

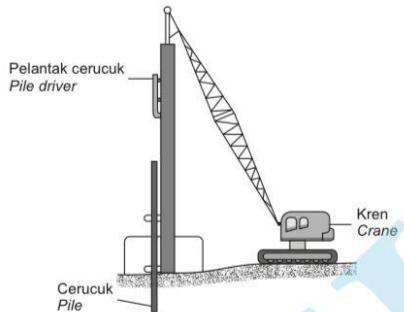
## KOMPILASI SOALAN PEMILIHAN CIRI/ASPEK DAN PENAMBAHBAIKAN/PENGUBAHSUAIAN (English ver)

### ✓ Bab 2 Force and Motion 1

1.

(d) Rajah 6.4 menunjukkan satu model penanam cerucuk yang digunakan pada satu tapak pembinaan bangunan. Anda dikehendaki mengubah suai reka bentuk model penanam cerucuk itu supaya kerja untuk menanam cerucuk di kawasan pembinaan menjadi lebih berkesan.

*Diagram 6.4 shows a pile planter model used in a construction site. You are required to modify a pile planter model so that will make the piling works in the construction site will be more efficient.*



Rajah/Diagram 6.4

Nyatakan dan terangkan pengubahsuaian berdasarkan aspek-aspek berikut:

*State and explain the modifications based on the following aspects:*

- Jisim pelantak cerucuk / Mass of pile driver
- Ketinggian maksimum dari cerucuk / Maximum height from pile
- Kekerasan pelantak cerucuk / Hardness of pile driver
- Kuasa enjin kren / Engine power of crane
- Bentuk cerucuk / Shape of pile

Pengubahsuaian / Modification	Alasan / Reason
(i) Jisim pelantak cerucuk mestilah besar <i>Mass of the pile driver must be large</i>	Dapat membekalkan daya yang besar untuk menanam cerucuk <i>Can produce large force to bury the pile</i>
(ii) Ketinggian dari cerucuk mestilah tinggi <i>The height of the pile must be high</i>	Tenaga keupayaan tinggi <i>High gravitational potential energy</i>
(iii) Pelantak cerucuk mestilah keras <i>The pile driver must be hard</i>	Masa impak singkat <i>Short time of impact</i>
(iv) Kuasa enjin mestilah tinggi <i>The engine power must be high</i>	Lebih banyak kerja penanaman cerucuk dapat dilakukan. <i>More piling work can be done</i>
(v) Bentuk cerucuk tajam di hujung <i>Shape of the pile is sharp at the end</i>	Mudah ditenggelamkan / tekanan tinggi <i>Easy to be buried / high pressure</i>

[10 markah/marks]

2.

(c)

Jenama Brand	Masa bertindak balas/ s Reaction time/ s	Jenis brek Type of brake	Daya tujahan enjin/N Engine thrust force/ N	Bentuk kereta Shape of car
A	0.3	ABS (Antilock Brake System)	10.0	 Kurang aerodinamik Less aerodynamic
B	0.5	Udara Air	13.5	 Kurang aerodinamik Less aerodynamic
C	0.2	ABS (Antilock Brake System)	12.8	 Aerodinamik Aerodynamic
D	0.6	Udara Air	16.0	 Aerodinamik Aerodynamic

Jadual/Table 1

Dalam satu pertandingan lumba kereta, empat buah kereta yang berjenama A, B, C dan D telah mengambil bahagian. Maklumat tentang empat buah kereta itu telah diberikan dalam Jadual 1.

*In a car racing competition, four cars branded A, B, C and D took part. The information of the four cars is given in Table 1.*

Anda dikehendaki mengkaji ciri-ciri kereta dalam Jadual 1.

*You are asked to study the characteristics of the cars in Table 1.*

Terangkan kesesuaian setiap ciri dalam Jadual 1 dan tentukan jenama kereta yang paling sesuai digunakan sebagai kereta lumba. Berikan sebab pilihan anda.

