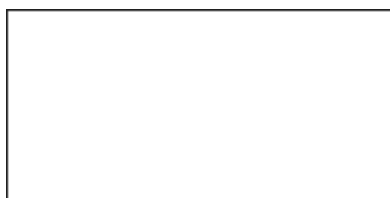


Diagram 5.1
Rajah 5.1

- a) Natural rubber monomers are isoprene or 2-methylbut-1,3-diene. Draw the structural formula of natural rubber monomer.

Monomer getah asli ialah isoprena atau 2-metilbut-1,3-diena. Lukiskan formula struktur bagi monomer getah asli.



[1 mark]

- b) The statement below relates to the properties of natural rubber.

Pernyataan di bawah berkaitan dengan sifat getah asli.

- When the rubber band is stretched and released, the rubber band will return to its original shape
Apabila gelang getah diregang dan dilepaskan, gelang getah akan kembali kepada bentuk asalnya
- Natural rubber easily oxidized by oxygen.
Getah asli mudah dioksidakan oleh oksigen

Explain why
Terangkan mengapa

- i) When the rubber band is stretched and released, the rubber band will return to its original shape
Apabila gelang getah diregang atau dilepaskan, gelang getah akan kembali kepada bentuk asalnya

[1 mark]

- ii) Getah asli mudah dioksidakan oleh oksigen
Natural rubber is easily oxidized by oxygen.

[1 mark]

- iii) Natural rubber is suitable for making erasers.
Getah asli sesuai digunakan untuk membuat getah pemadam.

[1 mark]

- c) Figure 5.2 shows a rubber particle found in latex.
Rajah 5.2 menunjukkan satu zarah getah yang terdapat dalam lateks.

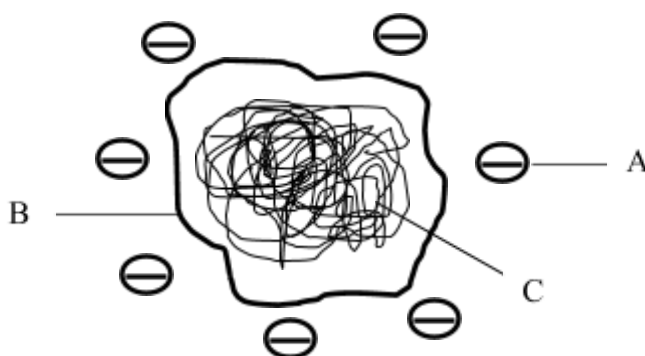


Diagram 5.2
Rajah 5.2

- i) Name the parts labelled
Namakan bahagian – bahagian yang berlabel

A: _____

B: _____

C. _____

[3 marks]

- ii) Why is latex obtained from rubber trees not coagulated even if it is left for 2 to 3 hours?

Mengapakah lateks yang diperolehi daripada pokok getah tidak mengalami penggumpalan walaupun dibiarkan selama 2 hingga 3 jam?

[2 marks]

- iii) Name one type of carboxylic acid that contains one carbon atom that can speed up the coagulation of latex.

Namakan satu jenis asid karboksilik yang mengandungi satu atom karbon yang dapat mempercepatkan penggumpalan lateks.

[1 mark]

Section B
Bahagian B

- 1 (a) Latex needs to be retained in liquid form for export. Suggest a chemical substance that can be added to the latex to keep the latex in liquid form.
Explain how the chemical acts.
Lateks perlu dikekalkan dalam bentuk cecair untuk dieksport ke luar negara. Cadangkan satu bahan kimia yang boleh ditambahkan ke dalam lateks bagi mengekalkan lateks dalam bentuk cecair.
Terangkan bagaimana bahan kimia itu bertindak.

[4 marks]

- (b) The properties of natural rubber can be improved by heating it together with sulfur. The rubber formed is known as vulcanized rubber.
Sifat getah asli boleh di tambah baik dengan memanaskannya bersama dengan sulfur.
Getah yang terbentuk di kenali sebagai getah tervulkan.

- i) Name the process producing the vulcanized rubber
Namakan proses penghasilan getah tervulkan
- ii) Compare the difference between natural rubber and vulcanized rubber in terms of:
- Elasticity
 - Heat resistance
 - Hardness

Banding beza getah asli dan getah tervulkan dari segi:

- *Kekenyalan*
- *Ketahanan terhadap haba*
- *Kekerasan*

- iii) Draw the formula of vulcanized rubber structure and explain the difference when compared to the formula of natural rubber structure
Lukiskan formula struktur getah tervulkan dan terangkan perbezaannya jika di bandingkan dengan formula struktur getah asli

[10 marks]

- (c) Diagram 1.1 shows the percentage composition of saturated and unsaturated fats in four types of cooking oil.

Rajah 1.1 menunjukkan peratus komposisi bagi lemak tepu dan lemak tak tepu dalam empat jenis minyak masak.

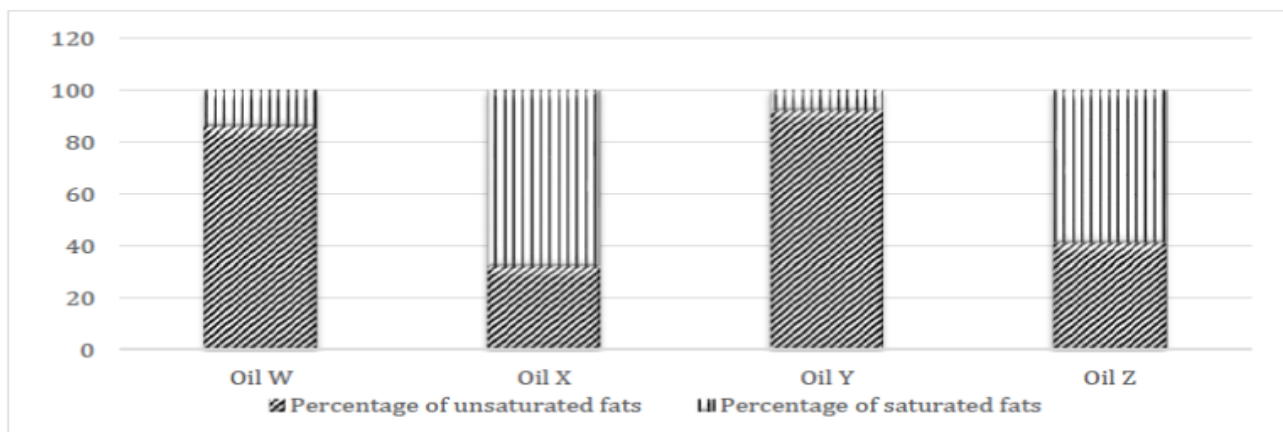


Diagram 1.1
Rajah 1.1

Classify cooking oils W, X, Y and Z in terms of:

Kelaskan minyak masak W, X, Y dan Z dari segi:

- saturated fats and unsaturated fats
lemak tepu dan lemak tak tepu
- physical condition at room temperature
keadaan fizikal pada suhu bilik
- melting point
takat lebur

[6 marks]

2. a) Table 2.1 shows the number of carbon atoms per molecule alcohol and the boiling point of methanol, ethanol, propan-1-ol and butan-1-ol.

Jadual 2.1 menunjukkan bilangan atom per molekul alkohol dan takat didih bagi metanol, etanol, propan-1-ol dan butan-1-ol.

Alcohol <i>Alkohol</i>	Number of carbon atoms per molecule alcohol <i>Bilangan atom karbon per molekul alkohol</i>	Boiling point (°C) <i>Takat didih (°C)</i>
Methanol <i>Metanol</i>	1	65
Ethanol <i>Etanol</i>	2	78
Propan-1-ol <i>Propan-1-ol</i>	3	97
Butan-1-ol <i>Butan-1-ol</i>	4	117

Table 2.1
Jadual 2.1

- i) By using the data in Table 2.1, plot a graph of melting point against the number of carbon atoms per molecule alcohol.

Dengan menggunakan data pada jadual 2.1, plot satu graf takat didih melawan bilangan atom per molekul alkohol.

[3 marks]

- ii) Name an alcohol that has five carbon atoms and draw its structural formulae. Predict the boiling point of the alcohol and explain the reason for your prediction.

Namakan alkohol yang mempunyai lima atom karbon dan lukiskan formula strukturnya. Ramalkan takat didih alkohol tersebut dan terangkan sebab untuk ramalan anda.

[6 marks]

- b) Teacher Neela is discussing the conversion of compound P to compound Q and ester R to her students. She states that compound P can be produced through fermentation of glucose. *Cikgu Neela sedang membincangkan penukaran sebatian P kepada sebatian Q dan ester R kepada pelajarannya. Beliau menyatakan bahawa sebatian P boleh dihasilkan melalui proses penapaian glukosa.*

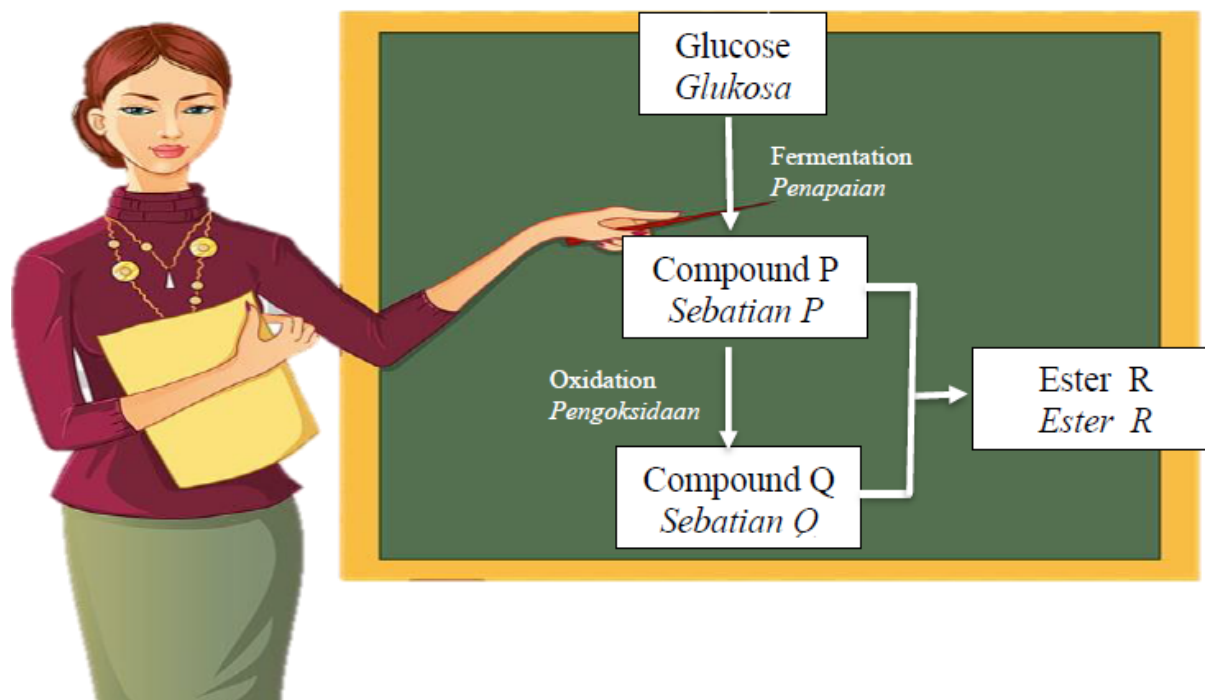


Diagram 2.1
Rajah 2.1

Based on the diagram 2.1;
Berdasarkan rajah 2.1;

- State the reagent used for oxidation process to converse compound P to Compound Q and write the chemical equation involved
Nyatakan bahan tindak balas yang digunakan untuk proses pengoksidaan dalam penukaran sebatian P kepada sebatian Q dan tuliskan persamaan kimia yang terlibat.
- Identify the homologous series, molecular formulae and structural formulae of compounds P, Q and R
Kenal pasti siri homolog, formula molekul dan formula struktur bagi sebatian P, sebatian Q dan sebatian R.

[11 marks]

Section C Bahagian C

1. a) Teacher Yatie gave three unlabeled reagent bottles containing ethane liquid, ethene liquid and ethanoic acid solution to her two chemistry students. She asked their help to identify the type of material found in each reagent bottle.

Cikgu Yatie memberikan tiga botol reagen yang tidak berlabel yang mengandungi cecair etana, cecair etena dan larutan asid etanoik kepada dua orang pelajar kimianya. Beliau telah meminta bantuan pelajarnya untuk mengenalpasti jenis bahan yang terdapat dalam setiap botol reagen tersebut.



Diagram 1.1
Rajah 1.1

Diagram 1.1 show how his chemistry students plan and conduct the experiments to identify the three carbon compounds through their knowledge of the chemical properties of carbon compounds.

Rajah 1.1 menunjukkan bagaimana pelajar kimia beliau merancang dan melaksanakan eksperimen untuk mengenal pasti ketiga-tiga sebatian karbon tersebut melalui pengetahuan mereka tentang sifat-sifat kimia sebatian karbon.

Based on the experiments conducted by the two students

Berdasarkan ujikaji yang dijalankan oleh kedua-dua pelajar tersebut,

- i) State observations when ethane liquid, ethene liquid and ethanoic acid solution was tested with acidic potassium manganate(VII) solution and magnesium metal.

Nyatakan pemerhatian apabila cecair etana, cecair etena dan larutan asid etanoik diuji dengan larutan kalium manganat(VII) berasid dan logam magnesium.

- ii) Include chemical equations for the reaction that took place
Sertakan persamaan kimia bagi tindak balas yang berlaku

[10 marks]

- b) The composition of organic compounds can be determined by burning them in air and then reviewing the resulting materials.

Komposisi sebatian organik dapat ditentukan dengan membakarnya dalam udara dan seterusnya mengkaji bahan yang terhasil.

Diagram 1.2 shows some examples of organic compounds.

Rajah 1.2 menunjukkan beberapa contoh sebatian organik.



Diagram 1.2
Rajah 1.2

Using the material found in Diagram 1.2, describe one experiment to determine the combustion products of organic compounds. Your description must contain:

Dengan menggunakan bahan yang terdapat dalam Rajah 1.2, huraikan satu eksperimen untuk menentukan hasil pembakaran sebatian organik. Huraian anda perlu mengandungi:

- i) Apparatus and materials
Radas dan bahan
- ii) Procedures
Prosedur
- iii) Combustion products of organic compound
Hasil pembakaran sebatian organik

[10 marks]

- 2 a) Esters are found naturally in fruits and the fragrant smell of fruit is due to the presence of esters. For example, the smell of apples is due to methyl butanoate ester and the the smell of orange fruit is due to the octyl ethanoate ester.

Diagram 2.1 shows the presence of the ester in an apple and orange.

Ester terdapat secara semula jadi dalam buah-buahan dan bau wangi buah adalah disebabkan kehadiran ester. Contohnya bau buah epal adalah disebabkan ester metil butanoat dan bau buah oren adalah di sebabkan ester oktil etanoat.

Rajah 2.1 menunjukkan kehadiran ester dalam buah epal dan oren.



Diagram 2.1
Rajah 2.1

- i) State the functional group of ester
Nyatakan kumpulan berfungsi bagi ester
- ii) Draw the structural formula for methyl butanoate ester
Lukiskan formula struktur bagi ester metil butanoat
- iii) For the two esters above,
Bagi kedua-dua ester diatas,
- State the type of alcohol and carboxylic acid used
Nyatakan jenis alkohol dan asid karboksilik yang digunakan
 - Write the chemical equation for the esterification reaction involved
Tuliskan persamaan kimia bagi tindak balas pengesteran yang terlibat
- [10 marks]

- b) Juwita plans to produce the smell of pineapple which is an ethyl butanoate ester in her school chemistry lab.

Describe an experiment to help Juwita prepare ethyl butanoate ester. Your description should contain

Juwita bercadang untuk menghasilkan bau nanas yang merupakan ester etil butanoat di makmal kimia sekolahnya.

Huraikan satu eksperimen untuk membantu Juwita untuk menyediakan ester etil butanoat. Huraian anda perlu mengandungi

- Apparatus and materials
Radas dan bahan
- Procedure
Prosedur
- Two physical properties of esters other than fragrant smell
Dua sifat fizik ester selain daripada bau wangi

[10 marks]

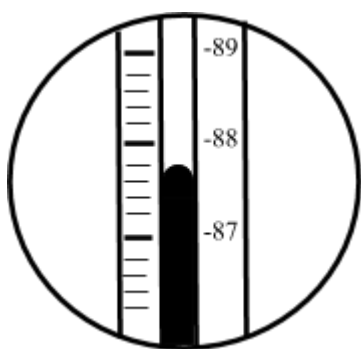
KERTAS 3 SOALAN STRUKTUR

1. A student conducts an experiment to determine the boiling point of four organic compounds consisting of different homologous series. The student used ethane gas, ethene gas, ethanol liquid and glacial ethanoic acid which have the same number of carbon atoms even though they are in different homologous series. Diagram 1.1 shows the boiling point of the four organic compounds.

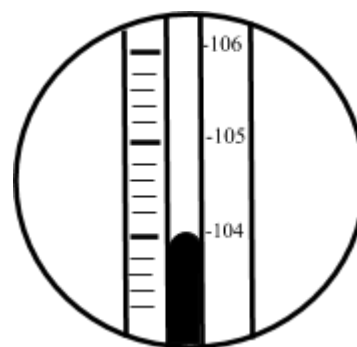
[Relative atomic mass: H = 1; C = 12; O = 16]

Seorang murid menjalankan satu eksperimen untuk menentukan takat didih empat sebatian organik yang terdiri daripada siri homolog yang berbeza . Pelajar tersebut telah menggunakan gas etana, gas etena, cecair etanol dan asid etanoik yang mempunyai bilangan atom karbon yang sama walaupun terdapat dalam siri homolog yang berbeza-beza. Rajah 1.1 menunjukkan takat didih bagi keempat-empat sebatian organik tersebut.

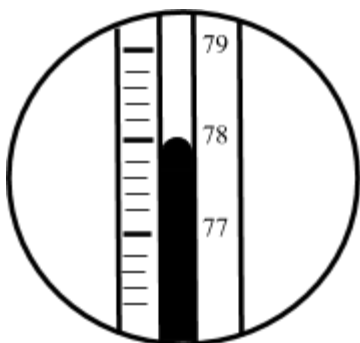
[Jisim atom relatif: H = 1; C = 12; O = 16]



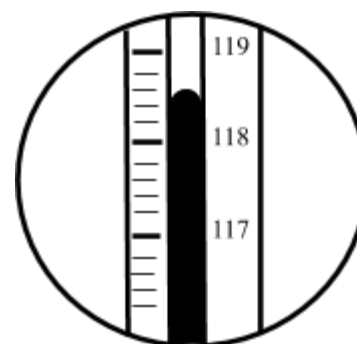
Boiling point of ethane
Takat didih etana = _____ °C



Boiling point of ethene
Takat didih etena = _____ °C



Boiling point of ethanol
Takat didih etanol = _____ °C



Boiling point of ethanoic acid
Takat didih asid etanoik = _____ °C

Diagram 1.1

Rajah 1.1

- a) Record the boiling point of organic compounds in the spaces provided in Diagram 1.1.

Rekodkan bacaan takat didih bagi sebatian organik dalam ruang yang disediakan dalam Rajah 1.1

[3 marks]

- b) Based on the Diagram 1.1, construct a table to record the boiling point of all the organic compounds
Berdasarkan Rajah 1.1, bina satu jadual untuk mencatat takat didih semua sebatian organik.

[3 marks]

- c) Complete Table 1.1 by calculating the relative molecular mass of each given organic compound.
Lengkapkan Jadual 1.1 dengan menghitung jisim molekul relatif bagi setiap sebatian organik yang diberikan.

Organic compound <i>Sebatian organik</i>	Molecular formulae <i>Formula molekul</i>	Relative molecular mass <i>Jisim molekul relatif</i>
Ethane <i>Etena</i>	C_2H_6	
Ethene <i>Etana</i>	C_2H_4	
Ethanol <i>Etanol</i>	C_2H_5OH	
Ethanoic acid <i>Asid etanoik</i>	CH_3COOH	

Table 1.1
Jadual 1.1

[3 marks]

- d) i) Based on Diagram 1.1, state one observation for this experiment.
Berdasarkan Rajah 1.1, nyatakan satu pemerhatian bagi eksperimen ini.

[3 marks]

- ii) Give the corresponding inference based on your answer in 1 (d)(i)
Beri inferens yang sepadan berdasarkan jawapan anda di (d)(i)

[3 marks]

- e) For this experiment, state
Bagi eksperimen ini, nyatakan
- i) the manipulated variable
pemboleh ubah dimanipulasikan

- ii) the responding variable
pemboleh ubah bergerak balas

- iii) the fixed variable
pemboleh ubah dimalarkan

[3 marks]

- f) State one hypothesis for this experiment.
Nyatakan satu hipotesis bagi eksperimen ini.

[3 marks]

- g) State the operational definition for boiling point of this experiment.
Nyatakan definisi secara operasi bagi takat didih untuk eksperimen ini.

[3 marks]

- h) Diagram 1.2 shows reaction of ethanol and ethanoic acid to produce compound X.
Rajah 1.2 menunjukkan tindak balas etanol dengan asid etanoik bagi menghasilkan sebatian X.

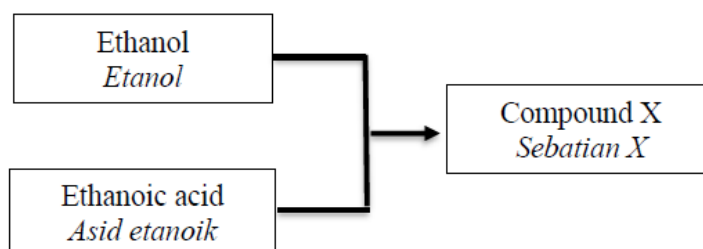


Diagram 1.2
Rajah 1.2

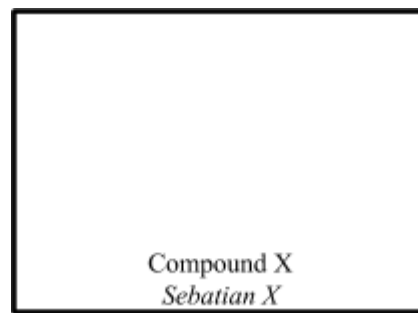
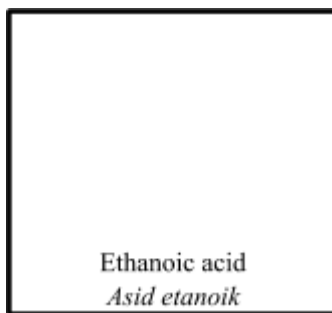
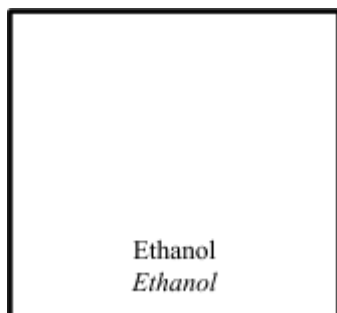
- i) Name the compound X.
Nyatakan nama sebatian X.

- ii) Name the homologous series of compound X.
Namakan siri homolog sebatian X.

- iii) Write the molecular formula of compound X.
Tuliskan formula molekul sebatian X.

[3 marks]

- i) Draw the structural formulae of ethanol, ethanoic acid and compound X.
Lukiskan formula struktur bagi etanol, asid etanoik dan sebatian X.



[3 marks]

- j) All organic compounds used and produced in this experiment are listed below.
Semua sebatian organik yang digunakan dan yang dihasilkan dalam eksperimen ini disenaraikan di bawah.

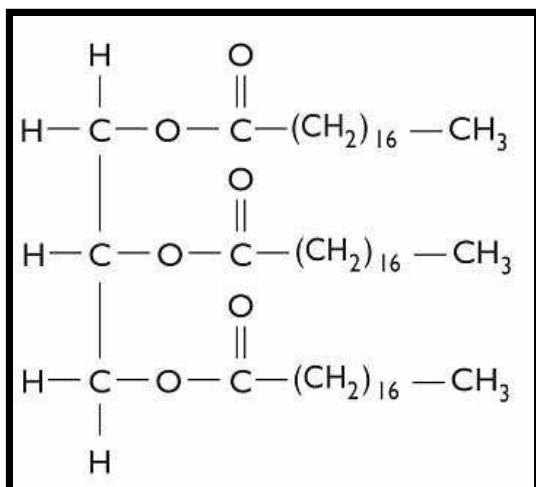
Ethane <i>Etana</i>	Ethanol <i>Etanol</i>
Ethene <i>Etena</i>	Ethanoic acid <i>Acid etanoik</i>
	Compound X <i>Sebatian X</i>

Classify these substances into hydrocarbon and non-hydrocarbon compounds.
Kelaskan bahan-bahan ini kepada sebatian hidrokarbon dan sebatian bukan hidrokarbon.

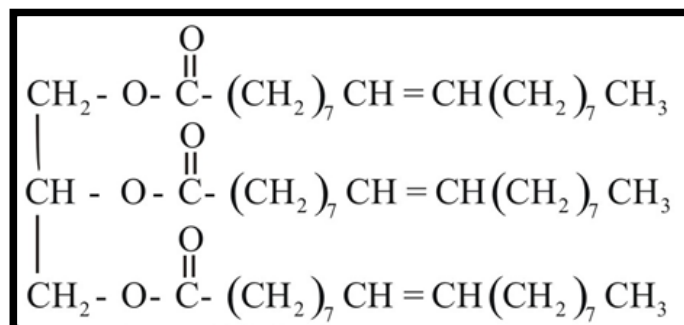
[3 marks]

2. Fats can be classified into two types, namely saturated fats and unsaturated fats. Diagram 2.1 shows the structural formula of the two types of fats labeled as fat A and fat B.

Lemak boleh di kelaskan kepada dua jenis iaitu lemak tepu dan lemak tak tepu. Rajah 2.1 menunjukkan formula struktur dua jenis lemak yang di label sebagai lemak A dan lemak B.



Fat A
Lemak A



Fat B
Lemak B

Diagram 2.1
Rajah 2.1

A student conducts an experiment to compare the reactivity of fats A and fats B based on the type of bond found in fat molecules.

Seorang murid menjalankan eksperimen untuk membandingkan kereaktifan lemak A dan lemak B berdasarkan jenis ikatan yang terdapat dalam molekul lemak.

This student adds 2 cm³ of liquid fat A into a test tube. Then 1 cm³ of bromine water, Br₂ is added to the test tube and shaken. Observations of color change, if any, are observed by the student. Then these steps are repeated using liquid fat B.

Murid tersebut memasukkan 2 cm³ cecair lemak A ke dalam tabung uji. Kemudian, 1 cm³ air bromin, Br₂ ditambahkan ke dalam tabung uji itu dan digoncangkan.

Pemerhatian terhadap perubahan warna, jika ada, diperhatikan oleh murid tersebut. Kemudian langkah-langkah tersebut diulangi dengan menggunakan cecair lemak B pula.

Next this activity is repeated again by this student by replacing bromine water with a acidified potassium manganate (VII), KMnO₄ solution.

Seterusnya aktiviti ini diulang lagi sekali oleh murid itu dengan menggantikan air bromin dengan larutan kalium manganat (VII), KMnO₄ berasid.

- a) i) Record the observations obtained by the student in Table 2.1.
Rekod pemerhatian yang diperolehi oleh murid itu di dalam Jadual 2.1.

Type of fat <i>Jenis lemak</i>	Observation <i>Pemerhatian</i>	
	With Bromine water <i>Dengan air bromin</i>	With acidified potassium manganate (VII) solution <i>Dengan larutan kalium manganat (VII) berasid</i>
Fat A <i>Lemak A</i>		
Fat B <i>Lemak B</i>		

Table 2.1
Jadual 2.1 [3 marks]

- ii) Match fat A and fat B according to the type of bond and the type of fat based on the observations obtained in (a)(ii).

Padankan lemak A dan lemak B mengikut jenis ikatan dan jenis lemak berdasarkan pemerhatian yang diperolehi di (a)(ii)

Type of bond <i>Jenis ikatan</i>		Type of fats <i>Jenis lemak</i>
Covalent double bond <i>Ikatan kovalen ganda dua</i>	Fat A <i>Lemak A</i>	Saturated fat <i>Lemak tepu</i>
Covalent single bond <i>Ikatan kovalen tunggal</i>	Fat B <i>Lemak B</i>	Unsaturated fat <i>Lemak tak tepu</i>

[3 marks]

- b) For this experiment, state
Bagi eksperimen ini, nyatakan
- i) the manipulated variable
pemboleh ubah dimanipulasikan

- ii) the responding variable
pemboleh ubah bergerak balas

- iii) the fixed variable
pemboleh ubah dimalarkan

[3 marks]

- c) State one hypothesis for this experiment.
Nyatakan satu hipotesis bagi eksperimen ini.

[3 marks]

- d) State the operational definition for the reactivity of the reaction in this experiment.
Nyatakan definisi secara operasi bagi kereaktifan tindak balas untuk eksperimen ini.

[3 marks]

- e) State the fat that is more reactive. Explain your answer.
Nyatakan lemak yang lebih reaktif. Terangkan jawapan anda.

[3 marks]

- f) Based on the structural formula of fat A and fat B as well as the type of bond present in both compounds, predict the sootiness of flame for both fats based on the percentage of carbon by mass. Describe your prediction.
Berdasarkan formula struktur lemak A dan lemak B serta jenis ikatan yang hadir di dalam kedua-dua sebatian, ramalkan kejelagaan nyalaan bagi kedua-dua lemak berdasarkan peratus karbon mengikut jisim. Huraikan ramalan anda.

[3 marks]

- g) Diagram 2.2 shows the process of converting fat B to fat A.
Rajah 2.2 menunjukkan proses penukaran lemak B kepada lemak A.



Name the process and state the catalyst and temperature used in this reaction.
Namakan proses tersebut dan nyatakan mangkin serta suhu yang digunakan dalam tindak balas ini.

[3 marks]

- h) Diagram 2.3 shows fat B which is an organic compound that has three types of functional groups.
Rajah 2.3 menunjukkan lemak B yang merupakan sebatian organik yang mempunyai tiga jenis kumpulan berfungsi.

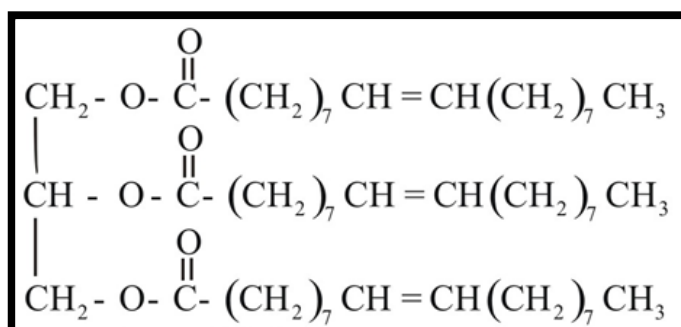


Diagram 2.3
Rajah 2.3

Study the structural formula of fat B in Diagram 2.3 and list the three functional groups present in the compound.
Kaji formula struktur lemak B dalam rajah 2.3 dan senaraikan tiga kumpulan berfungsi yang hadir dalam sebatian tersebut.

[3 marks]

- i) The esterification reaction between fatty acid and glycerol produces oil and fat. Based on the structural formula in figure 2.4, write the chemical equation for the production of fat A.

Tindak balas pengesteran antara asid lemak dengan gliserol menghasilkan minyak dan lemak. Berdasarkan formula struktur dalam rajah 2.4, tuliskan persamaan kimia bagi penghasilan lemak A.

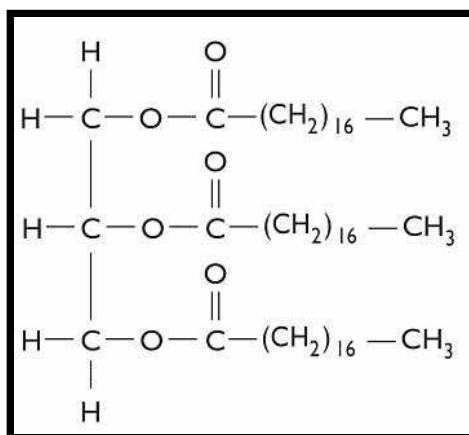


Diagram 2.4
Rajah 2.4

[3 marks]

- j) Diagram 2.5 shows a few types of saturated and unsaturated fats used in daily life.
Rajah 2.5 menunjukkan beberapa jenis lemak tepu dan lemak tak tepu yang digunakan dalam kehidupan seharian.



Diagram 2.5
Rajah 2.5

Classify the foods above into saturated and unsaturated fats.
Kelaskan makanan di atas kepada lemak tepu dan lemak tak tepu.

[3 marks]

KERTAS 3: MERANCANG EKSPERIMEN

- 1 Mr. Ali is a rubber plantation entrepreneur. Rubber factory A wants to buy latex in liquid form while rubber factory B wants to buy latex in solid form to produce tyres.
En. Ali adalah seorang pengusaha ladang getah. Kilang getah A mahu membeli lateks dalam bentuk cecair manakala kilang getah B mahu membeli lateks dalam bentuk pepejal untuk pembuatan tayar.

Diagram 1 shows a flow chart to prepare the rubber for rubber factory A and rubber factory B by Mr. Ali.

Rajah 1 menunjukkan carta alir untuk menyediakan getah bagi kilang getah A dan kilang getah B oleh En. Ali.

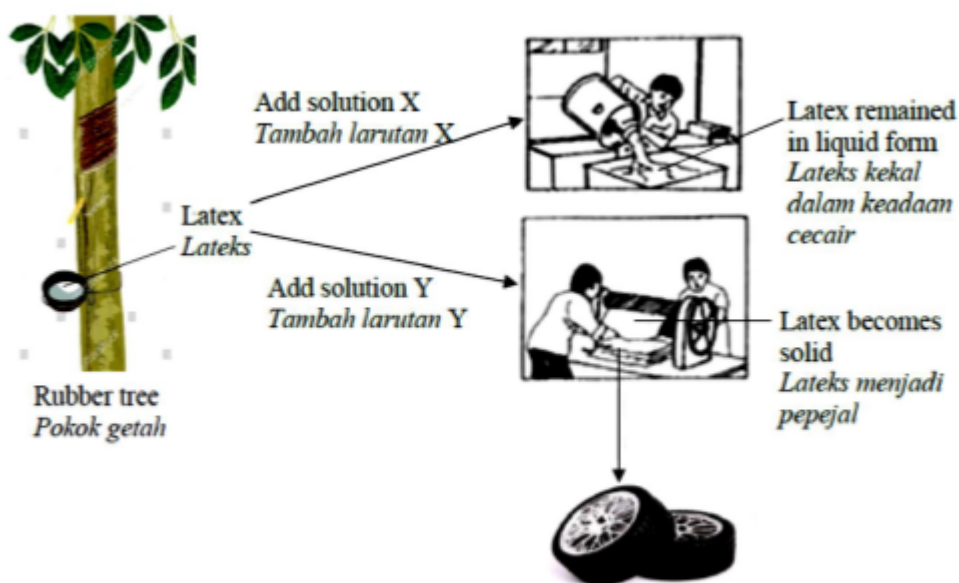


Diagram 1
Rajah 1

Using suitable substances and apparatus, plan **one** laboratory experiment to study the coagulation and prevention of coagulation of latex.

*Dengan menggunakan bahan dan radas yang sesuai, rancangkan **satu** eksperimen makmal untuk mengkaji penggumpalan dan pencegahan penggumpalan lateks.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of hypothesis
Pernyataan hipotesis

- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

2. The conversation below is about an experiment to identify three different types of organic compounds based on its sootiness of flame.
Perbualan di bawah adalah mengenai eksperimen untuk mengenalpasti tiga jenis sebatian organik yang berbeza berdasarkan kejelagaan nyalaan.

Today I'm going to supply you with three bottles of reagents labeled A, B and C which contain three different types of liquid of organic compounds.

It consists of alkane, alkene and alcohol liquid.

Plan an appropriate experiment to identify the types of organic compounds found in each of these reagent bottles.

Hari ini cikgu akan bekalkan kamu tiga botol reagen yang berlabel A, B dan C yang mengandungi tiga jenis cecair sebatian organik yang berbeza.

Ianya terdiri daripada cecair alkana, alkena dan alkohol.

Rancang satu eksperimen yang sesuai untuk mengenalpasti jenis sebatian organik yang terdapat dalam setiap botol reagen tersebut.

Since alkanes, alkenes and alcohols have different sootiness of flame, let's use sootiness of flame method to identify the type of liquid found in the reagent bottle given by the teacher.

Memandangkan alkana, alkena dan alkohol mempunyai kejelagaan nyalaan yang berbeza-beza, mari kita gunakan kaedah kejelagaan nyalaan bagi mengenalpasti jenis cecair yang terdapat dalam botol reagen yang diberikan oleh cikgu tadi.

Good idea!
Idea yang bagus



Using suitable substances and apparatus, plan **one** laboratory experiment to identify three different types of organic compounds based on its sootiness of flame.

*Dengan menggunakan bahan dan radas yang sesuai, rancangkan **satu** eksperimen makmal untuk mengenalpasti tiga jenis sebatian organik yang berbeza berdasarkan kejelagaan nyalaan*

Your planning should include the following aspects:

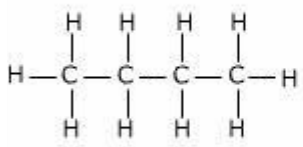
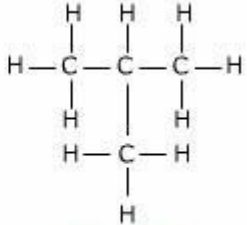
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

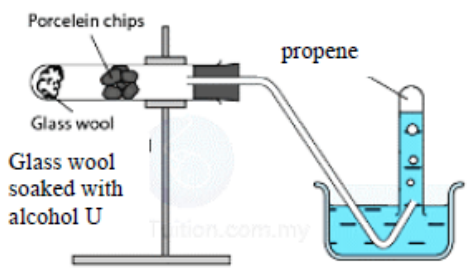
- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

SKEMA KERTAS 2 : CARBON COMPOUNDS/SEBATIAN KARBONSection A
Bahagian A

Questions			Rubrics	Marks
1	a	i	Carbon compounds are compounds that contain carbon elements that have been combined with other elements <i>Sebatian karbon ialah sebatian yang mengandungi unsur karbon yang telah bergabung dengan unsur lain</i>	1
		ii	Organic compound : <i>Fats</i> Lemak	1
			Inorganic compound : Calcium carbonate <i>Kalsium karbonat</i>	1
			<i>Other correct example are accepted</i>	
	b	i	Compound W : Hidrokarbon tepu <i>Saturated hydrocarbon</i>	1
			Reason contains only a single bond between one carbon atoms with other carbon atoms <i>mengandungi ikatan tunggal sahaja antara satu atom karbon dengan atom karbon yang lain</i>	1
			Compound X : Hidrokarbon tak tepu <i>Unsaturated hydrocarbon</i>	1
			Reason contains a double bond between one carbon atoms with other carbon atoms <i>mengandungi satu ikatan ganda dua antara satu atom karbon dengan atom karbon yang lain</i>	1
		ii	Reaction Y : Hydrogenation <i>Penghidrogenan</i>	1
			Reactant Z : Hydrogen gas <u>Gas</u> Hidrogen <i>Must write the states of matter</i>	1
		iii	Difficulty in breathing <i>Kesukaran bernafas</i>	1
			Total marks	10

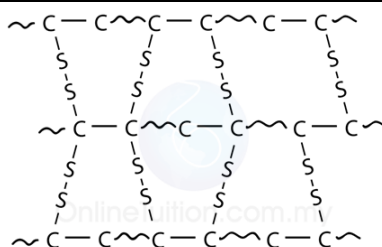
Questions			Rubrics	Marks
2	a	i	C_nH_{2n+2}	1
		ii	 	2
		iii	Molecular formula : C_5H_{10} Name of liquid X : Pent-1-ane <i>Pent-1-ana</i>	1 1
	b	i	Propane gas, butane gas, liquid X <i>Gas propana, gas butana, cecair X</i>	1
		ii	1. molar mass and molecular size increase with increasing number of carbon atoms <i>jisim molar dan saiz molekul bertambah dengan pertambahan bilangan atom karbon</i> 2. The heat required to overcome the attraction between molecules increases <i>Haba yang diperlukan untuk mengatasi daya tarikan antara molekul bertambah</i>	1 1
	c		1. Correct formula of reactant and product <i>Formula bahan tindak balas dan hasil tindak balas yang betul</i> 2. Balanced equation <i>Persamaan yang seimbang</i> $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$	1 1
		Total marks		10

Questions			Rubrics	Marks
3	a		$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $	1
		b		
		i	$\text{C}_3\text{H}_7\text{OH} \rightarrow \text{C}_3\text{H}_6 + \text{H}_2\text{O}$	1
		ii	Brown colour of bromine water decolourises <i>Warna perang air bromin dinyahwarnakan</i>	1
		iii	1. Functional diagram <i>Rajah yang berfungsi</i>	1
			2. Labelled diagram <i>Rajah yang dilabel</i>	1
				
	c	i	Hydrogenation <i>Penghidrogenan</i>	1
		ii	1. Add 2 cm ³ of liquid S and liquid T to two different test tubes and add a few drops of acidic potassium manganate (VII) solution and heat slowly <i>Tambah 2 cm³ cecair S dan cecair T ke dalam dua tabung uji yang berlainan dan tambah beberapa titis larutan kalium manganat(VII) berasid dan panaskan secara perlahan</i> 2. Compound S decolourises the purple color of acidic potassium manganate (VII) solution while compound T does not show any colour change <i>Sebatian S melunturkan warna ungu larutan kalium manganat(VII) berasid manakala sebatian T tidak menunjukkan sebarang perubahan</i>	1 1
	d	i	Esterification <i>Pengesteran</i>	1
		ii	Propyl propanoate <i>Propil propanoat</i>	1
			Total	10

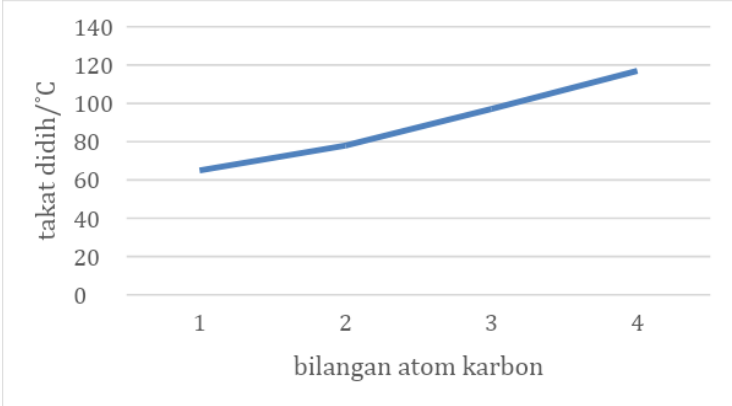
Questions			Rubrics	Marks
4	a	i	Unsaturated fats <i>Lemak tak tepu</i>	1
		ii	Single covalent bond // Double covalent bond // Carboxylate <i>Ikatan kovalen tunggal//Ikatan kovalen ganda dua//karboksilat</i> <i>Any two</i>	2
		iii	1.Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i> 2.The OH molecule is added to two carbon atoms that have a double bond <i>Molekul OH ditambah pada dua atom karbon yang mempunyai ikatan ganda dua</i>	1 1
	b	i	Hydrogenation <i>Penghidrogenan</i>	1
		ii	Temperature : 150°C - 200°C Catalyst : Nickel <i>Nikel</i>	1 1
		iii	Rich in beta carotene which contains vitamin A. Rich in vitamin E. Does not contain cholesterol Easy to digest and absorbed by the body Cheaper Fixed proportions between saturated fats and unsaturated fats Suitable for frying Purified physically without the use of chemical solvents <i>Kaya dengan beta karotena yang mengandungi vitamin A</i> <i>Kaya dengan vitamin E</i> <i>Tidak mengandungi kolesterol</i> <i>Senang dicernakan dan diserap oleh badan</i> <i>Lebih murah</i> <i>Perkadaran yang tetap antara lemak tepu dan lemak tak tepu</i> <i>Sesuai untuk menggoreng</i> <i>Ditulenkan secara fizikal tanpa penggunaan pelarut kimia</i> <i>Choose any two</i>	2
			Total	10

Questions			Rubrics	Marks
5	a	i	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_2 = \text{C} - \text{CH} = \text{CH}_2 \end{array}$	1
		b		
		i	Natural rubber is elastic <i>Getah asli kenyal</i>	1
		ii	Oxygen can be added to double bonds in natural rubber molecules <i>Oksigen boleh ditambahkan pada ikatan ganda dua dalam molekul getah asli</i>	1
		iii	Soft <i>Lembut</i>	1
	c	i	A : Negative charges <i>Cas negatif</i>	1
			B : Protein membrane <i>Membran protein</i>	1
			C : Rubber molecule <i>Molekul getah</i>	1
		ii	1. Protein membrane in rubber particles are negatively charged <i>Membran protein zarah getah bercas negatif</i>	1
			2. So, the rubber particles cannot get close to each other <i>Jadi, zarah-zarah getah tidak dapat mendekati satu dengan yang lain</i>	1
		iii	Methanoic acid <i>Asid metanoik</i>	1
Total				10

Section B
Bahagian B

Questions			Rubrics	Marks														
1	a		1. Ammonia solution 2. Its contains hydroxide ions 3. Hydroxide ions neutralize the asid produced by the action of bacteria in latex 4. So, the negative charge remains around the rubber particles and they repel each other 1. Larutan ammonia 2. Ia mengandungi ion hidroksida 3. Ion hidroksida meneutralkan asid yang dihasilkan oleh tindakan bakteria dalam lateks 3. Jadi, zarah-zarah getah kekal bercas negatif dan menolak antara satu sama lain	1 1 1 1														
		b	i	Vulcanization Pemvulkanan	1													
			ii		<table><tr><th>Type of rubber <i>Jenis getah</i></th><th>Natural rubber <i>Getah asli</i></th><th>Vulcanized rubber <i>Getah tervulkan</i></th></tr><tr><td>Elasticity <i>Kekenyalan</i></td><td>Less elastic <i>Kurang kenyal</i></td><td>More elastic <i>Lebih kenyal</i></td></tr><tr><td>Heat resistance <i>Ketahanan terhadap haba</i></td><td>Becomes soft and sticky when heated <i>Menjadi lembut dan melekit apabila dipanaskan</i></td><td>Does not become soft and sticky <i>Tidak menjadi lembut dan melekit</i></td></tr><tr><td>Hardness <i>Kekerasan</i></td><td>Soft <i>Lembut</i></td><td>Hard <i>Keras</i></td></tr></table>	Type of rubber <i>Jenis getah</i>	Natural rubber <i>Getah asli</i>	Vulcanized rubber <i>Getah tervulkan</i>	Elasticity <i>Kekenyalan</i>	Less elastic <i>Kurang kenyal</i>	More elastic <i>Lebih kenyal</i>	Heat resistance <i>Ketahanan terhadap haba</i>	Becomes soft and sticky when heated <i>Menjadi lembut dan melekit apabila dipanaskan</i>	Does not become soft and sticky <i>Tidak menjadi lembut dan melekit</i>	Hardness <i>Kekerasan</i>	Soft <i>Lembut</i>	Hard <i>Keras</i>	2 2 2
				Type of rubber <i>Jenis getah</i>	Natural rubber <i>Getah asli</i>	Vulcanized rubber <i>Getah tervulkan</i>												
				Elasticity <i>Kekenyalan</i>	Less elastic <i>Kurang kenyal</i>	More elastic <i>Lebih kenyal</i>												
	Heat resistance <i>Ketahanan terhadap haba</i>	Becomes soft and sticky when heated <i>Menjadi lembut dan melekit apabila dipanaskan</i>		Does not become soft and sticky <i>Tidak menjadi lembut dan melekit</i>														
	Hardness <i>Kekerasan</i>	Soft <i>Lembut</i>	Hard <i>Keras</i>															
	iii	1.  2. There is a cross chain of sulfur atoms between rubber molecules in vulcanized rubber compared to natural rubber <i>Terdapat rangkai silang atom sulfur antara molekul getah dalam getah tervulkan berbanding getah asli</i> 3. It limits the sliding between rubber molecules in vulcanized rubber <i>Ianya mengehadkan penggelongsoran antara molekul getah dalam getah tervulkan</i>	1 1 1															

	c	i	Saturated fats : X and Z <i>Lemak tepu : X dan Z</i> Unsaturated fats : W and Y <i>Lemak tak tepu : W dan Y</i>	1 1
		ii	X and Z : Solid or semisolid <i>X dan Z : Pepejal atau separa pepejal</i> W and Y : Liquid <i>W dan Y : Cecair</i>	1 1
		iii	X and Z : more than 20°C <i>X dan Z : lebih daripada 20°C</i> W and Y : less than 20°C <i>W dan Y : kurang dari 20°C</i>	1 1
TOTAL MARKS				20