*Explain the suitability of each characteristics in Table 1 and hence, determine which brand is most suitable to be used as a racing car. Justify your choice.*

Aspek / Aspect	Ciri-ciri / Characteristics	Penjelasan / Explanation
Masa bertindak balas / s Reaction time / s	Masa bertindak balas singkat Short reaction time	Cepat mengesan isyarat untuk mula bergerak Fast to detect signal to start moving
Jenis brek Type of brake	ABS	Mengelak dari tergelincir Prevent from skidding
Daya tujahan enjin / N Engine thrust force / N	Daya tujahan enjin tinggi Thrust force is high	Mempunyai lebih kuasa ketika bergerak/ menambahkan pecutan Has more power during moving / increase the acceleration
Bentuk kereta Shape of car	Bentuk aerodinamik Aerodynamic shape	Mengurangkan rintangan udara Reduce air resistance

Pilihan: C kerana mempunyai masa tindak balas yang singkat, ABS, daya tujahan yang tinggi dan bentuk kereta yang aerodinamik.

*Option: C because it has short reaction time, ABS, thrust force is high and the shape of car is aerodynamic.*

[10 markah/marks]

3.

(c) Rajah 8.2 menunjukkan seorang atlit papan selaju. Sukan ini merupakan satu acara yang baru dipertandingkan dalam sukan Olimpik Tokyo 2020.

*Diagram 8.2 shows a skateboard athlete. This sport is a new event competed in the Tokyo 2020 Olympics.*



Rajah 8.2

Diagram 8.2

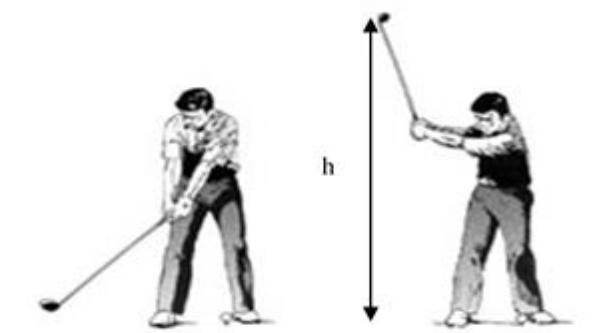
Menggunakan pengetahuan anda tentang daya dan gerakan, anda dikehendaki untuk memberi beberapa cadangan untuk membolehkan seorang itu memilih papan selaju yang sesuai dan selamat untuk digunakan untuk pertandingan berdasarkan beberapa aspek-aspek yang berikut:

*Using your knowledge of force and motion, you are required to give some suggestions to enable one to choose a suitable and safe skateboard to use for the competition based on some of the following aspects:*

Aspect	Reason
Deck size : big	More stable
Skateboard mass : small	Lighter / increase acceleration
Safety measurements : knee guard / elbow guard // helmet	Decrease impulsive force / extend the impact time

5.

Diagram 7.2 shows a man playing golf.



Rajah 7.1  
Diagram 7.1

Table 1 shows different type of golf club and height,  $h$  used in a golf game.

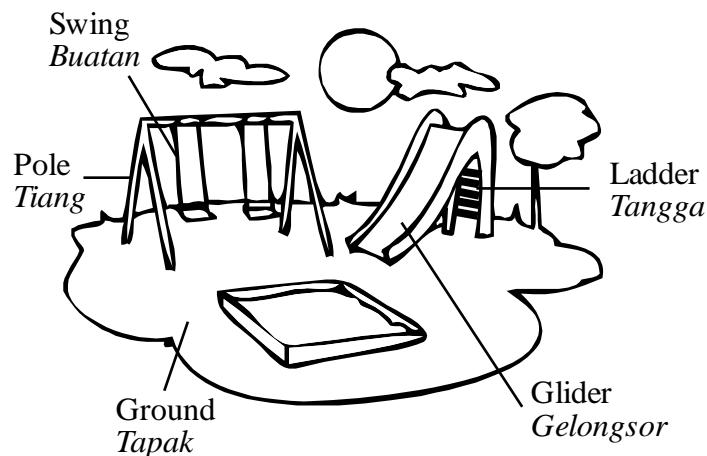
Method	Type of golf club	Height , $h$ (m)
X	Carbon fiber	1.5
Y	Wood	2.0
Z	Titanium	2.5

Table 1

Suggest the suitable method to increase the distance travelled by the ball based on the following aspects.

Aspect	Reason
Type of golf club : Titanium	Strong material / not easy to break
Height : Higher	More energy / faster

6. Diagram 7.3 shows a set of playing equipment to be placed in children playground



Rajah 7.3

Table 1 shows three types of the ground and the height of the glider used for the playground.