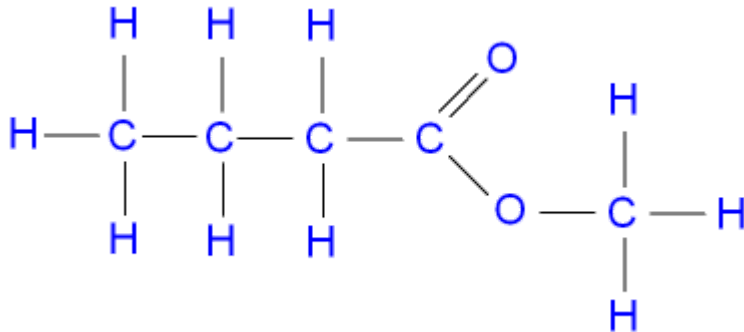
Questions			Rubrics	Marks
2	a	i	 1) 4 points transferred correctly 2) Axis labelled correctly with unit 3) Straight line graph <i>1) 4 titik dipindahkan dengan betul</i> <i>2) Paksi dilabel dengan betul dengan unit</i> <i>3) Graf garis lurus</i>	1 1 1
		ii	1. Pentan-1-ol/Pentanol 2. $ \begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H} \\ & & & & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - \text{O} - \text{H} \\ & & & & & & & & & \\ & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H} \end{array} $ 3. more than 117°C <i>lebih tinggi daripada 117°C</i> 4. The number of carbon atoms in the molecule increases 5. Molar mass and molecular size increase 6. The force of attraction between molecules increases 7. The heat required to overcome the interaction between	1 1 1

		molecules increase 4. Bilangan atom karbon dalam molekul bertambah 5. Jisim molar dan saiz molekul bertambah 6. Kekuatan daya tarikan antara molekul bertambah 7. Haba yang diperlukan untuk mengatasi daya tarikan antara molekul bertambah	Any 3																
b	i	Reagent: Acidified potassium manganate (VII) solution Bahan tindak balas : Larutan kalium manganat(VII) berasid 1. Correct formula of reactant and product Formula bahan tindak balas dan hasil tindak balas yang betul 2. Balanced equation Persamaan yang seimbang $\text{C}_2\text{H}_5\text{OH} + 2[\text{O}] \rightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O}$	1 1 1																
	ii	<table border="1"> <tr> <th>Type of compound <i>Jenis sebatian</i></th><th>P</th><th>Q</th><th>R</th></tr> <tr> <td>Homologous series <i>Siri homolog</i></td><td>Alcohol <i>Alkohol</i></td><td>Carboxylic acid <i>Asid karboksilik</i></td><td>Ester <i>Ester</i></td></tr> <tr> <td>Molecular formulae <i>Formula molekul</i></td><td>$\text{C}_2\text{H}_5\text{OH}$</td><td>$\text{CH}_3\text{COOH}$</td><td>$\text{CH}_3\text{COOC}_2\text{H}_5$</td></tr> <tr> <td>Structural formulae <i>Formula struktur</i></td><td> $\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$ </td><td> $\begin{array}{c} \text{H} & \text{O} \\ & // \\ \text{H}-\text{C}-\text{C} \\ & \\ \text{H} & \text{O}-\text{H} \end{array}$ </td><td> $\begin{array}{c} \text{H} & \text{O} & & \text{H} & \text{H} \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{H} \\ & & & & \\ \text{H} & & & \text{H} & \text{H} \end{array}$ </td></tr> </table>	Type of compound <i>Jenis sebatian</i>	P	Q	R	Homologous series <i>Siri homolog</i>	Alcohol <i>Alkohol</i>	Carboxylic acid <i>Asid karboksilik</i>	Ester <i>Ester</i>	Molecular formulae <i>Formula molekul</i>	$\text{C}_2\text{H}_5\text{OH}$	CH_3COOH	$\text{CH}_3\text{COOC}_2\text{H}_5$	Structural formulae <i>Formula struktur</i>	$\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$	$\begin{array}{c} \text{H} & \text{O} \\ & // \\ \text{H}-\text{C}-\text{C} \\ & \\ \text{H} & \text{O}-\text{H} \end{array}$	$\begin{array}{c} \text{H} & \text{O} & & \text{H} & \text{H} \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{H} \\ & & & & \\ \text{H} & & & \text{H} & \text{H} \end{array}$	Max 8
Type of compound <i>Jenis sebatian</i>	P	Q	R																
Homologous series <i>Siri homolog</i>	Alcohol <i>Alkohol</i>	Carboxylic acid <i>Asid karboksilik</i>	Ester <i>Ester</i>																
Molecular formulae <i>Formula molekul</i>	$\text{C}_2\text{H}_5\text{OH}$	CH_3COOH	$\text{CH}_3\text{COOC}_2\text{H}_5$																
Structural formulae <i>Formula struktur</i>	$\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$	$\begin{array}{c} \text{H} & \text{O} \\ & // \\ \text{H}-\text{C}-\text{C} \\ & \\ \text{H} & \text{O}-\text{H} \end{array}$	$\begin{array}{c} \text{H} & \text{O} & & \text{H} & \text{H} \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{H} \\ & & & & \\ \text{H} & & & \text{H} & \text{H} \end{array}$																
TOTAL MARKS			20																

Section C
Bahagian C

Questions			Rubrics				Marks												
1	a	i	<table><tr><td>Type of substance <i>Jenis bahan</i></td><td>Ethane <i>Etana</i></td><td>Ethene <i>Etena</i></td><td>Ethanoic acid solution <i>Larutan asid etanoik</i></td></tr><tr><td>Acidified potassium manganate (VII)solution <i>Larutan kalium manganat(VII) berasid</i></td><td>No colour changes <i>Tiada Perubahan warna</i></td><td>Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i></td><td>No colour changes <i>Tiada Perubahan warna</i></td></tr><tr><td>Magnesium metal <i>Logam magnesium</i></td><td>No change <i>Tiada Perubahan</i></td><td>No change <i>Tiada Perubahan</i></td><td>Effervescences <i>Pembuakan gas</i></td></tr></table>				Type of substance <i>Jenis bahan</i>	Ethane <i>Etana</i>	Ethene <i>Etena</i>	Ethanoic acid solution <i>Larutan asid etanoik</i>	Acidified potassium manganate (VII)solution <i>Larutan kalium manganat(VII) berasid</i>	No colour changes <i>Tiada Perubahan warna</i>	Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i>	No colour changes <i>Tiada Perubahan warna</i>	Magnesium metal <i>Logam magnesium</i>	No change <i>Tiada Perubahan</i>	No change <i>Tiada Perubahan</i>	Effervescences <i>Pembuakan gas</i>	6
			Type of substance <i>Jenis bahan</i>	Ethane <i>Etana</i>	Ethene <i>Etena</i>	Ethanoic acid solution <i>Larutan asid etanoik</i>													
	Acidified potassium manganate (VII)solution <i>Larutan kalium manganat(VII) berasid</i>		No colour changes <i>Tiada Perubahan warna</i>	Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i>	No colour changes <i>Tiada Perubahan warna</i>														
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	ii	1. Correct formula of reactant and product <i>Formula bahan tindak balas dan hasil tindak balas yang betul</i> 2. Balanced equation <i>Persamaan yang seimbang</i> $C_2H_4 + [O] + H_2O \rightarrow C_2H_4(OH)_2$ $2CH_3COOH + Mg \rightarrow (CH_3COO)_2Mg + H_2$				2 2													
b		i	Apparatus : Test tube, test tube holder, Bunsen burner, delivery tube with rubber stopper <i>Radas: Tabung uji, pemegang tabung uji, penunu Bunsen, salur penghantar dengan penyumbat getah</i> Materials : 1g bread, 1g paper, 1g sugar, 1g leaves, lime water, cobalt (II) chloride paper and litmus paper <i>Bahan : 1g roti, 1g kertas, 1g gula, 1g daun, air kapur, kertas kobalt(II) klorida dan kertas litmus</i>				1 1												
	ii		1. Weigh 1g of bread with a weighing scale and put in a boiling tube 2. Heat the boiling tube strongly 3. Pass the gas released through the delivery tube into a test tube containing lime water 4. At the same time test the gas released with litmus paper and cobalt (II) chloride paper as well 5. Record the changes observed in the table 6. Then repeat steps 1 to 5 using paper, sugar and leaves. <i>1. Timbang 1g roti dengan penimbang dan masukkan ke dalam tabung didih</i> <i>2. Panaskan tabung didih tersebut dengan kuat</i> <i>3. Lalukan gas yang terhasil melalui salur penghantar ke</i>				6												

		dalam tabung uji yang berisi air kapur 4. Dalam masa yang sama uji gas yang terbebas dengan kertas litmus dan kertas kobalt(II) klorida juga 5. Rekodkan perubahan yang diperhatikan di dalam jadual 6. Kemudian ulangi langkah 1 hingga 5 dengan menggunakan kertas, gula dan daun.	
	iii	Product of combustion is carbon dioxide and water Hasil pembakaran ialah karbon dioksida dan air	2
TOTAL MARKS			20

Questions			Rubrics	Marks									
2	1	i	Carboxylate <i>Karboksilat</i>	1									
		ii		1									
		iii	<table><tr><td>Ester</td><td>Methyl butanoate <i>Metil butanoat</i></td><td>Octyl ethanoate <i>Oktil etanoat</i></td></tr><tr><td>Alcohol used <i>Alkohol yang digunakan</i></td><td>Methanol <i>Metanol</i></td><td>Octanol <i>Oktanol</i></td></tr><tr><td>Carboxylic acid used <i>Asid karboksilik yang digunakan</i></td><td>Butanoic acid <i>Asid butanoik</i></td><td>Ethanoic acid <i>Asid etanoik</i></td></tr></table>	Ester	Methyl butanoate <i>Metil butanoat</i>	Octyl ethanoate <i>Oktil etanoat</i>	Alcohol used <i>Alkohol yang digunakan</i>	Methanol <i>Metanol</i>	Octanol <i>Oktanol</i>	Carboxylic acid used <i>Asid karboksilik yang digunakan</i>	Butanoic acid <i>Asid butanoik</i>	Ethanoic acid <i>Asid etanoik</i>	4
	Ester	Methyl butanoate <i>Metil butanoat</i>	Octyl ethanoate <i>Oktil etanoat</i>										
	Alcohol used <i>Alkohol yang digunakan</i>	Methanol <i>Metanol</i>	Octanol <i>Oktanol</i>										
Carboxylic acid used <i>Asid karboksilik yang digunakan</i>	Butanoic acid <i>Asid butanoik</i>	Ethanoic acid <i>Asid etanoik</i>											
		Methyl butanoate <i>Metil butanoate</i> $\text{C}_3\text{H}_7\text{COOH} + \text{CH}_3\text{OH} \rightarrow \text{C}_3\text{H}_7\text{COOCH}_3 + \text{H}_2\text{O}$ Octyl ethanoate <i>Oktil etanoat</i> $\text{CH}_3\text{COOH} + \text{C}_8\text{H}_{17}\text{OH} \rightarrow \text{CH}_3\text{COOC}_8\text{H}_{17} + \text{H}_2\text{O}$	2 2										
	b	Apparatus: Beaker, 250cm ³ , 100cm ³ measuring cylinder, tripod stand, wire gauze, Bunsen burner, lighter <i>Radas : Bikar, 250cm³, selinder penyukat 100cm³, tungku kaki tiga, kasa dawai, penunu Bunsen, pemetik api</i> Materials: glacial butanoic acid, ethanol, concentrated sulfuric	1 1										

Modul Kimia SPM WPKL

SKEMA KERTAS 3 : CARBON COMPOUNDS/SEBATIAN KARBON

SOALAN STRUKTUR

SOALAN 1

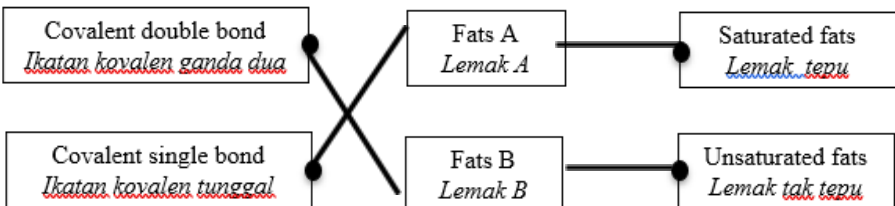
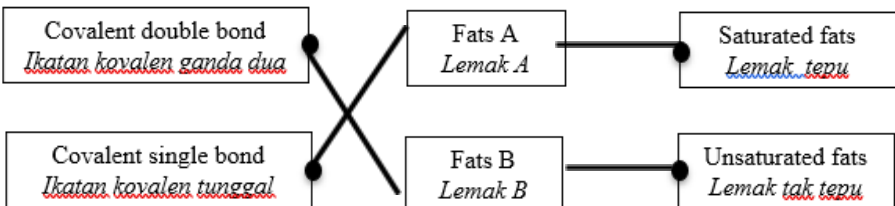
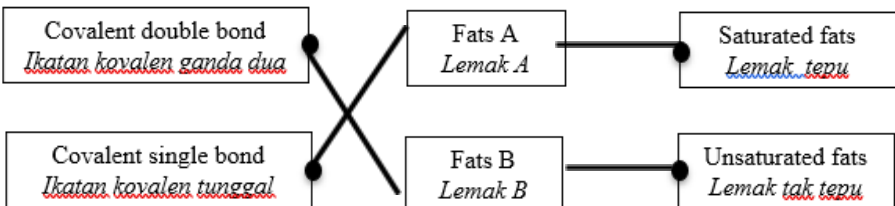
Questions	Rubrics	Marks										
a	Able to state all the boiling point into 1 decimal place Ethane = - 87.8°C Ethene = -104.0°C Ethanol = 78.0°C Ethanoic acid = 118.6°C <i>Boleh menyatakan semua takat didih sehingga 1 tempat perpuluhan</i> <i>Etana = - 87.8°C</i> <i>Etena = -104.0°C</i> <i>Etanol = 78.0°C</i> <i>Asid etanoik = 118.6°C</i>	3										
	Able to state 2-3 boiling point into 1 decimal place <i>Boleh menyatakan 2-3 takat didih sehingga 1 titik perpuluhan</i>	2										
	Able to state 1 boiling point into 1 decimal place <i>Boleh menyatakan 1 takat didih sehingga 1 titik perpuluhan</i>	1										
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0										
b	Able to construct a table to record the length that contain: 1. Correct titles with unit 2. Readings <i>Boleh membina jadual untuk merekod takat didih yang betul dengan:</i> <i>1. Tajuk betul dengan unit</i> <table><tr><th>Type of organic compound <i>Jenis sebatian organik</i></th><th>Boiling point/°C <i>Takat didih/°C</i></th></tr><tr><td>Ethane <i>Etana</i></td><td>-87.8</td></tr><tr><td>Ethene <i>Etena</i></td><td>-104.0</td></tr><tr><td>Ethanol <i>Etanol</i></td><td>78.0</td></tr><tr><td>Ethanoic acid <i>Asid etanoik</i></td><td>118.6</td></tr></table> <i>2. Bacaan</i>	Type of organic compound <i>Jenis sebatian organik</i>	Boiling point/°C <i>Takat didih/°C</i>	Ethane <i>Etana</i>	-87.8	Ethene <i>Etena</i>	-104.0	Ethanol <i>Etanol</i>	78.0	Ethanoic acid <i>Asid etanoik</i>	118.6	3
	Type of organic compound <i>Jenis sebatian organik</i>	Boiling point/°C <i>Takat didih/°C</i>										
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	Ethene <i>Etena</i>	-104.0										
	Ethanol <i>Etanol</i>	78.0										
Ethanoic acid <i>Asid etanoik</i>	118.6											
Able to construct a less accurate table that contains: 1. Titles without unit 2. Readings <i>Boleh membina jadual yang kurang tepat yang mengandungi:</i> <i>1. Tajuk tanpa unit</i> <i>2. Bacaan</i>	2											
Able to construct a table with at least one title / reading <i>Boleh membina jadual dengan sekurang-kurangnya satu tajuk / bacaan</i>	1											
No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0											

c	All relative molecular mass correct <i>Semua jisim molekul relatif betul</i>			3
	Organic compound <i>Sebatian organik</i>	Molecular formulae <i>Formula molekul</i>	Relative molecular mass <i>Jisim molekul relatif</i>	
	Ethane <i>Etena</i>	C ₂ H ₆	30	
	Ethene <i>Etana</i>	C ₂ H ₄	28	
	Ethanol <i>Etanol</i>	C ₂ H ₅ OH	46	
	Ethanoic acid <i>Asid etanoik</i>	CH ₃ COOH	60	
	Any three relative molecular mass correct <i>Mana-mana tiga jisim molekul relatif betul</i>			2
	Any two relative molecular mass correct <i>Mana-mana dua jisim molekul relatif betul</i>			1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>			0
d(i)	The increasing order of boiling point of these organic compounds is ethene, ethane, ethanol and ethanoic acid <i>Urutan pertambahan takat didih bagi sebatian organik ini adalah etena, etana, etanol dan asid etanoik</i>			3
	The boiling point of organic compounds is increasing <i>Takat didih sebatian organik semakin bertambah</i>			2
	The boiling point of organic compounds varies <i>Takat didih sebatian organik adalah berbeza-beza</i>			1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>			0
d(ii)	Organic compounds with a higher relative molecular mass have a larger molecular size //stronger forces of attraction // require a lot of heat energy to overcome the force of attraction between molecules compared to organic compounds with lower molecular mass <i>Sebatian organik yang mempunyai jisim molekul relatif yang tinggi mempunyai saiz molekul yang besar // daya tarikan antara molekul yang lebih kuat//memerlukan tenaga haba yang banyak untuk mengatasi daya tarikan antara molekul berbanding sebatian organik dengan jisim molekul yang rendah</i>			3
	Organic compounds that have a higher relative molecular mass have a larger molecular size // stronger forces of attraction // requires a lot of heat energy to weaken the bond <i>Sebatian organik yang mempunyai jisim molekul relatif yang tinggi mempunyai saiz molekul yang besar // daya tarikan antara molekul yang kuat//memerlukan tenaga haba yang banyak untuk melemahkan ikatan</i>			2
	Organic compounds relative molecular mass increases <i>Sebatian organik yang mempunyai jisim molekul relatif yang semakin bertambah</i>			1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>			0

e	Able to state three variables correctly <i>Boleh menyatakan tiga pemboleh ubah dengan betul</i>	3
	Manipulated variable : Relative molecular mass of substance <i>Pemboleh ubah manipulasi: Jisim molekul relatif bahan</i>	
	Responding variable: Boiling point of substance <i>Pemboleh ubah gerak balas : Takat didih bahan</i>	
	Fixed variable : Number of carbon atoms of the substance <i>Pemboleh ubah dimalarkan : Bilangan atom karbon dalam bahan</i>	
	Able to state two variables correctly <i>Boleh menyatakan dua pemboleh ubah dengan betul</i>	2
	Able to state one of the above variable <i>Boleh menyatakan satu pemboleh ubah dengan betul</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
f	Able to state the relationship between the manipulated variable and the responding variable with direction correctly <i>Boleh menyatakan hubungan antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas dalam arah yang betul</i>	3
	The higher the relative molecular mass of a substance, the higher the boiling point the substance <i>Semakin bertambah jisim molekul relatif sesuatu bahan, semakin bertambah takat didih bahan tersebut.</i>	2
	Able to state the relationship between the manipulated variable and the responding variable without direction <i>Boleh menyatakan hubungan antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas tanpa arah yang betul</i>	
	Relative molecular mass affects the boiling point of a substance <i>Jisim molekul relative sesuatu bahan mempengaruhi takat didih bahan tersebut</i>	1
	Able to give an idea of hypothesis <i>Boleh memberikan idea untuk hipotesis</i>	
	<i>Takat didih berbeza-beza</i>	0
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	
g	Able to state the correct operational definition for the boiling point in this experiment with the following aspects <i>Boleh menyatakan definisi operasi yang betul untuk takat didih dalam eksperimen ini dengan aspek berikut</i> 1. What must be done [measure and record boiling point] and 2. What is observed [change in boiling point] <i>1. Apa yang mesti dilakukan [ukur dan catat takat didih] dan</i> <i>2. Apa yang diperhatikan [perubahan takat didih]</i>	3

	When boiling point of different organic compound with different homologous series and same number of carbon atoms is measured, the boiling point increases with the relative molecular mass <i>Apabila takat didih sebatian organik yang berbeza siri homolog tetapi sama bilangan atom karbon diukur, takat didih bertambah dengan jisim molekul relatif</i> <i>Takat didih ialah suhu maksima yang diperolehi apabila bahan organik dipanaskan sehingga melebur.</i>	
	Able to state the correct operational definition for the boiling point in this experiment with the following aspects <i>Boleh menyatakan definisi operasi yang betul untuk takat didih dalam eksperimen ini dengan aspek berikut</i> 1. What must be done [measure and record boiling point] OR 2. What is observed [change in boiling point] <i>1. Apa yang mesti dilakukan [ukur dan catat takat didih] atau</i> <i>2. Apa yang diperhatikan [perubahan takat didih]</i> Boiling point of organic compound increases <i>Takat didih sebatian organik meningkat</i>	2
	Able to give an idea of the operational definition. <i>Boleh memberi idea mengenai definisi operasi.</i> Boiling point is the temperature where the substance starts to boil <i>Takat didih ialah suhu di mana bahan mula mendidih</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
h	Able to state all three answer correctly <i>Boleh menyatakan ketiga-tiga jawapan dengan betul</i> i) etil etanoat ii) ester iii) $\text{CH}_3\text{COOC}_2\text{H}_5$	3
	Able to state any two answer correctly <i>Boleh menyatakan mana-mana dua jawapan dengan betul</i>	2
	Able to state any one answer correctly <i>Boleh menyatakan mana-mana satu jawapan dengan betul</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
i	Able to draw all three structural formulae correctly <i>Boleh melukis ketiga-tiga formula struktur dengan betul</i> $\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$ $\begin{array}{c} \text{H} & \text{O} \\ & // \\ \text{H}-\text{C}-\text{C} \\ & \\ \text{H} & \text{O}-\text{H} \end{array}$ $\begin{array}{c} \text{H} & \text{O} & & \text{H} & \text{H} \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{H} \\ & & & & \\ \text{H} & & & \text{H} & \text{H} \end{array}$	3
	Able to draw any two structural formulae correctly <i>Boleh melukis mana-mana dua formula struktur dengan betul</i>	2
	Able to draw any one structural formulae correctly <i>Boleh melukis mana-mana satu formula struktur dengan betul</i>	1

	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0								
j	Able to classify all five substances into hydrocarbon and non-hydrocarbon 1. Correct headings 2. List of substance <i>Boleh mengelaskan kelima bahan kepada hidrokarbon dan bukan hidrokarbon</i> 1. <i>Tajuk yang betul</i> 2. <i>Senarai bahan</i> <table><tr><td>Hydrocarbon <i>Hidrokarbon</i></td><td>Non-hydrocarbon <i>Bukan hidrokarbon</i></td></tr><tr><td>Ethane <i>Etena</i></td><td>Ethanol <i>Etanol</i></td></tr><tr><td>Ethene <i>Etena</i></td><td>Ethanoic acid <i>Asid etanoik</i></td></tr><tr><td></td><td>Substance X <i>Bahan X</i></td></tr></table>	Hydrocarbon <i>Hidrokarbon</i>	Non-hydrocarbon <i>Bukan hidrokarbon</i>	Ethane <i>Etena</i>	Ethanol <i>Etanol</i>	Ethene <i>Etena</i>	Ethanoic acid <i>Asid etanoik</i>		Substance X <i>Bahan X</i>	3
Hydrocarbon <i>Hidrokarbon</i>	Non-hydrocarbon <i>Bukan hidrokarbon</i>									
Ethane <i>Etena</i>	Ethanol <i>Etanol</i>									
Ethene <i>Etena</i>	Ethanoic acid <i>Asid etanoik</i>									
	Substance X <i>Bahan X</i>									
	Able to classify three to four substances into hydrocarbon and non-hydrocarbon 1. Correct headings 2. List of substance <i>Boleh mengelaskan tiga ke empat bahan kepada hidrokarbon dan bukan hidrokarbon</i> 1. <i>Tajuk yang betul</i> 2. <i>Senarai bahan</i>	2								
	Able to classify one to two substances into hydrocarbon and non-hydrocarbon 1. Correct headings 2. List of substance <i>Boleh mengelaskan satu ke dua bahan kepada hidrokarbon dan bukan hidrokarbon</i> 1. <i>Tajuk yang betul</i> 2. <i>Senarai bahan</i>	1								
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0								
TOTAL MARKS		33								

Questions	Rubrics	Marks												
ai	Able to state all four observation correctly <i>Boleh menyatakan keempat-empat pemerhatian dengan betul</i>	3												
	<table><tr><th>Type of fats <i>Jenis lemak</i></th><th colspan="2">Observation <i>Pemerhatian</i></th></tr><tr><th></th><th>With Bromine water <i>Dengan air bromin</i></th><th>With acidified potassium manganate (VII) solution <i>Dengan larutan kalium manganat (VII) berasid</i></th></tr><tr><td>Fats A <i>Lemak A</i></td><td>No colour changes <i>Tiada perubahan warna</i></td><td>No colour changes <i>Tiada perubahan warna</i></td></tr><tr><td>Fats B <i>Lemak B</i></td><td>Brown colour bromine water decolourises <i>Warna perang air bromin dinyahwarnakan</i></td><td>Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i></td></tr></table>	Type of fats <i>Jenis lemak</i>	Observation <i>Pemerhatian</i>			With Bromine water <i>Dengan air bromin</i>	With acidified potassium manganate (VII) solution <i>Dengan larutan kalium manganat (VII) berasid</i>	Fats A <i>Lemak A</i>	No colour changes <i>Tiada perubahan warna</i>	No colour changes <i>Tiada perubahan warna</i>	Fats B <i>Lemak B</i>	Brown colour bromine water decolourises <i>Warna perang air bromin dinyahwarnakan</i>	Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i>	
	Type of fats <i>Jenis lemak</i>	Observation <i>Pemerhatian</i>												
		With Bromine water <i>Dengan air bromin</i>	With acidified potassium manganate (VII) solution <i>Dengan larutan kalium manganat (VII) berasid</i>											
	Fats A <i>Lemak A</i>	No colour changes <i>Tiada perubahan warna</i>	No colour changes <i>Tiada perubahan warna</i>											
Fats B <i>Lemak B</i>	Brown colour bromine water decolourises <i>Warna perang air bromin dinyahwarnakan</i>	Purple colour solution decolourises <i>Warna ungu larutan dinyahwarnakan</i>												
Able to state any three observation correctly <i>Boleh menyatakan mana-mana tiga pemerhatian dengan betul</i>	2													
Able to state any two observation correctly <i>Boleh menyatakan mana-mana dua pemerhatian dengan betul</i>	1													
No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0													
aii	Able to match all four answer correctly <i>Boleh memadankan kesemua empat jawapan dengan betul</i>	3												
	<table><tr><th>Type of bond <i>Jenis ikatan</i></th><th></th><th>Type of fats <i>Jenis lemak</i></th></tr><tr><td>Covalent double bond <i>Ikatan kovalen ganda dua</i></td><td></td><td>Saturated fats <i>Lemak tepu</i></td></tr><tr><td>Covalent single bond <i>Ikatan kovalen tunggal</i></td><td></td><td>Unsaturated fats <i>Lemak tak tepu</i></td></tr></table>	Type of bond <i>Jenis ikatan</i>		Type of fats <i>Jenis lemak</i>	Covalent double bond <i>Ikatan kovalen ganda dua</i>		Saturated fats <i>Lemak tepu</i>	Covalent single bond <i>Ikatan kovalen tunggal</i>		Unsaturated fats <i>Lemak tak tepu</i>				
	Type of bond <i>Jenis ikatan</i>		Type of fats <i>Jenis lemak</i>											
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Able to match any three answer correctly <i>Boleh memadankan mana-mana tiga jawapan dengan betul</i>	2													
Able to match any two answer correctly <i>Boleh memadankan mana-mana tiga dua jawapan dengan betul</i>	1													
No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0													
b	Able to state the relationship between the manipulated variable and the responding variable with direction correctly <i>Boleh menyatakan hubungan antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas dalam arah yang betul</i>	3												
	Manipulated variable : Type of fats <i>Pembolehubah manipulasi: Jenis lemak</i>													

	Responding variable: Colour changes on bromine liquid and acidified potassium manganate(VI) solution <i>Pemboleh ubah gerak balas : Perubahan warna pada air bromin dan larutan kalium manganat yang berasid (VI)</i> Fixed variable : Volume of substance used <i>Pemboleh ubah dimalarkan : Isipadu bahan yang digunakan</i>	
	Able to state two variables correctly <i>Boleh menyatakan dua pemboleh ubah dengan betul</i>	2
	Able to state one of the above variable <i>Boleh menyatakan satu pemboleh ubah dengan betul</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
c	Able to state the relationship between the manipulated variable and the responding variable with direction correctly <i>Boleh menyatakan hubungan antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas dalam arah yang betul</i> The presence of double bonds in fat causes the brown color of bromine water to be decolourises and the purple color of acidified potassium manganate(VI) to be decolourises and the presence of a single bond in fat causes no colour changes <i>Kehadiran ikatan ganda dua dalam lemak menyebabkan warna perang air bromin dilunturkan dan warna ungu kalium manganat yang berasid (VI) dilunturkan dan kehadiran ikatan tunggal dalam lemak menyebabkan tiada perubahan warna</i>	3
	Able to state the relationship between the manipulated variable and the responding variable without direction <i>Boleh menyatakan hubungan antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas tanpa arah yang betul</i> The presence of double bonds in fats causes a colour changes in liquid bromine solution and acidic potassium manganate (VI) and the presence of a single bond in fats causes no colour changes <i>Kehadiran ikatan ganda dua dalam lemak menyebabkan terdapatnya perubahan warna pada pada larutan bromin cair dan kalium manganat yang berasid (VI) dan kehadiran ikatan tunggal dalam lemak menyebabkan tiada perubahan warna</i>	2
	Able to give an idea of hypothesis <i>Boleh memberikan idea untuk hipotesis</i> <i>Fat A and Fat B show different color changes</i> <i>Lemak A dan Lemak B menunjukkan perubahan warna yang berbeza-beza</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
d	Able to state the correct operational definition for the reactivity in this experiment with the following aspects <i>Boleh menyatakan definisi operasi yang betul untuk kereaktifan dalam</i>	3

	<i>eksperimen ini dengan aspek berikut</i> 1. What must be done [observe and record colour changes] and 2. What is observed [change in colour changes] <i>1. Apa yang mesti dilakukan [perhati dan catat perubahan warna] dan 2. Apa yang diperhatikan [perubahan warna]</i> The brown color of bromine water and the purple color of the acidic solution of potassium manganate (VII) are decolourised when added to a compound that has a double covalent bond which is a compound that has high reactivity <i>Warna perang air bromin dan warna ungu larutan kalium manganat(VII)berasid dilunturkan apabila ditambahkan kepada sebatian yang mempunyai ikatan kovalen ganda dua iaitu sebatian yang mempunyai kereaktifan yang tinggi</i>	
	Able to state the correct operational definition for the reactivity in this experiment with the following aspects <i>Boleh menyatakan definisi operasi yang betul untuk kereaktifan dalam eksperimen ini dengan aspek berikut</i> 1. What must be done [observe and record colour changes] or 2. What is observed [change in colour changes] <i>1. Apa yang mesti dilakukan [perhati dan catat perubahan warna] atau 2. Apa yang diperhatikan [perubahan warna]</i> The brown color of bromine water and the purple color of the acidic potassium manganate (VII) solution are decolourized when added to compounds with double covalent bonds <i>Warna perang air bromin dan warna ungu larutan kalium manganat(VII)berasid dilunturkan apabila ditambahkan kepada sebatian yang mempunyai ikatan kovalen ganda dua</i>	2
	Able to give an idea of the operational definition. <i>Boleh memberi idea mengenai definisi operasi.</i> Reactivity is for compounds that change color <i>Kereaktifan ialah bagi sebatian yang mengalami perubahan warna</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
e	Able to choose correct fats and give two reason for the choice <i>Boleh memilih lemak yang betul dan memberikan dua sebab untuk pilihan yang dibuat</i> Fats B 1. Has double covalent bond 2. The electron pair in double covalent bond is shared together to form new bonds with the added material <i>Lemak B 1. Mempunyai ikatan ganda dua 2. Pasangan elektron ikatan kovalen ganda itu dikongsikan bersama dengan bahan yang ditambah membentuk ikatan baru</i>	3
	Able to choose correct fats and give one reason for the choice <i>Boleh memilih lemak yang betul dan memberikan satu sebab untuk pilihan yang dibuat</i>	2

	Fats B 1. Has double covalent bond or 2. The electron pair in covalent bond is shared together with the added material <i>Lemak B</i> 1. Mempunyai ikatan ganda dua atau 2. Pasangan elektron ikatan kovalen itu dikongsikan bersama dengan bahan yang ditambah	
	Able to choose correct fats only <i>Boleh memilih lemak yang betul sahaja</i> Fats B <i>Lemak B</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
f	Able to predict the sootiness of flame for both fats and give two reason <i>Boleh meramal kejelagaan nyalaan bagi kedua-dua lemak dan berikan dua sebab</i> 1. Fat B has more sootiness of flame than fat A when burned 2. The percentage of carbon by mass in fat B is higher than fat A <i>1. Lemak B mempunyai kejelagaan nyalaan yang lebih banyak berbanding lemak A apabila dibakar</i> <i>2. Peratus karbon mengikut jisim dalam lemak B adalah lebih tinggi berbanding Lemak A</i>	3
	Able to predict the sootiness of flame for both fats and give incomplete reason <i>Boleh meramal kejelagaan nyalaan bagi kedua-dua lemak dan berikan satu sebab yang tidak lengkap</i>	2
	Able to predict the sootiness of flame for both fats only <i>Boleh meramal kejelagaan nyalaan sahaja</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
g	Able to state the process, temperature and catalyst <i>Boleh menyatakan proses, suhu dan mangkin</i> Process : Hydrogenation <i>Proses : Penghidrogenan</i> Temperature : 180°C <i>Suhu</i> Catalyst : Nickel <i>Mangkin : Nikel</i>	3
	Able to state the process, temperature or catalyst <i>Boleh menyatakan proses, suhu atau mangkin</i>	2
	Able to state the process only <i>Boleh menyatakan proses sahaja</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
h	Able to state three type of functional group in given compound	3

	Boleh menyatakan tiga kumpulan berfungsi dalam sebatian yang diberikan Single covalent bond between carbon-carbon atom Ikatan kovalen tunggal antara atom karbon Double covalent bond between carbon-carbon atom Ikatan kovalen ganda dua antara atom karbon Carboxylate karboksilat	
	Able to state two type of functional group in given compound Boleh menyatakan dua kumpulan berfungsi dalam sebatian yang diberikan	2
	Able to state onetype of functional group in given compound Boleh menyatakan satu kumpulan berfungsi dalam sebatian yang diberikan	1
	No response or wrong response Tiada jawapan atau respon yang salah	0
i	Able to write correct and balanced chemical equation between stearic acid and glycerol to produce fats A Boleh menulis persamaan kimia yang betul dan seimbang antara asid stearik dan gliserol untuk menghasilkan lemak A $ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{OH} \\ \\ \text{H}-\text{C}-\text{OH} \\ \\ \text{H}-\text{C}-\text{OH} \\ \\ \text{H} \end{array} + 3 \text{CH}_3(\text{CH}_2)_{16}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH} \rightarrow \begin{array}{c} \text{H} \quad \text{O} \\ \quad \parallel \\ \text{H}-\text{C}-\text{O}-\text{C}-(\text{CH}_2)_{16}-\text{CH}_3 \\ \quad \parallel \\ \text{H}-\text{C}-\text{O}-\text{C}-(\text{CH}_2)_{16}-\text{CH}_3 \\ \quad \parallel \\ \text{H}-\text{C}-\text{O}-\text{C}-(\text{CH}_2)_{16}-\text{CH}_3 \\ \\ \text{H} \end{array} + 3\text{H}_2\text{O} $	3
	Able to write correct chemical equation between stearic acid and glycerol to produce fats A Boleh menulis persamaan kimia yang betul antara asid stearik dan gliserol untuk menghasilkan lemak A	2
	Able to write chemical equation between stearic acid and glycerol to produce fats A Boleh menulis persamaan antara asid stearik dan gliserol untuk menghasilkan lemak A	1
	No response or wrong response Tiada jawapan atau respon yang salah	0
j	Able to classify all four fats substances into saturated and unsaturated fats 1. Correct headings 2. List of substance Boleh mengelaskan keempat-empat bahan kepada lemak tepu dan lemak tak tepu 1. Tajuk yang betul 2. Senarai bahan	3

	Unsaturated fat <i>Lemak tak tepu</i>	Saturated fat <i>Lemak tepu</i>	
	Sunflower oil <i>Minyak bunga matahari</i>	Butter <i>Mentega</i>	
	Coconut oil <i>Minyak kelapa</i>	Ghee <i>Minyak sapi</i>	
	Able to classify three substances into saturated and unsaturated fats 1. Correct headings 2. List of substance <i>Boleh mengelaskan tiga bahan kepada lemak tepu dan lemak tak tepu</i> 1. <i>Tajuk yang betul</i> 2. <i>Senarai bahan</i>		2
	Able to classify two substance into saturated and unsaturated fats 1. Correct headings 2. List of substance <i>Boleh mengelaskan dua bahan kepada lemak tepu dan lemak tak tepu</i> 1. <i>Tajuk yang betul</i> 2. <i>Senarai bahan</i>		1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>		0
	TOTAL MARKS		33

SOALAN 1

Rubrics		Marks
a	Able to state the problem statement correctly. <i>Boleh menyatakan pernyataan masalah dengan betul</i>	3
	Does methanoic acid solution coagulate the latex and ammonia solution prevent coagulation of latex? <i>Adakah larutan asid metanoik menggumpalkan lateks dan larutan ammonia mencegah penggumpalan lateks</i>	
	Able to state the problem statement less correctly <i>Boleh menyatakan pernyataan masalah dengan kurang betul</i>	2
	Does acid solution coagulate the latex and alkali solution prevent coagulation of latex <i>Adakah larutan asid menggumpalkan lateks dan larutan alkali mencegah penggumpalan lateks</i>	
	Able to state an idea of problem statement <i>Boleh menyatakan idea pernyataan masalah</i>	1
b	<i>Adakah larutan Y menggumpalkan lateks dan larutan X mencegah penggumpalan lateks</i>	0
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	
	Able to list all variable correctly <i>Boleh menyenaraikan semua pembolehubah dengan betul</i>	3
	Manipulated variable : The type solution used <i>Pembolehubah manipulasi : Jenis larutan yang digunakan</i>	
	Responding variable : Coagulation of latex <i>Pembolehubah gerak balas : Penggumpalan lateks</i>	
	Fixed variable : Volume of latex used <i>Pembolehubah dimalarkan : Isipadu lateks yang digunakan</i>	
	Able to list 2 variable correctly or 1 correct + 2 idea <i>Boleh menyenaraikan 2 pembolehubah dengan betul atau 1 betul + 2 idea</i>	2
c	Able to list 1 variable correctly or 3 idea <i>Boleh menyenaraikan 1 pembolehubah dengan betul atau 3 idea</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
	Able to state the hypothesis correctly. <i>Boleh menyatakan hipotesis dengan betul</i>	3
	Methanoic acid solution coagulates the latex and ammonia solution prevent coagulation of latex <i>Larutan asid metanoik menggumpalkan lateks dan larutan ammonia mencegah penggumpalan lateks</i>	

	Able to state the hypothesis less correctly <i>Boleh menyatakan hipotesis dengan kurang betul</i>	
	Acid solution coagulate the latex and alkali solution prevent coagulation of latex <i>Larutan asid menggumpalkan lateks dan larutan alkali mencegah penggumpalan lateks</i>	2
	Able to state an idea of hypothesis <i>Boleh menyatakan idea untuk hipotesis</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
d	Able to give complete list of substances and apparatus <i>Boleh menyenaraikan senarai radas dan bahan yang lengkap</i>	
	Materials : 50cm ³ latex, ethanoic acid solution, ammonia solution <i>Bahan : 50cm³ lateks, larutan asid etanoik, larutan ammonia</i>	3
	Apparatus : Beaker 100cm ³ , glass rod and dropper, measuring cylinder 50cm <i>Radas : Bikar 100cm³, rod kaca, penitis selinder penyukat 50cm³</i>	
	Able to give at least two substances and apparatus <i>Boleh menyenaraikan sekurang-kurangnya dua radas dan bahan yang lengkap</i>	2
	Able to give at least one substance and apparatus <i>Boleh menyenaraikan sekurang-kurangnya satu radas dan bahan yang lengkap</i>	1
e	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
	Able to list all the steps correctly <i>Boleh menyenaraikan semua langkah-langkah dengan betul</i>	
	1. Fill 50 cm ³ of latex into the beaker, 100cm ³ 2. Then drop a few drops of methanoic acid solution into the beaker 3. Stir the solution evenly for 5 minutes with a glass rod 4. Observe and record changes in the schedule 5. Repeat steps 1 to 4 using ammonia solution to replace ethanoic acid solution.1. <i>1. Isikan 50 cm³ lateks ke dalam bikar, 100cm³ 2. Kemudian titiskan beberapa titis larutan asid metanoik ke dalam bikar tadi 3. Kacau larutan dengan sekata selama 5 minit dengan rod kaca 4. Perhatikan dan rekodkan perubahan dalam jadual 5. Ulangi langkah 1 hingga 4 dengan menggunakan larutan ammonia untuk menggantikan larutan asid etanoik.</i>	3
	Able to list steps 1,2,4 and 5 <i>Boleh menyenaraikan langkah 1,2,4 dan 5</i>	2
	Able to list steps 1,2 and 3	1

	Boleh menyenaraikan langkah 1,2 dan 3	
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
f	Able to tabulate the data with the following aspects 1. correct titles and correct unit 2. complete list of reacting mixture <i>Boleh menjadualkan data dengan aspek berikut</i> 1. tajuk yang betul dan unit yang betul 2. senarai lengkap campuran bahan tindak balas	2
	Type of solution <i>Jenis larutan</i>	
	Methanoic acid <i>Asid metanoik</i>	
	Ammonia solution <i>Larutan ammonia</i>	
	Able to construct a table with at least 1. one title 2. incomplete list of elements <i>Boleh menjadualkan data dengan aspek berikut</i> 1. 1 tajuk 2. senarai yang tidak lengkap campuran bahan tindak balas	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
TOTAL MARKS		17

SOALAN 2

Rubrics		Marks
a	Able to state the problem statement correctly. <i>Boleh menyatakan pernyataan masalah dengan betul</i>	3
	Is alkanes, alkenes and alcohol having different sootiness of flame when burnt in the air <i>Adakah alkana, alkena dan alkohol mempunyai kejelagaan nyalaan yang berbeza-beza apabila dibakar di udara</i>	
	Able to state the problem statement less correctly <i>Boleh menyatakan pernyataan masalah dengan kurang betul</i>	2
	Is alkanes, alkenes and alcohol having different sootiness of flame <i>Adakah alkana, alkena dan alkohol mempunyai kejelagaan nyalaan yang berbeza-beza</i>	
	Able to state an idea of problem statement <i>Boleh menyatakan idea pernyataan masalah</i>	1
	Is all the organic compounds having different sootiness of flame <i>Adakah semua sebatian organik mempunyai kejelagaan nyalaan yang berbeza-beza</i>	
	No response or wrong response	0

	Tiada jawapan atau respon yang salah	
b	Able to list all variable correctly <i>Boleh menyenaraikan semua pembolehubah dengan betul</i> Manipulated variable : The type organic compound used <i>Pembolehubah manipulasi : Jenis sebatian organik yang digunakan</i> Responding variable : Sootiness of flame <i>Pembolehubah gerak balas : Kejelagaan nyalaan</i> Fixed variable : Volume of liquid <i>Pembolehubah dimalarkan : Isipadu cecair</i>	3
	Able to list 2 variable correctly or 1 correct + 2 idea <i>Boleh menyenaraikan 2 pembolehubah dengan betul atau 1 betul + 2 idea</i>	2
	Able to list 1 variable correctly or 3 idea <i>Boleh menyenaraikan 1 pembolehubah dengan betul atau 3 idea</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
c	Able to state the hypothesis correctly. <i>Boleh menyatakan hipotesis dengan betul</i> Alcohol burns in the air with blue flame without soot and alkene burns with more sooty flame compared to alkane <i>Alkohol terbakar di udara dengan nyalaan biru tanpa jelaga dan alkena terbakar dengan nyalaan lebih berjelaga berbanding dengan alkana</i>	3
	Able to state the hypothesis less correctly <i>Boleh menyatakan hipotesis dengan kurang betul</i> Alcohol burns in the air with blue flame without soot and alkene and alkane burn with sooty flame <i>Alkohol terbakar di udara dengan nyalaan biru tanpa jelaga dan alkana dan alkana terbakar dengan nyalaan yang berjelaga</i>	2
	Able to state an idea of hypothesis <i>Boleh menyatakan idea untuk hipotesis</i> Alcohol, alkane and alkene burn with different sootiness in the air <i>Alkohol, alkana dan alkena terbakar dengan kejelagaan nyalaan yang berbeza</i>	1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>	0
d	Able to give complete list of substances and apparatus <i>Boleh menyenaraikan senarai radas dan bahan yang lengkap</i> Materials : 5cm³ ethane, 5cm³ ethene and 5cm³ ethanol, filter paper <i>Bahan : 5cm³ etena, 5cm³ etana and 5cm³ etanol, kertas turas</i> Apparatus : evaporating dish, wooden splinter, matches, tongs, measuring cylinder, 10cm³, weighing scale <i>Radas : mangkuk penyejat, kayu uji, mancis, penyepit, selinder penyukat, 10cm³, mesin penimbang</i>	3

	Able to give at least two substances and apparatus <i>Boleh menyenaraikan sekurang-kurangnya dua radas dan bahan yang lengkap</i>			2
	Able to give at least one substance and apparatus <i>Boleh menyenaraikan sekurang-kurangnya satu radas dan bahan yang lengkap</i>			1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>			0
e	Able to list all the steps correctly <i>Boleh menyenaraikan semua langkah-langkah dengan betul</i> 1. 5 cm ³ of ethanol are poured into evaporating dish 2. Weigh the weight of a clean filter paper and record in the table 3. Burn the liquid ethanol quickly using burning wooden splinter 4. Bring closer a clean filter paper on top of flame and make sure doesn't not burn the filter paper 5. After 1 minutes, blow out the flame and quickly weigh the weight of filter paper and record in the table 6. Repeat steps 1 until 5 with alkane and alkene <i>1. 5 cm³ etanol dituangkan ke dalam mangkuk penyejat</i> <i>2. Timbang berat kertas turas yang bersih dan catat dalam jadual</i> <i>2. Tuangkan cecir etanol dengan cepat ke dalam mangkuk penyejat dan bakar cecair etanol dengan menggunakan kayu uji berbara</i> <i>3. Dekatkan kertas turas yang bersih di atas api dan pastikan tidak membakar kertas turas</i> <i>5. Selepas 1 minit, padamkan api dan timbang berat kertas turas dengan cepat dan catat di dalam jadual</i> <i>6. Ulangi langkah 1 hingga 5 dengan alkana dan alkena</i>			3
	Able to list steps 1,2,4 and 5 <i>Boleh menyenaraikan langkah 1,2,4 dan 5</i>			2
	Able to list steps 1,2 and 3 <i>Boleh menyenaraikan langkah 1,2 dan 3</i>			1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>			0
	Able to tabulate the data with the following aspects 1. correct titles and correct unit 2. complete list of reacting mixture <i>Boleh menjadualkan data dengan aspek berikut</i> <i>1. tajuk yang betul dan unit yang betul</i> <i>2. senarai lengkap campuran bahan tindak balas</i>			2
f	Type of liquid <i>Jenis cecair</i>	Mass of the filter paper before the combustion(g) <i>Jisim kertas turas sebelum pembakaran(g)</i>	Mass of the filter paper after the combustion(g) <i>Jisim kertas turas selepas pemanasan(g)</i>	
	Ethanol <i>etanol</i>			
	Ethene			

	<i>Etena</i>				
	Ethane				
	<i>Etana</i>				
	Able to construct a table with at least 1. one title 2. incomplete list of elements <i>Boleh menjadualkan data dengan aspek berikut</i> <i>1. 1 tajuk</i> <i>2. senarai yang tidak lengkap campuran bahan tindak balas</i>				1
	No response or wrong response <i>Tiada jawapan atau respon yang salah</i>				0
TOTAL MARKS					17

Set 7

Oxidation and Reduction
Pengoksidan Dan
Penurunan

TAJUK: OXIDATION AND REDUCTION/PENGOKSIDAAN DAN PENURUNAN**Section A**
Bahagian A

- 1 Diagram 1 shows an electrolysis process conducted in a school laboratory.
Rajah 1 menunjukkan satu proses elektrolisis yang dilakukan di dalam makmal sekolah.

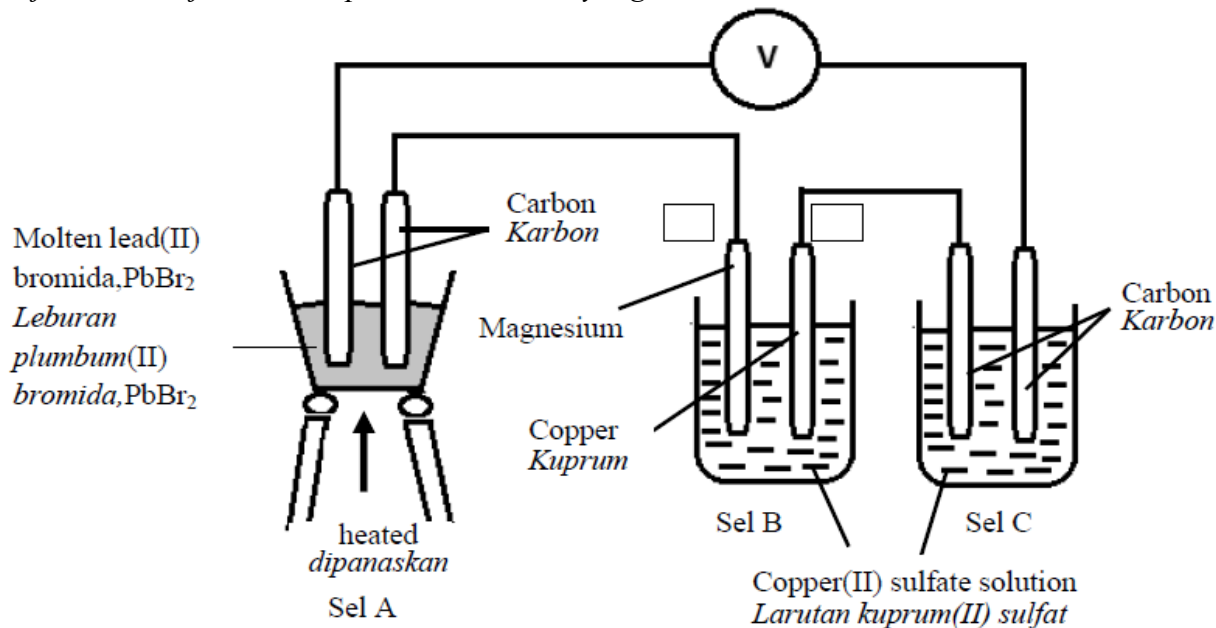


Diagram 1
Rajah 1

- (a) Electrolysis is one of the redox reactions. State the meaning of redox reaction?
Elektrolisis merupakan satu tindak balas redoks. Nyatakan maksud tindak balas redoks?

.....

[1 mark]

- (b) State the formula of ions present in molten lead(II) bromide.
Nyatakan formula ion-ion yang hadir dalam leburan plumbum(II) bromida.

.....

[1 mark]

- (c) Mark (/) in the box provided to show the anode electrode in the cell B.
Tandakan (/) di dalam petak yang menunjukkan elektrod anod pada sel B.

[1 mark]

- (d) (i) In cel B, write half equation at;
Di dalam sel B, tulis setengah persamaan pada;

Magnesium electrode / *Elektrod magnesium:*

.....

- (ii) Copper electrode/ *Elektrod kuprum :*

.....

[2 marks]

- (e) State the observation at both electrode in cell A
Nyatakan pemerhatian pada kedua-dua elektrod di dalam sel A

Anode/*anod:*

.....

Cathode/*katod:*

.....

[2 marks]

- (f) Explain the redox reaction in cell C in terms of electron transfer.
Terangkan tindak balas redoks dalam sel C dari segi pemindahan elektron.

.....

.....

[3 marks]

- 2 A group of students conduct an experiment to investigate the transfer of electrons at a distance in a redox reaction between iron (II) sulphate solution and acidified potassium dichromate (VI) solution. The ionic equation below represents the reaction occur.

Sekumpulan pelajar telah menjalankan satu eksperimen untuk mengkaji pemindahan elektron pada satu jarak dalam tindak balas redoks antara larutan ferum(II) sulfat dengan larutan kalium dikromat(VI) berasid. Persamaan ion di bawah mewakili tindak balas yang berlaku.



Based on the ionic equation:

Berdasarkan persamaan ion:

- (a) (i) State the colour change of iron (II) sulphate solution.
Nyatakan perubahan warna bagi larutan ferum(II) sulfat.

.....

[1 mark]

- (ii) State the process occurred in (a)(i).
Nyatakan proses yang berlaku di (a)(i).

.....

[1 mark]

- (b) (i) Calculate the oxidation number of chromium in dichromate (VI) ions.
Hitungkan nombor pengoksidaan kromium dalam ion dikromat(VI).

[2 marks]

- (c) (i) State the reducing agent in the reaction.
Nyatakan agen penurunan dalam tindak balas ini.

.....

[1 mark]

- (ii) Explain your answer based on transferring of electrons.
Terangkan jawapan anda dengan merujuk kepada pemindahan elektron.

.....

.....

.....

[2 marks]

- (d) (i) Table 2 shows a list of apparatus and materials.
Jadual 2 menunjukkan senarai radas dan bahan.

Apparatus and materials <i>Radas dan bahan</i>	
- U-tube <i>Tiub-U</i> - Galvanometer <i>Galvanometer</i> - Connecting wire <i>Wayar penyambung</i> - Carbon electrodes <i>Elektrod karbon</i>	- Iron (II) sulphate solution <i>Larutan ferum(II) sulfat</i> - Acidified potassium dichromate (VI) solution <i>Larutan kalium dikromat (VI) berasid.</i> - Dilute sulphuric acid <i>Asid sulfurik cair</i>

Table 2 / *Rajah 2*

Draw a labelled diagram to show the apparatus set-up to investigate the transfer of electrons at a distance. The diagram must include the apparatus and materials given in Table 2.

Lukis satu rajah berlabel untuk menunjukkan susunan radas bagi mengkaji pemindahan elektron pada suatu jarak. Rajah itu hendaklah menggunakan radas dan bahan yang diberi dalam Jadual 2.

[2 marks]

- (ii) The students replaced dilute sulphuric acid with sodium carbonate solution. Galvanometer needle does not show deflection. Explain why
Pelajar tersebut menggantikan asid sulfurik cair dengan larutan natrium karbonat.
Jarum galvanometer tidak menunjukkan pesongan? Terangkan mengapa.

.....

[2 marks]

3. Diagram 3.1 shows a reaction between sodium and chlorine gas.
Rajah 3.1 menunjukkan tindak balas antara natrium dan gas klorin.

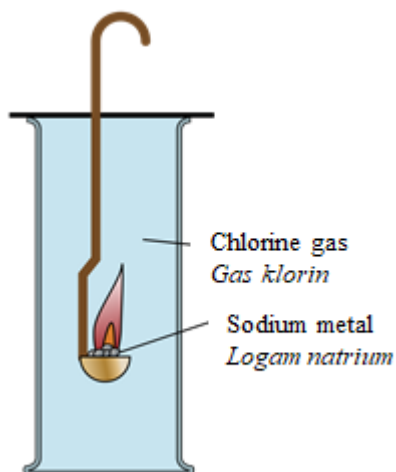


Diagram 3.1
Rajah 3.1

- (a) (i) Write a chemical equation for the reaction.
Tuliskan persamaan kimia bagi tindak balas ini.

.....

[1 mark]

- (ii) State the change in oxidation number for chlorine.
Nyatakan perubahan nombor pengoksidaan bagi klorin.

.....

[1 mark]

- (iii) Explain why sodium acts as the oxidising agent in terms of electron transfer.
Terangkan mengapa natrium bertindak sebagai agen penurunan dari segi pemindahan elektron.

.....

[1 mark]

- (b) (i) Diagram 3.2 shows the addition of bromine water into a test tube containing potassium iodide solution until in excess.
Rajah 3.2 menunjukkan penambahan air bromin ke dalam tabung uji yang mengandungi larutan kalium iodida sehingga berlebihan.

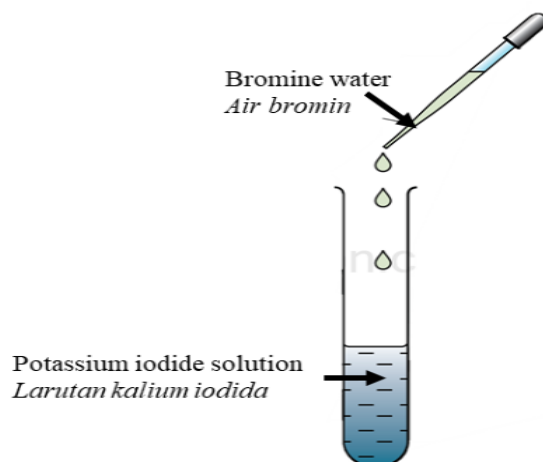


Diagram 3.2

Rajah 3.2

State the observation for the changes of the colour of the solution when bromine water is added into a test tube containing potassium iodide solution until in excess

Nyatakan perubahan kepada warna larutan apabila air bromin ditambahkan ke dalam tabung uji yang mengandungi larutan kalium iodida sehingga berlebihan.

.....
[1 mark]

- (ii) Write an ionic equations for the reaction in b(i)
Tuliskan persamaan ion bagi tindak balas di b(i)

.....
[1 mark]

- (iii) What is the role of bromine water in this reaction?
Apakah peranan air bromin dalam tindak balas ini?

.....
[1 mark]

- (iii) State the substance that can replace potassium iodide in this experiment.
Nyatakan bahan yang boleh menggantikan kalium iodida dalam eksperimen ini

.....
[1 mark]

c) Table 3 shows the result of the experiment.

Jadual 3 menunjukkan keputusan eksperimen.

Experiment <i>Eksperimen</i>	Result <i>Keputusan</i>
Hydrogen + oxide of metal J <i>Hydrogen + oksida logam J</i>	Metal oxide powder glows brightly. Black powder turned brown. <i>Serbuk oksida logam berbara degan terang. Serbuk hitam menjadi perang.</i>
Hydrogen + oxide of metal T <i>Hydrogen + oksida logam T</i>	Powder turns yellow when hot and white when cold. <i>Serbuk bertukar kuning apabila panas dan putih apabila sejuk.</i>
Hydrogen + magnesium oxide <i>Hydrogen + magnesium oksida</i>	No reaction. <i>Tiada tindak balas.</i>

Table 3

Jadual 3

(i) Suggest a name for metal T.

Cadangkan nama bagi logam T.

.....
[1 mark]

(ii) Arrange the reactivity of J, T, magnesium and hydrogen in an ascending order.

Susun kereaktifan J, T, magnesium dan hidrogen dalam susunan menaik.

.....
[1 mark]

(iii) Based on the observations, explain how you obtained the arrangement in(c) (ii).

Berdasarkan pemerhatian di atas, terangkan bagaimana anda dapat susunan seperti dalam (c) (ii).

.....
.....
.....
[3 marks]

- 4 Diagram 4.1 shows the extraction iron from hematite in a blast furnace. Hematite is heated with limestone and substance X.

Rajah 4.1 menunjukkan pengekstrakan besi daripada hematit dalam sebuah relau bagas. Hematit dipanaskan dengan batu kapur dan bahan X

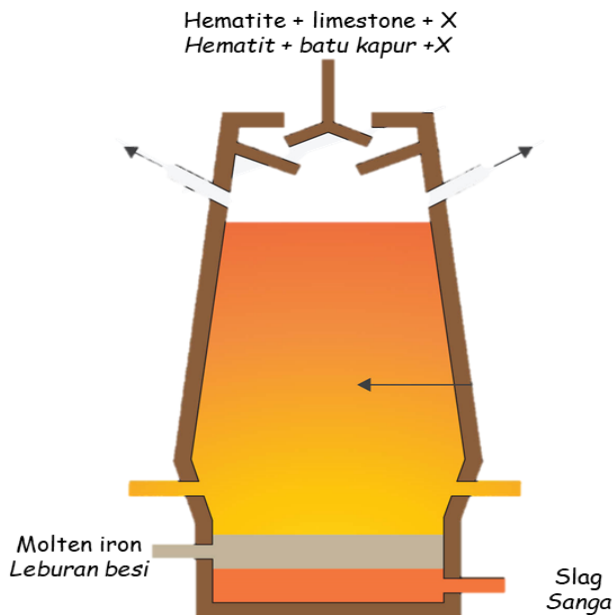


Diagram 4.1

Rajah 4.1

- (a) (i) The main component of hematite is iron oxide, Fe_2O_3 .
What is the oxidation number of iron in Fe_2O_3 ?
*Komponen utama hematit ialah besi oksida, Fe_2O_3 . Apakah nombor pengoksidaan besi dalam Fe_2O_3 ?
Tuliskan persamaan kimia bagi tindak balas ini.*
-
- [1 mark]
- (ii) Name substance X.
Namakan bahan X.
-
- [1 mark]
- (iii) What is the function of substance X?
Apakah fungsi bahan X?
-
- [1 mark]
- (iv) Write the chemical equation for the reaction.
Tuliskan persamaan kimia bagi tindak balas ini.
-

[2 marks]

- (b) (i) Diagram 4.2 shows the changes when chlorine water is added into a test tube that contains sodium bromide solution and 1, 1, 1-trichloroethane.
Rajah 4.2 menunjukkan perubahan yang berlaku apabila air klorin ditambah ke dalam tabung uji yang mengandungi larutan natrium bromida dan 1, 1, 1-trikloroetana.

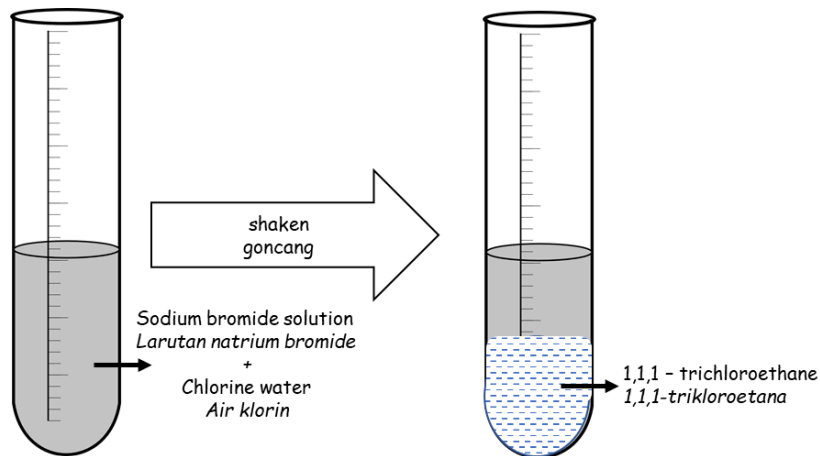


Diagram 4.2

Rajah 4.2

- (i) What is the colour of the 1, 1, 1-trichloroethane layer?
Apakah warna lapisan 1, 1, 1-trokloroetana?

.....

[1 mark]

- (ii) Name the substance that gives the colour in (b) (i).
Namakan bahan yang menyebabkan warna di (b) (i).

.....

[1 mark]

- (iii) State the change in oxidation number of chlorines
Nyatakan perubahan nombor pengoksidaan klorin.

.....

[1 mark]

- (iv) Name the process undergone by chlorine.
Namakan proses yang dilalui oleh klorin.

.....

[1 mark]

- (v) Suggest one reagent that can replace chlorine water.
Cadangkan satu bahan uji yang boleh menggantikan air klorin.

.....

[1 mark]

- 5 Diagram 5 shows the set-up of apparatus to study electron transfer at a distance.
Rajah 5 menunjukkan susunan radas untuk mengkaji pemindahan elektron pada satu jarak.

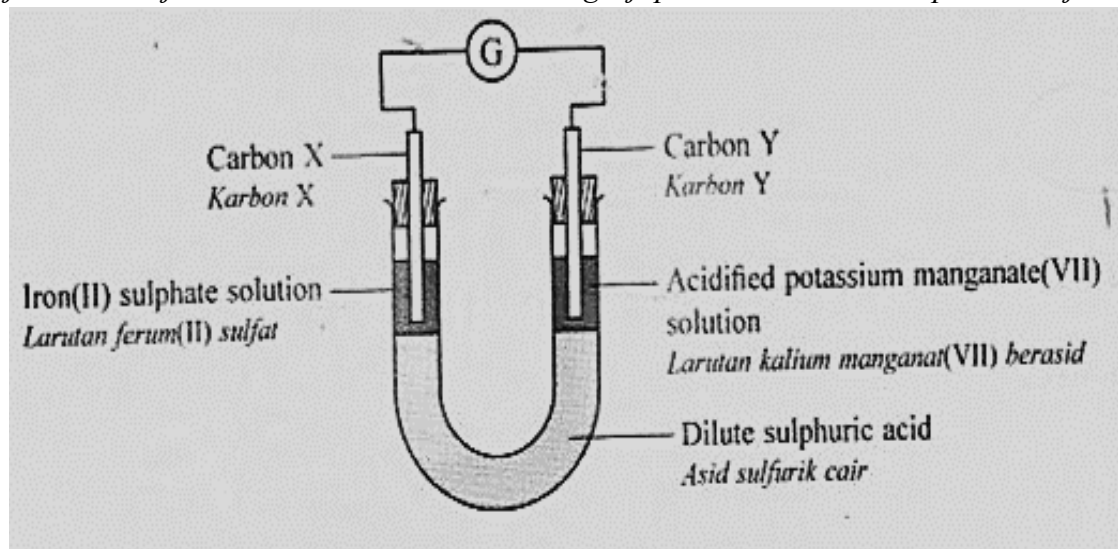


Diagram 5

Rajah 5

- (a) (i) What is the function of dilute sulphuric acid?
Apakah fungsi asid sulfurik cair?
-
- [1 mark]
- (b) (i) State the observation at carbon electrode X.
Nyatakan pemerhatian di elektrod X.
-
- [1 mark]
- (ii) Write the half-equation for the reaction in (b)(i).
Tuliskan persamaan setengah bagi tindak balas di (b) (i).
-
- [1 mark]
- (iii) Describe a confirmatory test for the product formed at carbon electrode X.
Terangkan satu ujian pengesahan bagi hasil yang terbentuk di elektrod karbon X.
-
-
-
- [2 marks]

- (c) (i) State the observation at carbon electrode Y.
Nyatakan satu pemerhatian di elektrod karbon Y.

.....

[1 mark]

- (ii) What is the role of acidified potassium manganate (VII) solution?
Apakah peranan larutan kalium manganat(VII) berasid?

.....

[1 mark]

- (iii) Give a reason for your answer in (c)(ii).
Berikan satu alasan bagi jawapan anda di (c) (ii).

.....

[1 mark]

- (d) Suggest another reagent that can replace acidified potassium manganate (VII) solution.
Cadangkan satu lagi reagen yang dapat menggantikan larutan kalium manganat(VII) berasid

.....

[1 mark]

Section B
Bahagian B

1. (a) The following are the formulae of two compounds.
Berikut adalah formula bagi dua sebatian.



Based on the formulae,
Berdasarkan kepada formula itu,

- (i) State the oxidation numbers for zinc and iron.
Nyatakan nombor pengoksidaan bagi zink dan ferum.

[2 marks]

- (ii) State the name of the compounds.
Nyatakan nama sebatian-sebatian itu.

[2 marks]

- (b) Table 1.1 shows two types of reactions.
Jadual 1.1 menunjukkan 2 jenis tindak balas.

Reaction I <i>Tindak balas I</i>	Reaction II <i>Tindak balas II</i>
Neutralisation <i>Peneutralan</i>	Displacement of metal <i>Penyesaran logam</i>

Table 1.1
Jadual 1.1

Identify which one is a redox reaction and which is not. By using a suitable example, explain your answer in terms of change in oxidation number.

Tentukan yang manakah tindak balas redoks dan yang bukan redoks. Dengan menggunakan contoh yang sesuai, terangkan jawapan anda dari segi perubahan nombor pengoksidaan.

[6 marks]

- (c) Two sets of an experiment are carried out to study the effect of other metals on the rusting of iron. For Set 1, an iron nail is coiled with metal P whereas in Set II the iron nail is coiled with metal Q. Both the coiled iron nails are dipped into hot jelly solution containing potassium hexacyanoferrate (III) solution and phenolphthalein. The results of the experiment are shown in Table 2.

Dua set eksperimen dijalankan untuk mengkaji kesan logam lain terhadap pengurangan besi. Bagi Set I, sebatang paku besi dililit dengan logam P, manakala dalam Set II, sebatang paku besi dililit dengan logam Q. Kedua-dua paku besi yang dililit dengan logam itu dimasukkan ke dalam agar-agar panas yang mengandungi larutan kalium heksasianoferat(III) dan felftalein. Keputusan yang diperolehi ditunjukkan dalam Jadual 2.

Set	Experiment Eksperimen	Observation Pemerhatian
I	Iron nail coiled with metal P <i>Paku besi dililit dengan logam P</i>	Dark blue colour formed <i>Warna biru tua terbentuk</i>
II	Iron nail coiled with metal Q <i>Paku besi dililit dengan logam Q</i>	Pink colour formed <i>Warna merah jambu terbentuk</i>

Table 1.2
Jadual 1.2

Based on the observations,

- (i) Suggest metal P and Q
- (ii) In each set of the experiment,
 - Explain the observations and include the half equation
 - State the metal that is oxidized

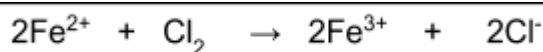
Berdasarkan pemerhatian,

- (i) Cadangkan logam P dan Q
- (ii) *Dalam setiap eksperimen,*
 - Terangkan pemerhatian dan sertakan persamaan setengah
 - Nyatakan logam yang dioksidakan

[10 marks]

2. (a) The following equation represents the redox reaction between iron (II) sulphate solution and chlorine water.

Persamaan kimia berikut mewakili tindak balas redoks antara larutan ferum(II) sulfat dan air klorin.



Based on the above equation, explain the redox reaction in terms of the change in oxidation number.

Berdasarkan persamaan di atas, terangkan tindak balas redoks dari segi perubahan nombor pengoksidaan.

[4 marks]

Diagram 2 shows the apparatus set-up for a metal displacement reaction.

Rajah 2 menunjukkan susunan radas bagi satu tindak balas penyesaran logam.

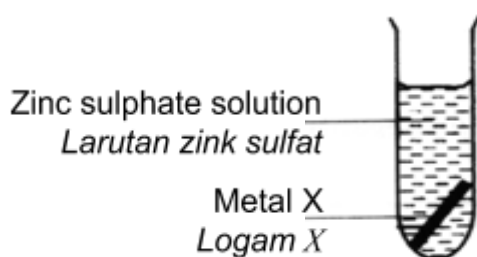


Diagram 2 / Rajah 2

- (i) Suggest a metal of X .

Cadangkan satu logam bagi X.

[1 mark]

- (ii) Based on your answer in 8(b)(i), explain the redox reaction in term of the transfer of electrons. Your answer should include the half-equations and ionic equation involved.

Berdasarkan jawapan anda di 8(b)(i), terangkan tindak balas redoks dari segi pemindahan elektron. Penerangan anda mesti merangkumi setengah persamaan dan persamaan ion yang terlibat.

[5 marks]

- (ii) Calculate the mass of zinc metal displaced when 100 cm³ of 0.2 mol dm⁻³ zinc sulphate is reacted with excess of metal X.

[Relative atomic mass: Zn, 65]

Hitung jisim logam zink yang disesarkan apabila 100 cm³ larutan zink sulfat 0.2 mol dm⁻³ bertindak balas dengan logam X berlebihan.

[Jisim atom relatif : Zn, 65]

[3 marks]

- (c) Daniell cell is an example of a voltaic cell. In this cell, zinc and copper are used as electrodes. Explain the redox reaction involved in Daniell cell. Your answer should consist of the following:
- Labelled diagram
 - Type of reaction at both of the electrodes
 - Observations

Sel Daniell ialah satu contoh sel voltan. Dalam sel ini zink dan kuprum digunakan sebagai elektrod. Terangkan tindak balas redoks yang terlibat dalam sel Daniell. Jawapan anda perlu mengandungi perkara berikut:

- *Gambarajah berlabel*
- *Jenis tindak balas di kedua-dua elektrod*
- *Pemerhatian.*

[7 marks]

Section C
Bahagian C

1. (a) Explain what is meant by the oxidation and reduction processes in terms of loss or gain of oxygen.

Terangkan apakah yang dimaksudkan dengan pengoksidaan dan penurunan dari segi kehilangan dan penerimaan oksigen.

[1 mark]

- (b) (i)

Carbon is placed between aluminium and zinc in the reactivity series of metals.

Karbon terletak di antara aluminium dan zink di dalam siri kereaktifan logam

Plan a laboratory experiment to verify the above statement.

Your answer should include:

Rancang satu eksperimen dalam makmal untuk mengesahkan pernyataan di atas. Jawapan anda perlu mengandungi:

- A list of materials and apparatus
Senarai bahan dan radas
- Procedure of the experiment
Prosedur eksperimen
- A labeled diagram showing the set-up of the apparatus
Gambar rajah berlabel menunjukkan susunan radas
- Observations
Pemerhatian

[9 marks]

(c)

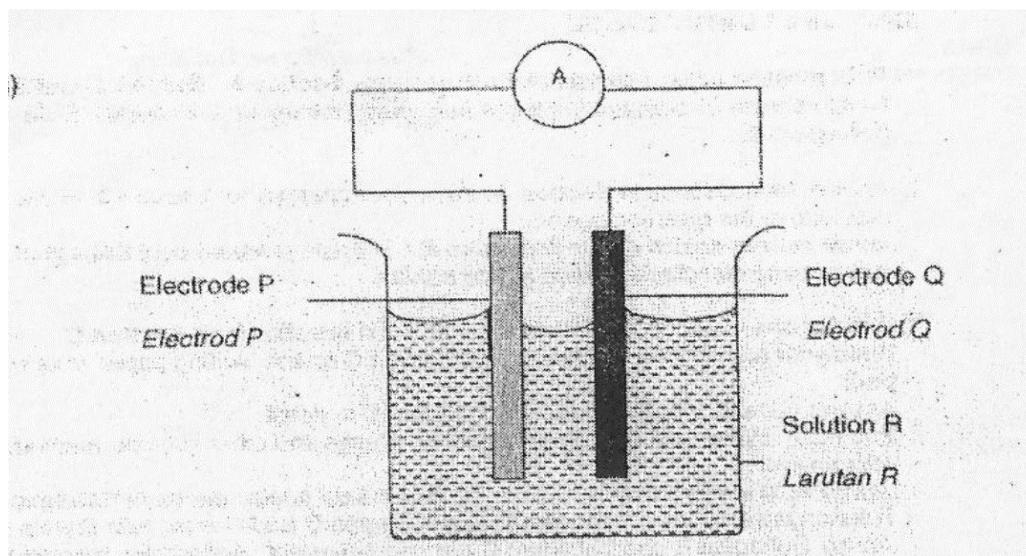


Diagram 1

Rajah 1

Diagram 1 shows an apparatus set-up to investigate the redox reaction in a voltaic cell. P and Q are metals.

Rajah 1 menunjukkan susunan radas untuk mengkaji tindak balas redoks di dalam sebuah sel ringkas. P dan Q adalah logam.

Electrode P <i>Elektrod P</i>	Mass of electrode increases <i>Jisim elektrod bertambah</i>
Electrode Q <i>Elektrod Q</i>	Mass of electrode decreases <i>Jisim elektrod berkurang</i>

Table 1

Jadual 1

Based on Table 1, suggest an example of electrode P, electrode Q and solution R.

Berdasarkan Jadual 1, cadangkan satu contoh elektrod P, elektrod Q dan larutan R

Explain the reactions that occur in the apparatus set-up in Diagram 1.

Terangkan tindak balas yang berlaku dalam susunan radas Rajah 1.

[10 marks]

2. (a) Diagram 2.1 shows the displacement reaction and its observation. Metal M powder is added to silver nitrate solution in a beaker.

Rajah 2.1 menunjukkan tindak balas penyesaran dan pemerhatiannya. Serbuk logam M ditambah ke dalam larutan argentum nitrat di dalam sebuah bikar.

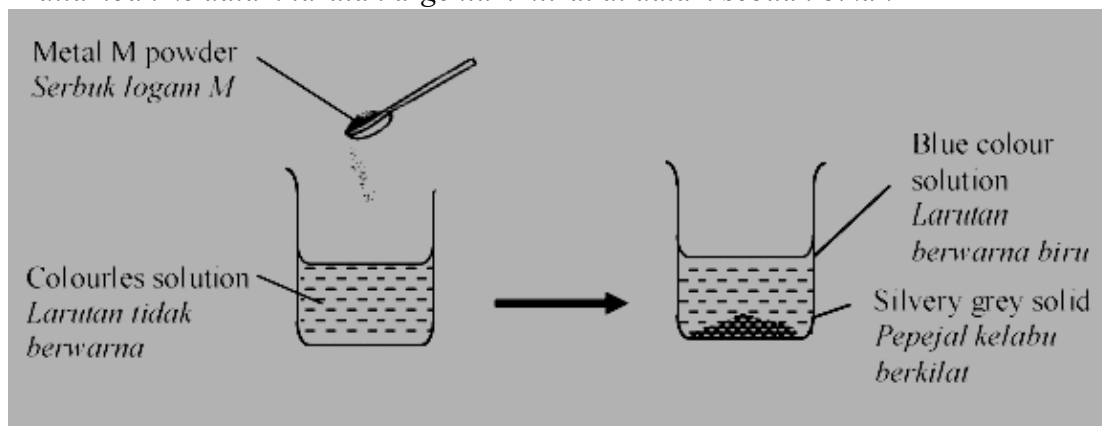


Diagram 2.1

Rajah 2.1

- (a) Based on Diagram 2.1, state the identity of metal M.
Write the half-equations to represent the oxidation and reduction.
State the change in the oxidation number for silver.
*Berdasarkan Rajah 2.1, nyatakan identiti logam M.
Tulis setengah persamaan untuk mewakili pengoksidaan dan penurunan.
Nyatakan perubahan nombor pengoksidaan bagi argentum.*

[4 marks]

- (b) Diagram 2.2 shows an apparatus set-up for an experiment to investigate a redox reaction.
Rajah 2.2 menunjukkan susunan radas bagi suatu eksperimen untuk mengkaji suatu tindak balas redoks.

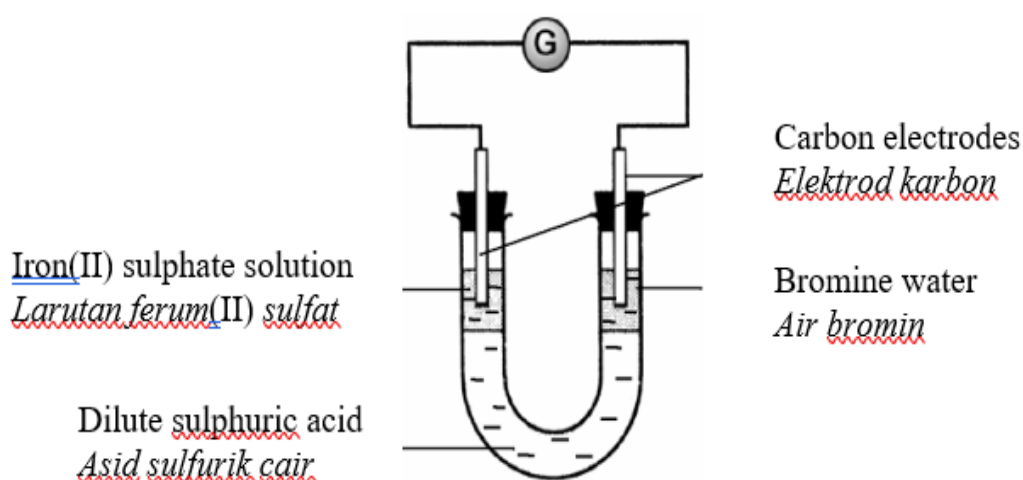


Diagram 2.2 / *Rajah 2.2*

Describe the oxidation and reduction that occurs in Diagram 2.2

Your answer must include:

- Role of each reactant
- The transfer of electron of each reactant
- The colour changes that can be observed after 15 minutes

Huraikan pengoksidaan dan penurunan yang berlaku di Rajah 2.2.

Jawapan anda mesti mengandungi:

- *Peranan setiap bahan tindak balas*
- *Pemindahan onicon yang berlaku ke atas setiap bahan tindak balas*
- *Perubahan warna yang dapat diperhtikan selepas 15 minit*

[6 marks]

- (b) You are required to determine the position of carbon in the Reactivity Series of Metals towards oxygen by using all the chemicals in the box below.

Anda diminta untuk menentukan kedudukan karbon dalam Siri Kereaktifan Logam terhadap oksigen dengan menggunakan semua bahan kimia seperti dalam kotak di bawah.

Carbon powder / <i>Serbuk karbon</i> Magnesium oxide powder / <i>Serbuk magnesium oksida</i> Copper(II) oxide powder / <i>Serbuk kuprum(II) oksida</i>
--

Your answer must include the following:

- The procedure of the experiment
- The observations
- Explanation on how to determine the position of carbon in the reactivity series
- Arrangement of carbon, magnesium and copper in ascending order of reactivity towards oxygen.

Jawapan anda mesti mengandungi :

- *Prosedur eksperimen*
- *Pemerhatian*
- *Penerangan bagaimana menentukan kedudukan carbon dalam siri kereaktifan*
- *Susunan karbon, magnesium dan kuprum dalam tertib menaik kereaktifan terhadap oksigen.*

[10 marks]

KERTAS 3 SOALAN STRUKTUR

1.

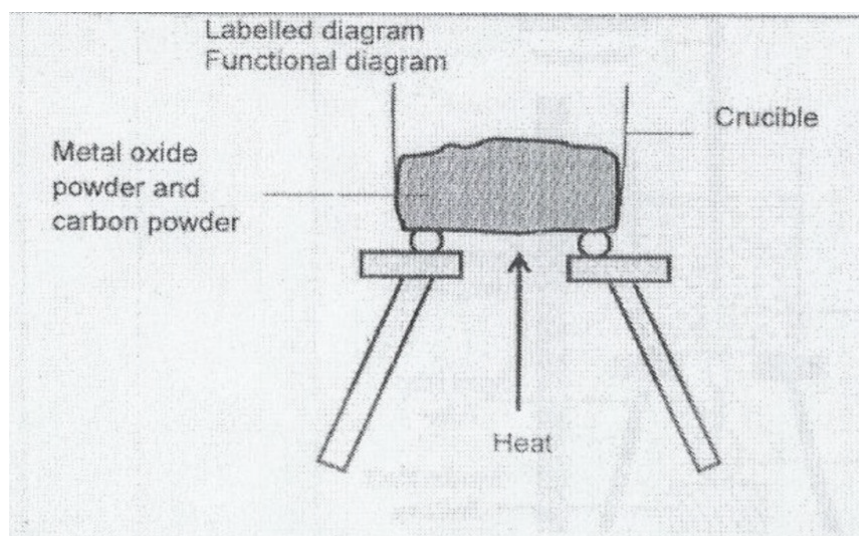


Diagram 1

Rajah 1

Diagram 1 shows the arrangement of apparatus used to determine the sequence of the metals in the reactivity series of metals by using carbon. The mixture of the following substances is heated strongly in a crucible:

Set 1: Lead (II) oxide and carbon

Set 2: Zinc oxide and carbon

Set 3: Copper (II) oxide and carbon

The results of the experiment are recorded in Table 1.

Rajah 1 menunjukkan susunan radas untuk menentukan turutan logam dalam siri kereaktifan logam dengan menggunakan karbon. Campuran bahan yang berikut dipanaskan dengan kuat dalam mangkuk pijar:

Set 1: plumbum(II) oksida dan karbon

Set 2: zink oksida dan karbon

Set 3: kuprum(II) oksida dan karbon

Keputusan eksperimen dicatat dalam Jadual 1.

Set	Observation <i>Pemerhatian</i>
Set 1: lead (II) oxide and carbon <i>Set 1: plumbum (II) oksida dan karbon</i>	Bright embers <i>Baraan terang</i>
Set 2: zinc oxide and carbon <i>Set 2: zink oksida dan karbon</i>	
Set 3: copper (II) oxide and carbon <i>Set 3: kuprum (II) oksida dan karbon</i>	

Table 1.1

Jadual 1.1

- (a) Complete Table 1.1 by stating the relevant observations of the reactions that occur.
Lengkapkan Jadual 1.1 dengan menyatakan pemerhatian yang berkaitan tentang tindak balas yang berlaku.

[3 marks]

- (b) Complete Table 1.2 based on the experiment.
Jadual 1.2 berdasarkan eksperimen.

[6 marks]

(i) Manipulated variable <i>Pemboleh ubah yang dimanipulasi</i> 	The way to manipulate the variable: <i>Cara memanipulasikan pemboleh ubah:</i>
(ii) Responding variable <i>Pembolehubah yang bergerak balas</i> 	What to observe in the responding variable? <i>Apa yang diperhatikan dalam pemboleh ubah:</i>
(iii) Fixed variable <i>Pembolehubah yang dimalarkan</i> 	The way to keep the variable at a constant: <i>Cara menetapkan pembolehubah yang dimalarkan:</i>

Table 1.2
Jadual 1.2

- (c) State the hypothesis of this experiment.
Nyatakan hipotesis eksperimen ini.

[3 marks]

- (d) Based on the observations made in this experiment, arrange the metals in an ascending order of the reactivity.
Berdasarkan pemerhatian anda dalam eksperimen ini, susunkan logam di atas dalam turutan kereaktifan menaik.

--	--	--

Reactivity of the metal increases
Kereaktifan logam semakin menaik

[3 marks]

- (e) The experiment is repeated using aluminum oxide. The result showed no visible change.
Eksperimen diulangi dengan menggunakan aluminum oksida. Tiada perubahan dikesan.

- (i) Predict the position of aluminium in the reactivity series of metals in (d).
Ramalkan kedudukan logam aluminium dalam siri kereaktifan logam di (d).

.....

.....

.....

[3 marks]

- (ii) Draw the arrow (↓) to show the position of aluminum in the reactivity series of metals in your answer in (d).
Lukiskan anak panah (↓) untuk menunjukkan kedudukan aluminium dalam siri kereaktifan logam dalam jawapan anda di (d).

[3 marks]

- 2 Table 2.1 shows the observation in five test tubes used to investigate the effect of other metals on rusting. A mixture of jelly solution, potassium hexacyanoferrate (III), $K_3Fe(CN)_6$ solution and phenolphthalein were used as medium in each test tube. The observations were recorded after one day.

Jadual 2.1 menunjukkan pemerhatian dalam lima buah tabung uji yang digunakan untuk menyiasat kesan logam lain ke atas pengurangan. Medium yang digunakan di dalam setiap tabung uji adalah campuran larutan agar, larutan kalium heksasianoferat(III), $K_3Fe(CN)_6$ dan fenolftalein. Pemerhatian direkod selepas satu hari

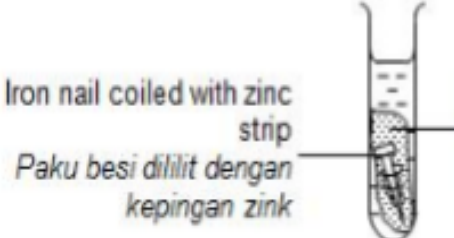
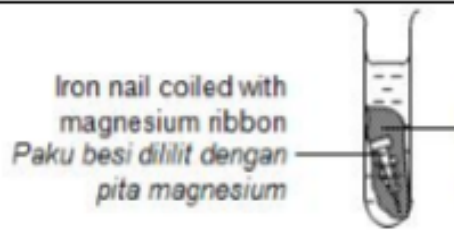
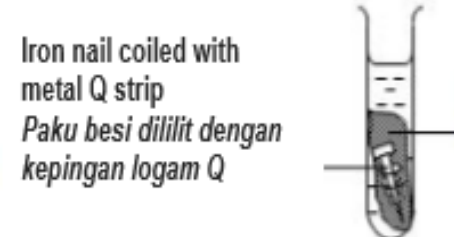
Test tube 1 Tabung uji 1		Very low intensity of blue colour Very low intensity of pink colour Keamatan warna biru sangat rendah Keamatan warna merah jambu sangat rendah
Test tube 2 Tabung uji 2		No blue spot Low intensity of pink colour Tiada tompokan biru Keamatan warna merah jambu sangat rendah
Test tube 3 Tabung uji 3		Low intensity blue of blue colour Low intensity of pink colour Keamatan warna biru rendah Keamatan warna merah jambu rendah
Test tube 4 Tabung uji 4		No blue spot High intensity of pink colour Tiada tompokan biru Keamatan warna merah jambu tinggi
Test tube 5 Tabung uji 5		High intensity blue of blue colour Low intensity of pink colour Keamatan warna biru sangat tinggi Keamatan warna merah jambu rendah

Table 2.1 // Jadual 2.1

- (a) State the observation and inference for test tube 2, 3 and 4.

Nyatakan pemerhatian dan inferens untuk tabung uji 2, 3 dan 4.

Test tube <i>Tabung uji</i>	Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>
2		
3		
4		

[6 marks]

- (b) Based on this experiment, state:

Berdasarkan eksperimen ini, nyatakan:

- (i) The manipulated variable:

Pembolehubah dimanipulasi:

.....

- (ii) The responding variable:

Pembolehubah bergerakbalas:

.....

- (iii) The fixed variable:

Pembolehubah dimalarkan:

.....

[3 marks]

- (c) State the operational definition for the potential difference.

Nyatakan definisi secara operasi bagi beza upaya.

.....

[3 marks]

- (d) Based on the observation of test tube 5 in Table 2.1, predict metal Q.
Berdasarkan pemerhatian bagi tabung uji 5 dalam Jadual 2.1, ramalkan logam Q

.....

.....

.....

.....

[3 marks]

KERTAS 3: MERANCANG EKPERIMEN

1. Teacher: Here I have 3 types of metal. Magnesium, zinc and Iron,
Can you help me to compare the reactivity of this metals?
Di sini saya mempunyai 3 jenis logam. Magnesium, zink and ferum.
Bolehkah kamu membantu saya membandingkan kereaktifan logam ini?

Students: We can try to test them by burning in oxygen.
Kita boleh cuba uji dengan membakarnya dalam oksigen.

Using suitable substance and apparatus, plan **one** laboratory experiment to investigate the reactivity of metal with oxygen.

*Dengan menggunakan bahan dan radas yang sesuai, rancangkan **satu** eksperimen makmal untuk mengkaji kereaktifan logam dengan oksigen.*

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks]

2. Diagram 2 shows a galvanized zinc roof which is made of iron coated with a zinc layer and food cans made from iron coated with a tin layer. Both the roof and the food cans do not rust easily.

Rajah 2 menunjukkan atap zink galvani diperbuat daripada besi yang disadurkan dengan lapisan zink dan tin makanan yang disadurkan dengan lapisan timah. Kedua-dua atap zink galvani dan tin makanan tidak mudah berkarat



Food cans
Tin makanan



Galvanised zinc roof
Atap zink galvani

Referring to the above example, plan a laboratory experiment to investigate the effect of other metals on the rusting of iron. You are given iron nails, magnesium ribbon, zinc strip, copper strip and tin strip.

Merujuk kepada contoh di atas, rancang satu eksperimen untuk mengkaji kesan logam lain terhadap pengurangan besi. Anda dibekalkan dengan paku besi, kerajang zink, kerajang kuprum dan kerajang timah.