Type	Material for the ground	Height of glider
P	Rubber	1.0 m
Q	Wood	2.0 m
R	Plastic	3.0 m

Table 1

Cadangkan ciri-ciri yang sesuai untuk taman permainan itu.

Aspect	Reason
Material for the ground: Rubber	Decrease impulse force / extend the impact time
Height of glider : Low	Decrease velocity / decrease momentum

7. These are the four piling systems, P, Q, R, S that are being used to insert a pile into the ground.

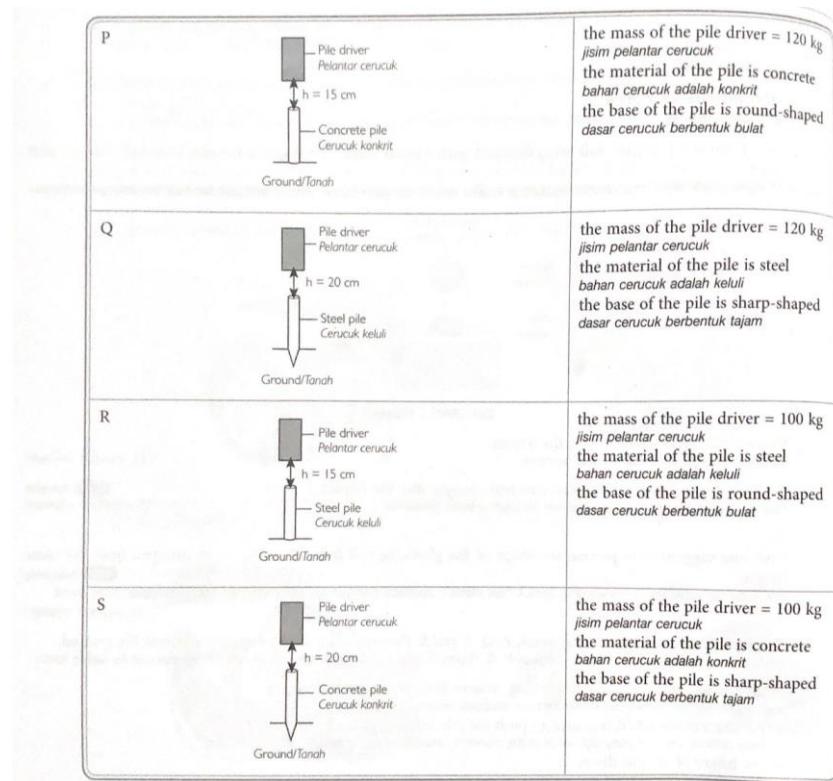


DIAGRAM 7.2/RAJAH 7.2

Determine the most suitable piling system and explain the ideal characteristic of each of the aspects :

- The mass of the pile driver used to push the pile into the ground
- The height the pile driver
- The pile material
- The shape at the base of the pile

Aspect	Reason
The mass of the pile driver used to push the pile into the ground : Bigger	To produce a bigger impulsive force during impact
The height the pile driver : Higher	To produce a bigger force during impact
The pile material : Steel	The material is stiffer
The shape at the base of the pile : Sharper	To make the pile produce a higher pressure on the ground

8. A man wanted to join a cycling competition and want to modify his bicycle in order to be the champion of the competition. These are the specification that you need to study :

- ✓ The position of bicycle seat and handle
- ✓ Type of clothing
- ✓ The density of the material that used for bicycle
- ✓ The size of tire diameter
- ✓ The usage of gear system
- ✓ Number of tire flowers

Modification	Reason
The position of bicycle seat is higher than the handle	Cyclist can cycling in an aerodynamic position
Tight clothing	Less air resistance
Low density of the material that used for bicycle	More acceleration
Bigger size of tire diameter	Bigger distance with a small force
Use gear system	Less energy usage
Small number of tire flowers	Decrease friction

9.

(c) Diagram 5.2 shows the design of four huge Newton's cradles, *S*, *T*, *U* and *V* with different specifications. **TPS** **HOTS**

Rajah 5.2 menunjukkan reka bentuk empat buah buaian Newton gergasi, *S*, *T*, *U* dan *V* dengan spesifikasi yang berbeza.