Your planning should include the following:

Perancangan anda haruslah mengandungi perkara-perkara berikut:

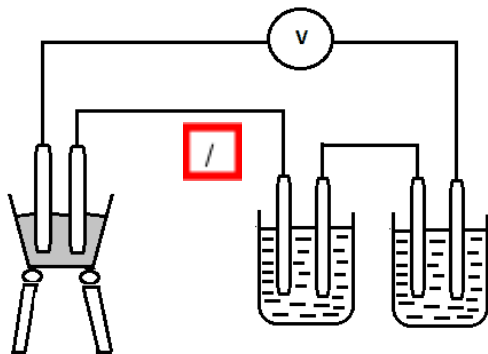
- (a) Statement of the problem
Pernyataan masalah
- (b) All the variables
Semua pembolehubah
- (c) Statement of the hypothesis
Pernyataan hipotesis
- (d) List of substances and apparatus
Senarai bahan dan radas
- (e) Procedure of the experiment
Prosedur eskperien
- (f) Tabulation of data
Penjadualan data

[17 marks]

SKEMA KERTAS 2:

OXIDATION AND REDUCTION/ PENGOKSIDAAN DAN PENURUNAN

Section A
Bahagian A

Questions Soalan			Rubrics Rubrik	Marks Markah
1	a		Chemical reaction that involves oxidation and reduction occurring at the same time <i>Tindak balas kimia yang melibatkan proses pengoksidaan dan proses penurunan yang berlaku secara serentak.</i>	1
	b		Pb^{2+} and Br^- <i>Pb^{2+} dan Br^-</i>	1
	c			1
	d	i	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	1
		ii	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$	1
	e		Anode: brown gas form <i>Anod : gas perang terhasil</i> Cathode: grey solid forms <i>Katod : pepejal kelabu terhasil</i>	1 1
	f		Cu^{2+} ion gain electrons in cathode Reduction reaction occur OH^- ion releases electrons at anode Oxidation reaction occur <i>Ion Cu^{2+} menerima elektron di katod</i> <i>Proses penurunan berlaku</i> <i>Ion OH^- melepaskan elektron di anod</i> <i>Proses pengoksidaan berlaku</i>	1 1 1 1
TOTAL MARKS				10

Questions Soalan			Rubrics Rubrik	Marks Markah
2	a	i	Green to brown <i>Hijau kepada perang</i>	1
		ii	Oxidation <i>Pengoksidaan</i>	1
	b		P1 : $2(x) + 7(-2) = -2$ P2 : +6	1 1
	c	(i)	Iron(II) sulphate // FeSO_4 // Fe^{2+} ion <i>Ferum(II) sulfat // FeSO_4 // ion Fe^{2+}</i>	1
	c	(ii)	P1 : iron(II) ion loses/releases electron to form iron(III) ion <i>Ion ferum(II) kehilangan/ membebaskan elektron membentuk ion ferum(III)</i>	1
			P2 : Iron(II) ion is oxidized <i>Ion ferum(II) dioksidakan</i>	1
	d	(i)	1. Functional diagram <i>Gambarajah berfungsi</i>	1
			2. Correct label <i>Label dengan betul</i>	1
			galvanometer Carbon electrodes Iron(II) sulphate solution Acidified potassium dichromate(VI) solution Dilute sulphuric acid	
		(ii)	P1 : Insoluble salt/ Iron(II) carbonate is formed <i>Garam tak terlarutkan/ Ferum(II) karbonat terbentuk</i>	1
			P2 : ions cannot move between the two solutions // incomplete circuit <i>ion tidak dapat melalui antara dua larutan // litar tidak lengkap</i>	1
TOTAL MARKS				11

Questions <i>Soalan</i>			Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
3	a	(i)	$2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$	1
		(ii)	$0 \rightarrow -1$	1
		(iii)	Sodium atom donates an electron to the chlorine atom and reduces it to the chloride ion <i>Atom natrium menderma satu elektron pada atom klorin dan menurunkannya kepada ion klorida</i>	1
	b	(i)	Purple/ <i>Ungu</i>	1
		(ii)	$\text{Br}_2 + 2\text{I}^- \rightarrow 2\text{Br}^- + \text{I}_2$	1
		(iii)	As an oxidizing agent <i>Sebagai agen pengoksidaan</i>	1
	c	(i)	Zinc/ <i>zink</i>	1
		(ii)	J, Hydrogen, T, Magnesium <i>J, Hidrogen, T, Magnesium</i>	1
		(iii)	Hydrogen reacted with oxide of J. So it is more reactive than J. However, it did not react with oxide of T which is zinc oxide. So hydrogen is less reactive than zinc. Magnesium is the most reactive in this experiment. <i>Hidrogen bertindak balas dengan oksida logam J. Jadi, ia lebih reaktif daripada J. Walau bagaimanapun, tiada tindak balas dengan oksida logam T, iaitu zink oksida. Jadi, hidrogen adalah kurang reaktif daripada zink. Magnesium adalah yang paling reaktif dalam eksperimen ini.</i>	3
TOTAL MARKS				11

Questions <i>Soalan</i>			Rubrics <i>Rubrik</i>	Marks <i>Markah</i>
4	a	(i)	+3	1
		(ii)	Carbon/ <i>Karbon</i>	1
		(iii)	Reducing agent/ <i>Agen penurunan</i>	1
		(iv)	$2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$ // $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ 1 – correct formula for reactants and products 1 – balanced chemical equation	2
	b	(i)	Brown colour/ <i>Warna perang</i>	1
		(ii)	Bromine/ <i>Bromin</i>	1
		(iii)	0 to -1	1

	(iv)	Reduction/ <i>Penurunan</i>	1
	(v)	Acidified potassium manganate(VII) solution/Acidified potassium dichromate(VI) solution <i>Kalium manganat(VII) berasid/kalium dikromat(VI) berasid</i>	1
TOTAL MARKS			10

Questions Soalan		Rubrics Rubrik	Marks Markah
5	a	Acts as a salt bridge to complete the circuit and separate the oxidizing and reducing agents. <i>Bertindak sebagai jambatan garam untuk melengkapkan litar dan mengasingkan agen pengoksidaan dan penurunan.</i>	1
	b	(i) Colourless solution turns yellow <i>Larutan tidak berwarna menjadi kuning</i>	1
		(ii) $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$	2
		(iii) A little solution is taken from around carbon electrode X and tested with a few drops of starch solution. A dark blue colouration is obtained. <i>Sedikit larutan diambil daripada bahagian elektrod karbon X dan diuji dengan beberapa titis larutan kanji. Warna biru hitam akan diperolehi.</i>	2
	c	(i) The purple is decolourised <i>Warna ungu dinyahwarnakan</i>	1
		(ii) As an oxidizing agent <i>Sebagai agen pengoksidaan</i>	1
		(iii) It oxidises iodide to iodine <i>Ia mengoksidakan iodide kepada iodin</i>	1
	d	Acidified potassium dichromate(VI) solution <i>Larutan kalium dikromat(VI) berasid</i>	1
TOTAL MARKS			10

Section B
Bahagian B

Questions Soalan			Rubrics Rubrik	Marks Markah
1	a	(i)	Zinc : +2, Iron : +3	2
		(ii)	Zinc chloride and Iron(III) oxide <i>Zink klorida dan Ferum(III) oksida</i>	2
	b		Reaction I – not a redox reaction Show suitable chemical equation for neutralization Show oxidation number of elements Show there's no change in oxidation number of elements <i>Tindak balas I – bukan tindak balas redoks</i> <i>Persamaan kimia yang sesuai bagi peneutralan</i> <i>Tunjuk nombor pengoksidaan bagi setiap unsur</i> <i>Tunjuk tiada perubahan nombor pengoksidaan bagi setiap unsur</i> Reaction II – redox reaction Show suitable chemical equation for displacement of metals Show oxidation numbers of elements Show change in oxidation numbers of elements <i>Tindak balas II – tindak balas redoks</i> <i>Tunjuk persamaan kimia yang sesuai bagi penyesaran logam</i> <i>Tunjuk nombor pengoksidaan setiap unsur</i> <i>Tunjuk terdapat perubahan nombor pengoksidaan bagi setiap unsur</i>	1 1 1 1 1 1 1
	c	(i)	P: Cu//Sn//Pb Q: Mg//Zn//Al	1 1
		(ii)	Set 1 Fe ²⁺ ions are produced Iron is more electropositive than P//Iron loses electrons to form Fe ²⁺ $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$ Iron is oxidized Set 2 OH ⁻ ions are produced Iron is less electropositive than Q//Q loses electrons to form Q ions $\text{Q} \rightarrow \text{Q}^{2+} + 2\text{e}^-$ Q is oxidized Set 1 <i>Ion Fe²⁺ terbentuk</i> <i>Ferum lebih elektropositif berbanding P//Ferum kehilangan electron untuk membentuk ion Fe²⁺</i> $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$ <i>Ferum dioksidakan</i>	1 1 1 1 1 1 1 1

			<u>Set 2</u> <i>Ion OH- hadir</i> <i>Ferum kurang elektropositif berbanding Q. Jadi Q kehilangan electron untuk membentuk ion Q</i> $Q \rightarrow Q^{2+} + 2e$ <i>Q dioksidakan</i>	
TOTAL MARKS				20

No. of Question <i>Nombor soalan</i>	Rubrics / rubrik	Marks <i>markah</i>	Total Mark <i>Jumlah markah</i>
2.	(a) Iron (II) ion / Fe^{2+} is oxidised / undergoes oxidation The oxidation number of iron increases from +2 to +3 Chlorine water / Cl_2 is reduced / undergoes reduction The oxidation number of chlorine decreases from 0 to -1 <i>Ion besi (II) / Fe^{2+} dioksidakan / mengalami pengoksidaan</i> <i>Bilangan pengoksidaan zat besi meningkat dari +2 hingga +3</i> <i>Air klorin / Cl_2 dikurangkan / mengalami pengurangan</i> <i>Bilangan pengoksidaan klorin menurun dari 0 hingga -1</i>	1 1 1 1	4
	(b) Magnesium / <i>other suitable metal</i> <i>Magnesium / logam lain yang sesuai</i>	1	1
	(i) Magnesium / Mg is oxidised because donates electrons Half-equation: $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}$ Zinc ions / Zn^{2+} is reduced because accepts electrons Half-equation: $\text{Zn}^{2+} + 2\text{e} \rightarrow \text{Zn}$ Ionic equation: $\text{Mg} + \text{Zn}^{2+} \rightarrow \text{Mg}^{2+} + \text{Zn}$ <i>Magnesium / Mg dioksidakan kerana menyumbangkan elektron</i> <i>Separuh persamaan: $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}$</i> <i>Ion zink / Zn^{2+} dikurangkan kerana menerima elektron</i> <i>Separuh persamaan: $\text{Zn}^{2+} + 2\text{e} \rightarrow \text{Zn}$</i> <i>Persamaan ion: $\text{Mg} + \text{Zn}^{2+} \rightarrow \text{Mg}^{2+} + \text{Zn}$</i>	1 1 1 1 1	5
	(iii) Number of mol of $\text{Zn}^{2+} = \frac{0.2 \times 100}{1000}$ $= 0.02 \text{ mol}$ Number of mol of Zn displaced $= 0.02 \text{ mol}$ Mass of zinc displaced $= 0.02 \times 65$ $= 1.3\text{g}$ <i>Bilangan mol $\text{Zn}^{2+} = \frac{0.2 \times 100}{1000}$</i> $= 0.02 \text{ mol}$ <i>Bilangan mol Zn dipindahkan $= 0.02 \text{ mol}$</i> <i>Jisim zink yang dipindahkan $= 0.02 \times 65$</i> $= 1.3\text{g}$	1 1 1	3

(c)	Functional diagram Labelled Zinc more electropositive than copper Electrode zinc : zinc atom oxidised to zinc ion Electrode copper: copper(II) ion reduced to copper atom Observation: Electrode zinc become thinner Electrode copper become thicker <i>Gambar rajah berfungsi</i> <i>Berlabel</i> <i>Zink lebih elektropositif daripada tembaga</i> <i>Elektrod zink: atom zink teroksidasi menjadi ion zink</i> <i>Tembaga elektrod: ion tembaga (II) diturunkan menjadi atom kuprum</i> <i>Pemerhatian:</i> <i>Zink elektrod menjadi lebih nipis</i> <i>Tembaga elektrod menjadi lebih tebal</i>	1 1 1 1 1 1 1 1	7 20
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Section C
Bahagian C

No. of Question <i>Nombor soalan</i>	Rubrics / rubrik	Marks <i>markah</i>
1	(a) Oxidation is the process of gaining oxygen. Reduction is the process of losing oxygen. <i>Pengoksidaan adalah proses penambahan oksigen. Penurunan adalah proses kehilangan oksigen.</i>	1
	b Materials Charcoal powder (carbon), zinc oxide powder, aluminium oxide powder	1
	Apparatus Crucible, pipe clay triangle, tripod stand, Bunsen burner	1
	Bahan <i>Serbuk arang (karbon), serbuk zink oksida, serbuk aluminium oksida</i> Radas <i>Mangkuk pijar, segitiga tanah liat, tungku kaki tiga, penunu Bunsen</i>	
	Diagram : Correct diagram + lable Functional Procedure - Put half a spatula of carbon powder and half a spatula of zinc oxide powder into a crucible. Mix the two powders. - Heat the mixture strongly. - Record the observations. - Repeat the above steps using aluminum oxide powder.	1 1 1 1

	Prosedur 1. Letakkan setengah spatula serbuk karbon dan setengah spatula serbuk zink oksida ke dalam sebiji mangkuk pijar. Campurkan serbuk tersebut. 2. Panaskan dengan kuat campuran itu. 3. Catatkan pemerhatian. 4. Ulang langkah-langkah di atas dengan menggunakan serbuk aluminium oksida. Observation/Pemerhatian <table><tr><th>Mixture Campuran</th><th>Observation Pemerhatian</th></tr><tr><td>Carbon and zinc oxide Karbon dan zink oksida</td><td>Bright glow Membara dengan terang</td></tr><tr><td>Carbon and aluminium oxide Karbon dan aluminium oksida</td><td>No change Tiada perubahan</td></tr></table>	Mixture Campuran	Observation Pemerhatian	Carbon and zinc oxide Karbon dan zink oksida	Bright glow Membara dengan terang	Carbon and aluminium oxide Karbon dan aluminium oksida	No change Tiada perubahan	1 1								
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c	Metal electrode P: Copper Metal electrode Q: Zinc Solution R: Copper (II) sulphate Elektrod logam P: Kuprum Elektrod logam Q: Zink Larutan R: Kuprum(II) sulfat Explanation <table><tr><td>1</td><td>Zinc: negative terminal Copper: positive terminal Zink: terminal negatif Kuprum: terminal positif</td></tr><tr><td>2</td><td>Zinc releases electrons and is oxidized to zinc ion. Copper (II) ions accepts the electrons and is reduced to copper// Zink membebaskan electron dan dioksidakan kepada ion zink. Ion Kuprum(II) menerima electron dan diturunkan kepada kuprum// $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}$ $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$</td></tr><tr><td>3</td><td>Zinc undergoes oxidation Copper(II) ions undergoes reduction Zink dioksidakan Ion kuprum(II) diturunkan.</td></tr><tr><td>4</td><td>Zinc is more electropositive than copper. Zink adalah lebih elektropositif berbanding dengan kuprum</td></tr><tr><td>5</td><td>Electrons transfer from the zinc electrode to the copper electrode Elektron dipindahkan dari elektrod zink ke elektrod kuprum.</td></tr><tr><td>6</td><td>Needle of voltmeter deflects Jarum voltmeter terpesong.</td></tr><tr><td>7</td><td>Copper(II) ions acts as the oxidizing agent Zinc acts as the reducing agent. Ion kuprum(II) bertindak sebagai agen pengoksidaan Zink bertindak sebagai agen penurunan.</td></tr></table>	1	Zinc: negative terminal Copper: positive terminal Zink: terminal negatif Kuprum: terminal positif	2	Zinc releases electrons and is oxidized to zinc ion. Copper (II) ions accepts the electrons and is reduced to copper// Zink membebaskan electron dan dioksidakan kepada ion zink. Ion Kuprum(II) menerima electron dan diturunkan kepada kuprum// $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}$ $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$	3	Zinc undergoes oxidation Copper(II) ions undergoes reduction Zink dioksidakan Ion kuprum(II) diturunkan.	4	Zinc is more electropositive than copper. Zink adalah lebih elektropositif berbanding dengan kuprum	5	Electrons transfer from the zinc electrode to the copper electrode Elektron dipindahkan dari elektrod zink ke elektrod kuprum.	6	Needle of voltmeter deflects Jarum voltmeter terpesong.	7	Copper(II) ions acts as the oxidizing agent Zinc acts as the reducing agent. Ion kuprum(II) bertindak sebagai agen pengoksidaan Zink bertindak sebagai agen penurunan.	1 1 1 1 1 1 1 1 1 1
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TOTAL MARKS		20														

No. of Q		Explanation	Marks	Total Mark											
2.	(a) (i)	Metal M : copper Half-equation for oxidation : $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$ Half -equation for reduction : $\text{Ag}^{+} + \text{e} \rightarrow \text{Ag}$ Oxidation number charge : +1 to 0 <i>Logam M: Kuprum</i> <i>Separuh persamaan untuk pengoksidaan: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}$</i> <i>Setengah-persamaan untuk penurunan: $\text{Ag}^{+} + \text{e} \rightarrow \text{Ag}$</i> <i>Caj nombor pengoksidaan: +1 hingga 0</i>	1 1 1 1	4											
	(b)	<table><tr><th>Reactant</th><th>Iron(II) sulphate</th><th>Bromine water</th></tr><tr><td>Role <i>Peranan</i></td><td>Reducing agent <i>Agen menurunkan</i></td><td>Oxidising agent <i>Agen pengoksidaan</i></td></tr><tr><td>Transfer of electron <i>Pemindahan elektron</i></td><td>Donates electron//Iron(II) ion donates electron to produce iron(III) ion <i>Derma elektron // Besi (II) ion menyumbangkan elektron untuk menghasilkan ion besi (III)</i></td><td>Accept electron//bromine accepts electron to produce bromide ion <i>Terima elektron // bromin menerima elektron untuk menghasilkan ion bromida</i></td></tr><tr><td>Colour change <i>Perubahan warna</i></td><td>Green/pale green to brown/yellowish brown <i>Hijau / hijau pucat kepada perang / kekuningan</i></td><td>Brown to colourless <i>Perang kepada tidak berwarna</i></td></tr></table>	Reactant	Iron(II) sulphate	Bromine water	Role <i>Peranan</i>	Reducing agent <i>Agen menurunkan</i>	Oxidising agent <i>Agen pengoksidaan</i>	Transfer of electron <i>Pemindahan elektron</i>	Donates electron//Iron(II) ion donates electron to produce iron(III) ion <i>Derma elektron // Besi (II) ion menyumbangkan elektron untuk menghasilkan ion besi (III)</i>	Accept electron//bromine accepts electron to produce bromide ion <i>Terima elektron // bromin menerima elektron untuk menghasilkan ion bromida</i>	Colour change <i>Perubahan warna</i>	Green/pale green to brown/yellowish brown <i>Hijau / hijau pucat kepada perang / kekuningan</i>	Brown to colourless <i>Perang kepada tidak berwarna</i>	1 + 1 1 + 1 1 + 1
Reactant	Iron(II) sulphate	Bromine water													
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Colour change <i>Perubahan warna</i>	Green/pale green to brown/yellowish brown <i>Hijau / hijau pucat kepada perang / kekuningan</i>	Brown to colourless <i>Perang kepada tidak berwarna</i>													

SKEMA KERTAS 3:

OXIDATION AND REDUCTION/ PENGOKSIDAAN DAN PENURUNAN
SOALAN STRUKTUR

SOALAN 1

Questions Soalan	Rubrics Rubrik		Marks markah
a	Dim embers; bright embers <i>Baraan tak terang; baraan yang terang</i>		3
b	i	Types of metal oxide/ <i>jenis oksida logam</i> By using different types of metal/ <i>menggunakan logam yang berbeza jenis</i>	6
	ii	Embers/brightness of embers/ <i>Keadaan baraan</i> Observe the formation of embers or brightness of products/ <i>memerhatikan baraan atau kecerahan nyalaan pada hasil tindak balas</i>	
	ii	Quantity of metal oxide/ <i>Kuantiti oksida logam</i>	
	i	Using same amount of metal oxide/ <i>menggunakan kuantiti yang sama oksida logam</i>	
c	The less reactive the metal when compared with carbon, the brighter the embers <i>Kurang reaktif logam tersebut berbanding dengan karbon, lebih terang baraan yang dihasilkan.</i>		3
d	Copper, lead, zinc		3
e	(i)	Aluminium is the most reactive. <i>Aluminium paling reaktif.</i>	3
	(ii)	Copper, lead, zinc , ↓	3
TOTAL MARKS			18

Questions Soalan	Rubrics Rubrik	Marks markah												
3(a)	<i>Able to state any 3 observations and their related inferences correctly.</i> Sample answer:	3												
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Question	Rubric	Score
3(b)	Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly. Sample answer When a less electropositive metal than iron is in contact with iron nail/ferum/Fe, the metal speeds up rusting/corrosion of iron but when a more electropositive metal is in contact with iron/ferum/Fe, the metal inhibits rusting/corrosion of iron // When the metal in contact with iron is lower than iron/ferum/Fe in electrochemical series, the rusting/corrosion of iron is faster but when the metal in contact with iron is higher than iron/ferum/Fe in electrochemical series, the iron does not rust/ rusting/corrosion of iron slower// The further the distance between less electropositive metals and iron/Fe in electrochemical series that in contact with iron, the higher is the intensity/more of blue spots formed but the further the distance between more	3

	electropositive metals and iron/Fe in electrochemical series that in contact with iron, the higher is the intensity/more of pink colour formed. <i>Mampu menyatakan hubungan antara pemboleh ubah dimanipulasi dengan pemboleh ubah bergerak balas dan menyatakan arah dengan betul. Jawapan contoh Apabila logam yang kurang elektropositif daripada besi bersentuhan dengan paku besi / ferum / Fe, logam mempercepat pengamatan / kakisan besi tetapi apabila logam yang lebih elektropositif bersentuhan dengan besi / ferum / Fe, logam menghalang karat / kakisan besi // Apabila logam yang bersentuhan dengan besi lebih rendah daripada besi / ferum / Fe dalam siri assay, karat / kakisan besi adalah lebih cepat tetapi apabila logam yang bersentuhan dengan besi lebih tinggi daripada besi / ferum / Fe dalam siri elektrokimia, besi tidak berkarat / berkarat / karat besi lebih perlahan // Semakin jauh jarak antara logam kurang elektropositif dan besi / Fe dalam siri elektrokimia bahawa jika bersentuhan dengan besi, semakin tinggi intensiti / lebih banyak bintik biru yang terbentuk tetapi semakin jauh jarak antara logam elektropositif dan besi / Fe dalam siri elektrik yang bersentuhan dengan besi, semakin tinggi s intensiti / lebih banyak warna merah jambu yang terbentuk.</i>	
	Able to state the relationship between the manipulated variable and the responding variable without stating the direction/ less accurately Sample answer When different metal in contact with iron, the more blue spot/rust formed <i>Mampu menyatakan hubungan antara pemboleh ubah dimanipulasi dan pemboleh ubah bergerak balas tanpa menyatakan arah / kurang tepat Contoh jawapan Apabila logam berlainan bersentuhan dengan besi, semakin banyak titik / karat biru terbentuk</i>	2
	Able to give an idea of hypothesis Sample answer Pair of metal will produce rust <i>Mampu memberi idea hipotesis Contoh jawapan Sepasang logam akan menghasilkan karat</i>	1
	No response or wrong response	0

Questions Soalan	Rubrics Rubrik	Marks markah
3(c)	Able to state all the variables in this experiment correctly. Sample answer (i) Manipulated variables : Type/different metal // position of metal in electrochemical series (ii) Responding variable : Rusting / corrosion // presence of blue/pink colour (iii) Constant variable : Size/mass of iron nail // type of nail // clean iron nails // temperature // medium in which the iron nail are kept	3
	<i>Mampu menyatakan semua pemboleh ubah dalam eksperimen ini dengan betul. Jawapan contoh (i) Pemboleh ubah dimanipulasi: Jenis / logam yang berbeza // kedudukan logam dalam siri elektrokimia (ii) Pemboleh ubah bergerak balas: Pengaratan / kakisan // kehadiran warna biru / merah jambu (iii) Pembolehubah malar: Saiz / jisim paku besi // jenis paku // paku besi bersih // suhu // medium di mana paku besi disimpan</i>	
	Able to state any two variables correctly	
	Able to state any one variable correctly	
	No response or wrong response	0

Questions Soalan	Rubrics Rubrik	Marks markah
3(d)	Able to give one operational definition of the experiment correctly with the following aspects: i.what you do ii.what you observe Sample answer Blue spot form when less electropositive metal is in contact with iron nail and dipped/put into jelly solutions that contain potassium hexacyanoferrate (III) and phenolphthalein// Rusting occurs when iron nail is in contact with tin/less electropositive metal and form blue colouration in potassium hexacyanoferrate(III) solution and phenolphthalein // No blue spot form when more electropositive metal is in contact with iron nail and dipped/put into jelly solutions that contain potassium hexacyanoferrate(III) and phenolphthalein // Rusting does not occurs when iron nail is in contact with Mg/Zn/more electropositive metal and form blue colouration in potassium hexacyanoferrate(III) solution and phenolphthalein // (based on test tube 1) Blue spot form when iron nail dipped intojelly solutions that contain potassium hexacyanoferrate (III) and phenolphthalein	3
	<i>Mampu memberikan satu definisi operasi eksperimen dengan betul dengan aspek berikut: i. Apa yang anda lakukan ii. Apa yang anda perhatikan Contoh jawapan Bentuk titik biru apabila logam kurang elektropositif bersentuhan dengan paku besi dan dicelupkan / dimasukkan ke dalam larutan agar-agar yang mengandungi kalium hexacyanoferrate (III) dan phenolphthalein // Pengaratan berlaku apabila paku besi bersentuhan dengan</i>	

	logam timah / kurang elektropositif dan membentuk pewarnaan biru dalam larutan kalium heksacyanoferrate (III) dan phenolphthalein // Tiada bentuk titik biru apabila lebih banyak logam elektropositif bersentuhan dengan besi kuku dan dicelup / dimasukkan ke dalam larutan agar-agar yang mengandungi kalium heksacyanoferrate (III) dan phenolphthalein // Pengaratan tidak berlaku apabila paku besi bersentuhan dengan Mg / Zn / lebih banyak logam elektropositif dan membentuk pewarnaan biru dalam larutan kalium heksacyanoferrate (III) dan fenolphthalein // (berdasarkan tabung uji 1) Bentuk bintik biru apabila paku besi dicelupkan ke dalam larutan agar-agar yang mengandungi kalium heksacyanoferrate (III) dan fenolphthalein	
	Able to give the operational definition for rusting incompletely with any one of the following aspects: i.what you do ii.what you observe Sample answer Metal is put into jelly blue spot form <i>Mampu memberikan definisi operasi untuk berkarat tidak lengkap dengan salah satu aspek berikut: i. Apa yang anda lakukan ii. Apa yang anda perhatikan Contoh jawapan Logam dimasukkan ke dalam bentuk titik biru jeli</i>	2
	Able to give an idea of operational definition for rusting Sample answer Iron corrodes/rust/oxidized <i>Mampu memberi idea definisi operasi untuk berkarat Contoh jawapan Besi berkarat / berkarat / teroksida</i>	1
	No response or wrong response	0

SKEMA KERTAS 3:
OXIDATION AND REDUCTION/ PENGOKSIDAAN DAN PENURUNAN
SOALAN MERANCANG EKSPERIMEN

SOALAN 1

No. of question Nombor soalan		Explanation Penerangan	Score skor
1.	(a)	Able to state the problem statement correctly How is reactivity of magnesium, zinc and iron metals when reacting with oxygen? <i>Mampu menyatakan pernyataan masalah dengan betul</i> <i>Bagaimana kereaktifan logam magnesium, zink dan ferum apabila bertindak balas dengan oksigen?</i>	3
		Able to give the statement of problem incorrectly To investigate the reactivity of magnesium, zinc and iron metals when reacting with oxygen? <i>Mampu memberikan pernyataan masalah dengan tidak betul</i> <i>Untuk mengkaji kereaktifan logam magnesium, zink dan ferum apabila bertindak balas dengan oksigen</i>	2
		Able to state the idea of statement of problem To study reactivity of metals <i>Mampu menyatakan idea pernyataan masalah</i> <i>Untuk mengkaji kereaktifan logam</i>	1
		No response or wrong response	0

	(b)	Able to state all variables correctly Sample answer: Manipulated variable : types of metals Responding variable : reactivity of metal towards oxygen Constant variable : size of metal <i>Mampu menyatakan semua pemboleh ubah dengan betul</i> <i>Contoh jawapan:</i> <i>Pemboleh ubah dimanipulasi: Jenis logam</i> <i>Pemboleh ubah bergerak balas: kereaktifan logam terhadap oksigen</i> <i>Pembolehubah malar: saiz logam</i>	3
		Able to state any two variables correctly <i>Mampu menyatakan dua pemboleh ubah dengan betul</i>	2
		Able to state any one variable correctly <i>Mampu menyatakan mana-mana pemboleh ubah dengan betul</i>	1
		No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

	(c)	Able to give the hypothesis accurately Sample answer: The reactivity of metals with oxygen increases from iron, zinc and magnesium <i>Mampu memberikan hipotesis dengan tepat</i> <i>Contoh jawapan:</i> <i>Kereaktifan logam dengan oksigen meningkat dari besi, zink dan magnesium</i>	3
		Able to give the hypothesis almost accurately Sample answer: The reactivity of magnesium metal with oxygen is the highest compared to the others <i>Mampu memberikan hipotesis hampir tepat</i> <i>Contoh jawapan: Kereaktifan logam magnesium dengan oksigen paling tinggi berbanding yang lain</i>	2
		Able to state an idea of the hypothesis The reactivity of magnesium metal with oxygen is the highest <i>Mampu menyatakan idea hipotesis</i> <i>Kereaktifan logam magnesium dengan oksigen paling tinggi</i>	1
		No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

(d)	Able to give the list of substances and apparatus correctly and completely Sample answer: Apparatus : Boiling tube, retort stand and clamp, Bunsen burner, spatula, forcep Substances : Potassium manganate (VI), Magnesium powder, zinc powder, iron fillings, glass wool, asbestos paper <i>Mampu memberikan senarai bahan dan radas dengan betul dan lengkap</i> <i>Contoh jawapan:</i> <i>MFP: Tiub didih, retort stand dan clamp, Bunsen burner, spatula, forcep</i> <i>Bahan: Kalium manganat (VI), serbuk magnesium, serbuk zink, lapisan besi, wul kaca, kertas asbestos</i>	3
	Able to give the list of substances and apparatus correctly but not completely Sample answer: List of apparatus and substances Potassium manganate (VI), Magnesium powder, zinc powder, iron fillings, asbestos paper Boiling tube, retort stand and clamp, Bunsen burner, spatula, <i>Mampu memberikan senarai bahan dan radas dengan betul tetapi tidak lengkap</i> <i>Contoh jawapan:</i> <i>Senarai radas dan bahan</i> <i>Kalium manganat (VI), Serbuk magnesium, serbuk zink, serbuk besi, kertas asbestos</i> <i>Tiub didih, retort stand dan clamp, Bunsen burner, spatula,</i>	2
	Able to give an idea about the list of substances and apparatus Sample answer: Any one apparatus and two substances <i>Mampu memberi idea mengenai senarai bahan dan radas</i> <i>Contoh jawapan:</i> <i>Mana-mana satu alat dan dua bahan</i>	1
	No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

(e)	Able to state the procedure correctly Sample answer: 1. One spatulaful of solid potassium manganate (VI) is put into a boiling tube 2. Some glass wool is pushed into the tube. The tube is clamped horizontally. 3. One spatulaful of magnesium powder is placed on asbestos paper. 4. The magnesium powder is heated strongly. Then the solid potassium manganate (VII) is heated. 5. Observation on how vigorously magnesium react with oxygen is recorded. 6. Step 1-4 repeated using zinc powder and iron powder. <i>Mampu menyatakan prosedur dengan betul</i> <i>Contoh jawapan:</i> 1. Satu spatula kalium manganat padat (VI) dimasukkan ke dalam tabung didih 2. Sebilangan bulu kaca ditolak ke dalam tiub. Tiub dikapit secara mendatar. 3. Satu spatulaful serbuk magnesium diletakkan di atas kertas asbestos. 4. Serbuk magnesium dipanaskan dengan kuat. Kemudian kalium manganat padat (VII) dipanaskan. 5. Pemerhatian tentang bagaimana magnesium bertindak balas dengan oksigen dicatatkan. 6. Langkah 1-5 diulang menggunakan serbuk zink dan serbuk besi.	3
	Able to state three steps of the procedure correctly Sample answer: Steps 2, 3, 5 <i>Mampu menyatakan tiga langkah prosedur dengan betul</i> <i>Contoh jawapan:</i> <i>Langkah 2, 3, 5</i>	2
	Able to state two steps of the procedure correctly Sample answer: Steps 2, 3 <i>Mampu menyatakan dua langkah prosedur dengan betul</i> <i>Contoh jawapan:</i> <i>Langkah 2, 3</i>	1
	No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

(f)	Able to show the tabulation of data correctly Table has 2 columns and 4 rows <i>Mampu menunjukkan tabulasi data dengan betul Jadual mempunyai 2 lajur dan 4 baris</i> Sample answer: <table><tr><th>Metal</th><th>Observation</th></tr><tr><td>Magnesium</td><td></td></tr><tr><td>Zinc</td><td></td></tr><tr><td>Iron</td><td></td></tr></table>	Metal	Observation	Magnesium		Zinc		Iron		3		
Metal	Observation											
Magnesium												
Zinc												
Iron												
	Able to show the tabulation of data less accurately. Table has 2 columns and 3 rows <i>Mampu menunjukkan tabulasi data dengan betul Jadual mempunyai 2 lajur dan 3 baris</i> Sample answer: <table><tr><th>Metal</th><th>Observation</th></tr><tr><td>Magnesium</td><td></td></tr><tr><td>Zinc</td><td></td></tr></table> Able to state an idea about the tabulation of data. Table has 2 columns and 2 rows <i>Mampu menunjukkan tabulasi data dengan betul Jadual mempunyai 2 lajur dan 2 baris</i> Sample answer: <table><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	Metal	Observation	Magnesium		Zinc						2 <
Metal	Observation											
Magnesium												
Zinc												

SOALAN 2

No. of question Nombor soalan		Explanation Penerangan	Score skor
2.	(a)	Able to state the problem statement correctly How is the effect of rusting when iron is in contact with other metals <i>Mampu menyatakan pernyataan masalah dengan betul</i> <i>Bagaimana kesan pengaratan ketika besi bersentuhan dengan logam lain</i>	3
		Able to give the statement of problem incorrectly To investigate the effect of other metals on the rusting of iron <i>Mampu memberikan pernyataan masalah dengan tidak betul</i> <i>Untuk mengkaji kesan logam lain terhadap pengaratan besi</i>	2
		Able to state the idea of statement of problem To study rusting of iron <i>Mampu menyatakan idea pernyataan masalah</i> <i>Untuk mengkaji pengaratan besi</i>	1
		No response or wrong response	0
	(b)	Able to state all variables correctly Sample answer: Manipulated variable : Different types of metals/different metals Responding variable : Rate of rusting/rusting of iron Constant variable : Iron nails/temperature <i>Mampu menyatakan semua pemboleh ubah dengan betul</i> <i>Contoh jawapan:</i> <i>Pemboleh ubah dimanipulasi: Jenis logam yang berbeza / logam yang berbeza</i> <i>Pemboleh ubah bergerak balas: Kadar pengaratan / pengaratan besi</i> <i>Pembolehubah malar: Paku / suhu besi</i>	3
		Able to state any two variables correctly <i>Mampu menyatakan dua pemboleh ubah dengan betul</i>	2
		Able to state any one variable correctly <i>Mampu menyatakan mana-mana pemboleh ubah dengan betul</i>	1
		No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

	(c)	Able to give the hypothesis accurately Sample answer: When a more electropositive metal is in contact with iron, the metal inhibits rusting/speeds up//Iron rusts faster when in contact with a less electropositive metal <i>Mampu memberikan hipotesis dengan tepat</i> <i>Contoh jawapan:</i> <i>Apabila logam yang lebih elektropositif bersentuhan dengan besi, logam menghalang pengaratan / mempercepat // Besi berkarat lebih cepat ketika bersentuhan dengan logam yang kurang elektropositif</i>	3
		Able to give the hypothesis almost accurately Sample answer: When a more reactive metal is in contact with iron, the metal inhibits rusting <i>Mampu memberikan hipotesis hampir tepat</i> <i>Contoh jawapan:</i> <i>Apabila logam yang lebih reaktif bersentuhan dengan besi, logam menghalang pengaratan</i>	2
		Able to state an idea of the hypothesis When a more electropositive metal is in contact with iron, the metal inhibits rusting <i>Mampu menyatakan idea hipotesis</i> <i>Apabila logam yang lebih elektropositif bersentuhan dengan besi, logam menghalang pengaratan</i>	1
		No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

(d)	Able to give the list of substances and apparatus correctly and completely Sample answer: Apparatus : Test tubes, test tube rack Substances : Sandpaper, iron nails, magnesium ribbon, zinc strip, copper strip, tin strip, hot jelly solution mixed with potassium hexacyanoferrate(III) solution and phenolphthalein indicator <i>Mampu memberikan senarai bahan dan radas dengan betul dan lengkap</i> <i>Contoh jawapan:</i> <i>MFP: Tabung uji, rak tabung uji</i> <i>Bahan: Kertas pasir, paku besi, pita magnesium, jalur zink, jalur tembaga, jalur timah, larutan jeli panas dicampurkan dengan larutan kalium heksacyanoferrate (III) dan penunjuk phenolphthalein</i>	3
	Able to give the list of substances and apparatus correctly but not completely Sample answer: List of apparatus and substances Test tube, iron nail, magnesium, zinc, copper, tin, water, potassium hexacyanoferrate (III)/phenolphthalein indicator <i>Mampu memberikan senarai bahan dan radas dengan betul tetapi tidak lengkap</i> <i>Contoh jawapan:</i> <i>Senarai radas dan bahan</i> <i>Tabung uji, paku besi, magnesium, zink, tembaga, timah, air, kalium heksacyanoferrate (III) /penunjuk phenolphthalein</i>	2
	Able to give an idea about the list of substances and apparatus Sample answer: Any one apparatus and two substances <i>Mampu memberi idea mengenai senarai bahan dan radas</i> <i>Contoh jawapan: Mana-mana satu alat dan dua bahan</i>	1
	No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

	(e)	Able to state the procedure correctly Sample answer: 1. All the metal strips are cleaned with sandpaper 2. The metal strip is coiled with around the iron nails and the put into each test tube. 3. The same volume of hot jelly solution is poured and mixed with the potassium hexacyanoferrate (III) and phenolphthalein indicator. 4. The test tubes are left aside for one day. 5. The intensity of the blue and Pink colour in each test tube is compared. <i>Mampu menyatakan prosedur dengan betul</i> <i>Contoh jawapan:</i> 1. Semua jalur logam dibersihkan dengan kertas pasir 2. Jalur logam dililit dengan sekitar paku besi dan dimasukkan ke dalam setiap tabung uji. 3. Isi padu larutan jeli panas dituangkan dan dicampurkan dengan kalium hexacyanoferrate (III) dan penunjuk fenolphthalein. 4. Tabung uji dibiarkan selama satu hari. 5. Keamatan warna biru dan Pink di setiap tabung uji dibandingkan.	3
		Able to state three steps of the procedure correctly Sample answer: Steps 2, 3, 5 <i>Mampu menyatakan tiga langkah prosedur dengan betul</i> <i>Contoh jawapan:</i> <i>Langkah 2, 3, 5</i>	2
		Able to state two steps of the procedure correctly Sample answer: Steps 2, 3 <i>Mampu menyatakan dua langkah prosedur dengan betul</i> <i>Contoh jawapan: Langkah 2, 3</i>	1
		No response or wrong response <i>Tiada respon atau respon yang salah</i>	0

(f)	Able to show the tabulation of data correctly Table has 6 columns and 3 rows <i>Mampu menunjukkan tabulasi data dengan betul</i> <i>Jadual mempunyai 6 lajur dan 3 baris</i> Sample answer: <table><tr><td>Test tube</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr><tr><td>Intensity of the blue colour</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Intensity of the pink colour</td><td></td><td></td><td></td><td></td><td></td></tr></table>	Test tube	A	B	C	D	E	Intensity of the blue colour						Intensity of the pink colour						3
	Test tube	A	B	C	D	E														
	Intensity of the blue colour																			
Intensity of the pink colour																				
	Able to show the tabulation of data less accurately. Table has 6 columns and 2 rows <i>Mampu menunjukkan tabulasi data dengan betul</i> <i>Jadual mempunyai 6 lajur dan 2 baris</i> Sample answer: <table><tr><td>Test tube</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr><tr><td>Observation</td><td></td><td></td><td></td><td></td><td></td></tr></table> Able to state an idea about the tabulation of data. Table has 2 columns and 2 rows <i>Mampu menunjukkan tabulasi data dengan betul</i> <i>Jadual mempunyai 2 lajur dan 2 baris</i> Sample answer: <table><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	Test tube	A	B	C	D	E	Observation										2		
Test tube	A	B	C	D	E															
Observation																				
		1																		
	No response or wrong respons <i>Tiada respon atau respon yang salah</i>	0																		

Set 8

Thermochemistry
Termokimia

TAJUK: THERMOCHEMISTRY/ TERMOKIMIASection A
Bahagian A

- 1 Diagram 1 shows the apparatus set-up to determine the heat of combustion of propanol, C_3H_7OH .

Rajah 1 menunjukkan susunan radas untuk menentukan haba pembakaran propanol, C_3H_7OH .

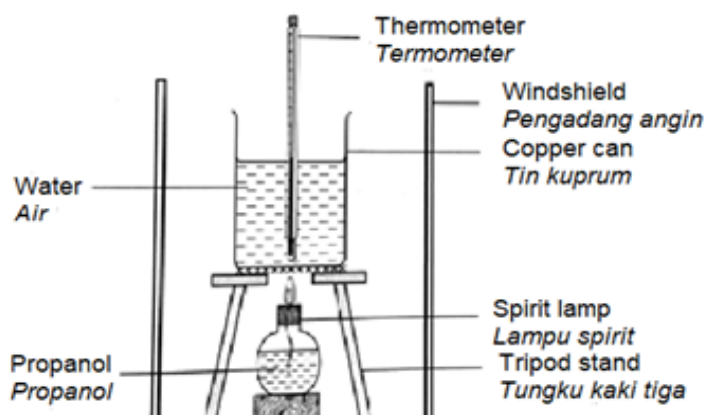


Diagram 1
Rajah 1

Table 1 shows the results of this experiment.

Jadual 1 menunjukkan keputusan eksperimen ini.

Volume of water used (cm^3) <i>Isi padu air yang digunakan (cm^3)</i>	100.00
Initial temperature of the water ($^{\circ}C$) <i>Suhu awal air ($^{\circ}C$)</i>	27.00
Highest temperature of the water ($^{\circ}C$) <i>Suhu tertinggi air ($^{\circ}C$)</i>	36.60
Mass of the spirit lamp and ethanol before burning (g) <i>Jisim lampu spirit dan etanol sebelum pembakaran (g)</i>	240.12
Mass of the spirit lamp and ethanol after burning (g) <i>Jisim lampu spirit dan etanol selepas pembakaran (g)</i>	240.00

Table 1 / Jadual 1

- (a) What is the meaning of heat of combustion of propanol?
Apakah yang dimaksudkan dengan haba pembakaran propanol?
-

[1 mark/1 markah]

- (b) Write a chemical equation for the complete combustion of propanol in excess oxygen.
Tuliskan persamaan kimia bagi pembakaran lengkap propanol dalam oksigen berlebihan.
-

[2 marks/ 2 markah]

- (c) Explain why a copper can is used in this experiment.
Terangkan mengapa tin kuprum digunakan dalam eksperimen ini.
-

[1 mark/ 1 markah]

- (d) Calculate the following.
Hitung yang berikut.

- i. The mass of propanol burnt
Jisim propanol yang terbakar

[1 mark/ markah]

- ii. The number of moles of propanol burnt
Bilangan mol propanol yang terbakar

[Relative atomic mass / *Jisim atom relatif*: H= 1, C= 12, O= 16]

[1 mark/ 1 markah]

- iii. The total amount of heat released during experiment
Jumlah tenaga haba yang terbebas semasa eksperimen
[Specific heat capacity of solution/ *Muatan haba tentu larutan* = $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$]

[1 mark/ 1 markah]

- iv. The heat of combustion of propanol
Haba pembakaran bagi propanol.

[1 mark/ 1 markah]

- (e) Electricity can be produced by burning methane in oxygen. Methane and oxygen react to produce carbon dioxide and water by releasing 889 kJ mol^{-1} of heat. Draw an energy level diagram that represents the energy change in this reaction.
Elektrik boleh dihasilkan dengan pembakaran metana dalam oksigen.
Metana dan oksigen bertindak balas menghasilkan karbon dioksida dan air dengan melepaskan sebanyak 889 kJ mol^{-1} haba. Lukis gambar rajah aras tenaga yang mewakili perubahan tenaga semasa tindak balas ini.

[2 marks/2 markah]

- 2 Diagram 2 shows an experiment carried out by a student to determine the heat of displacement for the reaction between zinc and copper (II) nitrate solution. Excess zinc powder is added to 50 cm³ of 0.2 mol dm⁻³ copper (II) nitrate solution.

Rajah 2 menunjukkan eksperimen yang dijalankan oleh seorang pelajar untuk menentukan haba penyesaran bagi tindak balas antara zink dengan larutan kuprum(II) nitrat. Serbuk zink berlebihan ditambahkan kepada 50 cm³ larutan kuprum(II) nitrat 0.2 mol dm⁻³.

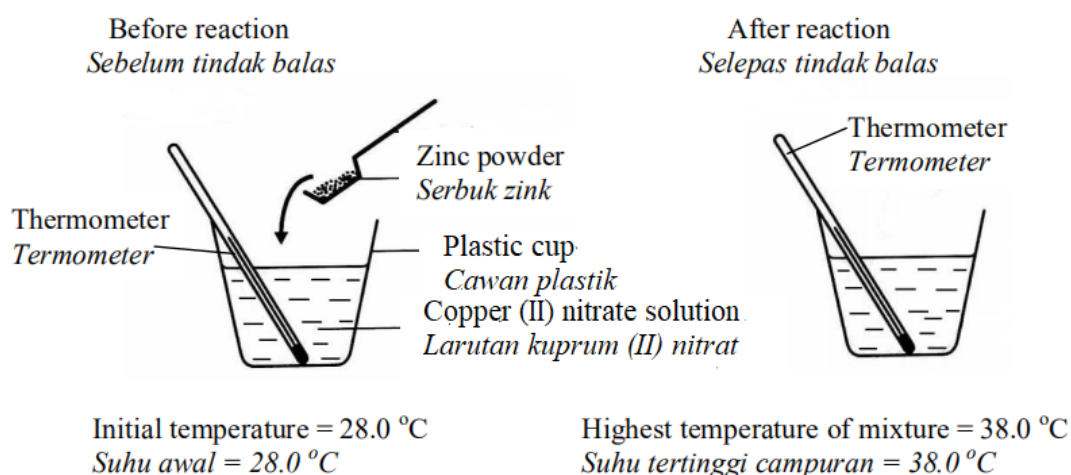


Diagram 2
Rajah 2

- (a) What is meant by heat of displacement?
Apakah yang dimaksudkan dengan haba penyesaran?

[1 mark/ 1 markah]

- (b) Why is plastic cup used in this experiment?
Mengapa cawan plastik digunakan dalam eksperimen ini?

[1 mark/ 1 markah]

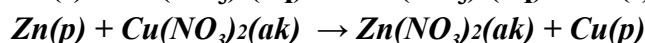
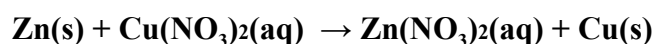
- (c) State **two** observations in the reaction other than increase in temperature.

Nyatakan **two** pemerhatian dalam tindak balas itu selain dari peningkatan suhu.

[2 marks/ 2 markah]

- (d) The chemical equation for the displacement reaction between zinc and copper (II) nitrate is as follows:

Persamaan bagi tindak balas penyesaran antara logam zink dengan larutan kuprum(II) nitrat adalah seperti berikut:



Calculate,

Hitung,

- i. The heat released in the reaction.

perubahan haba dalam tindak balas itu.

[Specific heat capacity of the solution, $c = 4.2 \text{ Jg}^{-1}\text{°C}^{-1}$,

Density of the solution = 1 gcm^{-3}]

[Muatan haba tentu larutan, $c = 4.2 \text{ Jg}^{-1}\text{°C}^{-1}$, Ketumpatan larutan = 1 g cm^{-3}]

[1 mark/ 1 markah]

- ii. The heat of displacement of copper by zinc.

haba penyesaran kuprum oleh zink.

[3 marks/ 3 markah]

- (e) Suggest another metal that can displace copper (II) ions, Cu^{2+} .

Cadangkan satu logam lain yang dapat menyesarkan ion kuprum, Cu^{2+} .

[1 mark/ 1 markah]

- (f) Why is zinc powder added in excess?
 Mengapa serbuk zink ditambah secara berlebihan?

[1 mark/ 1 markah]

- 3 Diagram 3 shows the apparatus set-up to determine the heat of neutralization in an experiment. Potassium chloride solution and water produced when 50.0 cm^3 of 1.0 mol dm^{-3} acid A reacts with 50.0 cm^3 of 1.0 mol dm^{-3} alkali B.

Rajah 3 menunjukkan susunan radas untuk menentukan haba peneutralan dalam suatu eksperimen. Larutan kalium klorida dan air terhasil apabila 50.0 cm^3 asid A 1.0 mol dm^{-3} bertindak balas dengan 50.0 cm^3 alkali B 1.0 mol dm^{-3} .

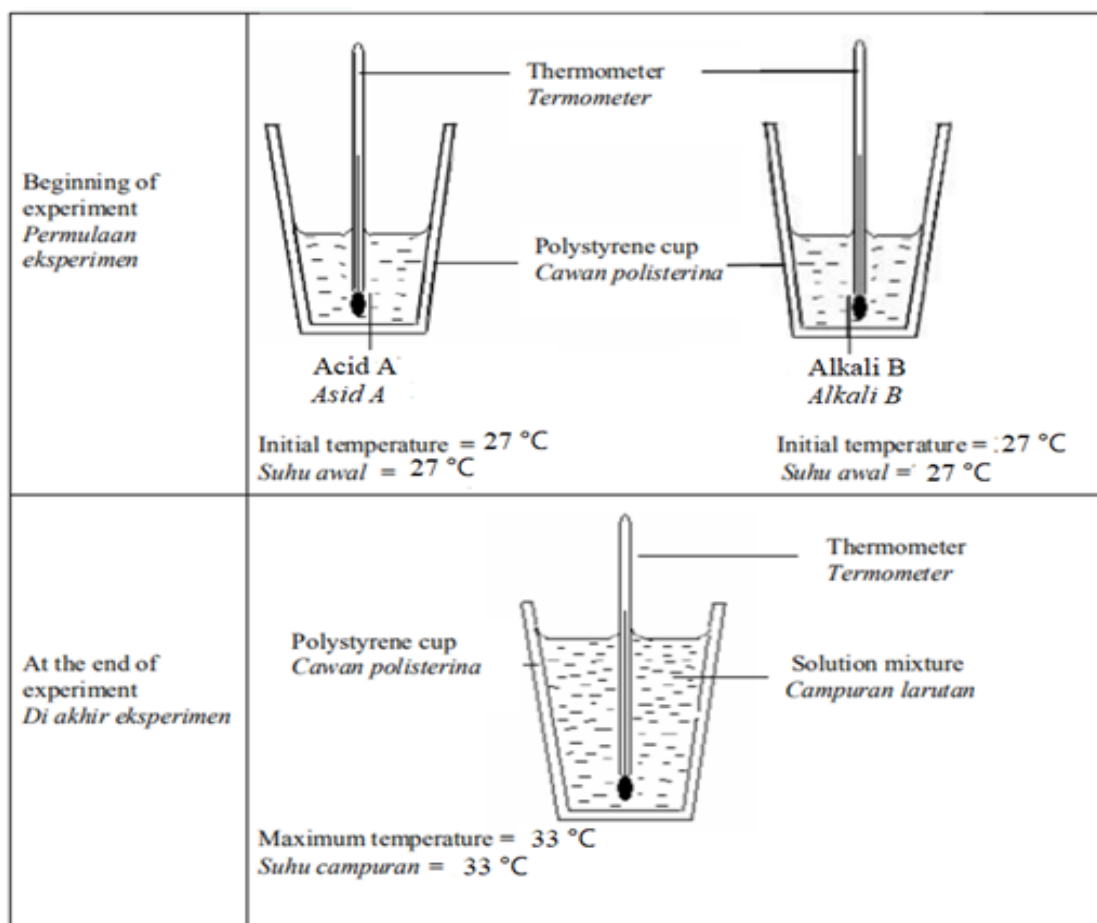


Diagram 3
 Rajah 3

- (a) State the meaning of heat of neutralization.

Nyatakan maksud haba peneutralan.

[1 mark/1 markah]

- (b) Name the acid A and alkali B involved in this reaction.

Namakan asid A dan alkali B yang terlibat dalam tindak balas ini.

Acid A :

Asid A : _____

Alkali B:

Alkali B : _____

[2 marks/ 2 markah]

- (c) Write an ionic equation for the reaction between acid A and alkali B.

Tulis persamaan ion bagi tindak balas antara asid A dan alkali B.

[1 mark/ 1 markah]

- (d) Based on the data obtained from the experiment, calculate:

Berdasarkan data yang diperolehi daripada eksperimen, hitungkan:

- i. number of moles of acid A used.

bilangan mol bagi asid A yang digunakan

[1 mark/ 1 markah]

- ii. heat change in the experiment.

perubahan haba dalam eksperimen ini

[Specific heat capacity of solution = $4.2 \text{ Jg}^{-1}\text{C}^{-1}$, Density of solution = 1 g cm^{-3}]

[Muatan haba tentu larutan = $4.2 \text{ Jg}^{-1}\text{C}^{-1}$, Ketumpatan larutan = 1 g cm^{-3}]

[1 mark/ 1 markah]

- iii. Heat of neutralization.
haba peneutralan.

[1 mark/ 1 markah]

- (e) Draw the energy level diagram for the reaction.
Lukiskan gambar rajah aras tenaga bagi tindak balas ini.

[2 marks/ 2 markah]

- (f) Predict the value of the heat of neutralisation if alkali B is replaced with an ammonia solution when it reacts with acid A.
Ramalkan nilai haba peneutralan jika alkali B diganti dengan larutan ammonia apabila bertindak balas dengan asid A.

[1 mark/ 1 markah]

4. Table 4 shows the heats of combustion of some common fuels.

Jadual 4 menunjukkan haba pembakaran beberapa bahan api yang biasa digunakan.

Fuel <i>Bahan api</i>	Heat of combustion (kJ mol ⁻¹) <i>Haba pembakaran (kJ mol⁻¹)</i>
Methane <i>Metana</i>	-890
Propane <i>Propana</i>	-2 230
Ethanol <i>Etanol</i>	-1 376
Propanol <i>Propanol</i>	-2 016

Table 4

Jadual 4

- (a) The combustion of the fuels is an exothermic reaction. What is meant by exothermic reaction?

Pembakaran bahan api adalah tindak balas eksotermik. Apakah yang dimaksudkan dengan tindak balas eksotermik?

[2 marks / 2 markah]

- (b) Diagram 4 shows the energy profile for the combustion of ethanol.
Rajah 4 menunjukkan profil tenaga bagi pembakaran etanol.

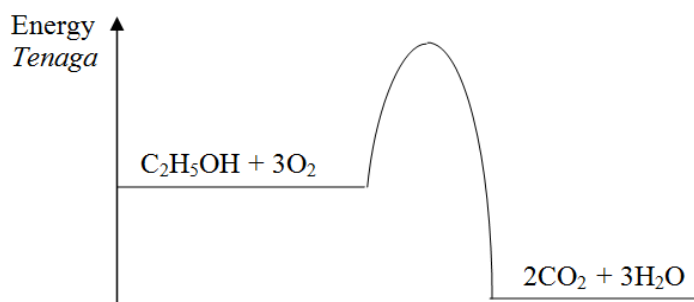


Diagram 4

Rajah 4

Mark ΔH for the reaction in Diagram (b).

Tandakan ΔH bagi tindak balas itu dalam Rajah (b).

[1 marks / 1 markah]

- (c) (i) Compare the heat of combustion of methane and propane.
Bandingkan haba pembakaran metana dan propana.

[1 marks / 1 markah]

- (ii) Explain your answer in (c)(i).
Terangkan jawapan anda di (c) (i).

[1 marks / 1 markah]

- (d) Calculate the fuel value of propanol.
[molar mass of propanol, $C_3H_7OH = 60 \text{ g mol}^{-1}$]
Hitungkan nilai bahan api bagi propanol.
[Jisim Molar propanol, $C_3H_7OH = 60 \text{ g mol}^{-1}$]

[2 marks / 2 markah]

- (e) During a football game, a player found that his knee was swollen after being hit by the opponent. A physiotherapist put ice cubes on his knee to relieve the pain.
Semasa perlawanan bola sepak, seorang pemain mendapati lututnya bengkak selepas berlanggar dengan pemain lawan. Seorang ahli fisioterapi meletakkan ketulan ais pada lutut pemain itu untuk mengurangkan kesakitan.



As a chemistry student, suggest another method to help the player.

Explain how the method you choose will help the player.

Sebagai seorang pelajar kimia, cadangkan kaedah lain untuk membantu pemain itu.

Terangkan bagaimana kaedah yang dipilih dapat membantu atlit itu.

[1 marks / 1 markah]

5. Diagram 5 shows an experiment to determine the heat of displacement of the reaction between copper and silver nitrate solution. In this experiment, excess copper powder was added to 50 cm^3 of 1.0 mol dm^{-3} silver nitrate solution. The heat of displacement in this experiment is -105 kJ mol^{-1} .

[Specific heat capacity of the solution = $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$, density of the solution = 1 g cm^{-3}]

Rajah 5 menunjukkan suatu eksperimen untuk menentukan haba penyesaran bagi tindak balas antara kuprum dan larutan argentum nitrat. Dalam eksperimen ini, serbuk kuprum berlebihan ditambah ke 50 cm^3 larutan argentum nitrat 1.0 mol dm^{-3} . Haba penyesaran untuk eksperimen ini ialah -105 kJ mol^{-1} .

[Muatan haba tentu bahan larutan = $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$, ketumpatan larutan = 1 g cm^{-3}]

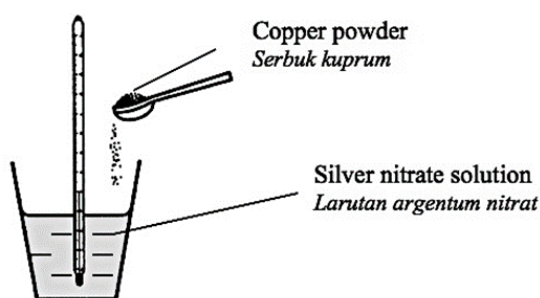


Diagram 5

Rajah 5

- (a) Based on this experiment, what is meant by heat of displacement?

Berdasarkan eksperimen ini, apakah yang dimaksudkan dengan haba penyesaran?

[1 marks / 1 markah]

- (b) State one observation for this experiment

Nyatakan satu pemerhatian bagi eksperimen ini.

[1 marks / 1 markah]

- (c) Besides using sodium hydroxide solution, describe briefly another test to verify the cation formed after the experiment is done.

Selain daripada penggunaan larutan natrium hidroksida, terangkan secara ringkas suatu ujian lain untuk mengesahkan kation yang terbentuk selepas eksperimen dijalankan.

[2 marks / 2 markah]

- (d) Based on the information from this experiment, calculate
Berdasarkan maklumat daripada eksperimen ini, hitungkan

- (i) The number of moles of silver ions reacted
bilangan mol ion argentum yang bertindak balas

[1 marks / 1 markah]

- (ii) The heat released
Jumlah haba terbebas

[1 marks / 1 markah]

- (iii) The change in temperature
Perubahan dalam suhu

[2 marks / 2 markah]

- (iv) The experiment is repeated using 50 cm³ of 0.5 mol dm⁻³ silver nitrate solution and excess copper powder. State the temperature change in this experiment. Explain why the change of temperature is different from the experiment in (d) (iii).
Eksperimen diulang dengan menggunakan 50 cm³ larutan argentum nitrat 0.5 mol dm⁻³ dan serbuk kuprum. Nyatakan perubahan suhu bagi eksperimen ini. Terangkan mengapa perubahan suhu ini berbeza daripada eksperimen dalam d(iii).
-
-

[2 marks / 2 markah]

Section B
Bahagian B

7. (a) An experiment is carried out to determine the heat of precipitation of silver chloride. Diagram 7.1 shows the energy level for reaction between silver nitrate and sodium chloride.

Satu eksperimen dijalankan untuk menentukan haba pemendakan bagi argentum klorida. Rajah 7.1 menunjukkan aras tenaga bagi tindak balas antara argentum nitrat dan natrium klorida.

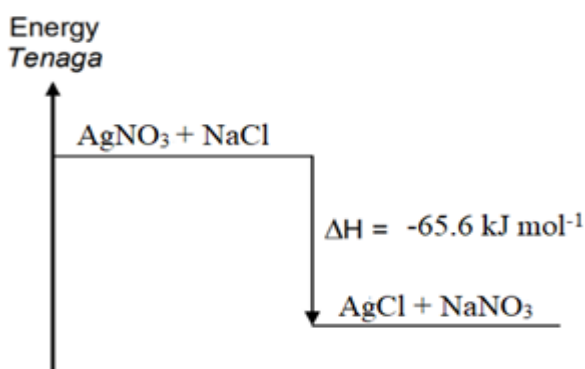


Diagram 7.1
Rajah 7.1

- (i) State **two** observations in the experiment.
*Nyatakan **dua** pemerhatian dalam eksperimen itu.*
- [1 mark/ 1 markah]
- (ii) Write two statements that can be concluded from Diagram 7.1.
Tulis dua pernyataan yang boleh dirumus daripada Rajah 7.1.
- [2 marks /2 markah]
- (iii) In another reaction, 50 cm³ of 0.2 mol dm⁻³ lead (II) nitrate is added to 50 cm³ of 0.2 mol dm⁻³ copper (II) sulphate solution. The temperature of the mixture increased by 7.0 °C. Write the chemical equation involved and calculate the heat of precipitation of lead (II) sulphate.
Dalam satu tindak balas lain, 50 cm³ plumbum (II) nitrat 0.2 mol dm⁻³ ditambah kepada 50 cm³ larutan kuprum(II) sulfat 0.2 mol dm⁻³. Suhu campuran telah meningkat sebanyak 7.0 °C. Tulis persamaan kimia yang berlaku dan hitung haba pemendakan bagi plumbum (II) sulfat.
- [7 marks/7 markah]

- (b) (i) Table 7.2 shows the heat released when 1 mol of two different alkalis, alkali A and B reacted with hydrochloric acid in Experiment I and II whereas in Experiment III, alkali B reacted with acid C.

Jadual 7.2 menunjukkan haba yang dibebaskan apabila 1 mol bagi dua alkali yang berlainan, alkali A dan B bertindak balas dengan asid hidroklorik dalam Eksperimen I dan II manakala dalam eksperimen III, alkali B bertindak balas dengan asid C.

Experiment <i>Eksperimen</i>	Reaction <i>Tindak balas</i>	Heat of neutralisation <i>Haba peneutralan</i> (kJ mol ⁻¹)
I	Alkali A and hydrochloric acid <i>Alkali A dan asid hidroklorik</i>	- 57
II	Alkali B and hydrochloric acid <i>Alkali B dan asid hidroklorik</i>	- 54
III	Alkali B and acid C <i>Alkali B dan asid C</i>	- 52

Table 7.2
Jadual 7.2

Based on Table 7.2, suggest one example of alkali A, B and acid C. Explain why there is a difference in the value of the heat released in Experiment I and II.

Berdasarkan Jadual 7.2, cadangkan satu contoh bagi alkali A, B dan asid C.

Jelaskan mengapa terdapat perbezaan nilai haba yang dibebaskan dalam Eksperimen I dan II.

[7 marks/ 7 markah]

- (ii) The following thermochemical equation represents the reaction between sulphuric acid and sodium hydroxide solution;



Heat of neutralisation for the reaction is - 57 kJ mol⁻¹ but not - 114 kJ mol⁻¹.

Explain why.

Persamaan termokimia berikut mewakili tindak balas antara asid sulfurik dengan natrium hidroksida:



Haba tindak balas peneutralan bagi tindak balas di atas adalah - 57 kJ mol⁻¹ dan bukannya - 114 kJ mol⁻¹. Terangkan.

[2 marks/ 2 markah]

- 8 (a) The thermochemical equation below shows the precipitation reaction between 20 cm³ 0.5 mol dm⁻³ potassium chloride solution and 20 cm³ 0.5 mol dm⁻³ silver nitrate solution.

Persamaan termokimia bagi tindak balas pemendakan di bawah menunjukkan tindak balas antara 20 cm³ 0.5 mol dm⁻³ larutan kalium klorida dan 20 cm³ 0.5 mol dm⁻³ larutan argentum nitrat.



- (i) State the meaning of heat of precipitation for this reaction.

Nyatakan maksud haba pemendakan untuk tindak balas ini

[1 marks / 1 markah]

- (ii) Draw the energy level diagram for the reaction.

Lukis gambar rajah aras tenaga bagi tindak balas ini.

[2 marks / 2 markah]

- (iii) Calculate the change in temperature for this precipitation reaction.

[Specific heat capacity of solution = 4.2 Jg⁻¹°C⁻¹, Density of solution = 1 g cm⁻³]

Hitung perubahan suhu bagi tindak balas pemendakan ini.

[Muatan Haba tentu larutan = 4.2 Jg⁻¹°C⁻¹, Ketumpatan larutan = 1 g cm⁻³]

State the temperature change for the reaction if sodium chloride solution is used to replace potassium chloride solution while other conditions remain the same. Give your reason.

Nyatakan perubahan suhu bagi tindak balas pemendakan jika larutan natrium klorida digunakan menggantikan larutan kalium klorida manakala lain-lain keadaan kekal sama. Berikan alasan anda.

[7 marks / 7 markah]

- (b) Table 8 shows the heat released for Experiment I, II and III for different acids that has reacted with sodium hydroxide solution.

Jadual 8 menunjukkan haba yang dibebaskan bagi tindak balas I, II dan III menggunakan asid berlainan yang telah bertindak balas dengan larutan natrium hidroksida.

Experiment <i>Eksperimen</i>	Chemical Equation <i>Persamaan kimia</i>	Heat of neutralisation <i>Haba peneutralan</i> (kJ mol ⁻¹)
I	$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$	-57
II	$\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$	-54
III	$\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$	-57

Table 8
Jadual 8

Based on Table 8, explain the difference in heat released between:

Berdasarkan Jadual 8, terangkan perbezaan dalam haba dibebaskan antara :

- Experiment I and Experiment II
Eksperimen I dan Eksperimen II
- Experiment I and Experiment III
Eksperimen I dan Eksperimen III

[7 marks / 7 markah]

- (c) During a football game, a player found that his leg was swollen after being hit by the opponent player. As a chemistry student, suggest how to help the player.

Explain how the method you choose will help the player.

Semasa perlawanan bola sepak, seorang pemain mendapati kakinya bengkak selepas berlanggar dengan pemain lawan. Sebagai seorang pelajar kimia, cadangkan kaedah lain untuk membantu pemain itu.

Terangkan bagaimana kaedah yang dipilih dapat membantu pemain itu.



Diagram 8
Rajah 8

[3 marks / 3 markah]

Section C
Bahagian C

9. (a) Diagram 9 shows a brown solid deposited on the iron spoon due to an electroplating experiment where the spoon is immersed into copper (II) nitrate, $\text{Cu}(\text{NO}_3)_2$ solution. The beaker that was used to immerse the spoon also became hot.

Rajah 9 menunjukkan pepejal perang yang terbentuk pada sudu besi akibat daripada eksperimen penyaduran di mana sudu tersebut direndam ke dalam larutan kuprum (II)nitrat, $\text{Cu}(\text{NO}_3)_2$.Didapati bikar yang digunakan untuk merendam sudu tersebut juga menjadi panas.



Diagram 9

Rajah 9

If heat released to form 1 mol of brown solid is $X \text{ kJ mol}^{-1}$, identify the type of reaction and draw an energy level diagram for the reaction.

Jika haba yang dibebaskan untuk membentuk 1 mol pepejal perang ialah $X \text{ kJ mol}^{-1}$, kenal pasti jenis tindak balas yang berlaku dan lukis gambarajah aras tenaga bagi tindak balas itu.

[3 marks/ 3 markah]

- (b) Table 9 shows the thermochemical equation for experiment I, experiment II and experiment III.

Jadual 9 menunjukkan persamaan termokimia bagi eksperimen I, eksperimen II dan eksperimen III.

Experiment <i>Eksperimen</i>	Thermochemical equation <i>Persamaan termokimia</i>
I	$\text{Mg} + \text{Cu}^{2+} \rightarrow \text{Mg}^{2+} + \text{Cu} \quad \Delta H = -352 \text{ kJ mol}^{-1}$
II	$\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu} \quad \Delta H = -210 \text{ kJ mol}^{-1}$
III	$\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 \quad \Delta H = +12.7 \text{ kJ mol}^{-1}$

Table 9
Jadual 9

Based on all the information in Table 9:

Berdasarkan kepada semua maklumat di dalam Jadual 9:

- (i) Calculate the temperature change in experiment I when excess magnesium powder is added into 100 cm^3 of 0.1 mol dm^{-3} copper (II) sulphate solution, CuSO_4 solution.

[Specific heat capacity of solution = $4.2 \text{ J } ^\circ\text{C}^{-1}$, Density of solution = 1 g cm^{-3}]

Hitung perubahan suhu dalam eksperimen I apabila serbuk magnesium berlebihan dicampurkan kepada 100 cm^3 larutan kuprum(II) sulfat, CuSO_4 0.1 mol dm^{-3} .

[Muatan haba tentu larutan = $4.2 \text{ J } ^\circ\text{C}^{-1}$, ketumpatan larutan = 1 g cm^{-3}]

[4 marks/ 4 markah]

- (ii) By comparing the value of heat of reaction in experiment II and experiment III, state three information that can be deduced from the table.

Dengan membandingkan nilai haba tindak balas bagi eksperimen II dan eksperimen III, nyatakan tiga maklumat yang boleh disimpulkan daripada jadual tersebut.

[3 marks/ 3 markah]

- (iii) Based on Experiment I, describe an experiment to determine the heat of displacement of copper by magnesium. In your description, include a labelled diagram and two precautions that should be taken during the experiment.

Berdasarkan Eksperimen I, huraikan satu eksperimen untuk menentukan haba penyesaran kuprum oleh magnesium. Dalam penerangan anda sertakan gambar rajah berlabel dan dua langkah berjaga-jaga semasa menjalankan eksperimen.

[10 marks/ 10 markah]

10. (a) Table 10 shows the value for the heat of combustion of three types of alcohol.
Jadual 10 menunjukkan nilai haba pembakaran bagi tiga jenis alkohol.

Alcohol <i>Alkohol</i>	Heat of combustion <i>Haba pembakaran</i> (kJ mol ⁻¹)
Ethanol	-1376
Propanol	-2016
Butanol	-2678

Table 10
Jadual 10

- (i) 3.7 g of butanol is used to heat 500 cm³ of water. The temperature of water rises from 28.0 °C to 88.0 °C. Calculate the heat of combustion for butanol.
[Relative atomic mass ; H = 1, C = 12, O = 16, Specific heat capacity of water 4.2 Jg⁻¹ °C⁻¹]
3.7 g butanol digunakan untuk memanaskan 500 cm³ air. Suhu air meningkat dari 28.0 °C ke 88.0 °C. Hitung haba pembakaran bagi butanol.
[Jisim atom relatif ; H = 1, C = 12, O = 16, Muatan haba tentu air ialah 4.2 Jg⁻¹ °C⁻¹]

[5 marks / 5 markah]

- (ii) The value for the heat of combustion obtained in (a)(i) is less than the theoretical value given in Table 10. Explain why the difference occurs.
Nilai haba pembakaran yang diperolehi di (a)(i) adalah lebih rendah daripada nilai teori yang diberikan di Jadual 10. Jelaskan mengapa perbezaan itu berlaku.

[2 marks / 2 markah]

- (iii) Based on Table 10, identify which alcohol has isomers.
Draw the structural formula and name one of the isomers.
Berdasarkan Jadual 10, kenalpasti alkohol manakah yang mempunyai isomer.
Lukis formula struktur dan namakan salah satu isomer tersebut.

[3 marks / 3 markah]

(b)

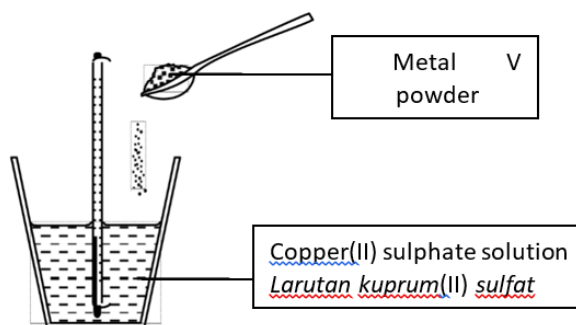


Diagram 10

Rajah 10

Haikal wants to determine the heat of displacement of metal V in his chemistry class using the apparatus set up as in Diagram 10.

By using a named metal V, describe how Haikal can carry out the experiment. Your description should include the following aspects:

- Procedure of experiment
- Calculation to determine the heat of displacement

Haikal hendak menentukan haba penyesaran logam V dalam kelas kimianya dengan menggunakan alat radas seperti Rajah 10.

Dengan menggunakan logam V yang dinamakan, huraikan bagaimana Haikal dapat menjalankan eksperimen tersebut.

Huraian anda hendaklah mengandungi aspek berikut:

- *Prosedur eksperimen*
- *Pengiraan untuk menentukan haba penyesaran*

[10 marks / 10 markah]

KERTAS 3 SOALAN STRUKTUR

1. A student carried out an experiment to investigate the heat of neutralization of sodium hydroxide solution with two different acids. Diagram 1.1 and 1.2 show the initial temperature reading of solution and highest temperature reading of the mixture.

Seorang pelajar telah menjalankan satu eksperimen untuk mengkaji haba peneutralan antara larutan natrium hidroksida dengan dua asid yang berbeza. Rajah 1.1 dan 1.2 menunjukkan bacaan suhu awal larutan dan bacaan suhu tertinggi bagi campuran.

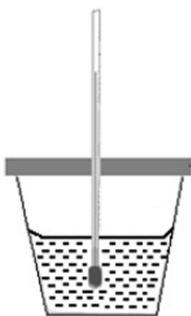
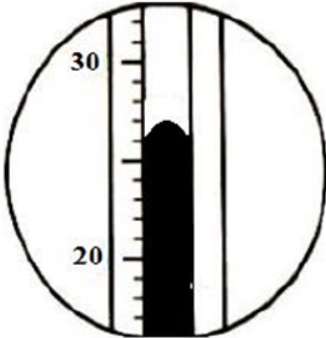
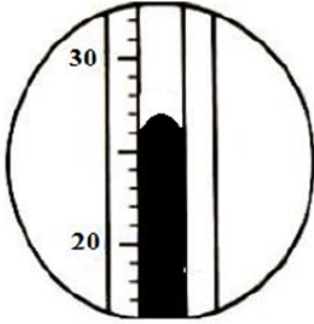
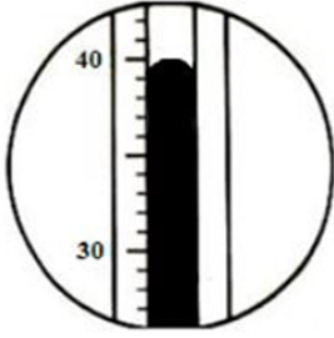
Reactants <i>Bahan tindak balas</i>	Initial temperature of solution (°C) <i>Suhu awal larutan (°C)</i>	Highest temperature of mixture (°C) <i>Suhu tertinggi campuran (°C)</i>
Set I  50 cm³ of 2.0 mol dm⁻³ hydrochloric acid <i>50 cm³ asid hidroklorik 2.0 mol dm⁻³</i> +  50 cm³ of 2.0 mol dm⁻³ sodium hydroxide solution <i>50 cm³ larutan natrium hidroksida 2.0 mol dm⁻³</i>	 	

Diagram 1.1

Rajah 1.1

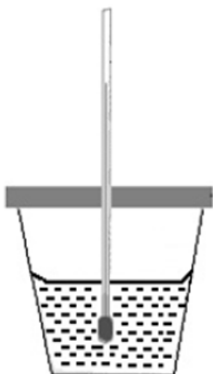
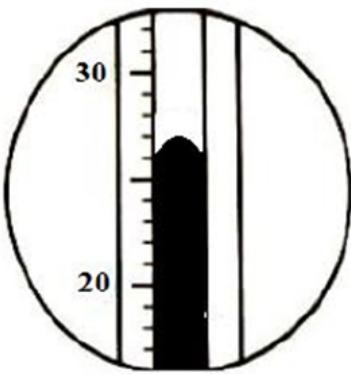
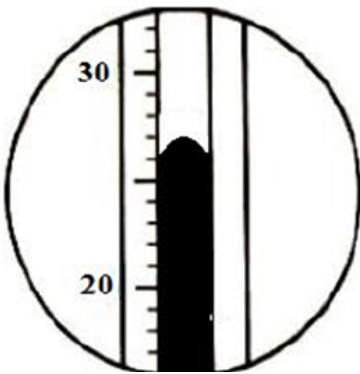
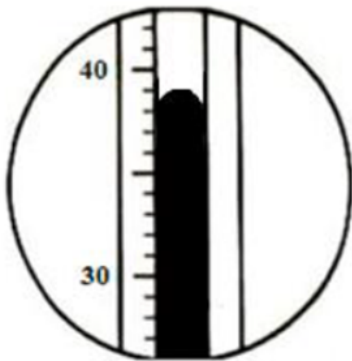
Reactants <i>Bahan tindak balas</i>	Initial temperature of solution (°C) <i>Suhu awal larutan (°C)</i>	Highest temperature of mixture (°C) <i>Suhu tertinggi campuran (°C)</i>
Set II  50 cm³ of 2.0 moldm⁻³ ethanoic acid <i>50 cm³ asid etanoik 2.0 mol dm⁻³</i> +  50 cm³ of 2.0 moldm⁻³ sodium hydroxide solution <i>50 cm³ larutan natrium hidroksida 2.0 mol dm⁻³</i>	 _____  _____	 _____

Diagram 1.2 / *Rajah 1.2*

- (a) Record the reading of the initial temperature of solution and highest temperature of mixture in the spaces provided in Diagram 1.1 and Diagram 1.2,

Catatkan bacaan suhu awal larutan dan suhu tertinggi campuran dalam ruang yang disediakan dalam Rajah 1.1 dan Rajah 1.2.

[3 marks / 3 markah]

- (b) Calculate and complete the table below.

Hitung dan lengkapkan jadual di bawah.

	Set I	Set II
Volume of mixture / cm ³ <i>Isipadu campuran / cm³</i>	100	100
Number of mole = molarity x volume <i>Bilangan mol = kemolaran x isipadu</i>	0.1	0.1
Heat release = mcθ [Specific heat capacity of solution = 4.2 J g ⁻¹ °C ⁻¹] <i>Haba dibebas = mcθ</i> [Muatan haba tentu bagi larutan = 4.2 J g ⁻¹ °C ⁻¹]		
Heat of neutralization / kJ mol ⁻¹ <i>Haba peneutralan / kJ mol⁻¹</i>		

[3 marks / 3 markah]

- (c) For both experiments, state

Bagi kedua-dua eksperimen, nyatakan

- (i) Manipulated variable / *Pemboleh ubah yang dimanipulasikan*

- (ii) Responding variable / *Pemboleh ubah yang bergerak balas*

(iii) Constant variable / *Pemboleh ubah yang dimalarkan*

[3 marks / 3 markah]

(d) State the hypothesis for this experiment.

Nyatakan hipotesis bagi eksperimen ini.

[3 marks / 3 markah]

(e) State the operational definition of heat of neutralization for the experiment.

Nyatakan definisi secara operasi bagi haba peneutralan bagi eksperimen ini.

[3 marks / 3 markah]

(f) State the relationship between the strength of the acid and heat of neutralization.

Nyatakan hubungan antara kekuatan asid dan haba peneutralan.

[3 marks / 3 markah]

2. A student carried out two experiments to determine the heat of precipitation of insoluble salt lead (II) sulphate.

In Experiment I, 25.0 cm^3 lead(II) nitrate solution 0.5 mol dm^{-3} is added into 25.0 cm^3 sodium sulphate solution 0.5 mol dm^{-3} . Diagram 2.1 shows the set-up of apparatus used.

Seorang murid telah menjalankan dua eksperimen untuk menentukan haba pemendakan garam tak terlarutkan plumbum(II) sulfat.

Dalam Eksperimen I, 25.0 cm^3 larutan plumbum(II) nitrat 0.5 mol dm^{-3} ditambahkan kepada 25.0 cm^3 larutan natrium sulfat 0.5 mol dm^{-3} . Rajah 2.1 menunjukkan susunan radas dan bahan yang digunakan.

Experiment I

Eksperimen I

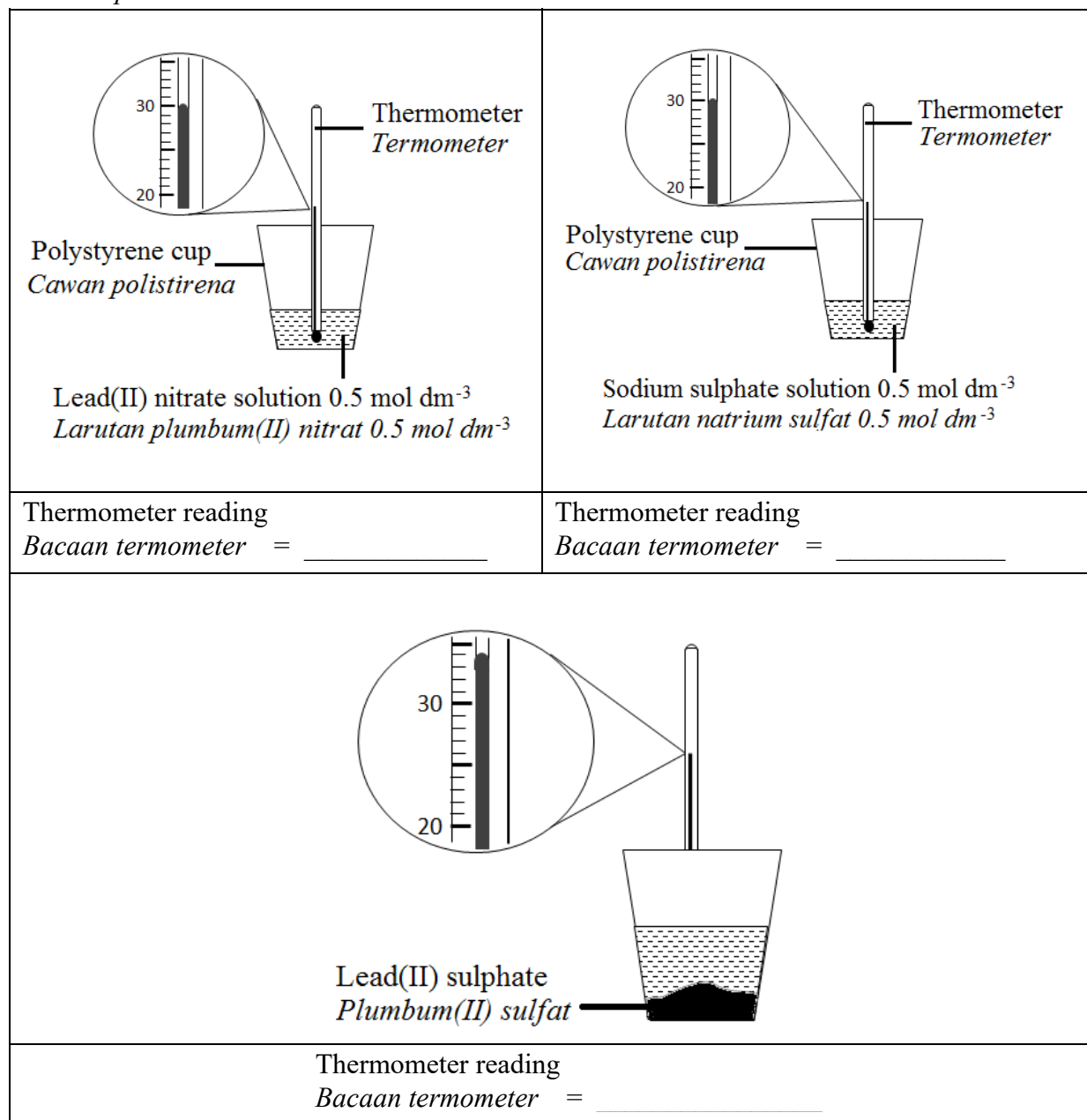


Diagram 2.1

Rajah 2.1

In Experiment II, 25.0 cm^3 lead(II) nitrate solution 1.0 mol dm^{-3} is added into 25.0 cm^3 sodium sulphate solution 1.0 mol dm^{-3} . Diagram 2.2 shows the set-up of apparatus used.

Dalam Eksperimen II, 25.0 cm^3 larutan plumbum(II) nitrat 1.0 mol dm^{-3} ditambahkan kepada 25.0 cm^3 larutan natrium sulfat 1.0 mol dm^{-3} . Rajah 2.2 menunjukkan susunan radas dan bahan yang digunakan.

Experiment II

Eksperimen II

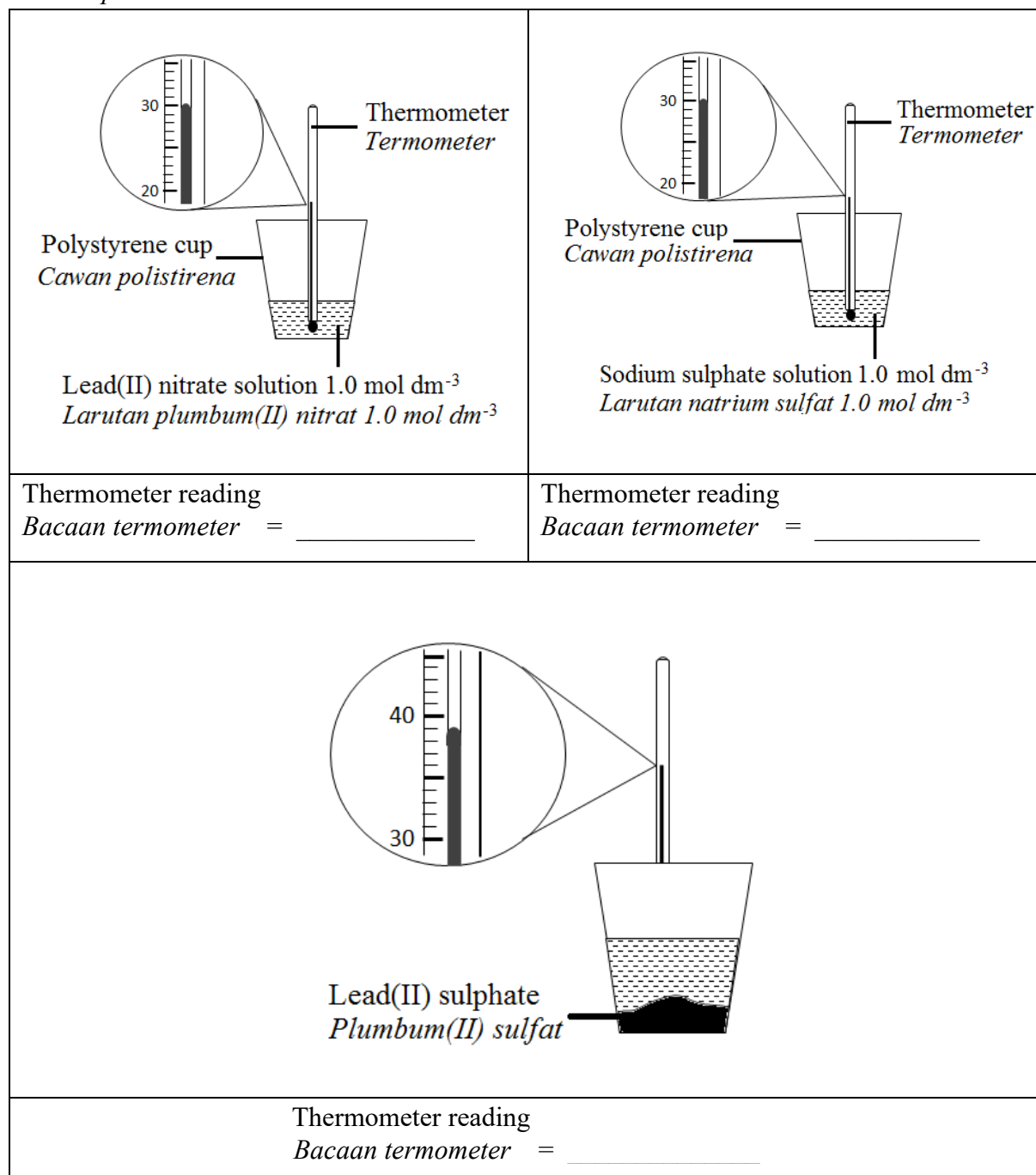


Diagram 2.2

Rajah 2.2

- (a) Record the thermometer readings in the spaces provided in Diagram 2.1 and 2.2.
Rekodkan bacaan termometer pada ruang yang disediakan dalam Rajah 2.1 dan 2.2.

[3 marks / 3 markah]

- (b) Based on the experiment, complete the table below.
Berdasarkan kepada eksperimen tersebut, lengkapkan jadual di bawah.

Manipulated variable: <i>Pemboleh ubah dimanipulasikan:</i> _____ _____ _____	Method to manipulate the variable: <i>Kaedah untuk memanipulasikan pemboleh ubah:</i> _____ _____ _____
Responding variable: <i>Pemboleh ubah bergerak balas:</i> _____ _____ _____	How the variable is responding: <i>Bagaimana pemboleh ubah itu bergerak balas:</i> _____ _____ _____
Fixed variable: <i>Pemboleh ubah dimalarkan:</i> _____ _____ _____	Method to maintain the fixed variable: <i>Kaedah menetapkan pemboleh ubah :</i> _____ _____ _____

[6 marks / 6 markah]

- (c) State one hypothesis for both experiments.
Nyatakan satu hipotesis bagi kedua-dua eksperimen.

[3 marks / 3 markah]

- (d) State three observations that you could obtain in Experiment I other than the change in temperature. Write the suitable inference for each observation.

Nyatakan tiga pemerhatian yang boleh diperolehi di dalam Eksperimen I selain daripada perubahan suhu. Tuliskan inferens yang sesuai bagi setiap pemerhatian.

Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>

[6 marks / 6 markah]

- (e) Determine the heat of precipitation for the reaction between 25.0 cm³ lead(II) nitrate solution 0.5 mol dm⁻³ with 25.0 cm³ sodium sulphate solution 0.5 mol dm⁻³.

Tentukan haba pemendakan bagi tindak balas di antara 25.0 cm³ larutan plumbum(II) nitrat 0.5 mol dm⁻³ dan 25.0 cm³ larutan natrium sulfat 0.5 mol dm⁻³.

[3 marks / 3 markah]

- (f) Give the operational definition for the heat of precipitation.

Berikan definisi secara operasi bagi haba pemendakan.

[3 marks / 3 markah]

- (g) How does the temperature change in Experiment I and II differ? Explain why.

Bagaimanakah perubahan suhu dalam Eksperimen I dan Eksperimen II berbeza? Terangkan mengapa.

[3 marks / 3 markah]

- (h) Based on the temperature in Experiment I, predict the change in temperature if the experiment is repeated using 25.0 cm³ lead(II) nitrate solution 0.5 mol dm⁻³ with 25.0 cm³ potassium sulphate solution 0.5 mol dm⁻³.

Berdasarkan kepada suhu Eksperimen I, ramalkan perubahan suhu jika eksperimen diulang dengan menggunakan 25.0 cm³ larutan plumbum(II) nitrat 0.5 mol dm⁻³ dan 25.0 cm³ larutan kalium sulfat 0.5 mol dm⁻³.

[3 marks / 3 markah]

- (i) Classify the ions in lead(II) nitrate solution and sodium sulphate solution into cations and anions.

Kelaskan ion-ion di dalam larutan plumbum(II) nitrat dan natrium sulfat kepada kation dan anion.

Cation <i>Kation</i>	Anion <i>Anion</i>

[3 marks / 3 markah]

3. An experiment is carried out to determine the heat of combustion of a few alcohols. The initial mass of the spirit lamp containing methanol is measured before burning the methanol. 100 cm³ of water is then heated with methanol in the spirit lamp until the temperature of water rises by 25°C. The final mass of the lamp containing methanol is measured again after burning. Diagram 3.1 shows the set-up of apparatus and thermometer reading in water for this experiment. The experiment was repeated by using ethanol and propanol.

Satu eksperimen telah dijalankan untuk menentukan haba pembakaran beberapa alkohol. Jisim awal pelita yang mengandungi metanol diukur sebelum pembakaran metanol. 100 cm³ air kemudian dipanaskan dengan metanol dalam pelita sehingga suhu air meningkat sebanyak 25°C. Jisim akhir pelita yang mengandungi metanol diukur sekali lagi selepas pembakaran. Rajah 3.1 menunjukkan susunan radas dan bacaan termometer suhu air bagi eksperimen ini. Eksperimen diulangi dengan menggunakan etanol dan propanol.

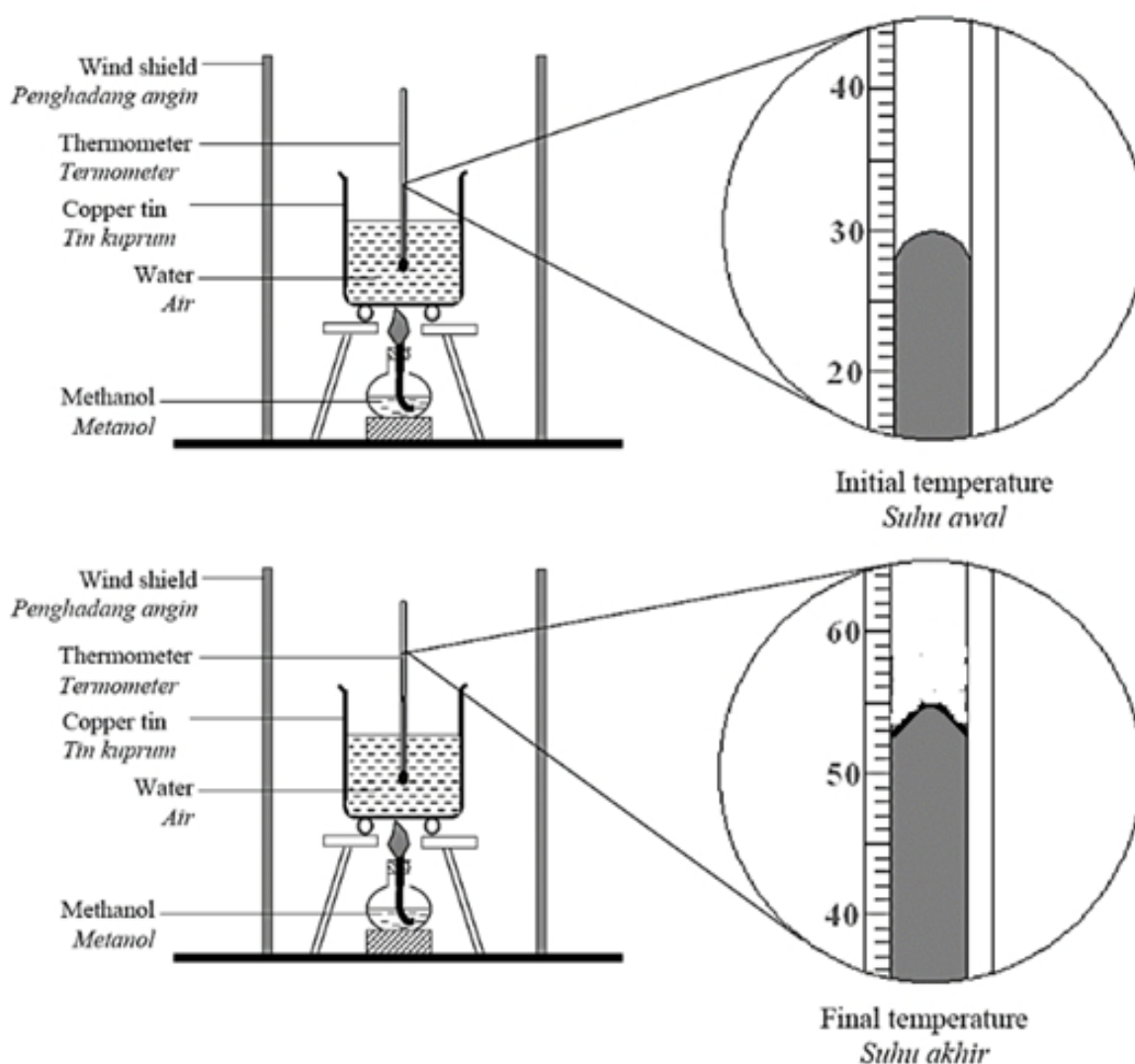


Diagram 3.1

Rajah 3.1

Diagram 3.2 and diagram 3.3 shows the reading of the mass of methanol and spirit lamp before and after combustion.

Rajah 3.2 dan rajah 3.3 menunjukkan jisim pelita dan metanol sebelum dan selepas pembakaran.

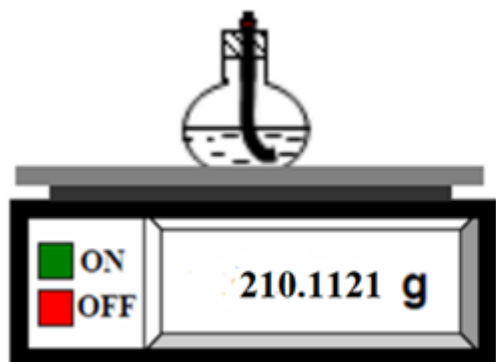


Diagram 3.2

Rajah 3.2

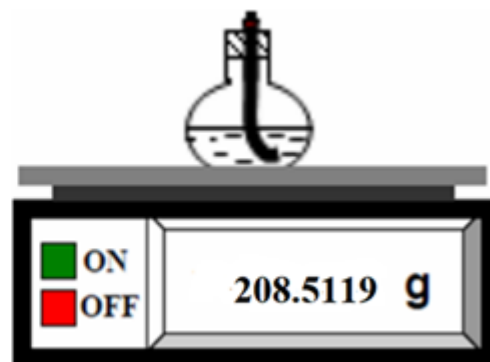


Diagram 3.3

Rajah 3.3

- (a) For this experiment, state
Bagi eksperimen ini, nyatakan
- manipulated variable :
pemboleh ubah dimanipulasi:

-
- the responding variable :
pemboleh ubah bergerak balas :

-
- the fixed variable :
pemboleh ubah dimalarkan :

[3 marks/ 3 markah]

- (b) State **one** hypothesis for this experiment.
*Nyatakan **satu** hipotesis bagi eksperimen ini.*

[3 marks/ 3 markah]

- (c) i. Calculate the heat released by methanol.

Hitung haba yang dibebaskan oleh metanol.

(Heat capacity of the solution is $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$, density of solution is 1.0 g cm^{-3} .)

(Muatan haba tentu larutan ialah $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$, ketumpatan larutan ialah 1.0 g cm^{-3}]

[1 mark/ 1 markah]

- ii. Calculate the number of moles of methanol burnt.

Hitung bilangan mol metanol yang terbakar.

(RAM/ JAR: C = 12, H = 1, O = 16)

[1 mark/ 1 markah]

- iii. Calculate the heat of combustion for methanol.

Hitung haba pembakaran bagi metanol.

[1 mark/ 1 markah]

- (d) Draw the energy level diagram for heat of combustion of methanol.

Lukis gambar rajah aras tenaga bagi haba pembakaran metanol.

[3 marks/ 3 markah]

- (e) Predict the heat of combustion of ethanol.
Ramalkan haba pembakaran bagi etanol.

[3 marks/ 3 markah]

KERTAS 3: MERANCANG EKSPERIMEN

- 1 Diagram 1 shows two different alternative fuels found in petrol stations, methanol, CH_3OH and ethanol, $\text{C}_2\text{H}_5\text{OH}$.

Rajah 1 menunjukkan dua minyak alternatif yang berbeza dijumpai di stesen petrol iaitu, metanol, CH_3OH dan etanol, $\text{C}_2\text{H}_5\text{OH}$.



Diagram 1
Rajah 1

Based on information above, plan an experiment to compare the heat of combustion of methanol and ethanol.

Berdasarkan maklumat di atas, rancang satu eksperimen makmal untuk mengkaji haba pembakaran bagi metanol dan etanol.

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas

- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks/17 markah]

2 Table 2 shows a conversation between two students.

Jadual 2 menunjukkan perbualan di antara dua murid.

Kelly: My cup feels warm when I add in ethanoic acid into sodium hydroxide. <i>Cawan saya berasa panas apabila saya menambah asid etanoik ke dalam natrium hidroksida.</i> Naim: You are right! But it isn't as warm as when I added hydrochloric acid into sodium hydroxide in my cup. <i>Betul kata kamu! Tetapi ia tidak sepanas seperti apabila saya menambah asid hidroklorik ke dalam natrium hidroksida dalam cawan saya.</i>
--

Table 2
Jadual 2

Based on the conversation above, plan an experiment to compare the heat of neutralization between different types of acid with sodium hydroxide solution.

Berdasarkan maklumat di atas, rancang satu eksperimen untuk membandingkan haba peneutralan antara asid berlainan jenis dengan natrium hidroksida.

Your planning should include the following aspects:

Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks/17 markah]

3.

Experiment I : $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ $\Delta H = - 57.5 \text{ kJmol}^{-1}$

Experiment II : $\text{NaOH} + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$ $\Delta H = - 55 \text{ kJmol}^{-1}$

The value of the heat of neutralization for the reaction between sodium hydroxide solution and strong acid solution is higher than the value of the heat of neutralization for the reaction between sodium hydroxide solution and weak acid solution.

Nilai haba peneutralan bagi tindak balas antara larutan natrium hidroksida dengan larutan asid kuat lebih tinggi daripada haba peneutralan larutan natrium hidroksida dengan larutan asid lemah.

Based on the above statement, you are required to design an experiment to determine and compare the heat of neutralization between sodium hydroxide solution with a named strong acid solution and a weak acid solution.

Berdasarkan pernyataan di atas, anda dikehendaki merancang eksperimen untuk menentukan haba peneutralan di antara larutan natrium hidroksida dengan satu larutan asid kuat dan satu larutan asid lemah yang dinamakan.