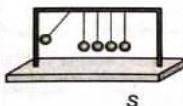
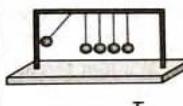
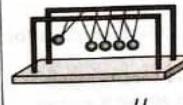
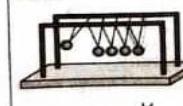
 <b>S</b>	<p>Maximum tension of string  <i>Ketegangan maksimum tali</i>  <math>= 100 \text{ N}</math></p> <p>Density of frame  <i>Ketumpatan rangka</i>  <math>= 1500 \text{ kg m}^{-3}</math></p> <p>Mass of the metal bob  <i>Jisim ladung logam</i>  <math>= 1.5 \text{ kg}</math></p>
 <b>T</b>	<p>Maximum tension of string  <i>Ketegangan maksimum tali</i>  <math>= 1500 \text{ N}</math></p> <p>Density of frame  <i>Ketumpatan rangka</i>  <math>= 200 \text{ kg m}^{-3}</math></p> <p>Mass of the metal bob  <i>Jisim ladung logam</i>  <math>= 0.1 \text{ kg}</math></p>
 <b>U</b>	<p>Maximum tension of string  <i>Ketegangan maksimum tali</i>  <math>= 100 \text{ N}</math></p> <p>Density of frame  <i>Ketumpatan rangka</i>  <math>= 1500 \text{ kg m}^{-3}</math></p> <p>Mass of the metal bob  <i>Jisim ladung logam</i>  <math>= 0.1 \text{ kg}</math></p>
 <b>V</b>	<p>Maximum tension of string  <i>Ketegangan maksimum tali</i>  <math>= 1500 \text{ N}</math></p> <p>Density of frame  <i>Ketumpatan rangka</i>  <math>= 200 \text{ kg m}^{-3}</math></p> <p>Mass of the metal bob  <i>Jisim ladung logam</i>  <math>= 1.5 \text{ kg}</math></p>

Diagram 5.2 / Rajah 5.2

You are assigned to determine the most suitable design to be used as a display unit in a science fair. Study all the specifications of the designs from the following aspects:

*Anda ditugaskan untuk menentukan reka bentuk yang paling sesuai untuk digunakan sebagai unit pameran dalam pesta sains. Kaji semua spesifikasi bagi setiap reka bentuk dari segi aspek yang berikut:*

- (i) the maximum tension of the string  
*ketegangan maksimum tali*
- (ii) the density of the frame  
*ketumpatan rangka*
- (iii) the mass of the metal bob  
*jisim ladung logam*
- (iv) the arrangement of the strings  
*susunan tali*

Explain the suitability of the aspects and determine the most suitable design. Give reason for your choice.

*Terangkan kesesuaian aspek-aspek dan tentukan reka bentuk yang paling sesuai. Berikan sebab bagi pilihan anda.*

[10 marks / 10 markah]

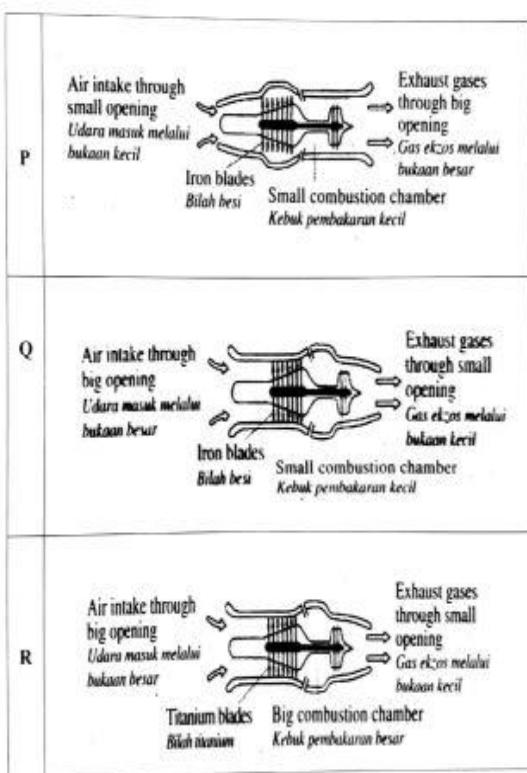
Specification	Reason
High tension	Can support the weight of the metal bob and the drag force
Low density of frame	Decrease the overall weight / portable /easy to lift and install the frame
Heavier metal bob	Big inertia/ the swing can last a long time
The arrangement of the strings followed the design V	Stabilizing the pendulum / decrease the tension of string/ maintain the momentum in one direction

10.