Your planning should include the following aspects:

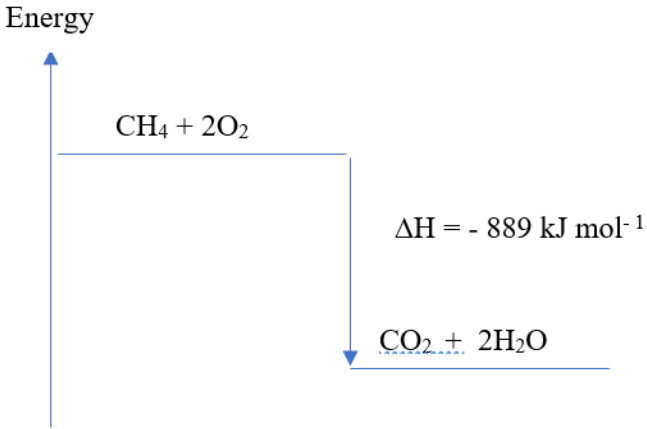
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

- (a) Problem statement
Pernyataan masalah
- (b) All the variables
Semua pemboleh ubah
- (c) Statement of hypothesis
Pernyataan hipotesis
- (d) List of materials and apparatus
Senarai bahan dan radas
- (e) Procedure for the experiment
Prosedur eksperimen
- (f) Tabulation of data
Penjadualan data

[17 marks/17 markah]

SKEMA KERTAS 2 : THERMOCHEMISTRY/ TERMOKIMIA**Section A**
Bahagian A

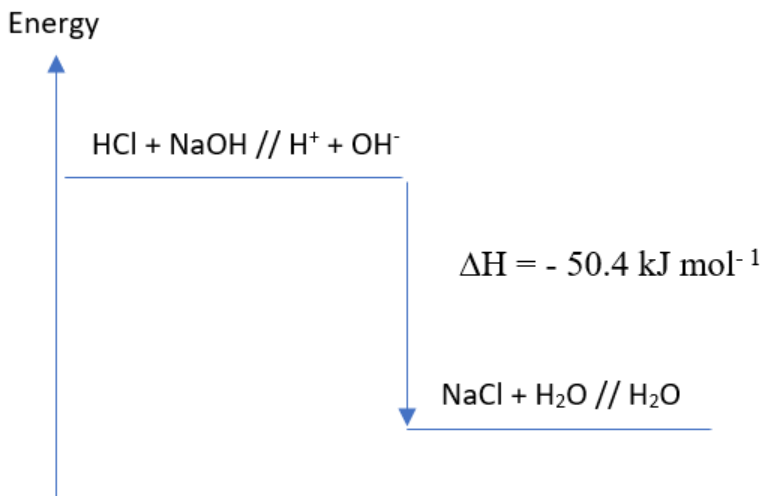
Questions			Rubrics	Marks
1	a)		[Able to state the meaning of heat of combustion correctly] Answer: Heat of combustion is the amount of heat energy released when 1 mole of propanol is burnt in excess oxygen. <i>Haba pembakaran adalah jumlah tenaga haba yang dibebaskan apabila 1 mol propanol terbakar dalam oksigen berlebihan.</i>	1
	b)		[Able to write the chemical equation of combustion of propanol correctly] 1. Correct formula of reactants and products <i>Formula bahan dan hasil tindak balas</i> 2. Balanced chemical equation <i>Persamaan kimia yang seimbang</i> Answer: $\text{C}_3\text{H}_7\text{OH} + 9/2\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$	1 1
	c)		[Able to explain why copper can be used correctly] Answer: Copper is a good heat conductor <i>Kuprum adalah konduktor haba yang baik</i>	1
	d) i)		[Able to calculate the mass of propanol burnt correctly] Answer: mass = 240.12 - 240.00 = 0.12 g	1
	ii)		[Able to calculate the number of moles of propanol burnt correctly] Answer: number of mole of propanol burnt = $\frac{0.12}{60} = 0.002$ moles	1

	iii)	[Able to calculate the heat released correctly] Answer: Heat released = $100 \times 4.2 \times 9.6 = 4032 \text{ J}$	1
	iv)	[Able to calculate the heat of combustion correctly] Answer: Heat of combustion, $\Delta H = \frac{4032}{0.002}$ $= 2\,016\,000 \text{ J mol}^{-1}$ $= 2016 \text{ kJ mol}^{-1}$	1
e)		[Able to draw the energy level diagram correctly] Answer: 1. Axis <i>Paksi</i> 2. Correct reactants, products and ΔH <i>Bahan, hasil tindak balas dan ΔH</i> 	1 1
TOTAL MARKS			10

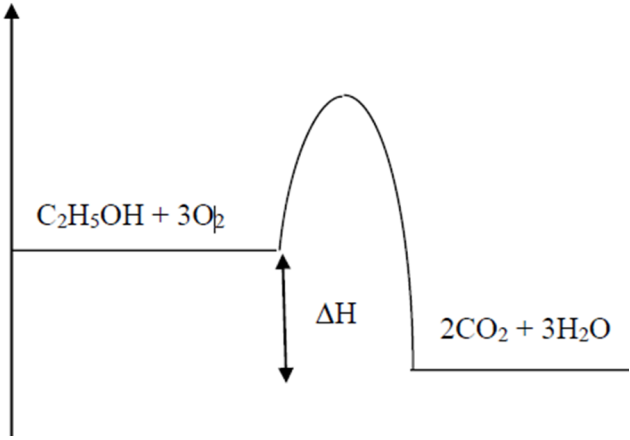
Questions		Rubrics	Marks
2	a)	[Able to state the meaning of heat of displacement correctly] Answer: Heat released when 1 mol of metal is displaced from its salt solution by a more electropositive metal.	1

		<i>Haba yang dibebaskan apabila 1 mol logam disesarkan daripada larutan garamnya oleh logam yang lebih elektropositif.</i>	
b)		[Able to state why polystyrene cup is used correctly] Answer: To reduce heat loss to the surrounding <i>Untuk mengurangkan kehilangan haba ke persekitaran</i>	1
c)		[Able to state 2 observations correctly] Answer: 1. Brown solid deposited <i>Pepejal perang terenal</i> 2. Blue colour solution turns to colourless <i>Larutan berwarna biru bertukar ke tidak berwarna</i>	1 1
d)	i)	[Able to calculate the heat released correctly] Answer: $H = 50 \times 4.2 \times 10^{\circ}\text{C} = 2100 \text{ J}$	1
	ii)	[Able to calculate correctly] 1. number of mole <i>nombor mol</i> 2. Heat of displacement with correct unit and negative sign <i>Haba penyesaran dengan unit tepat dan tanda negatif</i> Answer: $n = \frac{50 \times 0.2}{1000} // 0.01 \text{ moles}$ $\Delta H = - \frac{2100 \text{ J}}{0.01 \text{ mol}} // - 210\,000 \text{ J mol}^{-1} // - 210 \text{ kJ mol}^{-1}$	1 1+1
e)		[Able to suggest another metal that can displace Cu^{2+}] Sample Answer: Magnesium // Aluminium // Iron <i>Magnesium // Aluminium // Ferum</i>	1
f)		[Able to explain why zinc powder is added in excess] Answer: To ensure all copper (II) ions are displaced <i>Untuk memastikan semua ion kuprum (II) telah disesarkan</i>	1
TOTAL MARKS			10

Questions			Rubrics	Marks
3	a)		[Able to state the meaning of heat of neutralization correctly] Answer: Heat released when 1 mol H^+ ion react with 1 mol OH^- ion to produce 1 mol of water <i>Haba yang dibebaskan apabila 1 mol ion H^+ bertindak balas dengan ion OH^- untuk membentuk 1 mol air.</i>	1
	b)		[Able to suggest acid X and alkali Y correctly] Answer: Acid X :hydrochloric acid <i>Asid hidroklorik</i> Alkali Y : sodium hydroxide <i>Natrium hidroksida</i>	1 1
	c)		[Able to write the ionic equation of correctly] Answer: $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$	1
	d) i)		[Able to number of moles calculate correctly] Answer: $n = \frac{50 \times 1.0}{1000}$ // 0.05 moles	1
		ii)	[Able to calculate heat released correctly] $H = 100 \times 4.2 \times 6^\circ\text{C} = 2520 \text{ J}$	1
		iii)	[Able to calculate heat of neutralization correctly] $\Delta H = - \frac{2520 \text{ J}}{0.05 \text{ mol}}$ // - 50 400 J mol^{-1} // - 50.4 kJ mol^{-1}	1
	e		[Able to draw the energy level diagram correctly] Answer: 1. Axis	1

		<i>Paksi</i> 2. Correct reactants, products and ΔH <i>Bahan, hasil tindak balas dan ΔH</i> Answer: 	1
f		[Able to predict correctly] Less//smaller than 50.4 kJ mol^{-1} <i>Kurang // Lebih kecil daripada 50.4 kJ mol^{-1}</i>	1
TOTAL MARKS			10

Questions			Rubrics	Marks
4	a		Reaction that gives out / released heat to the surroundings. <i>Tindak balas kimia yang membebaskan haba ke persekitaran.</i>	2

b			1
c	(i)	Heat of combustion of propane is higher than methane <i>Haba pembakaran propana lebih tinggi daripada metana.</i>	1
	(ii)	• The number of carbon / hydrogen atoms per molecule propane is higher • More carbon dioxide / water produced when propane is burnt • More heat energy released <i>• Bilangan atom karbon per molekul dalam propana lebih tinggi/ banyak</i> <i>• Lebih banyak karbon dioksida / air dihasilkan apabila propana dibakar</i> <i>• Lebih banyak tenaga haba dibebaskan</i>	1
d		Molar mass of propanol, $C_3H_7OH = 60 \text{ g mol}^{-1}$ 60 g of C_3H_7OH burnt released 2016 kJ // 1 g C_3H_7OH burnt released $1 \times 2016 \text{ kJ}$ 60 $= 33.6 \text{ kJ g}^{-1}$ (correct answer with correct unit)	2

	e		● place the cold packs on his swollen knee ● to absorb heat from his swollen knee ● constrict blood vessels and slow down blood flow / reduce the formation of fluid in the affected area. ● Menggunakan/meletakkan pek sejuk di tempat bengkak ● Untuk menyerap haba daripada bengkak ● Mengecilkan salur darah dan memperlahankan peredaran darah /mengurangkan pembentukan cecair pada kawasan yang membengkak.	1
TOTAL MARKS				8

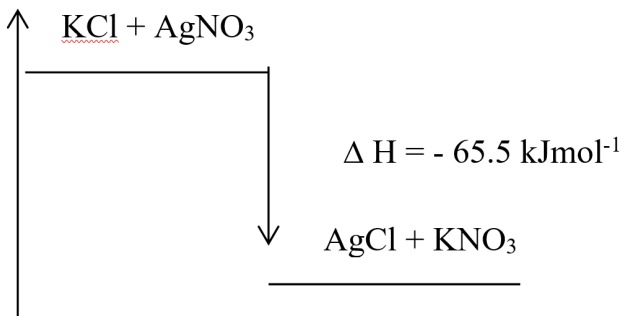
Questions			Rubrics	Marks
2	a		Heat change / released when 1 mol of silver is displaced from silver nitrate solution by copper <i>Perubahan/ Pembebasan haba apabila 1 mol argentum disesarkan daripada larutan argentum nitrat oleh kuprum</i>	1
	b		The colourless solution turns blue // a grey solid is formed // copper powder dissolves into the solution <i>Larutan jernih bertukar biru // pepejal kelabu terbentuk // serbuk kuprum larut ke dalam larutan</i>	1

	c		● Add ammonia solution until in excess ● Blue precipitate formed ● Blue precipitate dissolves in excess ammonia solution to form dark blue solution ● <i>Tambah larutan ammonia secara berlebihan</i> ● <i>Mendakan biru terbentuk</i> ● <i>Mendakan biru larut dalam larutan ammonia berlebihan membentuk larutan biru gelap</i>	2
	d	i	Mol of $\text{Ag}^+ = 50 \times 1.0 / 1000 = 0.05 \text{ mol}$	1
		ii	Heat released = $105000 \times 0.05 \text{ J} / 5250 \text{ J}$ (with unit)	1
		iii	Temperature change = $5250 / (50 \times 4.2) = 25^\circ\text{C}$ (with unit)	1
	e		1. $12.5^\circ\text{C}/\text{half}$ 2. concentration of Ag^+ is half <i>Kepekatan ion Ag^+ separuh</i> 3. Number of mol of Ag^+ per unit volume is half <i>Bilangan mol Ag^+ per unit isipadu adalah separuh</i>	2
TOTAL MARKS				9

Section B
Bahagian B

Questions			Rubrics	Marks
1	a)	i)	[Able to state 2 observations correctly] Answer: 1. Reading of thermometer increased <i>Bacaan termometer meningkat</i> 2. White precipitate formed <i>Mendakan putih terbentuk</i>	1 1
		ii)	[Able to write 2 statements that can be concluded correctly] Answer: 1. The reaction is an exothermic reaction // The reaction releases heat energy <i>Tindak balas ini adalah tindak balas eksotermik //</i> <i>Tindak balas ini membebaskan tenaga haba</i> 2. The total energy content of reactants is higher than the total energy content of products <i>Jumlah kandungan tenaga bagi bahan tindak balas adalah lebih tinggi daripada jumlah kandungan tenaga bagi hasil tindak balas.</i>	1 1
		iii)	[Able to write chemical equation correctly and calculate the heat of precipitation with correct unit and negative sign] 1. Correct formula of reactants and products <i>Formula bahan dan hasil tindak balas</i> 2. Balanced chemical equation <i>Persamaan kimia yang seimbang</i> Answer: $\text{Pb}(\text{NO}_3)_2 + \text{CuSO}_4 \rightarrow \text{PbSO}_4 + \text{Cu}(\text{NO}_3)_2$ $\text{H} = 100 \times 4.2 \times 7$ $= 2940 \text{ J}$	1 1 1

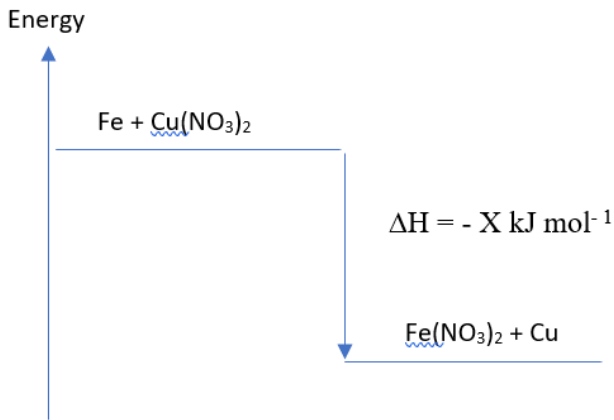
		$n = \frac{50 \times 0.2}{1000} = 0.01 \text{ moles}$ $\Delta H = \frac{2940}{0.01 \text{ mol}} = 294\,000 \text{ J mol}^{-1}$ $\Delta H = -294\,000 \text{ J mol}^{-1} = -294 \text{ kJ mol}^{-1}$	1 1 1 1
b)	i)	[Able to suggest an example of Alkali A, Alkali B and Acid C correctly and explain the difference in the value of the heat released in Experiment I and II] Answer: Alkali A: Sodium hydroxide <i>Natrium hidroksida</i> Alkali B : Ammonia <i>Ammonia</i> Acid C: Ethanoic acid <i>Asid etanoik</i> NaOH is a strong alkali / dissociates completely in water whereas ammonia is a weak alkali that dissociates partially in water. Some of the heat released is used to dissociate ammonia completely. <i>NaOH ialah alkali kuat / bercerai lengkap dalam air manakala ammonia ialah alkali lemah / bercerai separa dalam air. Sebahagian haba yang dibebaskan digunakan untuk penceraian ammonia dengan lengkap.</i>	1 1 1 1 1 1 1 1
	ii)	[Able to explain why the heat of neutralisation for the reaction is - 57 kJ mol⁻¹ but not - 114 kJ mol⁻¹] Answer: Heat of neutralisation is heat released when 1 mol of water is formed. In the reaction, 2 mol of water is formed; <i>Haba peneutralan adalah haba yang dibebaskan apabila 1 mol air terbentuk.</i> <i>Di dalam tindak balas, 2 mol air yang terbentuk;</i> $\Delta H = 114/2 = 57 \text{ kJ mol}^{-1}$	1 1
TOTAL MARKS			20

Questions			Rubrics	Marks
2	a	i	Heat of precipitation is heat change when 1 mole of silver chloride is formed from its ions in aqueous solution. <i>Haba yang dibebaskan apabila 1 mol mendakan argentum klorida terbentuk</i>	1
		ii	Tenaga  1. Diagram shows energy level diagram for exothermic reaction. 2. Label energy and draw correct level of energy of reactants and products 3. Write correct equation of reactant and product, and $\Delta H = -65.5 \text{ kJ mol}^{-1}$ 1. <i>gambar rajah yang menunjukkan aras tenaga bagi tindak balas eksotermik</i> 2. <i>label – Tenaga, persamaan kimia atau persamaan ion yang betul, $\Delta H = -65.5 \text{ kJ mol}^{-3}$</i>	2

	iii	1. Pengiraan bil mol AgCl terbentuk 2 2. Perkaitan antara ΔH dan haba yang dibebaskan 1 3. Pengiraan perubahan suhu serta unit 2 Contoh Jawapan : 1. Bil. mol AgCl = Bil mol AgNO₃ // KCl $= MV / 1000$ $= \frac{0.5 \times 20}{1000} // 0.01 \text{ mol}$ 2. 1 mol AgCl membebaskan 65500 J 0.01 mol AgCl membebaskan = $0.01 \times 65500 = 655 \text{ J}$ 3. Haba yang dibebaskan = $mc\theta$ $655 \text{ J} = (20+20) \times 4.2 \times X$ $X = \frac{655}{40 \times 4.2} // 3.89 \text{ }^{\circ}\text{C}$ 4. Nilai perubahan suhu ialah sama // 3.89 $^{\circ}\text{C}$ 1 5. Bil mol mendakan AgCl tetap sama 1	
	b	1. The heat of neutralization of Experiment I is higher than Experiment II. 1 2. HCl is strong acid while ethanoic acid is weak acid// //HCl ionises completely in water to produce high concentration of H⁺ ion//CH₃COOH ionizes partially in water to produce low concentration of H⁺ ion 1 3. In Experiment II, some of heat given out during neutralization reaction is used to dissociate/ionise the ethanoic acid molecules completely in water//part of heat that is released is used to break the bonds in the molecules of ethanoic acid that has not been ionized 1 4. The heat of neutralization of Experiment I is same Experiment III. 1 5. H₂SO₄ is a diprotic acid// HCl is a monoprotic acid. 1	

		6. H_2SO_4 produced two moles of hydrogen ion/H^+ when one mole of the acid ionised in water // HCl produced one mole of hydrogen ion/ H^+ when one mole of the acid ionised in water. 7. When one mole of OH^- reacts with two moles of H^+ will produce one mole of water, the heat of neutralisation is still the same as Experiment I because the definition of heat of neutralisation is based on the formation of one mole of water. 1. <i>Haba peneutralan dalam eksperimen I lebih tinggi daripada eksperimen II.</i> 2. <i>HCl adalah asid kuat manakala asid etanoik adalah asid lemah // HCl mengion sepenuhnya di dalam air manakala asid etanoik mengion separa di dalam air.</i> 3. <i>Didalam eksperimen II, sebahagian haba terbebas digunakan untuk mengionkan molekul asid etanoik di dalam air.</i> 4. <i>Haba peneutralan untuk eksperimen I dan III adalah sama.</i> 5. <i>HCl dan H_2SO_4 kedua-duanya adalah asid kuat; HCl adalah asid monoprotik manakala H_2SO_4 adalah asid diprotik.</i> 6. <i>H_2SO_4 menghasilkan 2 mol kepekatan ion hidrogen/ HCl menghasilkan 1 mol kepekatan ion hidrogen</i> 7. <i>Apabila 1 mol ion OH^- bertindak balas dengan 2 mol ion hidrogen, ia masih menghasilkan 1 mol air. Jadi haba peneutralan masih sama iaitu menghasilkan 1 mol air.</i>	1 1
c		- place the cold packs on his swollen knee -to absorbs heat from his swollen knee - constrict blood vessels and slow down blood flow / reduce the formation of fluid in the affected area. - <i>Letakkan ais/ pek sejuk pada kawasan yang bengkak</i> - <i>Bagi menyerap haba dari kawasan yang bengkak</i> - <i>Menghalang salur darah membengkak dan memperlahankan aliran darah/ mengurangkan pembentukan cecair pada kawasan yang membengkak.</i>	1 1 1
TOTAL MARKS			20

Section C
Bahagian C

Questions			Rubrics	Marks
9	a)		[Able to identify the type of reaction and draw an energy level diagram for the reaction] Answer: - Exothermic reaction - Label energy and draw correct level of energy of reactants and products - Write correct equation of reactant and product, and $\Delta H = -X \text{ kJ mol}^{-1}$ <i>Tindak balas eksotermik</i> <i>Label tenaga dan lukis aras tenaga bahan dan hasil tindak balas dengan betul</i> <i>Tulis persamaan bahan dan hasil tindak balas dengan betul, dan $\Delta H = -X \text{ kJ mol}^{-1}$</i> 	1 1 1
	b)	i)	[Able to Calculate the temperature change in experiment I correctly] Answer: $n = \frac{100 \times 0.1}{1000}$ // 0.01 moles	1

		Heat change = 0.01 x 352 000 = 3520 J $\theta = \frac{3520}{100 \times 4.2}$ = 8.4 °C	1										
	ii)	[Able to compare the value of heat in Experiment II and III correctly] Answer: <table><tr><th>Experiment II</th><th>Experiment III</th></tr><tr><td>Exothermic reaction <i>Tindak balas eksotermik</i></td><td>Endothermic reaction <i>Tindak balas endotermik</i></td></tr><tr><td>Heat is released to surroundings <i>Haba dibebaskan ke persekitaran</i></td><td>Heat is absorbed from surroundings <i>Haba diserap dari persekitaran</i></td></tr><tr><td>Temperature of surroundings increase <i>Suhu persekitaran meningkat</i></td><td>Temperature of surrounding decrease <i>Suhu persekitaran menurun</i></td></tr><tr><td>Total energy content of reactants is higher than total energy content of products <i>Jumlah kandungan tenaga bahan tindak balas lebih tinggi daripada jumlah kandungan tenaga hasil tindak balas</i></td><td>Total energy content of products is higher than total energy content of reactants <i>Jumlah kandungan tenaga hasil tindak balas lebih tinggi daripada jumlah kandungan tenaga bahan tindak balas</i></td></tr></table> *any three	Experiment II	Experiment III	Exothermic reaction <i>Tindak balas eksotermik</i>	Endothermic reaction <i>Tindak balas endotermik</i>	Heat is released to surroundings <i>Haba dibebaskan ke persekitaran</i>	Heat is absorbed from surroundings <i>Haba diserap dari persekitaran</i>	Temperature of surroundings increase <i>Suhu persekitaran meningkat</i>	Temperature of surrounding decrease <i>Suhu persekitaran menurun</i>	Total energy content of reactants is higher than total energy content of products <i>Jumlah kandungan tenaga bahan tindak balas lebih tinggi daripada jumlah kandungan tenaga hasil tindak balas</i>	Total energy content of products is higher than total energy content of reactants <i>Jumlah kandungan tenaga hasil tindak balas lebih tinggi daripada jumlah kandungan tenaga bahan tindak balas</i>	1
Experiment II	Experiment III												
Exothermic reaction <i>Tindak balas eksotermik</i>	Endothermic reaction <i>Tindak balas endotermik</i>												
Heat is released to surroundings <i>Haba dibebaskan ke persekitaran</i>	Heat is absorbed from surroundings <i>Haba diserap dari persekitaran</i>												
Temperature of surroundings increase <i>Suhu persekitaran meningkat</i>	Temperature of surrounding decrease <i>Suhu persekitaran menurun</i>												
Total energy content of reactants is higher than total energy content of products <i>Jumlah kandungan tenaga bahan tindak balas lebih tinggi daripada jumlah kandungan tenaga hasil tindak balas</i>	Total energy content of products is higher than total energy content of reactants <i>Jumlah kandungan tenaga hasil tindak balas lebih tinggi daripada jumlah kandungan tenaga bahan tindak balas</i>												
	iii)	[Able to describe an experiment to determine the heat of displacement of copper by magnesium] 1. Suggested material: Copper (II) sulphate, CuSO₄ // Copper (II) nitrate, Cu(NO₃)₂ <i>Bahan dicadangkan: Kuprum (II) sulfat, CuSO₄ // Kuprum (II) nitrat, Cu(NO₃)₂</i> 2. Measure 100 cm³ of 0.1 mol dm⁻³ of copper (II) sulphate and pour into a polystyrene cup. <i>Sukat 100 cm³ 0.1 mol dm⁻³ kuprum (II) sulfat dan tuangkan ke dalam cawan polistirena.</i> 3. Measure and record the initial temperature of the	1										

		solution. <i>Sukat dan rekod suhu awal larutan.</i> 4. Add 2 spatulas of magnesium into the same polystyrene cup. <i>Tambahkan 2 spatula magnesium ke dalam cawan polistirena yang sama.</i> 5. Stir the mixture. <i>Kacau campuran itu.</i> 6. Record the highest temperature. <i>Rekod suhu tertinggi.</i> [Able to draw correctly] 7. Functional diagram <i>Rajah berfungsi</i> 8. Labelled <i>Dilabel</i> [Able to state two precautions correctly] Sample answer: 1. The initial temperature is taken after a few minutes. <i>Suhu awal diambil selepas beberapa minit.</i> 2. The highest temperature must be the highest temperature of the solution. <i>Suhu tertinggi mestilah suhu tertinggi larutan.</i> 3. Metal powders are used instead of metal granules to reduce heat loss to surroundings. <i>Serbuk logam digunakan dan bukan ketulan logam untuk mengurangkan kehilangan haba ke persekitaran.</i> 4. Use a polystyrene cup to reduce heat loss. <i>Gunakan cawan polistirena untuk mengurangkan kehilangan haba.</i> *Any two	1 1 1 1 1 1 1 1 1
TOTAL MARKS			20

Questions	Rubrics	Marks
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2	a	i	P1. Number of mole of butanol = // 0.05 mol P2. Heat released = $mc\theta$ $= 500 \times 4.2 \times 60 // 126000 \text{ J} // 126 \text{ kJ}$ P3. 0.05 mol of butanol burnt completely to release 126000 J 1 mol of butanol released P4. [value is correct] 2520 kJ P5. [Negative sign with correct unit] $\Delta H = - 2520 \text{ kJ mol}^{-1}$ ecf: P3 & P5	5
		ii	P1. Some heat is lost to the surrounding//heat is absorbed by the apparatus/ tripod stand/ windshield/copper can P2. Butanol undergoes incomplete combustion // does not undergo complete combustion <i>P1 : Haba terbebas ke persekitaran// haba diserap oleh alat radas/ tungku kaki tiga/pengadang angin/ tin kuprum</i> <i>P2 : Butanol mengalami pembakaran tidak lengkap</i>	2
		iii	P1. Butanol//Propanol P2. Correct structural formula of any isomers P3. Name based on isomer in P2 Sample answer :	3

		<table><tr><th>Structural formula</th><th>Name</th></tr><tr><td>$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$</td><td>Propan-1-ol</td></tr><tr><td>$\begin{array}{c} & \text{H} & \\ & & \\ \text{H} & \text{O} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$</td><td>Propan-2-ol</td></tr><tr><td>$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$</td><td>Butan-1-ol</td></tr><tr><td>$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & & \\ \text{H} & \text{OH} & \text{H} & \text{H} \end{array}$</td><td>Butan-2-ol</td></tr><tr><td>$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & \\ \text{H} & \text{CH}_3 & \text{H} \end{array}$</td><td>2-methylpropan-1-ol</td></tr><tr><td>$\begin{array}{c} & \text{H} & \text{CH}_3 & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{OH} & \text{H} \end{array}$</td><td>2-methylpropan-2-ol</td></tr></table>	Structural formula	Name	$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$	Propan-1-ol	$\begin{array}{c} & \text{H} & \\ & & \\ \text{H} & \text{O} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$	Propan-2-ol	$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$	Butan-1-ol	$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & & \\ \text{H} & \text{OH} & \text{H} & \text{H} \end{array}$	Butan-2-ol	$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & \\ \text{H} & \text{CH}_3 & \text{H} \end{array}$	2-methylpropan-1-ol	$\begin{array}{c} & \text{H} & \text{CH}_3 & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{OH} & \text{H} \end{array}$	2-methylpropan-2-ol	
Structural formula	Name																
$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$	Propan-1-ol																
$\begin{array}{c} & \text{H} & \\ & & \\ \text{H} & \text{O} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$	Propan-2-ol																
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$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & & \\ \text{H} & \text{OH} & \text{H} & \text{H} \end{array}$	Butan-2-ol																
$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & \\ \text{H} & \text{CH}_3 & \text{H} \end{array}$	2-methylpropan-1-ol																
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b	P1. Named metal V P2. Measure [25.0 – 50.0] cm³ of [0.1-1.0]mol dm⁻³ copper(II) sulphate solution P3. Pour the solution into a plastic/ polystyrene cup P4. Record the initial temperature of the solution P5. Add quickly excess/ 1 spatula of metal V powder into copper(II) sulphate solution P6. Stir the mixture P7. Record the highest/maximum temperature reached P8. Data: Initial temperature of copper (II) sulphate solution = T1 °C Highest temperature = T2 °C P9. Heat given out = 25 x 4.2 (T2 – T1) = X J P10. Number of mole of copper(II) sulphate = = Y mol P11. ΔH = - X/Y = - Z kJmol⁻¹	10															

TOTAL MARKS				20

SKEMA KERTAS 3 : Thermochemistry / Termokimia

SOALAN STRUKTUR

SOALAN 1

Questions		Rubrics	Marks														
1	a	<i>[Able to record all the temperature readings accurately with one decimal place]</i> <i>Answer:</i> <table border="1"> <thead> <tr> <th rowspan="2">Set</th><th colspan="2">Initial temperature / °C</th><th rowspan="2">Highest Temperature/ °C</th></tr> <tr> <th>Acid</th><th>Alkali</th></tr> </thead> <tbody> <tr> <td>I</td><td>27.0</td><td>27.0</td><td>40.0</td></tr> <tr> <td>II</td><td>27.0</td><td>27.0</td><td>39.0</td></tr> </tbody> </table>	Set	Initial temperature / °C		Highest Temperature/ °C	Acid	Alkali	I	27.0	27.0	40.0	II	27.0	27.0	39.0	3
Set	Initial temperature / °C			Highest Temperature/ °C													
	Acid	Alkali															
I	27.0	27.0	40.0														
II	27.0	27.0	39.0														
		<i>[Able to record any 4 temperature reading accurately //</i> <i>All readings correctly but with two decimal places/without decimal place]</i>	2														
		<i>[Able to record any 2 temperature reading correctly]</i>	1														
		<i>[No response given or wrong response]</i>	0														

1	b	<i>[Able to calculate the heat release and heat of neutralization for Set I and Set II correctly and completely]</i> <table><tr><td></td><td>Set I</td><td>Set II</td></tr><tr><td>Heat release = mcΘ</td><td>(100) x 4.2 x 13 = 5460 J</td><td>(100) x 4.2 x 12 = 5040 J</td></tr><tr><td>Heat of neutralization/ kJmol⁻¹</td><td>5460 / 0.1 = 54.6</td><td>5040 / 0.1 = 50.4</td></tr></table>		Set I	Set II	Heat release = mcΘ	(100) x 4.2 x 13 = 5460 J	(100) x 4.2 x 12 = 5040 J	Heat of neutralization/ kJmol ⁻¹	5460 / 0.1 = 54.6	5040 / 0.1 = 50.4	3
	Set I	Set II										
Heat release = mcΘ	(100) x 4.2 x 13 = 5460 J	(100) x 4.2 x 12 = 5040 J										
Heat of neutralization/ kJmol ⁻¹	5460 / 0.1 = 54.6	5040 / 0.1 = 50.4										
		<i>[Able to calculate the heat release AND heat of neutralization for set I OR set II correctly]</i>	2									
		<i>[Able to calculate the heat release OR heat of neutralization for set I OR set II correctly]</i>	1									
		<i>[No response given or wrong response]</i>	0									
1	c	<i>[Able to state all the variables correctly]</i> Sample answer: Manipulated variable : hydrochloric acid and ethanoic acid // strength of acids//strong and weak acid Responding variable : heat of neutralization // temperature increase Constant variable : volume and concentration of acid // volume and concentration of sodium hydroxide solution // polystyrene cup	3									
		<i>[Able to state any two variables correctly]</i>	2									
		<i>[Able to state any one variable correctly]</i>	1									
		<i>[No response given or wrong response]</i>	0									

1	d	<i>[Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly]</i> <i>Sample answer:</i> Reaction of hydrochloric acid and sodium hydroxide solution produce higher heat of neutralization than reaction of ethanoic acid and sodium hydroxide solution // Reaction of hydrochloric acid and sodium hydroxide solution produce higher heat of neutralization while reaction of ethanoic acid and sodium hydroxide solution produce lower heat of neutralization a: RV :Temperature increase	3
		<i>[Able to state the relationship between the manipulated variable and the responding variable less correctly]</i> <i>Sample answer:</i> Heat of neutralization of hydrochloric acid and sodium hydroxide solution is higher than heat of neutralization of ethanoic acid and sodium hydroxide solution // Reaction of hydrochloric acid and sodium hydroxide solution produce higher heat of neutralization // Reaction of ethanoic acid and sodium hydroxide solution produce lower heat of neutralization	2
		<i>[Able to state the idea of hypothesis]</i> <i>Sample answer:</i> Reaction between hydrochloric acid and sodium hydroxide solution produce more heat	1
		<i>[No response given or wrong response]</i>	0

1	e	<i>[Able to state the correct operational definition of heat of neutralization based on the following aspects:</i> <i>(i) What should be done</i> <i>(ii) What should be observed]</i> <i>Sample answer:</i> The heat released that cause temperature to rise when 1 mole of water formed// Temperature rises when 1 mole of water is formed due to the heat released	3
		<i>[Able to give the operational definition almost accurately]</i> <i>Sample answer:</i> The heat released that cause temperature to rise // Acid react with alkali released heat	2
		<i>[Able to state an idea of operational definition]</i> <i>Sample answer:</i> Heat released // temperature rise	1
		<i>[No response given or wrong response]</i>	0
1	f	<i>[Able to state the relationship between manipulated variable and responding variable correctly]</i> <i>Sample answer:</i> Reaction of hydrochloric acid/strong acid with sodium hydroxide solution produce higher heat of neutralization AND reaction of ethanoic acid/weak acid with sodium hydroxide solution produce lower heat of neutralization	3

		<i>[Able to state the relationship between manipulated variable and responding variable but in the opposite direction]</i> <i>Sample answer:</i> Reaction of hydrochloric acid/strong acid with sodium hydroxide solution produce higher heat of neutralization // Reaction of ethanoic acid/weak acid with sodium hydroxide solution produce lower heat of neutralization// Hydrochloric acid produce higher heat of neutralization AND ethanoic acid produce lower heat of neutralization	2
		<i>[Able to state an idea of the hypothesis]</i> <i>Sample answer:</i> Different acid produce different heat // Type of acid affect the heat of neutralization	1
		<i>[No response given or wrong response]</i>	0
		TOTAL MARKS	18

SOALAN 2

Questions	Rubrics	Marks

2	a	<i>[Able to record initial temperature, highest temperature and temperature change with one decimal place dan unit correctly]</i> <i>[Dapat mencatat suhu awal, suhu tertinggi dan perubahan suhu dengan satu titik perpuluhan dan berunit dengan betul]</i> <i>Answer / Jawapan:</i> Eksperimen I Initial temperature : 30.0 °C, 30.0 °C Highest temperature : 34.0 °C <i>Suhu awal : 30.0 °C, 30.0 °C</i> <i>Suhu tertinggi : 34.0 °C</i> Eksperimen II Initial temperature : 30.0 °C, 30.0 °C Highest temperature : 39.0 °C <i>Suhu awal : 30.0 °C, 30.0 °C</i> <i>Suhu tertinggi : 39.0 °C</i>	3
		<i>[Able to record all temperature reading without decimal place or unit correctly //</i> <i>Able to record at least five temperature reading correctly]</i> <i>[Dapat mencatat semua bacaan tanpa titik perpuluhan atau unit dengan betul //</i> <i>Dapat mencatat mana-mana lima bacaan suhu dengan betul]</i>	2
		<i>[Able to record at least three temperature reading]</i> <i>[Dapat mencatat mana-mana tiga bacaan suhu]</i>	1
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0

2	b	<i>[Able to state all variables and the action to be taken correctly]</i> <i>[Dapat menyatakan semua pemboleh ubah dan tindakan yang perlu diambil dengan betul]</i> Sample answer: <table><tr><td>Manipulated variable: <i>Pembolehubah dimanipulasikan:</i> Concentration of solution <i>Kepekatan larutan</i></td><td>Method to manipulate the variable: <i>Kaedah untuk memanipulasikan pembolehubah:</i> Replace concentration 0.5 mol dm⁻³ with 1.0 mol dm⁻³ solution <i>Menggantikan larutan kepekatan 0.5 mol dm⁻³ dengan 1.0 mol dm⁻³</i></td></tr><tr><td>Responding variable: <i>Pembolehubah bergerak balas:</i> Temperature change // Heat released <i>Perubahan suhu //</i> <i>Haba dibebaskan</i></td><td>How the variable is responding: <i>Bagaimana pembolehubah itu bergerakbalas:</i> Temperature change increase when the concentration of solution increase.// Heat released increase. <i>Perubahan suhu bertambah apabila kepekatan larutan bertambah //</i> <i>Haba dibebaskan bertambah</i></td></tr><tr><td>Fixed variable: <i>Pembolehubah dimalarkan:</i> Type of container // Surrounding temperature <i>Jenis bekas //</i> <i>Suhu persekitaran</i></td><td>Method to maintain the fixed variable: <i>Kaedah menetapkan pembolehubah:</i> Using same type of container // Using same temperature Gunakan jenis bekas yang sama // Gunakan suhu yang sama</td></tr></table>	Manipulated variable: <i>Pembolehubah dimanipulasikan:</i> Concentration of solution <i>Kepekatan larutan</i>	Method to manipulate the variable: <i>Kaedah untuk memanipulasikan pembolehubah:</i> Replace concentration 0.5 mol dm ⁻³ with 1.0 mol dm ⁻³ solution <i>Menggantikan larutan kepekatan 0.5 mol dm⁻³ dengan 1.0 mol dm⁻³</i>	Responding variable: <i>Pembolehubah bergerak balas:</i> Temperature change // Heat released <i>Perubahan suhu //</i> <i>Haba dibebaskan</i>	How the variable is responding: <i>Bagaimana pembolehubah itu bergerakbalas:</i> Temperature change increase when the concentration of solution increase.// Heat released increase. <i>Perubahan suhu bertambah apabila kepekatan larutan bertambah //</i> <i>Haba dibebaskan bertambah</i>	Fixed variable: <i>Pembolehubah dimalarkan:</i> Type of container // Surrounding temperature <i>Jenis bekas //</i> <i>Suhu persekitaran</i>	Method to maintain the fixed variable: <i>Kaedah menetapkan pembolehubah:</i> Using same type of container // Using same temperature Gunakan jenis bekas yang sama // Gunakan suhu yang sama	6
Manipulated variable: <i>Pembolehubah dimanipulasikan:</i> Concentration of solution <i>Kepekatan larutan</i>	Method to manipulate the variable: <i>Kaedah untuk memanipulasikan pembolehubah:</i> Replace concentration 0.5 mol dm ⁻³ with 1.0 mol dm ⁻³ solution <i>Menggantikan larutan kepekatan 0.5 mol dm⁻³ dengan 1.0 mol dm⁻³</i>								
Responding variable: <i>Pembolehubah bergerak balas:</i> Temperature change // Heat released <i>Perubahan suhu //</i> <i>Haba dibebaskan</i>	How the variable is responding: <i>Bagaimana pembolehubah itu bergerakbalas:</i> Temperature change increase when the concentration of solution increase.// Heat released increase. <i>Perubahan suhu bertambah apabila kepekatan larutan bertambah //</i> <i>Haba dibebaskan bertambah</i>								
Fixed variable: <i>Pembolehubah dimalarkan:</i> Type of container // Surrounding temperature <i>Jenis bekas //</i> <i>Suhu persekitaran</i>	Method to maintain the fixed variable: <i>Kaedah menetapkan pembolehubah:</i> Using same type of container // Using same temperature Gunakan jenis bekas yang sama // Gunakan suhu yang sama								
		<i>[Able to state all variables and at least two action to be taken correctly]</i> <i>[Dapat menyatakan semua pemboleh ubah dan sekurang-kurangnya dua tindakan yang perlu diambil yang sepadan dengan betul]</i>	5						

		<i>[Able to state at least two variables and at least two action to be taken correctly]</i> <i>[Dapat menyatakan sekurang-kurangnya dua pemboleh ubah dan sekurang-kurangnya dua tindakan yang perlu diambil yang sepadan dengan betul]</i>	4
		<i>[Able to state at least two variables and at least one action to be taken correctly]</i> <i>[Dapat menyatakan sekurang-kurangnya dua pemboleh ubah dan sekurang-kurangnya satu tindakan yang perlu diambil yang sepadan dengan betul]</i>	3
		<i>[Able to state at least one variables and at least one action to be taken correctly]</i> <i>[Dapat menyatakan sekurang-kurangnya satu pemboleh ubah dan sekurang-kurangnya satu tindakan yang perlu diambil yang sepadan dengan betul]</i>	2
		<i>[Able to state at least one variables correctly]</i> <i>[Dapat menyatakan sekurang-kurangnya satu pemboleh ubah dengan betul]</i>	1
2	c	<i>[Able to state the relationship between manipulated variable and responding variable with direction correctly]</i> <i>[Dapat menyatakan hubungan di antara pemboleh ubah dimanipulasi dengan pemboleh ubah bergerak balas dengan arah dengan betul]</i> <i>Sample answer / Contoh jawapan :</i> When the higher concentration of lead(II) nitrat solution with sodium sulphate solution, the higher (heat released) / (temperature change) <i>Apabila semakin tinggi kepekatan larutan plumbum(II) nitrat dengan natrium sulfat semakin tinggi (haba dibebaskan) / (perubahan suhu) .</i>	3

		<i>[Able to state the relationship between manipulated variable dan responding variable without direction]</i> <i>[Dapat menyatakan hubungan di antara pemboleh ubah dimanipulasi dengan pemboleh ubah bergerak balas tanpa arah]</i> <i>Sample answer :</i> Concentration of solution affect (heat released) / temperature change) (heat released) / (temperature change) increases / higher / lower / same when concentration of lead (II) nitrate solution with sodium sulphate solution increases. <i>Kepekatan larutan mempengaruhi (haba dibebaskan) / (perubahan suhu)</i> <i>(haba dibebaskan) / (perubahan suhu) meningkat / (lebih tinggi) / (lebih rendah) / (sama) apabila kepekatan larutan plumbum(II) nitrat dengan natrium sulfat meningkat</i>	2				
		<i>[Able to state the idea of hypothesis]</i> <i>[Dapat menyatakan idea bagi hipotesis]</i> <i>Sample answer :</i> (heat release) / (temperature change) differ <i>(haba dibebaskan) / (perubahan suhu) berbeza</i>	1				
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0				
2	d	<i>[Able to state all observation and all corresponding inference correctly]</i> <i>[Dapat menyatakan tiga pemerhatian dan tiga inferens yang sepadan dengan betul]</i> <i>Sample answer:</i> <table><tr><td>Observation <i>Pemerhatian</i></td><td>Inference <i>Inferens</i></td></tr><tr><td>Cup become hot <i>Cawan menjadi panas</i></td><td>Heat released // Exothermic reaction <i>Haba dibebas //</i> <i>Tindak balas eksotermik</i></td></tr></table>	Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>	Cup become hot <i>Cawan menjadi panas</i>	Heat released // Exothermic reaction <i>Haba dibebas //</i> <i>Tindak balas eksotermik</i>	6
Observation <i>Pemerhatian</i>	Inference <i>Inferens</i>						
Cup become hot <i>Cawan menjadi panas</i>	Heat released // Exothermic reaction <i>Haba dibebas //</i> <i>Tindak balas eksotermik</i>						

		<table><tr><td>White precipitation <i>Mendakan putih</i></td><td>Lead(II sulphate solution formed // Insoluble salt formed <i>Plumbum sulfat terhasil // garam tak larut terhasil</i></td></tr><tr><td>Colourless solution <i>Larutan tidak berwarna</i></td><td>Sodium nitrate solution formed <i>Larutan natrium nitrat terbentuk</i></td></tr></table>	White precipitation <i>Mendakan putih</i>	Lead(II sulphate solution formed // Insoluble salt formed <i>Plumbum sulfat terhasil // garam tak larut terhasil</i>	Colourless solution <i>Larutan tidak berwarna</i>	Sodium nitrate solution formed <i>Larutan natrium nitrat terbentuk</i>	
White precipitation <i>Mendakan putih</i>	Lead(II sulphate solution formed // Insoluble salt formed <i>Plumbum sulfat terhasil // garam tak larut terhasil</i>						
Colourless solution <i>Larutan tidak berwarna</i>	Sodium nitrate solution formed <i>Larutan natrium nitrat terbentuk</i>						
		<i>[Able to state all observation and two corresponding inference correctly]</i> <i>[Dapat menyatakan tiga pemerhatian dan dua inferens yang sepadan dengan betul]</i>	5				
		<i>[Able to state two observation and two corresponding inference correctly]</i> <i>[Dapat menyatakan dua pemerhatian dan dua inferens yang sepadan dengan betul]</i>	4				
		<i>[Able to state two observation and one corresponding inference correctly]</i> <i>[Dapat menyatakan dua pemerhatian dan satu inferens yang sepadan dengan betul]</i>	3				
		<i>[Able to state one observation and one corresponding inference correctly]</i> <i>[Dapat menyatakan satu pemerhatian dan satu inferens yang sepadan dengan betul]</i>	2				
		<i>[Able to state one observation correctly]</i> <i>[Dapat menyatakan satu pemerhatian dengan betul]</i>	1				
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0				

2	e	<i>[Able to calculate heat of precipitation by shows three step calculation with unit correctly]</i> <i>[Dapat mengira haba pemendakan dengan menunjukkan tiga langkah pengiraan dengan unit yang betul]</i> Answer: Step 1 : $\text{Heat change} = 50 \times 4.2 \times 4.5$ $= 945 \text{ J}$ Step 2: $\text{Number of mole of Pb(NO}_3\text{)} = (0.5 \times 25) / 1000$ $= 0.0125 \text{ mol}$ Step 3 : $\text{Heat of precipitation} = 945\text{J} / 0.0125 \text{ mol} = - 75.6 \text{ kJmol}^{-1}$	3
		<i>[Able to calculate heat of precipitation by shows two calculation correctly]</i> <i>[Dapat mengira haba pemendakan dengan menunjukkan dua langkah pengiraan yang betul]</i>	2
		<i>[Able to calculate heat of precipitation by shows one calculation correctly]</i> <i>[Dapat mengira haba pemendakan dengan menunjukkan satu langkah pengiraan yang betul]</i>	1
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0

2	f	<i>[Able to give operational definition for heat of precipitation of lead(II) sulphate in this experiment with the following aspect correctly]</i> <i>[Dapat memberikan definisi secara operasi yang betul bagi haba pemendakan plumbum(II) sulfat dalam eksperimen ini dengan aspek-aspek berikut dengan betul]</i> What should be done : 1 mol of lead(II) sulphate precipitated from reaction between lead(II) nitrat solution and sodium sulphate What should be observed : temperature increases <i>Apa yang dibuat : 1 mol plumbum(II) sulfat termendak dari tindakbalas antara larutan plumbum(II) nitrat dan larutan natrium sulfat</i> <i>Apa yang diperhatikan : suhu meningkat</i> <i>Sample answer:</i> temperature increases when 1 mol of lead(II) sulphate precipitated from reaction between lead(II) nitrat solution and sodium sulphate solution <i>suhu meningkat apabila 1 mol plumbum(II) sulfat termendak dari tindakbalas antara larutan plumbum(II) nitrat dan larutan natrium sulfat</i>	3
		<i>[Able to give operational definition for heat of precipitation of lead(II) sulphate in this experiment with the following aspect less correctly]</i> <i>[Dapat memberikan definisi secara operasi yang betul bagi haba pemendakan plumbum(II) sulfat dalam eksperimen ini dengan aspek-aspek berikut dengan kurang betul]</i> What should be done : 1 mol of lead(II) sulphate precipitated What should be observed : temperature increases <i>Apa yang dibuat : 1 mol plumbum(II) sulfat termendak</i> <i>Apa yang diperhatikan : suhu meningkat</i> <i>Sample answer:</i> Temperature increases when 1 mol of lead(II) sulphate precipitated Heat change increases when 1 mol of lead(II) sulphate precipitated <i>Suhu meningkat apabila 1 mol plumbum(II) sulfat termendak</i> <i>Haba dibebaskan meningkat apabila 1 mol plumbum(II) sulfat termendak</i>	2

		<i>[Able to give the idea of operational definition]</i> <i>[Memberikan idea definisi secara operasi]</i> <i>Sampel answer :</i> <i>Temperature increases</i> <i>Suhu meningkat</i>	1
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0
2	g	<i>[Able to state the different of temperature change in Experiment I and II with reason correctly]</i> <i>[Dapat menyatakan perbezaan perubahan suhu Eksperimen I dan Eksperimen II dan alasan yang betul]</i> <i>Sample answer:</i> <i>Temperature change in experiment II is higher than experiment I</i> <i>Perubahan suhu Eksperimen II lebih tinggi daripada Eksperimen I</i> <i>Reason :</i> <i>Concentration of lead(II) ion and sulphate ion in experiment II is higher //</i> <i>Number of mol of lead(II) sulphate formed in experiment II is higher</i> <i>Kepekatan ion plumbum(II) dan ion sulfat di dalam Eksperimen II lebih tinggi //</i> <i>Bilangan mol plumbum(II) sulfat yang terhasil dalam Eksperimen II lebih tinggi.</i>	3
		<i>[Able to compare temperature change in experiment I or II and give a reason correctly]</i> <i>[Dapat membandingkan perubahan suhu Eksperimen I ATAU II dan alasan yang betul]</i> <i>Contoh jawapan:</i> <i>Temperature change in experiment II is higher //</i> <i>Perubahan suhu Eksperimen II lebih tinggi //</i> <i>Reason :</i> <i>Concentration lead(II) ion and sulphate ion in experiment II is higher //</i> <i>Kepekatan ion plumbum(II) dan ion sulfat di dalam Eksperimen II lebih tinggi //</i>	2

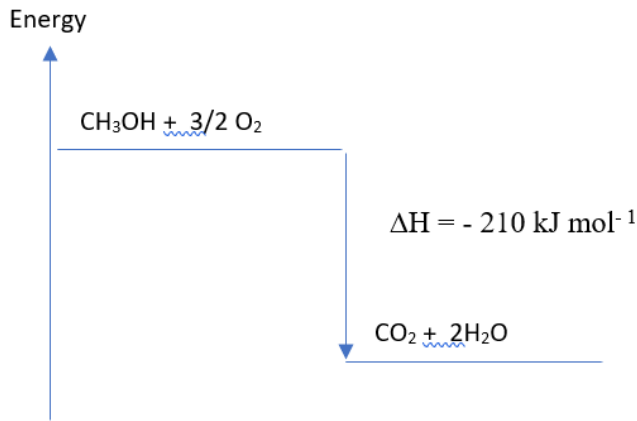
		<i>[Able to state the idea for difference in temperature change in experiment I and II or idea for the reason correctly]</i> <i>[Dapat menyatakan idea bagi perbezaan perubahan suhu dalam Eksperimen I dan II atau idea bagi alasan yang betul]</i> <i>Contoh jawapan :</i> The difference temperature change in experiment I and II is 4.5°C <i>Perbezaan suhu Eksperimen I tinggi dan Eksperimen II adalah 4.5°C</i> <i>Alasan:</i> Concentration of solution in experiment I is 0.5 whereas experiment II is 1.0 <i>Kepekatan larutan Eksperimen I ialah 0.5 manakala Eksperimen II 1.0</i>	1
		No response or wrong response <i>Tiada respons atau respons salah</i>	0
2	h	<i>[Able to predict the temperature correctly]</i> <i>[Dapat meramal suhu dengan betul]</i> <i>Answer : 4.5°C</i>	3
		<i>[Able to predict temperature in range $4.3 < X < 4.7$]</i> <i>[Dapat meramal suhu pada julat $4.3 < X < 4.7$]</i>	2
		<i>[Able to predict temperature in range 4.1 - 4.3 or 4.7 - 4.9]</i> <i>[Dapat meramal suhu pada julat 4.1 – 4.3 atau 4.7- 4.9]</i>	1
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0

2	i	<i>[Able to classify all ions in lead(II) nitrate solution and sodium sulphate solution into cation and anion]</i> <i>[Dapat mengelaskan semua ion dalam larutan plumbum(II) nitrat dan larutan natrium sulfat kepada kation dan anion]</i> <i>Sample answer :</i> <table><tr><td>Cation <i>Kation</i></td><td>Anion <i>Anion</i></td></tr><tr><td>Lead (II) ion / <i>Ion Plumbum(II)</i> Sodium ion / <i>Ion Natrium</i> Hydrogen ion / <i>Ion Hidrogen</i></td><td>Nitrate ion / <i>Ion Nitrat</i> Sulphate ion / <i>Ion Sulfat</i> Hydroxide ion / <i>Ion Hidroksida</i></td></tr></table> <i>* accept if using correct formula</i> <i>terima jika guna formula ion yang betul</i>	Cation <i>Kation</i>	Anion <i>Anion</i>	Lead (II) ion / <i>Ion Plumbum(II)</i> Sodium ion / <i>Ion Natrium</i> Hydrogen ion / <i>Ion Hidrogen</i>	Nitrate ion / <i>Ion Nitrat</i> Sulphate ion / <i>Ion Sulfat</i> Hydroxide ion / <i>Ion Hidroksida</i>	3
Cation <i>Kation</i>	Anion <i>Anion</i>						
Lead (II) ion / <i>Ion Plumbum(II)</i> Sodium ion / <i>Ion Natrium</i> Hydrogen ion / <i>Ion Hidrogen</i>	Nitrate ion / <i>Ion Nitrat</i> Sulphate ion / <i>Ion Sulfat</i> Hydroxide ion / <i>Ion Hidroksida</i>						
		<i>[Able to classify four ions in lead(II) nitrate solution and sodium sulphate solution into cation and anion]</i> <i>[Dapat mengelaskan empat ion dalam larutan plumbum(II) nitrat dan larutan natrium sulfat kepada kation dan anion]</i>	2				
		<i>[Able to classify two ions in lead(II) nitrate solution and sodium sulphate solution into cation and anion]</i> <i>[Dapat mengelaskan dua ion dalam larutan plumbum(II) nitrat dan larutan natrium sulfat kepada kation dan anion]</i>	1				
		<i>[No response or wrong response]</i> <i>[Tiada respons atau respons salah]</i>	0				
		TOTAL MARKS	27				

SOALAN 3

Questions	Rubrics	Marks
a)	<i>[Able to state all variables correctly]</i> Answer:	
i)	manipulated variable: type of alcohol // methanol, ethanol and propanol	1

	ii)	<i>Pemboleh ubah dimanipulasi : jenis alkohol // metanol, etanol dan propanol</i> Responding variable: Heat of combustion <i>Pemboleh ubah bergerak balas : Haba pembakaran</i> Fixed variable: Volume of water	1
	iii)	<i>Pemboleh ubah dimalarkan : isipadu air</i>	1
		[Able to state any two variables correctly]	2
		[Able to state any one variables correctly]	1
		[No response given or wrong response]	0
b)		[Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly] Sample Answer: The bigger the size of alcohol molecule / the higher the number of carbon atoms per alcohol molecule, the higher the heat of combustion. <i>Semakin besar saiz molekul alkohol/ semakin banyak bilangan atom karbon per molekul alkohol, semakin tinggi haba pembakaran</i>	3
		[Able to state the relationship between the manipulated variable and the responding variable less correctly] Sample Answer: The size of alcohol molecule / the number of carbon atoms per alcohol molecule affects the heat of combustion. <i>Saiz molekul alkohol/ bilangan atom karbon per molekul alkohol mempengaruhi haba pembakaran</i>	2
		[Able to state the idea of hypothesis] Sample Answer: Heat of combustion is different for different alcohol <i>Haba pembakaran berbeza bagi alkohol yang berbeza</i>	1
		[No response given or wrong response]	0
c)	i)	[Able to calculate heat released correctly] Answer: $H = 100 \times 4.2 \times 25$	1

		$= 10\,500\text{ J}$	
	ii)	[Able to calculate number of moles correctly] Answer: $n = \frac{1.6\text{ g}}{32} = 0.05\text{ moles}$	1
	iii)	[Able to calculate heat of combustion correctly] Answer: $\Delta H = \frac{10\,500\text{ J}}{0.05\text{mol}}$ $\Delta H = -210\,000\text{ J mol}^{-1} = -210\text{ kJ mol}^{-1}$	1
d)		[Able to draw the energy level diagram correctly] 1. Axis <i>Paksi</i> 2. Correct reactants and products <i>Bahan dan hasil tindak balas yang betul</i> 3. Correct ΔH <i>ΔH yang betul</i> Answer: 	1 1 1
e)		[Able to predict heat of combustion correctly with negative sign and unit] Answer: $\Delta H = -420\,000\text{ J mol}^{-1} = -420\text{ kJ mol}^{-1}$	3
		[Able to predict heat of combustion correctly with unit] Answer:	2

		$\Delta H = 420\,000\text{ J mol}^{-1} = 420\text{ kJ mol}^{-1}$	
		[Able to predict heat of combustion correctly] Answer: $\Delta H = 420\,000 = 420$	1
		[No response given or wrong response]	0
TOTAL MARKS			15

SOALAN 1

Rubrics		Marks
a	[Able to state problem statement with named alcohols correctly] Sample answer: Do methanol and ethanol have different heat of combustion? <i>Adakah metanol dan etanol mempunyai haba pembakaran yang berbeza?</i>	3
	[Able to state the problem statement less accurately] Sample answer: Do alcohols have different heat of combustion? <i>Adakah alkohol mempunyai haba pembakaran yang berbeza?</i>	2
	[Able to state an idea about problem statement] Sample answer: Different alcohols affect heat of combustion <i>Alkohol berbeza mempengaruhi haba pembakaran</i>	1
	[No response given or wrong response]	
b)	[Able to state all variables correctly] Answer:	
i)	manipulated variable: type of alcohol // methanol and ethanol <i>Pemboleh ubah dimanipulasi : jenis alkohol // metanol dan etanol</i>	1
	Responding variable: Heat of combustion <i>Pemboleh ubah bergerak balas : haba pembakaran</i>	1
ii)	Fixed variable: Volume of water <i>Pemboleh ubah dimalarkan : isipadu air</i>	1
iii)		
	[Able to state two variables correctly]	2
	[Able to state one variable correctly]	1
	[No response given or wrong response]	0
c)	[Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly] Sample Answer: The bigger the size of alcohol molecule / the higher the number of carbon atoms per alcohol molecule, the higher the heat of combustion. <i>Semakin besar saiz molekul alkohol/ semakin banyak bil atom karbon per molekul alkohol, semakin tinggi haba pembakaran.</i>	3

	[Able to state the relationship between the manipulated variable and the responding variable without stating the direction/ less accurately] Sample Answer: The size of alcohol molecule / the number of carbon atoms per alcohol molecule affects the heat of combustion. <i>Saiz molekul alkohol/ bilangan atom karbon per molekul alkohol mempengaruhi haba pembakaran</i>	2
	[Able to state the idea of hypothesis] Sample Answer: Heat of combustion is different for different alcohol <i>Haba pembakaran berbeza bagi alkohol yang berbeza</i>	1
	[No response given or wrong response]	0
d)	[Able to state all apparatus and materials completely] Sample Answer: Apparatus: Spirit lamp, thermometer, measuring cylinder, tripod stand, clay pipe triangle, wind shield, copper can <i>Radas: Lampu spirit, termometer, silinder penyukat, tungku kaki tiga, segitiga tanah liat, pengadang angin, tin kuprum</i> Materials: Methanol, Ethanol, water <i>Bahan: Metanol, etanol, air</i>	3
	[Able to give the list of the apparatus and materials correctly but not complete] Sample answer: Apparatus: thermometer, spirit lamp, copper can <i>Radas: termometer, lampu spirit, tin kuprum</i> Materials: Methanol, Ethanol <i>Bahan: Metanol, etanol</i>	2
	[Able to give an idea on the list of the apparatus and substances correctly] Any one materials and one apparatus with thermometer	1
	[No response or wrong response] reject : no thermometer	0

e)	[Able to write all steps accurately] Answer: Procedure: 100 cm³ of water is measured with a measuring cylinder and poured into a copper can which is placed on top of a tripod stand. A wind shield is placed surrounding the tripod stand. <i>100 cm³ air disukat dengan silinder penyukat dan dituang ke dalam tin kuprum dan diletakkan di atas tungku kaki tiga. Pengadang angin diletakkan di sekeliling tungku kaki tiga.</i> - Record the initial temperature using a thermometer. <i>Rekodkan suhu awal dengan termometer.</i> - The methanol spirit lamp is weighed and placed under the copper can and lighted. <i>Lampu spirit metanol ditimbang dan diletakkan di bawah tin kuprum dan dinyalakan.</i> - The water in the copper can is stirred with a thermometer. <i>Air di dalam tin kuprum dikacau dengan termometer.</i> - When the temperature of the water increases by 30°C, the flame is distinguished and the highest temperature is recorded. <i>Apabila suhu air meningkat sebanyak 30°C, nyalaan api dipadamkan dan suhu tertinggi direkod.</i> - The spirit lamp is then weighed again. <i>Lampu spirit kemudiannya ditimbang sekali lagi.</i> - The experiment is repeated using an ethanol spirit lamp. <i>Eksperimen diulang dengan menggunakan lampu spirit etanol.</i>	3						
	[Able to state 5 steps of the experiment] Steps 1,2,4,5 and 6.	2						
	[Able to state 2 minimum steps correctly] Steps 1, 5	1						
	[No response or wrong response]	0						
f)	[Able to construct the table that contains the following information] - Columns and rows - Headings in the table - With unit Answer: <table border="1"> <thead> <tr> <th>Type of alcohol <i>Jenis alkohol</i></th><th>Methanol <i>Metanol</i></th><th>Ethanol <i>Etanol</i></th></tr> </thead> <tbody> <tr> <td>Initial mass of lamp (g)</td><td></td><td></td></tr> </tbody> </table>	Type of alcohol <i>Jenis alkohol</i>	Methanol <i>Metanol</i>	Ethanol <i>Etanol</i>	Initial mass of lamp (g)			
Type of alcohol <i>Jenis alkohol</i>	Methanol <i>Metanol</i>	Ethanol <i>Etanol</i>						
Initial mass of lamp (g)								

	Jisim awal lampu (g) Final mass of lamp (g) Jisim akhir lampu (g) Mass of alcohol used (g) Jisim alkohol yang digunakan (g) Initial temperature (°C) Suhu awal (°C) Final temperature (°C) Suhu akhir (°C) Change in temperature, θ (°C) Perubahan suhu, θ (°C)			2															
	[Able to construct the table that contains the following information 1. Columns and rows 2. Headings in the table 3. Without unit // Able to state an idea about the tabulation of data] Tabulation of data has the following elements : 1. minimum 2 columns and 2 rows Sample answer: <table><tr><td>Type of alcohol Jenis alkohol</td><td>Methanol Metanol</td><td>Ethanol Etanol</td></tr><tr><td>Initial mass of lamp Jisim awal lampu</td><td></td><td></td></tr><tr><td>Final mass of lamp Jisim akhir lampu</td><td></td><td></td></tr><tr><td>Mass of alcohol used Jisim alkohol yang digunakan</td><td></td><td></td></tr><tr><td>Change in temperature, θ Perubahan suhu, θ</td><td></td><td></td></tr></table>			Type of alcohol Jenis alkohol	Methanol Metanol	Ethanol Etanol	Initial mass of lamp Jisim awal lampu			Final mass of lamp Jisim akhir lampu			Mass of alcohol used Jisim alkohol yang digunakan			Change in temperature, θ Perubahan suhu, θ			1
Type of alcohol Jenis alkohol	Methanol Metanol	Ethanol Etanol																	
Initial mass of lamp Jisim awal lampu																			
Final mass of lamp Jisim akhir lampu																			
Mass of alcohol used Jisim alkohol yang digunakan																			
Change in temperature, θ Perubahan suhu, θ																			
	[No response or wrong response]			0															

TOTAL MARKS	17
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SOALAN 2

Rubrics		Marks
a)	[Able to state problem statement with named acid and alkali correctly] Answer: Is the heat of neutralisation of a ethanoic acid with sodium hydroxide lower than heat of neutralisation between hydrochloric acid and sodium hydroxide? <i>Adakah haba peneutralan antara asid etanoik dengan natrium hidroksida kurang daripada haba peneutralan antara asid hidroklorik dengan natrium hidroksida?</i>	3
	[Able to state the problem statement less accurately] Sample answer: Is the heat of neutralisation of a weak acid with strong alkali lower than heat of neutralisation between strong acid and weak alkali? <i>Adakah haba peneutralan antara asid lemah dengan alkali kuat kurang daripada haba peneutralan antara asid kuat dengan alkali kuat?</i>	2
	[Able to state an idea about problem statement] <i>Sample answer :</i> Heat of neutralisation is affected by the strength of acid. <i>Haba peneutralan dipengaruhi oleh kekuatan asid.</i>	1
	[No response or wrong response]	0
b)	[Able to state all variables correctly]	1
i)	manipulated variable: Hydrochloric acid and ethanoic acid // strong acid and weak acid	1
ii)	<i>Pemboleh ubah dimanipulasi : jenis asid // asid kuat dan asid lemah</i> Responding variable: Heat of neutralization	1
iii)	<i>Pemboleh ubah bergerak balas : haba peneutralan</i> Fixed variable: Volume and concentration of acid // type of alkali <i>Pemboleh ubah dimalarkan : isipadu dan kepekatan asid // jenis alkali</i>	1
	[Able to state two variables correctly]	2
	[Able to state one variables correctly]	1
	[No response or wrong response]	0
c)	[Able to state the relationship between the manipulated variable and the	

	responding variable and state the direction correctly] Sample Answer: The heat of neutralisation of ethanoic acid with sodium hydroxide is lower than the heat of neutralisation between hydrochloric acid and sodium hydroxide. <i>Haba peneutralan antara asid etanoik dengan natrium hidroksida adalah lebih rendah daripada haba peneutralan antara asid hidroklorik dengan natrium hidroksida.</i>	3
	[Able to state the relationship between the manipulated variable and the responding variable without stating the direction/ less accurately] Sample Answer: Different strength of acid react with sodium hydroxide, different value of heat of neutralization. <i>Kekuatan asid yang berbeza bertindak balas dengan natrium hidroksida, berbeza nilai haba peneutralan.</i>	2
	[Able to state the idea of hypothesis] Sample answer: Heat of neutralization is affected by type of acid. <i>Haba peneutralan dipengaruhi oleh jenis asid.</i>	1
	[No response or wrong response]	0
d)	[Able to state all apparatus and materials completely.] Apparatus: Polystyrene cup, thermometer, measuring cylinder <i>Radas: Cawan polistirena, termometer, silinder penyukat</i> Materials: Hydrochloric acid 2 mol dm⁻³, sodium hydroxide 2 mol dm⁻³, ethanoic acid 2 mol dm⁻³ <i>Bahan: Asid hidroklorik 2 mol dm⁻³, natrium hidroksida 2 mol dm⁻³, asid etanoik 2 mol dm⁻³</i>	3
	[Able to give the list of the apparatus and materials correctly but not complete] Sample answer : Materials: sodium hydroxide solution, hydrochloric acid / ethanoic acid <i>Bahan: larutan natrium hidroksida, asid hidroklorik / asid etanoik</i>	2

	Apparatus: Polystyrene cup, thermometer <i>Radas: Cawan polistirena , termometer</i>	
	[Able to give an idea on the list of the apparatus and substances correctly] Any one materials and one apparatus with thermometer	1
	[No response or wrong response] reject : no thermometer	0
e)	[Able to write all steps accurately] Sample Answer: Procedure: 50 cm³ of hydrochloric acid 2 mol dm⁻³ is measured with a measuring cylinder and poured into a polystyrene cup. <i>50 cm³ asid hidroklorik 2 mol dm⁻³ disukat dengan silinder penyukat dan dituang ke dalam cawan polistirena.</i> - The initial temperature is measured with a thermometer after a few minutes and recorded. <i>Suhu awal disukat dengan termometer selepas beberapa minit dan direkod.</i> 50 cm³ of sodium hydroxide 2mol dm⁻³ is measured using a clean measuring cylinder and poured into the polystyrene cup. <i>50 cm³ natrium hidroksida 2 mol dm⁻³ disukat dengan silinder penyukat dan dituang ke dalam cawan polistirena.</i> - The temperature is measured with a thermometer after a few minutes and recorded. <i>Suhu disukat dengan termometer selepas beberapa minit dan direkod.</i> - The hydrochloric acid is quickly poured into the polystyrene cup containing sodium hydroxide. <i>Asid hidroklorik dituang dengan cepat ke dalam cawan polistirena yang mengandungi natrium hidroksida.</i> - The mixture is stirred with a thermometer, and the highest temperature achieved is recorded. <i>Campuran itu dikacau dengan termometer, dan suhu tertinggi tercapai direkodkan,</i> - The experiment is repeated by replacing hydrochloric acid with ethanoic acid of the same concentration. <i>Eksperimen ini diulang dengan menggantikan asid hidroklorik dengan asid etanoik dengan kepekatan yang sama.</i>	3
	[Able to state 5 steps of the experiment] Steps 2, 4, 5, 6, 7	2

	[Able to state 5 steps of the experiment] Steps 2, 4, 5, 6, 7	1																		
	[No response or wrong response]	0																		
	[Able to construct the table that contains the following information] 1. Columns and rows 2. Headings in the table 3. With unit Answer: <table border="1"> <thead> <tr> <th>Type of acid <i>Jenis asid</i></th><th>Hydrochloric acid <i>Asid hidroklorik</i></th><th>Ethanoic acid <i>Asid etanoik</i></th></tr> </thead> <tbody> <tr> <td>Initial temperature of sodium hydroxide (°C) <i>Suhu awal natrium hidroksida (°C)</i></td><td></td><td></td></tr> <tr> <td>Initial temperature of acid (°C) <i>Suhu awal asid (°C)</i></td><td></td><td></td></tr> <tr> <td>Average temperature of acid and alkali (°C) <i>Purata suhu asid dan alkali (°C)</i></td><td></td><td></td></tr> <tr> <td>Highest temperature of the mixture (°C) <i>Suhu tertinggi campuran (°C)</i></td><td></td><td></td></tr> <tr> <td>Increase in temperature, θ (°C) <i>Kenaikan suhu, θ (°C)</i></td><td></td><td></td></tr> </tbody> </table>	Type of acid <i>Jenis asid</i>	Hydrochloric acid <i>Asid hidroklorik</i>	Ethanoic acid <i>Asid etanoik</i>	Initial temperature of sodium hydroxide (°C) <i>Suhu awal natrium hidroksida (°C)</i>			Initial temperature of acid (°C) <i>Suhu awal asid (°C)</i>			Average temperature of acid and alkali (°C) <i>Purata suhu asid dan alkali (°C)</i>			Highest temperature of the mixture (°C) <i>Suhu tertinggi campuran (°C)</i>			Increase in temperature, θ (°C) <i>Kenaikan suhu, θ (°C)</i>			2
Type of acid <i>Jenis asid</i>	Hydrochloric acid <i>Asid hidroklorik</i>	Ethanoic acid <i>Asid etanoik</i>																		
Initial temperature of sodium hydroxide (°C) <i>Suhu awal natrium hidroksida (°C)</i>																				
Initial temperature of acid (°C) <i>Suhu awal asid (°C)</i>																				
Average temperature of acid and alkali (°C) <i>Purata suhu asid dan alkali (°C)</i>																				
Highest temperature of the mixture (°C) <i>Suhu tertinggi campuran (°C)</i>																				
Increase in temperature, θ (°C) <i>Kenaikan suhu, θ (°C)</i>																				
	[Able to construct the table that contains the following information] 1. Columns and rows 2. Headings in the table 3. Without unit // Able to state an idea about the tabulation of data] Tabulation of data has the following elements : 1. minimum 2 columns and 2 rows Sample answer : <table border="1"> <tbody> <tr> <td>Pair of acid/alkali</td><td>Initial temperature</td><td>Highest temperature</td></tr> </tbody> </table>	Pair of acid/alkali	Initial temperature	Highest temperature	1															
Pair of acid/alkali	Initial temperature	Highest temperature																		

		Acid	Alkali	of the mixture	
	[No response or wrong response]				0
TOTAL MARKS					17

SOALAN 2

Rubrics		Marks
a	<i>[Able to state the problem statement with the named strong acid solution and weak acid solution accurately]</i> Sample answer : Does the heat of neutralisation between hydrochloric acid and sodium hydroxide solution is higher than the heat of neutralisation between ethanoic acid and sodium hydroxide solution? <i>Adakah haba peneutralan tindak balas asid hidroklorik dan natrium hidroksida lebih tinggi daripada haba peneutralan tindak balas antara asid etanoik dan natrium hidroksida?</i>	3
	<i>[Able to state the problem statement less accurately]</i> Sample answer : Does the heat of neutralization between strong acid and weak acid with strong alkali different? //To study the heat of neutralization between strong and weak acid with strong alkali. <i>Adakah haba peneutralan yang terhasil bagi tindak balas antara asid kuat dan asid lemah dengan alkali kuat berbeza? //</i> <i>Untuk mengkaji haba peneutralan yang terhasil bagi tindak balas antara asid kuat dan asid lemah dengan alkali kuat</i>	2

	<i>[Able to state an idea about problem statement]</i> Sample answer : Heat of neutralisation is affected by the strength of acid. <i>Haba peneutralan dipengaruhi oleh kekuatan asid.</i>	1
	<i>No response or wrong response</i>	0
b	<i>[Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly]</i> Sample answer : The reaction between hydrochloric acid/strong acid and sodium hydroxide will give the higher value of heat of neutralization than the reaction between ethanoic acid/weak acid with sodium hydroxide. <i>Tindak balas antara asid hidroklorik / asid kuat dengan natrium hidroksida akan memberi nilai haba peneutralan yang lebih tinggi berbanding tindak balas antara asid etanoik/ asid lemah dengan natrium hidroksida.</i>	3
	<i>[Able to state the relationship between the manipulated variable and the responding variable without stating the direction/ less accurately]</i> Sample answer Different strength of acid react with sodium hydroxide, different value of heat of neutralization. <i>Kekuatan asid yang berbeza yang bertindak balas dengan natrium hidroksida menghasilkan nilai haba peneutralan yang berbeza.</i>	2
	<i>[Able to give an idea of hypothesis]</i> Sample answer: The strength of acid affect the heat of neutralization <i>Kekuatan asid mempengaruhi nilai haba peneutralan</i>	1

	<i>No response or wrong response</i>	0
c	<i>[Able to state all the variables accurately]</i> Sample answer : Manipulated variable: Hydrochloric Acid and Ethanoic Acid (any suitable named strong and weak acid) // Strong acid and weak acid Responding variable : Heat of neutralisation Fixed variable : Concentration and volume of NaOH solution//NaOH solution // polystyrene cup // Concentration and volume of acid solution <i>Pemboleh ubah dimanipulasikan: Asid hidroklorik dan asid etanoik // asid kuat dan asid lemah</i> <i>Pemboleh ubah bergerak balas : Haba peneutralan</i> <i>Pemboleh ubah dimalarkan: Kepekatan dan isipadu larutan NaOH// cawan polistirena// kepekatan dan isipadu larutan asid</i>	3
	<i>[Able to give any two variables accurately]</i>	2
	<i>[Able to give any one variable accurately]</i>	1
	<i>[No response or wrong response]</i>	0

d	<i>[Able to list down the materials and apparatus completely]</i> Sample answer : Materials : [0.5-2.0 mol dm⁻³] sodium hydroxide solution, [0.5-2.0 mol dm⁻³] hydrochloric acid, [0.5-2.0 mol dm⁻³] ethanoic acid (any suitable strong and weak named acid), Apparatus :Polystyrene/plastic cup, thermometer, [50-100cm³] measuring cylinder Bahan : [0.5-2.0 mol dm⁻³] larutan natrium hidroksida, [0.5-2.0 mol dm⁻³] asid hidroklorik, [0.5-2.0 mol dm⁻³] asid etanoik Alat radas: Cawan polistirena/ cawan plastik,termometer, [50-100cm³] silinder penyukat	3
	<i>[Able to give the list of the apparatus and materials correctly but not complete]</i> Sample answer : sodium hydroxide solution, hydrochloric acid / ethanoic acid, Polystyrene/plastic cup, thermometer Larutan natrium hidroksida, asid hidroklorik/ asid etanoik, cawan polistirena / cawan plastic, termometer	2
	<i>[Able to give an idea on the list of the apparatus and substances correctly]</i> Any one materials and one apparatus with thermometer Mana-mana satu bahan dan radas dengan termometer	1
	<i>[No response or wrong response]</i> reject : no thermometer	0

e	<i>[Able to state all the steps of the experiment accurately]</i> Example 1. [25-100 cm³] of sodium hydroxide solution is poured into a polystyrene cup using a measuring cylinder. 2. The initial temperature of sodium hydroxide solution is recorded. 3. [25-100 cm³] of hydrochloric acid is measured into another polystyrene cup. 4. The initial temperature of hydrochloric acid is recorded. 5. Hydrochloric acid is then poured quickly into a cup containing sodium hydroxide solution. 6. The mixture is stirred using thermometer and the highest temperature is recorded. 7. Repeat steps 1 to 6 using ethanoic acid instead of hydrochloric acid. 1. [25-100 cm³] larutan natrium hidroksida di sukat dengan silinder penyukat dan di tuang ke dalam cawan polistirena. 2. Suhu awal larutan natrium hidroksida dicatatkan. 3. [25-100 cm³] larutan asid hidroklorik di sukat dengan silinder penyukat dan di tuang ke dalam cawan polistirena. 4. Suhu awal larutan asid hidroklorik dicatatkan. 5. Asid hidroklorik dituang dengan cepat dan cermat ke dalam larutan natrium hidroksida. 6. Campuran tindak balas dikacau dengan termometer dan suhu tertinggi direkodkan. 7. Langkah 1-6 diulang dengan menggunakan asid etanoik untuk menggantikan asid hidroklorik.	3
	<i>[Able to state 5 steps of the experiment]</i> Steps 2, 4, 5, 6, 7	2

	<i>[Able to state 2 minimum steps correctly]</i> Steps 5, 6	1																		
	<i>No response or wrong response</i>	0																		
f	<i>[Able to construt the table that contains the following information]</i> 1. Columns and rows 2. Headings in the table 3. With unit <i>Sample answer:</i> <table><tr><th rowspan="2">Pair of acid/alkali</th><th colspan="3">Initial temperature/ °C</th><th rowspan="2">Highest temperature of the mixture/°C</th></tr><tr><th>Acid</th><th>Alkali</th><th>Average</th></tr><tr><td>NaOH/HCl</td><td></td><td></td><td></td><td></td></tr><tr><td>NaOH/CH₃COOH</td><td></td><td></td><td></td><td></td></tr></table>	Pair of acid/alkali	Initial temperature/ °C			Highest temperature of the mixture/°C	Acid	Alkali	Average	NaOH/HCl					NaOH/CH ₃ COOH					2
Pair of acid/alkali	Initial temperature/ °C			Highest temperature of the mixture/°C																
	Acid	Alkali	Average																	
NaOH/HCl																				
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	<i>[Able to construt the table that contains the following information</i> <i>1. Columns and rows</i> <i>2. Headings in the table</i> <i>3. Without unit</i> <i>// Able to state an idea about the tabulation of data]</i> <i>Tabulation of data has the following elements :</i> <i>1. minimum 2 columns and 2 rows</i> <i>Sample answer :</i> <table><tr><th rowspan="2">Pair of acid/alkali</th><th colspan="2">Initial temperature</th><th rowspan="2">Highest temperature of the mixture</th></tr><tr><th>Acid</th><th>Alkali</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table> <i>//</i> <table><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	Pair of acid/alkali	Initial temperature		Highest temperature of the mixture	Acid	Alkali													1
Pair of acid/alkali	Initial temperature		Highest temperature of the mixture																	
	Acid	Alkali																		
	<i>No response or wrong response</i>	0																		
TOTAL MARKS		17																		

Set 9

Chemical for Consumers
*Bahan Kimia Untuk
Pengguna*

TAJUK: BAHAN KIMIA UNTUK PENGGUNA

Section A
Bahagian A

1. Diagram 1 shows the label of ingredients on a bottle of pineapple jam.
Rajah 1 menunjukkan label ramuan pada sebotol jem nanas.

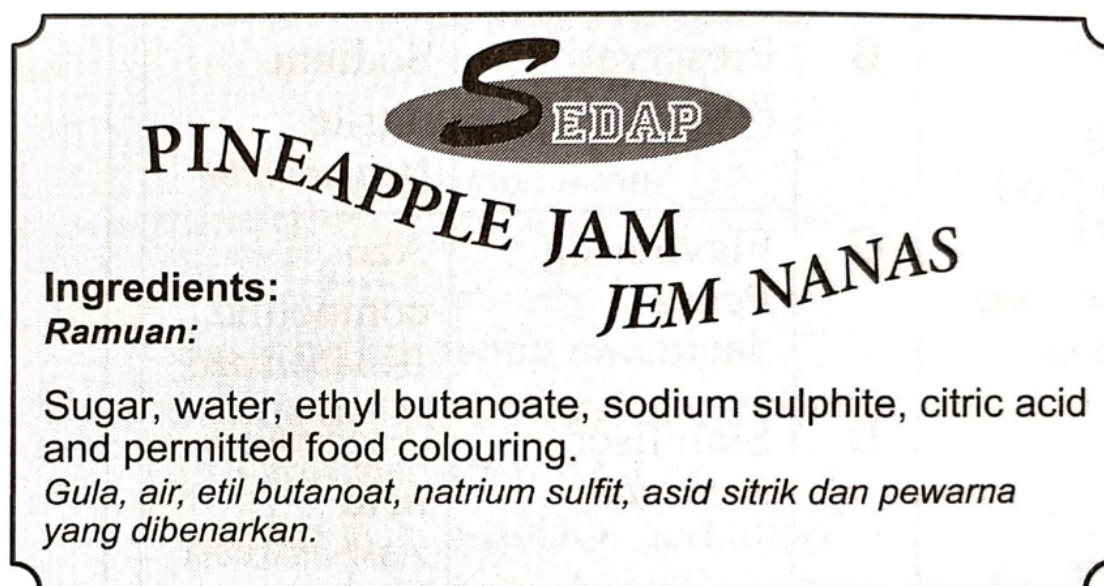


Diagram / *Rajah* 1

- (a) State one suitable food colouring to be used in the pineapple jam.
Nyatakan satu pewarna makanan yang sesuai digunakan dalam jem nanas.

[1 mark/markah]

- (b) State two purposes of adding sugar in the pineapple jam.
Nyatakan dua tujuan menambahkan gula dalam jem nanas.

[2 marks/markah]

- (c) What is the function of sodium sulphite in the pineapple jam?
Apakah fungsi natrium sulfit dalam jem nanas?

[1 mark/markah]

- (d)(i) State two reasons why citric acid is added into the pineapple jam.
Nyatakan dua sebab mengapa asid sitrik ditambahkan ke dalam jem nanas.

[2 marks/markah]

- (ii) State another food additive that can be used to replace citric acid.
Nyatakan bahan tambah makanan yang lain yang boleh digunakan untuk menggantikan asid sitrik.

[1 mark/markah]

- (e) During the manufacturing of the pineapple jam, ethyl butanoate is added.
Semasa pembuatan jem nanas, etil butanoat ditambahkan.

- (i) State the functional group of ethyl butanoate.
Nyatakan kumpulan berfungsi bagi etil butanoat.

[1 mark/markah]

- (ii) State two chemicals that can be used to prepare ethyl butanoate in the school laboratory.
Nyatakan dua bahan kimia yang boleh digunakan untuk menyediakan etil butanoat di dalam makmal sekolah.

[2 marks/markah]

- (f) Suggest another food additive that can replace sugar so that the pineapple jam will be suitable for the consumption of a diabetic patient.
Cadangkan satu bahan tambah makanan yang lain yang dapat menggantikan gula dalam jem nanas supaya jem ini sesuai diambil oleh pesakit diabetes.

[1 mark/markah]

2(a) Diagram 2 shows an aloe vera plant. Aloe vera plant can be used as a traditional medicine.

Rajah 2 menunjukkan pokok lidah buaya. Pokok lidah buaya boleh digunakan sebagai ubat tradisional.

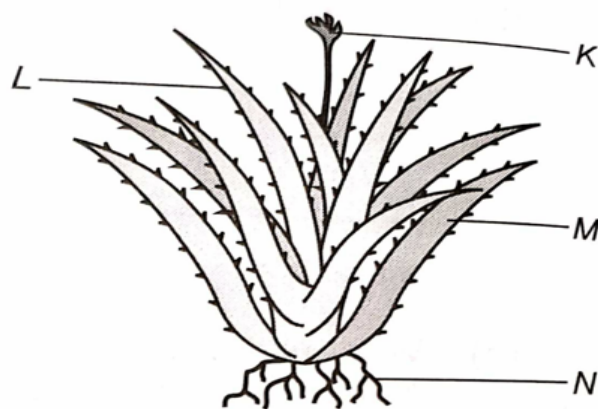


Diagram / Rajah 2

- (i) Which of the parts K, L, M or N is used as the main source of medicine?
Antara bahagian K, L, M dan N, yang manakah digunakan sebagai sumber utama ubat?
-
- [1 mark/markah]
- (ii) What type of disease can be cured by using aloe vera?
Apakah jenis penyakit yang dapat diubati dengan menggunakan lidah buaya?
-
- [1 mark/markah]
- (iii) How is aloe vera used to treat the disease in (a)(ii)?
Bagaimanakah lidah buaya digunakan mengubati penyakit di (a)(ii)?
-
- [1 mark/markah]

- (b) Table 2 shows three types of medicine.

Jadual 2 menunjukkan tiga jenis ubat.

Type of medicine <i>Jenis ubat</i>	Function <i>Fungsi</i>
Antibiotics <i>Antibiotik</i>	(i) _____
Psychotherapeutic medicine <i>Ubat psikoterapeutik</i>	(ii) _____
Analgesics <i>Analgesik</i>	(iii) _____

Table/*Jadual* 2

- (i) Complete Table 2 to show the functions of the types of medicine given.

Lengkapkan Jadual 2 untuk menunjukkan fungsi ubat yang diberikan.

[3 marks/markah]

- (ii) What is the side effect of analgesic medicine such as aspirin if it is used by a child below 2 years old?

Apakah kesan sampingan ubat analgesik, seperti aspirin, jika digunakan oleh seorang kanak-kanak yang berumur 2 tahun ke bawah?

[1 mark/markah]

- (iii) Why must patients complete the course of antibiotics prescribed by the doctor?

Mengapakah pesakit perlu menghabiskan antibiotik yang dipreskripsikan oleh doktor?

[1 mark/markah]

- (iv) Barbiturate is an example of psychotherapeutic medicine. State the function of barbiturate.

Barbiturat ialah satu contoh ubat psikoterapeutik. Nyatakan fungsi barbiturat.

[1 mark/markah]

- 3 The equation below shows the preparation of soap in the laboratory.
Persamaan di bawah menunjukkan penyediaan sabun di dalam makmal.

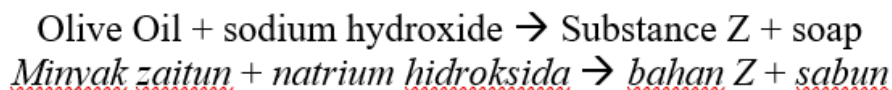


Diagram / Rajah 3

- (a)(i) State the name of the process.
Nyatakan nama proses itu.

[1 mark/markah]

- (ii) What is the name of substance Z?
Apakah nama bahan Z?

[1 mark/markah]

- (iii) Explain why sodium chloride solid is added to the mixture.
Jelaskan mengapa pepejal natrium klorida ditambahkan kepada campuran.

[1 mark/markah]

- (b) Two cleaning agents, P and Q, are used to wash clothes in well water and pipe water.
Table 3 shows the results obtained.
Dua bahan pencuci, P dan Q, digunakan untuk mencuci kain dalam air perigi dan air paip.
Jadual 3 menunjukkan keputusan yang diperolehi.

Cleaning agent <i>Bahan pencuci</i>	Well water <i>Air perigi</i>	Pipe water <i>Air paip</i>
P	Forms scum. <i>Membentuk kekat.</i>	Does not form scum. <i>Tidak membentuk kekat.</i>
Q	Does not form scum. <i>Tidak membentuk kekat.</i>	Does not form scum. <i>Tidak membentuk kekat.</i>

Table / *Jadual* 3

4541

- (i) State the type of cleaning agents P and Q.

Nyatakan jenis bahan pencuci P dan Q.

P : _____

Q : _____

[2 marks/markah]

- (ii) What is the meaning of scum?

Apakah maksud kekat?

[1 mark/markah]

- (iii) State the two ions in well water that cause the formation of scum.

Nyatakan dua ion dalam air perigi yang menyebabkan pembentukan kekat.

[2 marks/markah]

- (iv) State one advantage of cleaning agent P compared to Q.

Nyatakan satu kelebihan bahan pencuci P berbanding dengan Q.

[1 mark/markah]

- 4 Diagram 4.1 shows three main substances needed in the preparation of soap in the school laboratory.

Rajah 4.1 menunjukkan tiga bahan utama yang diperlukan dalam penghasilan sabun di makmal sekolah.

Sodium chloride <i>Natrium klorida</i>	Sodium hydroxide solution <i>Larutan natrium hidroksida</i>	Palm oil <i>Minyak kelapa sawit</i>
---	--	--

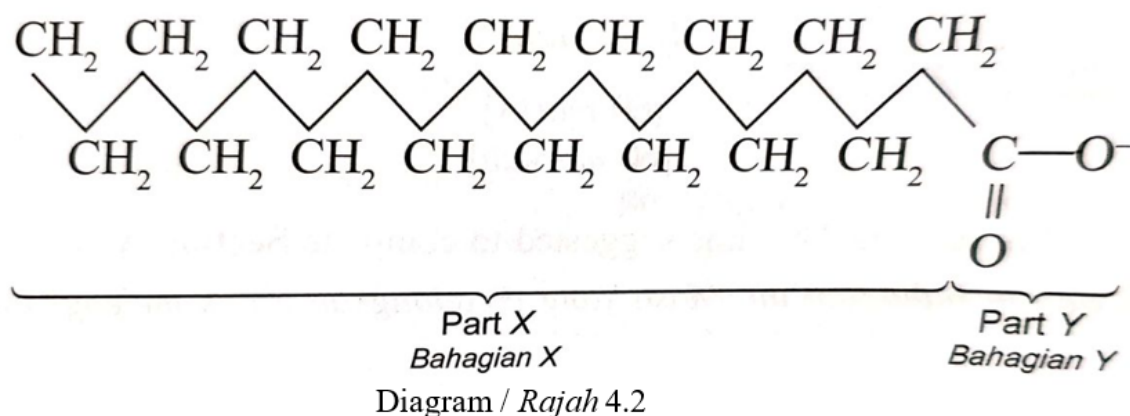
Diagram / Rajah 4.1

- (a) What is meant by soap?
Apakah yang dimaksudkan dengan sabun?
- _____
- [1 mark/markah]
- (b) What is the homologous series of palm oil?
Apakah siri homolog bagi minyak kelapa sawit?
- _____
- [1 mark/markah]
- (c) When concentrated sodium hydroxide is added to sunflower oil, substances X and Y are formed.
Apabila natrium hidroksida pekat ditambah pada minyak bunga matahari, bahan X dan Y terhasil.
- (i) Name substances X and Y.
Namakan bahan X dan Y.
- X: _____
- Y: _____
- [2 marks/markah]
- (ii) State the name of the process to prepare soap.
Nyatakan nama proses penyediaan sabun.
- _____
- [1 mark/markah]
- (d) Why is sodium chloride powder added to the soap mixture?
Mengapakah serbuk natrium klorida ditambahkan kepada campuran sabun?
- _____
- [1 mark/markah]

- (e) State another chemical that can replace concentrated sodium hydroxide to obtain soap.
Nyatakan bahan kimia lain yang boleh menggantikan natrium hidroksida pekat untuk menghasilkan sabun.

[1 mark/markah]

- (f) Diagram 4.2 shows the structural formula of a soap anion.
Rajah 4.2 menunjukkan struktur formula bagi suatu anion sabun.



- (i) State the hydrophilic and hydrophobic parts of the soap anion.
Nyatakan bahagian hidrofilik dan hidrofobik dalam anion sabun itu.

Part X/*Bahagian X*: _____

Part Y/*Bahagian Y*: _____

[2 marks/markah]

- (ii) State the property of the hydrophobic part of the soap anion.
Nyatakan sifat bagi bahagian hidrofobik dalam anion sabun itu.

[1 mark/markah]

- 5 The following chemical equation shows a reaction in the preparation of soap in a laboratory.
Persamaan kimia yang berikut menunjukkan suatu tindak balas semasa penyediaan sabun di dalam makmal.

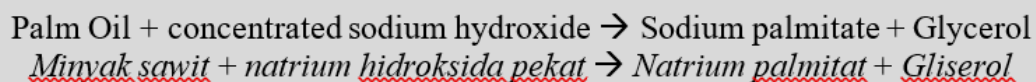


Diagram / Rajah 5.1

- (a) What is this reaction called?
Apakah nama tindak balas ini?

[1 mark/markah]

- (b) What is the homologous series of palm oil?
Apakah siri homolog minyak sawit?

[1 mark/markah]

- (c)(i) Draw the structural molecule of soap.
Lukis struktur molekul bagi sabun.

[2 marks/markah]

- (ii) Based on the structure in (c)(i), which part of the soap molecule is soluble in grease?
Berdasarkan struktur di (c)(i), bahagian sabun yang manakah larut di dalam gris?

[1 mark/markah]

- (d) Diagram 5.2 shows the cleaning action of soap. Based on Diagram 5.2, explain the cleansing action of soap.

Rajah 5.2 menunjukkan tindakan pencucian sabun. Berdasarkan Rajah 5.2, terangkan tindakan pencucian sabun.

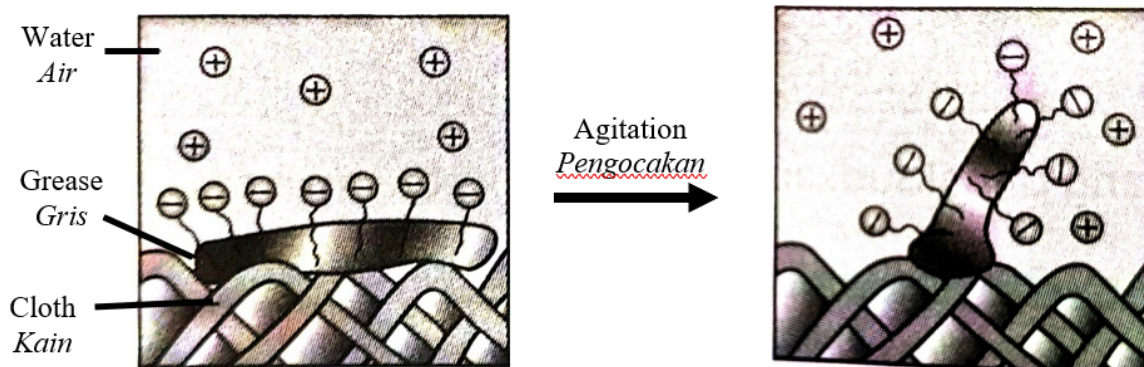


Diagram 5.2
Rajah 5.2

[5 marks/markah]

- (e)(i) What is hard water?
Apakah air liat?

[2 marks/markah]

- (ii) Explain briefly the cleansing action of soap in hard water.
Terangkan dengan ringkas tindakan pencucian sabun di dalam air liat.

[3 marks/markah]

Section B

Bahagian B

- 6(a) Diagram 6 shows the label on a box of sugar-free cake bought from a shop. Identify three types of food additives present in this cake and state their functions.

Rajah 6 menunjukkan label pada satu kotak kek tanpa gula yang dibeli dari kedai. Kenal pasti tiga jenis bahan tambah makanan yang hadir dalam kek ini dan nyatakan fungsinya.

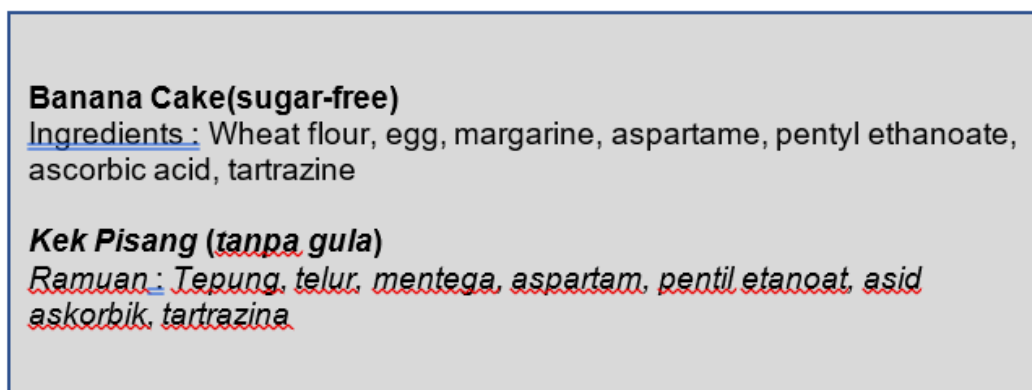


Diagram 6/Rajah 6

[7 marks /markah]

- (b) Food additives are now widely used in processed foods for specific purposes. The use of food additives however may give rise to health problems. Give three examples of food additives and their functions and any health problems that may arise.

Bahan tambahan makanan digunakan secara meluas dalam makanan proses untuk tujuan tertentu. Namun begitu, penggunaan bahan-bahan tambahan makanan mungkin menimbulkan masalah kesihatan. Beri tiga contoh bahan tambah makanan dan fungsinya serta sebarang masalah kesihatan yang mungkin berlaku.

[9 markah]

- (c) List two types of modern medicines. Name one example for each type.

Senaraikan dua jenis ubat moden. Namakan satu contoh bagi setiap jenis.

[4 markah]

- 7(a) The following are the structural formulae of two cleaning agents X and Y.
Berikut adalah formula struktur untuk dua agen pembersih X dan Y.

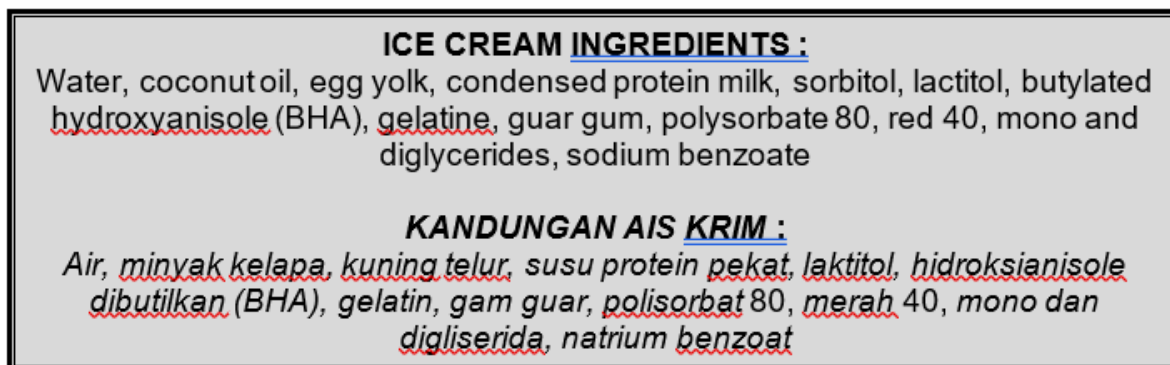
Cleaning agent X : $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2 - \text{OSO}_3^- \text{Na}^+$
Agen pembersih X

Cleaning agent Y : $\text{CH}_3(\text{CH}_2)_{14} - \text{CO}_2^- \text{Na}^+$
Agen pembersih Y

- (i) Identify the hydrophilic parts and the hydrophobic parts of cleaning agents X and Y.
Kenal pasti bahagian hidrofilik dan bahagian hidrofobik bagi agen pembersih X dan Y.
[4 marks / markah]
- (ii) Using either one of the cleaning agents : X or Y, explain the cleansing action of the cleaning agent in removing grease.
Dengan menggunakan sama ada agen pembersih X atau Y , terangkan tindakan pembersihan agen pembersih tersebut dalam penanggalan gris.
[4 marks / markah]
- (iii) Compare the advantages and disadvantages of these two cleaning agents : X and Y.
Bandingkan kelebihan dan kekurangan dua agen pembersih ini : X dan Y.
[4 marks / markah]
- (b) Using suitable materials, describe how you can prepare a sample of soap in the laboratory. Name the reaction involved.
Dengan menggunakan bahan yang sesuai, huraikan bagaimana anda boleh menyediakan satu sampel sabun dalam makmal. Namakan tindak balas yang terlibat.
[8 marks/ markah]

Section C
Bahagian C

- 8(a) Diagram 8.1 shows a label on an ice cream container.
Rajah 8.1 menunjukkan label pada suatu bekas ais krim.