(c) The jet engine of an airplane uses the principle of conservation of momentum to produce a forward thrust.

Table 1 shows three different jet engine, P, Q and R, that been used to move forward the airplane.

*Enjin jet dalam pesawat menggunakan prinsip keabadian momentum dalam menghasilkan daya nijah ke hadapan.*  
*Jadual 1 menunjukkan tiga enjin jet berlainan, P, Q dan R yang digunakan untuk menggerakkan pesawat.*



Jadual 1

Table 1

Based on Table 1, state the suitable characteristics of the jet engine which can move the airplane with the highest velocity.  
 Give reason for the suitability of the characteristics.

*Berdasarkan Jadual 1, nyatakan kesesuaian enjin jet yang digunakan untuk menggerakkan pesawat dengan halaju yang sangat tinggi.  
 Berikan sebab untuk kesesuaian ciri-ciri tersebut.*

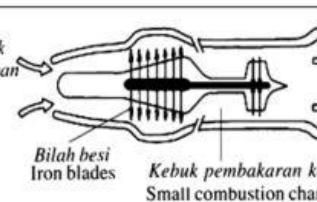
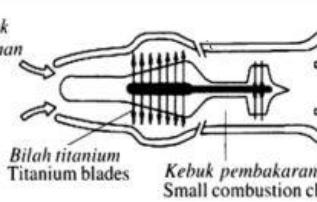
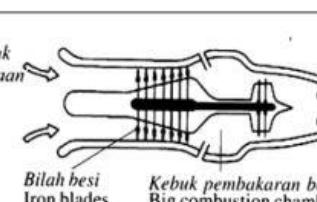
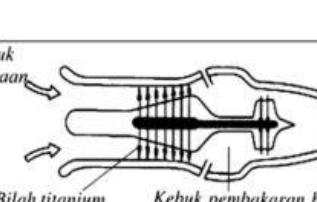
Aspect	Reason
The size of combustion chamber : Big	More fuel can be used
The size of exhaust opening : Small	Produce a high gas pressure

11.

(c) (i) Sebuah syarikat penerbangan ingin memilih enjin jet yang sesuai untuk digunakan pada kapal terbang supaya kapal terbang itu boleh bergerak dengan laju yang tinggi.

Jadual 17 menunjukkan spesifikasi bagi empat enjin jet P, Q, R dan S.

Kaji spesifikasi dan justifikasi setiap aspek. Pilih enjin jet yang paling sesuai. Anda perlu menyakinkan ahli lembaga dengan memberi sebab untuk pilihan anda.

	<i>Spesifikasi</i> <i>Specifications</i>
P	<p><i>Udara masuk melalui bukaan kecil</i> Air intake through small opening</p>  <p><i>Bilah besi</i> Iron blades</p> <p><i>Kebuk pembakaran kecil</i> Small combustion chamber</p> <p><i>Gas ekzos melalui bukaan besar</i> Exhaust gases through big opening</p>
Q	<p><i>Udara masuk melalui bukaan kecil</i> Air intake through small opening</p>  <p><i>Bilah titanium</i> Titanium blades</p> <p><i>Kebuk pembakaran kecil</i> Small combustion chamber</p> <p><i>Gas ekzos melalui bukaan besar</i> Exhaust gases through big opening</p>
R	<p><i>Udara masuk melalui bukaan besar</i> Air intake through big opening</p>  <p><i>Bilah besi</i> Iron blades</p> <p><i>Kebuk pembakaran besar</i> Big combustion chamber</p> <p><i>Gas ekzos melalui bukaan kecil</i> Exhaust gases through small opening</p>
S	<p><i>Udara masuk melalui bukaan besar</i> Air intake through big opening</p>  <p><i>Bilah titanium</i> Titanium blades</p> <p><i>Kebuk pembakaran besar</i> Big combustion chamber</p> <p><i>Gas ekzos melalui bukaan kecil</i> Exhaust gases through small opening</p>

Jadual 17  
Jadual 17

[10 markah]  
[10 marks]

Specification	Reason
Air intake through big opening	More air can enter the engine
The type of blade is titanium blades	Low density / light / heat resistant / strong / stainless / long lasting / high melting point / withstanding high pressure / cannot be oxidized
The size of the combustion chamber is big	Produce a lot of fire / explosions / combustions / high combustion rate
Exhaust gases through small opening	High velocity / high momentum / high energy/ high thrust

12.