Diagram/Rajah 8.1

- (i) From the list of the ingredients, state two types of food additives found in the ice cream. Name one example and state its function for each type of food additives.
Daripada senarai bahan kandungan, nyatakan dua jenis bahan tambah makanan yang terdapat dalam ais krim ini. Namakan satu contoh dan nyatakan fungsinya untuk setiap jenis bahan tambah makanan itu.
[6 marks / markah]
- (ii) Food additives are still widely used in our foods. In your opinion, do you agree that food additives should be continued being used in our foods? Give your reason.
Bahan tambah makanan masih digunakan dalam makanan kita secara meluas. Pada pendapat anda, adakah anda setuju bahawa bahan tambah makanan terus digunakan dalam makanan kita? Berikan alasan anda.
[4 marks / markah]
- (b) A student conducted an activity to compare the effectiveness of cleansing action of soap and detergent by using sea water and rain water. Describe an experiment to compare the cleansing effect of soap and detergent in sea water and rain water. In your description, include the procedure of the experiment and conclusion.
Seorang pelajar menjalankan satu aktiviti untuk membandingkan keberkesanan tindakan pencucian sabun dan detergen dengan menggunakan air laut dan air hujan. Huraikan satu eksperimen untuk membandingkan keberkesanan pencucian sabun dan detergen menggunakan air laut dan air hujan. Dalam huraian anda, sertakan prosedur eksperimen dan kesimpulan.
[7 marks / markah]

- (c) Diagram 8.2 shows a conversation between a patient and a doctor.
Rajah 8.2 menunjukkan perbualan antara seorang pesakit dengan seorang doktor.



Diagram/Rajah 8.2

Based on the conversation, state the type, example and the function of the medicine given by the doctor.

Berdasarkan perbualan, nyatakan jenis, contoh dan fungsi ubat yang diberikan oleh doktor.

[3 marks / markah]

9. The following poster shows the precaution steps to be taken in battling coronavirus, COVID-19.

Poster berikut menunjukkan beberapa langkah berjaga-jaga dalam memerangi virus korona, COVID-19.



Diagram / Rajah 9

- (a) Explain the effectiveness of water and soap in washing of hands.
Terangkan keberkesanan air dan sabun dalam pencucian tangan.

[6 marks / markah]

- (b) Based on your answer in (a), describe the cleansing action for soap to remove the dirt from the clothes.
Berdasarkan jawapan anda di (a), huraikan kesan pencucian bagi sabun untuk menanggalkan kotoran daripada pakaian.

[8 marks / markah]

- (c) Name two types of modern medicine, function and an example for each type of medicine.
Namakan dua jenis ubat moden, fungsinya dan satu contoh bagi setiap jenis ubat.

[6 marks / markah]

KERTAS 3 SOALAN STRUKTUR

1. Diagram 1 shows the set-up of apparatus used to investigate the cleansing action of soap and detergent on a pair of socks with oily stain.

Rajah 1 menunjukkan susunan radas yang digunakan untuk mengkaji tindakan pencucian sabun dan detergen ke atas sepasang stokin dengan kotoran berminyak.

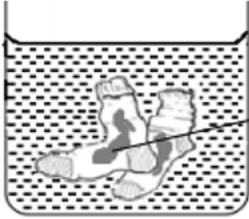
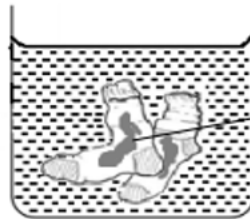
Experiment <i>Eksperimen</i>	Apparatus <i>Radas</i>	Observation <i>Pemerhatian</i>
I	Detergent + hard water <i>Detergen + air liat</i> 	Detergent + hard water <i>Detergen + air liat</i> 
II	Soap + hard water <i>Sabun + air liat</i> 	Soap + hard water <i>Sabun + air liat</i> 

Diagram 1/ *Rajah 1*

- (a) (i) State one observation based on the Diagram 1.
Nyatakan satu pemerhatian berdasarkan pada Rajah 1.

[3 marks/*markah*]

- (ii) Based on the observation in 1(a)(i), state your inference.
Berdasarkan pemerhatian pada 1(a)(i), nyatakan inferens anda.

[3 marks/*markah*]

- (b) Experiment II is repeated by using soft water to replace hard water. Predict your observation.

Eksperimen II diulang menggunakan air lembut menggantikan air liat. Ramalkan pemerhatian anda.

[3 marks/markah]

2. Diagram 2 shows two beakers each containing water and saturated sugar solution. One spoon of rice is placed in the two beakers and is left for one week as shown in the diagram.

Rajah 2 menunjukkan dua bikar setiap bikar yang mengandungi air dan larutan gula pekat. Satu sudu nasi diletakkan ke dalam kedua-dua bikar tersebut dan dibiarkan selama satu minggu.

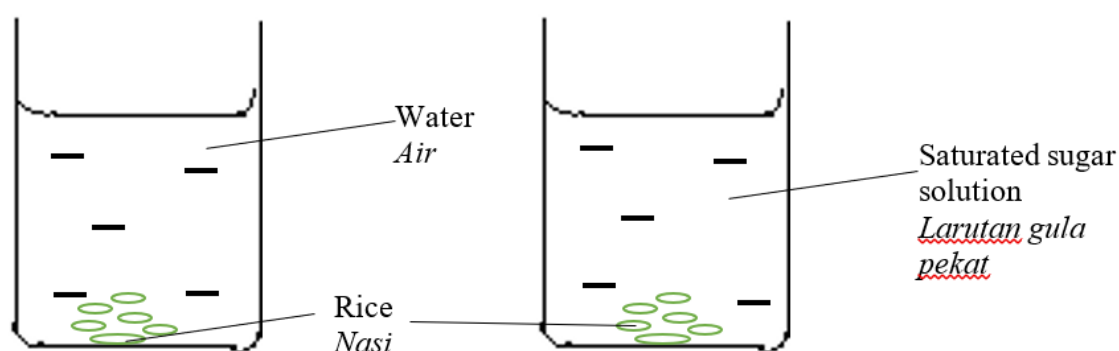


Diagram 2
Rajah 2

- (a) State the observation after one week in each of the beaker.

Nyatakan pemerhatian yang berlaku selepas satu minggu di dalam kedua-dua bikar tersebut.

[3 marks/markah]

- (b) State all the variables involved in this experiment.

Nyatakan pemboleh ubah bagi eksperimen ini.

[3 marks / markah]

Manipulated variable <i>Pemboleh ubah dimanipulasikan</i>	
Responding variable <i>Pemboleh ubah bergerak balas</i>	
Fixed variable <i>Pemboleh ubah dimalarkan</i>	

- (c) State the inference for this experiment.

Nyatakan inferens bagi eksperimen ini.

[3 marks / markah]

- (d) State the operational definition for this experiment.

Nyatakan definisi secara operasi bagi eksperimen ini.

[3 marks / markah]

- (e) What do you think will happen if we replace the saturated sugar solution with a salt solution instead?

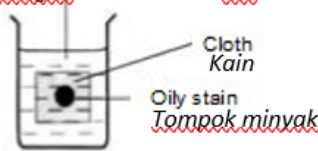
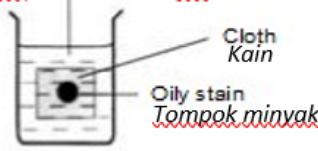
Apakah yang akan terjadi sekiranya kita menggantikan larutan gula tepu dengan larutan garam?

[3 marks /markah]

KERTAS 3: MERANCANG EKSPERIMEN

1. Diagram 1 shows the set-up of apparatus used to investigate the cleansing action of soap and detergent on a piece of cloth stained with oil.

Rajah 1 menunjukkan susunan radas yang digunakan untuk menyiasat tindakan pembersihan sabun dan detergen pada pakaian yang dikotori minyak.

Experiment <i>Eksperimen</i>	Apparatus <i>Radas</i>	Observation <i>Pemerhatian</i>
I	Detergent + 500 cm³ hard water <i>Detergen + 500 cm³ air liat</i> 	Oil stained removed <i>Kesan minyak ditanggalkan</i>
II	Soap + 500 cm³ hard water <i>Sabun + 500 cm³ air liat</i> 	Oil stained remains <i>Kesan minyak kekal</i>

Diagram/Rajah 1

Based on the above diagram, plan one laboratory experiment to compare the effectiveness of soap and detergent in hard water.

Berdasarkan rajah di atas, rancang satu eksperimen untuk membandingkan keberkesanan sabun dan detergen dalam air liat.

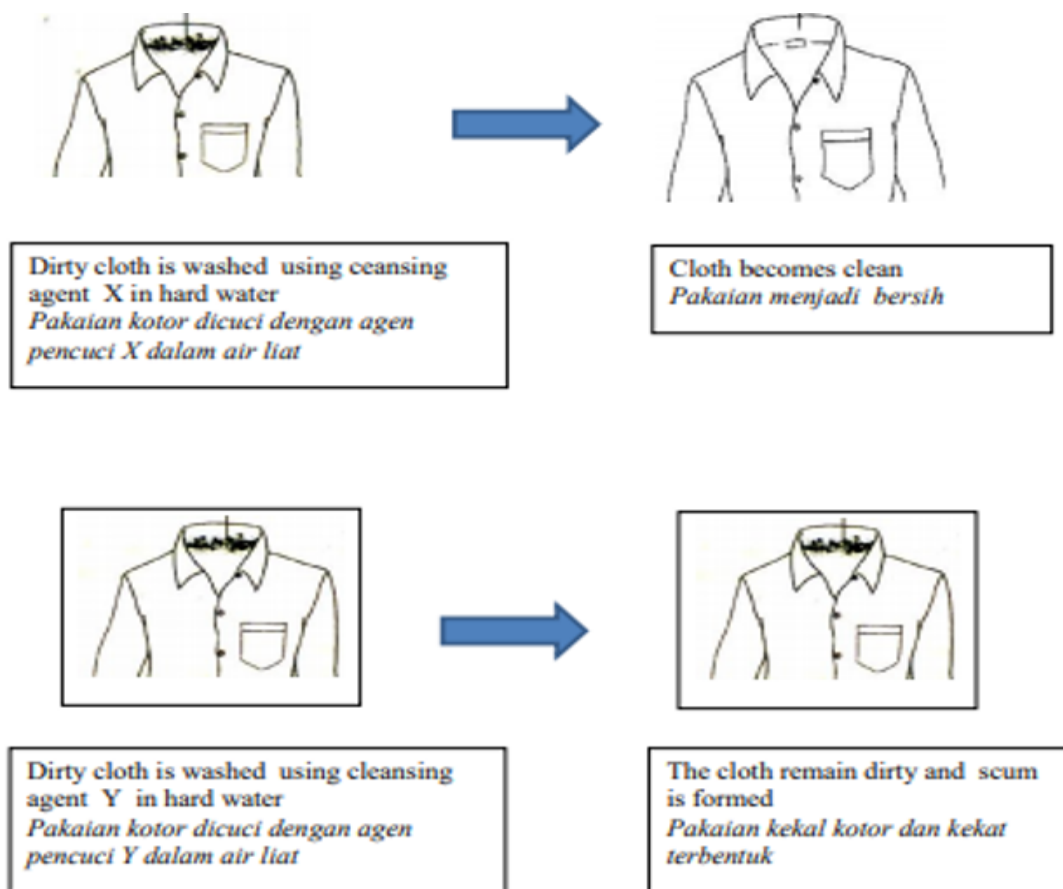
Your planning should include the following aspects:

Perancangan anda perlu mengikut aspek berikut:

- Aim of the experiment/*Tujuan eksperimen*
- All the variables/*Semua pemboleh ubah*
- Statement of the hypothesis /*Pernyataan hipotesis*
- List of substances and apparatus /*Senarai bahan dan radas*
- Procedure of the experiment /*Kaedah eksperimen*
- Tabulation of data/*Penjadualan data*

[17 marks/markah]

2. Based on observation in Diagram 2, plan an experiment to investigate the effectiveness of cleansing agent X and cleansing agent Y in hard water.
Berdasarkan pemerhatian dalam Rajah 2, rancang satu eksperimen untuk mengkaji keberkesanan agen pencuci X dan agen pencuci Y dalam air liat.



Diagram/Rajah 2

Your planning should include the following aspects.

Perancangan anda hendaklah mengandungi aspek-aspek berikut:.

- (a) Aim of the experiment / *Tujuan eksperimen*
- (b) All the variables/ *Semua pemboleh ubah*
- (c) Statement of the hypothesis / *Pernyataan hipotesis*
- (d) Lists of substances and apparatus / *Senarai bahan dan alat radas*
- (e) Procedure for the experiment/ *Prosedur eksperimen*
- (f) Tabulation of data/ *Penjadualan data*

[17 marks/ *markah*]

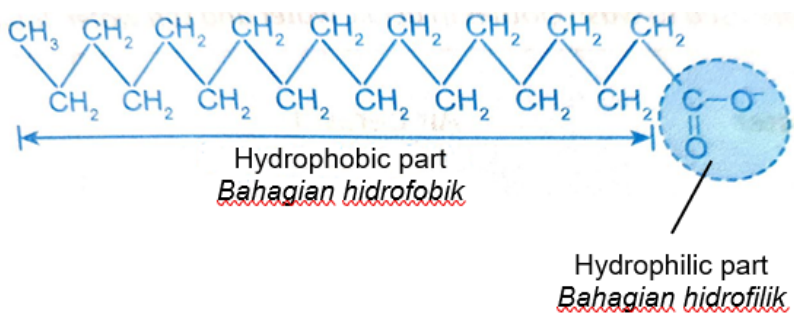
SET 9:BAHAN KIMIA UNTUK PENGGUNA

SKEMA KERTAS 2 : BAHAN KIMIA UNTUK PENGGUNA

Section A
Bahagian A

Section A/Bahagian A		
No.	Answer <i>Jawapan</i>	Marks <i>Markah</i>
1(a)	Azo compounds <i>Sebatian Azo</i>	1
(b)	As a preservative and as a food flavouring <i>Sebagai pengawet dan perisa makanan</i>	2
(c)	As a preservative <i>Sebagai pengawet</i>	1
(d)(i)	As an antioxidant and as a food flavouring <i>Sebagai pengantioksida dan perisa makanan</i>	2
(ii)	Ascorbic acid <i>Asid askorbik</i>	1
(e)(i)	Carboxylate group <i>Kumpulan karboksilat</i>	1
(ii)	Ethanol and butanoic acid <i>Etanol dan asid butanoik</i>	2
(f)	Aspartame <i>Aspartam</i>	1
2(a)(i)	M	1
(ii)	Skin disease <i>Penyakit kulit</i>	1
(iii)	The extract of its leaves is applied on the affected area. <i>Ekstrak daripada daunnya disapu pada kawasan yang dijangkiti.</i>	1

(b)(i)	Antibiotics – to kill and prevent the growth of bacteria <i>Antibiotik – untuk membunuh dan mencegah pertumbuhan bakteria</i>	1
	Psychotherapeutic medicine – to change the emotions and behaviour of the patient <i>Ubat psikoterapeutik – untuk mengubah emosi dan kelakuan pesakit</i>	1
	Analgesics – to relieve pain without causing numbness or affecting consciousness <i>Analgesik – melegakan kesakitan tanpa menyebabkan kebas atau mempengaruhi kesedaran</i>	1
(ii)	May cause bleeding in the stomach <i>Mungkin menyebabkan pendarahan dalam perut</i>	1
(iii)	So that all the bacteria that cause the disease are killed <i>Supaya semua bakteria yang menyebabkan penyakit dapat dibunuh</i>	1
(iv)	Calms down the patient's emotion so that the patient can sleep properly <i>Melegakan emosi pesakit supaya pesakit dapat tidur dengan baik</i>	1
3(a)(i)	Saponification/Saponifikasi	1
(ii)	Glycerol/Gliserol	1
(iii)	To help precipitate the solid soap <i>Untuk membantu dalam memendakkan pepejal sabun</i>	1
(b)(i)	P – soap / sabun	1
	Q – detergent / detergen	1
(ii)	The white precipitate that is formed when soap reacts with certain mineral ions that are present in hard water <i>Mendakan putih yang terbentuk apabila sabun bertindak balas dengan sesetengah ion mineral yang hadir dalam air liat.</i>	1
(iii)	Mg ²⁺ and/dan Ca ²⁺	2

(iv)	Easily biodegradable <i>Mudah terbiodegradasi</i>	1
4(a)	A soap is a sodium or potassium salt of fatty acid <i>Sabun ialah garam natrium atau kalium bagi asid lemak</i>	1
(b)	Ester	1
(c)(i)	Soap/ <i>Sabun</i> Glycerol/ <i>Gliserol</i>	1 1
(ii)	Saponification/ <i>Saponifikasi</i>	1
(d)	To precipitate the soap <i>Untuk memendakkan sabun</i>	1
(e)	Concentrated potassium hydroxide <i>Kalium hidroksida pekat</i>	1
(f)(i)	X : Hydrophobic/ <i>Hidrofobik</i> Y : Hydrophilic/ <i>Hidrofilik</i>	1 1
(ii)	Dissolve in organic solvents <i>Larut dalam pelarut organik</i>	1
5(a)	Saponification/ <i>Saponifikasi</i>	1
(b)	Ester	1
(c)(i)	 Hydrophobic part <i>Bahagian hidrofobik</i> Hydrophilic part <i>Bahagian hidrofilik</i>	1 1
(c)(ii)	Hydrocarbon chain / <i>Rantai hidrokarbon</i>	1

(d)	The molecule of soap consists of a polar end and a hydrocarbon chain. <i>Molekul sabun terdiri daripada hujung berpolar dan rantai hidrokarbon.</i> The polar end is hydrophilic which dissolves in water while the hydrocarbon chain is hydrophobic which dissolves in grease. <i>Hujung berpolar bersifat hidrofilik, iaitu larut di dalam air, manakala rantai hidrokarbon bersifat hidrofobik, iaitu larut di dalam gris.</i> When water is agitated, the grease will come off the cloth and form an emulsion layer. <i>Apabila air dikocak, gris akan tertanggal daripada pakaian dan membentuk lapisan emulsi.</i> It is carried away by rinsing the cloth with clean water. <i>Lapisan ini ditanggalkan apabila pakaian dibilas dengan air yang bersih.</i>	1 2 1 1
(e)(i)	Water that consists of Mg^{2+} and Ca^{2+} ions. <i>Air yang mengandungi ion-ion Mg^{2+} dan Ca^{2+}.</i>	2
(ii)	Soap cannot clean effectively in hard water. <i>Sabun tidak dapat mencuci dengan berkesan di dalam air liat.</i> It will form scum if it reacts with Mg^{2+} and Ca^{2+} ions. <i>Sabun akan membentuk kekat apabila bertindak balas dengan ion-ion Mg^{2+} dan Ca^{2+}</i>	1 2

Section B/Bahagian B			
No.	Answer/Jawapan		Marks Markah
6(a)	Ingredient Ramuan	Type of food additive Jenis bahan tambah makanan	Function Fungsi
	Aspartame Aspartam	Flavouring agent Agen perasa	To make the cake taste sweet/to replace sugar Untuk memaniskan kek/menggantikan gula
	Pentyl ethanoate Pentil etanoat	Flavouring agent Agen perasa	To add flavour Untuk menambahkan rasa
	Ascorbic acid Asid askorbik	Antioxidant Pengantioksida	To prevent oxidation of the cake Mengelakkan pengoksidaan kek
	Tartrazine Tatrazin	Dye/colouring agent Agen pewarna	To add colour to the cake Untuk menambahkan warna pada kek
	Able to state the ingredient with correct food additive Boleh menyatakan ramuan dengan satu bahan tambah makanan yang betul		1,1 1,1 1,1 1,1 (Max:7 m) 1

(b)			
	Food additive <i>Bahan tambah makanan</i>	Function <i>Fungsi</i>	Health problem that may occur <i>Masalah kesihatan yang mungkin berlaku</i>
	Sodium nitrite <i>Natrium nitrit</i>	To preserve meat to last longer <i>Untuk mengawet daging supaya tahan lama</i>	May produce carcinogens <i>Mungkin menghasilkan karsinogen</i>
	Monosodium glutamate(MSG) <i>Mononatrium glutamate</i>	To increase flavour of food <i>Meningkatkan rasa makanan</i>	May cause allergy <i>Mungkin menyebabkan alahan</i>
	Azo/triphenyl compounds/dyes <i>Azo/sebatian trifenil/pewarna</i>	To add colour to food/make food appear more attractive <i>Menambahkan warna kepada makanan/menjadikan makanan kelihatan lebih menarik</i>	May cause hyperactivity/allergy <i>Mungkin menyebabkan hiperaktif/alahan</i>
	Saccharin <i>Sakarin</i>	Produce sweetness <i>Menjadikan makanan lebih manis</i>	May produce carcinogen <i>Menghasilkan karsinogen</i>
	Any three/ <i>Mana-mana tiga</i>		

(c)			
	Type of medicine <i>Jenis ubat</i>	Example <i>Contoh</i>	
	Analgesics <i>Analgesik</i>	Aspirin/paracetamol/codeine <i>Aspirin/parasetamol/Kodeine</i>	
	Antibiotics <i>Antibiotik</i>	Penicilin/streptomycin <i>Penisilin/ streptomisin</i>	
	Psychotherapeutic drugs <i>Ubat psikoterapeutik</i>	Stimulant/antidepressant/antipsychotic drug <i>Stimulan/antidepresan/ubat antipsikotik</i>	
Any two/ <i>Mana-mana dua</i>			

7(a)(i)	Cleaning agent X : $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2 - \text{OSO}_3^- \text{Na}^+$ <u>Agen pembersih X</u> Hydrophobic Hidrofobik Hydrophilic Hidrofilik Cleaning agent Y : $\text{CH}_3(\text{CH}_2)_{14} - \text{CO}_2^- \text{Na}^+$ <u>Agen pembersih Y</u> Hydrophobic Hidrofobik Hydrophilic Hidrofilik	2
		2
(ii)	1. Detergent X/Y dissociates to ions which lower the surface tension of water. <i>Detergen X/Y terurai menjadi ion yang merendahkan tekanan pada permukaan air.</i> 2. When shaken with water, the hydrophobic component of the cleaning agent X/Y dissolves in grease and emulsifies the grease into tiny grease droplets. <i>Bila digoncang dengan air, bahagian hidrofobik agen pencuci X/Y larut di dalam gris dan mengemulsikan gris kepada titisan kecil gris.</i> 3. The hydrophilic component of the cleaning agent X/Y dissolves in water.	1 1 1
(iii)	<i>Bahagian hidrofilik agen pencuci X/Y larut di dalam air.</i> 4. When rinsed with more water, the grease droplets are removed together with the water. <i>Apabila dibilas dengan lebih banyak air, titisan gris tertanggal di dalam air.</i> Advantages of cleaning agent X compared to cleaning agent Y Kelebihan agen pencuci X berbanding agen pencuci Y 1. Cleaning agent X is effective in both soft and hard water whereas cleaning agent Y can only clean in soft water. <i>Agen pencuci X lebih berkesan dalam air lembut dan air liat manakala agen pencuci Y hanya berkesan dalam air lembut.</i> 2. Cleaning agent X do not form scum in hard water whereas cleaning agent Y forms scum in hard water. <i>Agen pencuci X tidak membentuk kekat di dalam air keras manakala agen pencuci Y membentuk kekat di dalam air liat.</i>	1 1 1

7(b)	3. Cleaning agent X can be added with different types of additives to improve its cleaning action./ <i>Boleh menambahkan pelbagai jenis bahan tambahan di dalam agen pencuci X untuk mempertingkatkan keberkesanan pencucian.</i>	1
	Advantages of cleaning agent Y compared to cleaning agent X <i>Kelebihan agen pencuci Y berbanding dengan agen pencuci X</i>	
	1. Cleaning agent Y is biodegradable whereas cleaning agent X is not. <i>Agen pencuci Y terbiodegradasi manakala agen pencuci X tidak terbiodegradasi.</i>	1
	2. The additives added to cleaning agent X may cause allergy (or kill aquatic living things) <i>Bahan tambahan kepada agen pencuci X menyebabkan alahan(atau membunuh organisma akuatik)</i>	1
	3. The phosphates added to cleaning agent X can encourage the growth of water algae which deplete the oxygen in the water. <i>Fosfat ditambahkan kepada agen pencuci X menyebabkan pertumbuhan alga air yang menyebabkan kekurangan oksigen di dalam air.</i>	1
	Any 4 points/Mana-mana 4 poin	1
	Materials/Bahan :	
	Vegetable oil, 5 moldm⁻³ sodium hydroxide solution, sodium chloride(salt) <i>Minyak sayuran, larutan natrium hidroksida 5 moldm⁻³, natrium klorida(garam)</i>	1
	Apparatus/Radas:	
	Beaker, measuring cylinder, glass rod <i>Bikar, silinder penyukat, rod kaca</i>	1
	Procedure/Prosedur:	
	1. 5 cm³ of vegetable oil is placed in a beaker. <i>5 cm³ minyak sayuran diletakkan ke dalam bikar.</i>	1
	2. 25 cm³ of 5 moldm⁻³ sodium hydroxide solution is added to the oil. <i>25 cm³ larutan natrium hidroksida 5 moldm⁻³ ditambahkan ke dalam minyak.</i>	1
	3. The mixture is heated and stirred continuously. <i>Campuran tersebut dipanaskan dan digaulkan.</i>	1
	4. About 150 cm³ of water is added to the mixture, followed by 3 spatula of sodium chloride. <i>150 cm³ air ditambahkan ke dalam campuran, diikuti dengan 3</i>	1

spatula natrium klorida.

5. The mixture is boiled for about 5 minutes and allowed to cool. The precipitate formed is filtered and dried between filter papers.

Campuran tersebut dididihkan selama 5 menit dan biarkan campuran tersebut untuk menyejuk. Mendakan yang terbentuk ditapis dan dikeringkan dengan menggunakan kertas turas.

6. The reaction is known as saponification.

Tindak balas tersebut ialah saponifikasi.

BAHAGIAN C

8(a)(i)

Type <i>Jenis</i>	Example <i>Contoh</i>	Function <i>Fungsi</i>
Flavouring <i>Perisa</i>	Sorbitol//Lacticol <i>Sorbitol//Laktikol</i>	Improves the taste of ice cream <i>Meningkatkan rasa ais krim</i>
Stabiliser <i>Penstabil</i>	Gelatine//Guar gum//Polysorbate 80//Mono and diglycerides <i>Gelatin//Gam guar//Polisorbat 80//Mono dan digliserida 80//Mono dan digliserida</i>	Prevents emulsion from separating out <i>Mencegah emulsi daripada terpisah keluar</i>
Colouring <i>Pewarna</i>	Red 40 <i>Merah 40</i>	Adds colour to the ice cream <i>Menambah warna kepada air krim</i>
Preservative <i>Pengawet</i>	Sodium benzoate <i>Natrium benzoat</i>	Makes the ice cream lasts longer <i>Membuat ais krim tahan lebih lama</i>
Antioxidant <i>Antioksida</i>	Butylated hydroxyanisole <i>Hidroksianisole dibutilkan(BHA)</i>	Prevents oxidation that causes rancid fat <i>Mencegah pengoksidaan yang menyebabkan lemak tengik</i>

1,1,1

1,1,1

1,1,1

1,1,1

1,1,1

(ii)	Any two/<i>Mana-mana dua</i> 1. Agree / <i>Bersetuju</i> 2. Food not easily spoiled./ <i>Makanan tidak mudah rosak.</i> 3. Demand for food is rising because of population boom <i>Permintaan untuk makanan semakin meningkat kerana peningkatan populasi</i> 4. Can lower the cost of food./ <i>Boleh mengurangkan kos makanan.</i> Or/<i>Atau</i> 1. Disagree / <i>Tidak bersetuju</i> 2. Can cause illness/ <i>Boleh menyebabkan penyakit</i> 3. Cost of medical rises/ <i>Kos kenaikan perubatan</i> 4. Cost of buying food supplements <i>Kos untuk membeli makanan tambahan</i>	1 1 1 1 1 1 1 1 1
(b)	1. Pour sea water and rain water into two basins respectively. <i>Tuangkan air laut dan air hujan ke dalam dua besen masing-masing.</i> 2. Add soap into the basins. <i>Tambahkan sabun ke dalam kedua-dua besen.</i> 3. Dip a piece of cloth with oily stain into each basin. <i>Celupkan kain dengan kotoran berminyak ke dalam setiap besen.</i> 4. Wash and rinse the cloth. <i>Basuh dan bilas kain.</i> 5. Repeat steps 1 to 4 by using detergent. <i>Ulang langkah 1 hingga 4 dengan menggunakan detergen.</i> Conclusion/<i>Kesimpulan:</i> 6. The oily stain on cloth washed in sea water using soap remains but the oily stain on cloth washed in sea water using detergent disappears. <i>Kotoran berminyak pada kain dicuci dengan air laut menggunakan sabun kekal tetapi kotoran berminyak pada kain dicuci dengan air laut menggunakan detergen hilang.</i> 7. Detergent is more effective than soap in sea water. <i>Detergen adalah lebih berkesan daripada sabun dalam air laut.</i>	1 1 1 1 1 1 1

(c)	Example of medicine <i>Contoh ubat</i>	Type of medicine <i>Jenis ubat</i>	Function <i>Fungsi</i>	1,1,1
	Tranquiliser // Barbiturate <i>Penenang //</i> <i>Barbiturat</i>	Psychotherapeutic <i>Psikoterapeutik</i>	Calms down // Reduces tension <i>Menenangkan //</i> <i>Mengurangkan</i> <i>tekanan</i>	
9(a)	1. Our hands has oils on it. <i>Terdapat lapisan minyak pada tangan kita.</i>			1
	2. Virus sticks to the oil. <i>Virus senang melekat pada lapisan minyak tersebut.</i>			1
	3. Soap can decrease the surface tension. <i>Sabun mengurangkan tekanan pada permukaan tangan.</i>			1
	4. When washing with soap, rubbing physically causes friction. <i>Apabila tangan dicuci dengan menggunakan sabun, geseran berlaku semasa tangan bergeser.</i>			1+1
	5. During rinsing, virus is washed off with the soap. <i>Semasa dibilas, virus dicuci bersama dengan sabun.</i>			1
(b)	1. Soap dissolves in water and reduces the surface tension of water to wet the dirty cloth. <i>Sabun larut dalam air dan mengurangkan ketegangan permukaan air supaya pakaian dapat dibasahkan.</i>			1
	2. The hydrophobic part of the anion dissolves in grease. <i>Bahagian hidrofobik larut di dalam gris.</i>			1
	3. The hydrophilic part dissolves in water. <i>Bahagian hidrofilik larut di dalam air.</i>			1
	4. Grease is loosened and lifted off the surface of clothes by rubbing, scrubbing or heating. <i>Gris akan tertanggal daripada permukaan pakaian dengan menggosok, menyental atau pemanasan.</i>			1
	5. The hydrophilic part surrounds the grease and is lifted off the surface of clothes. <i>Bahagian hidrofilik mengelilingi gris dan menanggalkannya daripada permukaan pakaian.</i>			1+1
	6. The grease is dispersed into smaller droplet/emulsified.			1

	<i>Gris dipecahkan kepada titisan kecil/diemulsikan.</i> 7. Rinsing away the dirty water removes the grease droplets. <i>Membilas air kotoran menanggalkan titisan gris.</i>	1
(c)	1. Analgesics are modern medicines that relieve pain. <i>Analgesik adalah ubat moden yang mengurangkan kesakitan.</i> Example/Contoh: Pacetamol/Parasetamol	1,1,1
	2. Antibiotics are modern medicines that cure diseases caused by bacteria. <i>Antibiotik adalah ubat moden yang merawat penyakit yang disebabkan oleh bakteria.</i> Example/Contoh : Streptomycin/Streptomisin.	1,1,1

Paper 3 (Structure question) Kertas 3(Soalan struktur)		
No.	Answer/Jawapan	Mark Markah
1(a)(i)	Oily stain in experiment I is removed/ Disappeared AND oily stain in Experiment II remains// <i>Kotoran berminyak dalam Eksperimen I disingkirkan/ dihilangkan DAN kotoran berminyak dalam Eksperimen II kekal.</i> Sock in Experiment I is clean and stain remains in Experiment II <i>Stokin dalam Eksperimen I bersih dan kotoran kekal dalam Eksperimen II</i>	3
	Oily stain in Experiment I removed// <i>Kotoran berminyak dalam Eksperimen I disingkirkan</i> Oily stain in Experiment II remain// <i>Kotoran berminyak dalam Eksperimen II kekal</i> Sock is clean in Experiment I// <i>Stokin bersih dalam Eksperimen I</i> The stain remains in Experiment II// <i>Kotoran kekal dalam Eksperimen II</i> Sock in Experiment I is cleaner than in Experiment II// <i>Stokin dalam Eksperimen I lebih bersih berbanding dalam Eksperimen II</i>	2
	Oily stain removed// <i>Kotoran berminyak disingkirkan</i> Oily stain remains// <i>Kotoran berminyak kekal</i> Sock is clean// <i>Stokin bersih</i>	1
	No response given/wrong response <i>Tiada jawapan diberikan / Jawapan salah</i>	0
1(a)(ii)	Cleansing action of detergent is more effective in hard water compared to soap (vice versa) <i>Kuasa pencucian bagi detergen lebih efektif dalam air liat berbanding sabun (atau sebaliknya)</i>	3

	Cleansing action of detergent is effective in hard water/ <i>Kuasa pencucian bagi detergent lebih berkesan dalam air liat//</i>	2						
	Cleansing action of soap is less effective in hard water/ <i>Kuasa pencucian bagi sabun kurang berkesan dalam air liat</i>							
	Detergent is a good/ better cleaning agent <i>Detergen ialah agen pencuci yang baik/ bagus</i>	1						
	No response given/wrong response <i>Tiada jawapan diberikan / Jawapan salah</i>	0						
1(b)	Oily stain is removed/ disappeared/ <i>Kotoran berminyak disingkirkan/ dihilangkan//</i> Sock is clean/ <i>Stokin bersih</i>	3						
	White precipitate not produced/ <i>Mendakan putih tidak dihasilkan</i>	2						
	No stain/ <i>Tiada kotoran</i>	1						
	No response given/wrong response <i>Tiada jawapan diberikan / Jawapan salah</i>	0						
2(a)	Beaker filled with water : Rice turn rancid and smelly <i>Bikar berisi air : Nasi basi dan berbau busuk</i> Beaker filled with saturated sugar solution : Rice smells fragrant <i>Bikar berisi larutan gula pekat : Nasi berbau wangi</i>	3						
(b)	<table><tr><td>Manipulated variable <i>Pembolehubah dimanipulasikan</i></td><td>Presence of preservative <i>Kehadiran pengawet</i></td></tr><tr><td>Responding variable <i>Pembolehubah bergerak balas</i></td><td>Fermentation of rice <i>Penapaian nasi</i></td></tr><tr><td>Fixed variable <i>Pembolehubah dimalarkan</i></td><td>Volume of solution used <i>Isipadu larutan yang digunakan</i></td></tr></table>	Manipulated variable <i>Pembolehubah dimanipulasikan</i>	Presence of preservative <i>Kehadiran pengawet</i>	Responding variable <i>Pembolehubah bergerak balas</i>	Fermentation of rice <i>Penapaian nasi</i>	Fixed variable <i>Pembolehubah dimalarkan</i>	Volume of solution used <i>Isipadu larutan yang digunakan</i>	3
Manipulated variable <i>Pembolehubah dimanipulasikan</i>	Presence of preservative <i>Kehadiran pengawet</i>							
Responding variable <i>Pembolehubah bergerak balas</i>	Fermentation of rice <i>Penapaian nasi</i>							
Fixed variable <i>Pembolehubah dimalarkan</i>	Volume of solution used <i>Isipadu larutan yang digunakan</i>							
(c)	Sugar is a preservative. <i>Gula ialah pengawet makanan.</i>	3						

(d)	Rice is placed in different types of solutions and is preserved in sugar solution to avoid it being rancid. <i>Nasi direndamkan ke dalam larutan yang berlainan jenis dan diawetkan ke dalam larutan gula untuk mengelakkan nasi tersebut daripada basi.</i>	3
(e)	Rice will not turn rancid and smelly like in beaker containing water only. <i>Nasi tidak akan basi dan berbau busuk seperti di dalam bikar yang mengandungi air.</i>	3
Paper 3(Planning experiment) Kertas 3(Merancang eksperimen)		
1(a)	Able to give the aim of the experiment accurately. <i>Dapat memberikan tujuan eksperimen dengan tepat.</i> Sample answer/Sampel Jawapan To compare the effectiveness of the cleansing action of soap and detergent in hard water. <i>Untuk membandingkan keberkesanan tindakan pencucian bagi sabun dan detergen di dalam air liat..</i>	3
	Able to give the aim of the experiment correctly. <i>Dapat memberikan tujuan eksperimen dengan betul.</i> Sample answer/Sampel Jawapan To compare the cleansing action of soap and detergent. <i>Untuk membandingkan keberkesanan tindakan pencucian antara sabun dan detergen.</i>	2
	Able to give a relevant idea with the aim of the experiment. <i>Dapat memberikan idea relevan dengan tujuan eksperimen.</i> To study the cleaning agent. <i>Untuk mengkaji agen pencuci.</i>	1
	Wrong or no response <i>Salah atau tiada jawapan</i>	0

(b)	Able to state the three variables accurately. <i>Dapat menyatakan tiga pemboleh ubah dengan tepat.</i> Answer Manipulated variable: Soap and detergent Responding variable: Effectiveness of cleansing action // the ability to remove the oily stains on cloth Fixed variable: cloth with oily stains, hard water <i>Jawapan</i> <i>Pemboleh ubah dimanipulasikan : Sabun dan detergen</i> <i>Pemboleh ubah bergerak balas: Keberkesanan tindakan pencucian // kebolehan untuk menanggalkan kotoran pada kain</i> <i>Pemboleh ubah tetap : Kain dengan tompok minyak, air keras</i>	3
	Able to state two variables correctly <i>Dapat menyatakan dua pemboleh ubah dengan tepat</i>	2
	Able to state one variable correctly <i>Dapat menyatakan satu pemboleh ubah dengan tepat</i>	1
	Wrong or no response <i>Salah atau tiada jawapan</i>	0
(c)	Able to state the hypothesis accurately with direction <i>Dapat menyatakan hipotesis dengan tepat dengan arah</i> Sample answer/<i>Sampel Jawapan</i> The cleansing action of a detergent is more effective in hard water than a soap <i>Tindakan pencucian detergen adalah lebih berkesan di dalam air keras berbanding sabun</i>	3
	Able to make hypothesis less accurately. <i>Dapat menyatakan hipotesis dengan kurang tepat.</i> Detergent is more effective than soap <i>Detergen lebih berkesan daripada sabun</i>	2
	Able to give an idea of making hypothesis. <i>Dapat menyatakan suatu idea tentang hipotesis.</i> Detergent is more effective. <i>Detergen lebih berkesan.</i>	1

	Wrong or no response. <i>Salah atau tiada jawapan.</i>	0
(d)	Able to state the complete list of apparatus and material as follows./ <i>Dapat menyatakan senarai radas dan bahan lengkap</i> Apparatus : 2 beakers, , glass rod// <i>Radas : 2 bikar, rod kaca</i> Materials : Hard water, soap and detergent solution, 2 pieces of clothes stained with oil. <i>Bahan : air liat, larutan air sabun dan detergen, 2 keping kain dengan tompok minyak</i>	3
	Able to list the apparatus and materials less completely <i>Dapat menyenaraikan senarai radas dan bahan dengan kurang lengkap.</i> Apparatus : Beakers// <i>Radas : Bikar</i> Materials : Hard water, soap and detergent solution, pieces of clothes stained with oil. <i>Bahan : air liat, larutan air sabun dan detergen, kepingan kain dengan tompok minyak.</i>	2
	Able to list an idea of the apparatus and materials. <i>Dapat menyenaraikan suatu idea tentang radas dan bahan.</i> Sample answer/ <i>Sampel Jawapan</i> Soap, detergent, (any container), hard water, dirty cloth <i>Sabun, detergen, (apa-apa bekas), Air liat, kain kotor</i>	1
	Wrong or no response <i>Salah atau tiada jawapan</i>	0

(e)	Able to state procedures correctly as follows <i>Dapat menyatakan semua prosedur dengan tepat</i> 1. [50 - 200] cm³ of hard water is poured into a beaker 2. Soap is added into the beakers 3. A piece of cloth stained with oil is immersed in the solution. 4. The cloth is shaken/rubbed 5. Observation is recorded. 6. Repeat steps 1-5 by using detergent. 1. [50-200] cm³ air liat dituangkan ke dalam suatu bikar 2. Sabun ditambahkan ke dalam semua bikar itu 3. Sekeping kain bertompok minyak direndamkan ke dalam larutan itu. 4. Kain tersebut digosok. 5. Rekodkan pemerhatian 6. Ulangi langkah 1-5 dengan menggunakan detergen	3
	Able to list the steps of the procedures less accurately. <i>Dapat menyenaraikan prosedur dengan kurang tepat.</i> Sample answer/<i>Sampel Jawapan</i> Steps/<i>Langkah</i> 1, 2,3,4,6	2
	Able to list an idea of procedures. <i>Dapat menyenaraikan suatu idea tentang prosedur.</i> Sample answer/<i>Sampel Jawapan</i> Steps/<i>Langkah</i> Hard water is poured into (any container) <i>Air liat dituangkan ke dalam (mana-mana bekas)</i> Soap and detergent is added. <i>Sabun dan detergen ditambahkan.</i>	1
	Wrong or no response <i>Salah atau tiada jawapan</i>	0

(f)	Able to tabulate the data correctly <i>Dapat menjadualkan data dengan tepat</i> Sample answer/<i>Sampel jawapan</i> <table><tr><td>Types of cleaning agent <i>Jenis agen pencuci</i></td><td>Observation <i>Pemerhatian</i></td></tr><tr><td>Soap <i>Sabun</i></td><td></td></tr><tr><td>Detergent <i>Detergen</i></td><td></td></tr></table>	Types of cleaning agent <i>Jenis agen pencuci</i>	Observation <i>Pemerhatian</i>	Soap <i>Sabun</i>		Detergent <i>Detergen</i>		2
Types of cleaning agent <i>Jenis agen pencuci</i>	Observation <i>Pemerhatian</i>							
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Soap/ <i>Sabun</i>								
Detergent/ <i>Detergen</i>								
	Wrong or no response//<i>Salah atau tiada jawapan</i>	0						
2(a)	To compare the effectiveness of the cleansing action of soap and detergent in hard water. <i>Membandingkan keberkesanan pencucian detergen dan sabun dalam air liat.</i>	3						
(b)	Manipulated variables: Detergent and soap <i>Pemboleh ubah dimanipulasikan: Detergen dan sabun</i> Responding variables: <i>Pemboleh ubah bergerak balas: menyingkirkan kotoran seperti gris</i> Constant variables: Hard water <i>Pemboleh ubah dimalarkan: Air liat</i>	3						
(c)	Detergen able to get rid of grease faster than soap in hard water. <i>Dalam air liat, detergen menyingkirkan gris lebih cepat daripada sabun.</i>	3						

(d)	Materials: Detergent, soap, cloth, hard water Apparatus: Beaker <i>Bahan: Detergen, sabun, baju dan air liat</i> <i>Radas: Bikar</i>	3												
(e)	1. Hard water poured into two beakers. 2. Detergent and soap put into two beakers separately. 3. Dirty cloth is dipped into each beaker. 4. Cloth are rinsed. <i>1. Air liat dituang ke dalam dua bikar.</i> <i>2. Detergen dan sabun diletakkan secara berasingan ke dalam bikar.</i> <i>3. Baju yang kotor diletakkan ke dalam setiap bikar.</i> <i>4. Baju dibilas</i>	3												
(f)	<table><tr><td>Experiment</td><td>Observation</td></tr><tr><td>Cloth in detergent</td><td></td></tr><tr><td>Cloth in soap</td><td></td></tr></table> <table><tr><td><i>Experimen</i></td><td><i>Pemerhatian</i></td></tr><tr><td><i>Baju dalam detergen</i></td><td></td></tr><tr><td><i>Baju dalam sabun</i></td><td></td></tr></table>	Experiment	Observation	Cloth in detergent		Cloth in soap		<i>Experimen</i>	<i>Pemerhatian</i>	<i>Baju dalam detergen</i>		<i>Baju dalam sabun</i>		2
Experiment	Observation													
Cloth in detergent														
Cloth in soap														
<i>Experimen</i>	<i>Pemerhatian</i>													
<i>Baju dalam detergen</i>														
<i>Baju dalam sabun</i>														

THE PERIODIC TABLE OF ELEMENTS

1	H	Hydrogen	1
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10	Ne	Neon	20
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Proton number
Symbol
Name of element
Relative atomic mass

3	Li	Lithium	7
4	Be	Beryllium	9
11	Na	Sodium	23
12	Mg	Magnesium	24

5	B	Boron	11	6	C	Carbon	12	7	N	Nitrogen	14	8	O	Oxygen	16	9	F	Flourine	19	10	Ne	Neon	20
13	Al	Aluminium	27	14	Si	Silicon	28	15	P	Phosphorus	31	16	S	Sulphur	32	17	Cl	Chlorine	35	18	Ar	Argon	40
19	K	Potassium	39	20	Ca	Calcium	40	21	Sc	Scandium	45	22	Ti	Titanium	48	23	V	Vanadium	51	24	Cr	Chromium	52
37	Rb	Rubidium	86	38	Sr	Strontium	88	39	Y	Yttrium	89	40	Zr	Zirconium	91	41	Nb	Niobium	93	42	Mo	Molybdenum	96
55	Cs	Cesium	133	56	Ba	Barium	137	57	La	Lanthanum	139	72	Hf	Hafnium	179	73	Ta	Tantalum	181	74	W	Tungsten	184
87	Fr	Francium	223	88	Ra	Radium	226	89	Ac	Actinium	227	104	Unq	Unnilquadium	257	105	Unp	Unnilpentium	260	106	Unh	Unnilhexium	263
29	Cu	Copper	64	30	Zn	Zinc	65	45	Co	Cobalt	59	46	Ni	Nickel	59	47	Cd	Cadmium	112	48	In	Indium	115
27	Co	Cobalt	59	28	Ni	Nickel	59	29	Cu	Copper	64	30	Zn	Zinc	65	31	Ga	Gallium	70	32	Ge	Germanium	73
43	Tc	Technetium	98	44	Ru	Ruthenium	101	45	Rh	Rhodium	103	46	Pd	Palladium	106	47	Ag	Silver	108	48	Cd	Cadmium	112
75	Re	Rhenium	186	76	Os	Osmium	190	77	Ir	Iridium	192	78	Pt	Platinum	195	79	Au	Gold	197	80	Hg	Mercury	201
107	Uns	Unnilseptium	262	108	Uno	Unniloctium	265	109	Une	Unnilennium	266	81	Tl	Thallium	204	82	Pb	Lead	207	83	Bi	Bismuth	209
103	I	Iodine	127	53	Sb	Antimony	122	52	Te	Tellurium	128	54	Xe	Xenon	131	84	Kr	Krypton	84	36	Se	Selenium	79
127	I	Iodine	127	85	At	Astatine	210	86	Rn	Radon	222	87	Fr	Francium	223	88	Ra	Radium	226	89	Ac	Actinium	227

58	Ce	Cerium	140	59	Pr	Praseodymium	141	60	Nd	Neodymium	144	61	Pm	Promethium	147	62	Sm	Samarium	150	63	Eu	Europium	152
90	Th	Thorium	232	91	Pa	Protactinium	231	92	U	Uranium	238	93	Np	Neptunium	237	94	Pu	Plutonium	244	95	Am	Americium	243
101	Md	Mendelevium	256	102	No	Nobelium	254	103	Lr	Lawrencium	257	104	Rf	Rutherfordium	261	105	Db	Dubnium	262	106	Sg	Seaborgium	266
107	Bh	Berkelium	247	108	Cf	Californium	249	109	Es	Einsteinium	254	110	Fm	Fermium	253	111	Mn	Mendelevium	256	112	Lv	Livermorium	260
113	Yb	Ytterbium	173	114	Lu	Lutetium	175	115	Uut	Ununtrium	288	116	Uuq	Ununquadium	289	117	Uuh	Ununhexium	294	118	Uuo	Ununoctium	294