(b) Table 11 shows the design and specifications of four different jet engines, J, K, L and M. Study the specifications of all four jet engines.

Jadual 11 menunjukkan reka bentuk dan spesifikasi bagi empat enjin jet yang berbeza, J, K, L dan M. Kaji spesifikasi keempat-empat enjin jet tersebut.

Jet engine Enjin jet	Fuel used Bahan api digunakan	Melting point of blade material Takat lebur bilah	Number of blades Bilangan bilah	Size of combustion chamber Saiz kebuk pembakaran
J	Kerosene Kerosin	Low Rendah	More Lebih banyak	Smaller Lebih kecil
K	Petrol Petrol	Low Rendah	Less Kurang	Smaller Lebih kecil
L	Kerosene Kerosin	High Tinggi	More Lebih banyak	Bigger Lebih besar
M	Diesel Diesel	High Tinggi	Less Kurang	Bigger Lebih besar

TABLE 11/JADUAL 11

Explain the suitability of each design and its specifications.

Determine the most suitable jet engine to be used in the aircraft. Justify your choice.

Terangkan kesesuaian bagi setiap reka bentuk dan spesifikasinya.

Tentukan enjin jet yang paling sesuai digunakan dalam pesawat udara. Wajarkan pilihan anda.

[10 marks/10 markah]

Aspect	Reason
Fuel used : Kerosene	Flammable and easy to increase acceleration / easy to get the hot gases in the combustion chamber
Melting point of blade material : High	Will not easily melt / high temperature resistant
Number of blades: More	To increase the air compression
Size of combustion chamber : Bigger	To increase the mass of the exhaust gases from the exhaust

✓ Bab 3 Gravitation

1.

(d) Jadual 7 menunjukkan ciri-ciri lemparan tukul besi F, G dan H yang terlibat dalam sebuah acara sukan lempar tukul besi.

*Table 7 shows the characteristics of the F, G and H hammer throws involved in a hammer throw sport event.*

Lemparan tukul besi <i>Hammer throw</i>	Panjang tali keluli <i>Length of steel string ( m )</i>	Laju linear tukul besi ketika diputarkan <i>Linear speed of the hammer when it is rotated ( m s<sup>-1</sup> )</i>
F	1.85	24
G	1.55	20
H	1.15	29

Jadual 7

*Table 7*

Berdasarkan spesifikasi dalam Jadual 7, nyatakan ciri-ciri yang sesuai bagi lemparan tukul besi yang mempunyai tegangan tali yang paling tinggi ketika diputarkan.

Beri sebab untuk kesesuaian ciri tersebut.

*Based on the specifications in Table 7, state the suitable characteristics of the hammer throw that has the highest rope tension when it is rotated.*

*Give reason for the suitability for each of the characteristic.*

Characteristic	Reason
Length of steel string : Short	To produce high centripetal force
Linear speed: Big	To produce high angular acceleration

2.

(b) Diagram 3.2 shows the internal structure of a rocket.  
*Rajah 3.2 menunjukkan struktur dalam sebuah roket.*

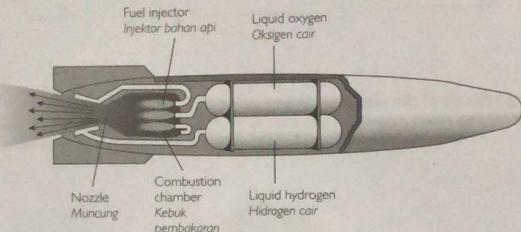


DIAGRAM 3.2/RAJAH 3.2

Explain how the rocket can function to produce the escape velocity required to launch a spacecraft into outer space.

*Terangkan bagaimana roket itu boleh berfungsi untuk menghasilkan halaju lepas yang diperlukan bagi melancarkan kapal angkasa ke angkasa lepas.*

[4 marks/4 markah]

(c) You are required to plan a trip to a planet in a spacecraft. Suggest and explain how to equip the spacecraft to ensure the passenger can travel safely to and back from the planet of destination. In your explanation, describe the following aspects:

*Anda dikehendaki merancang percutian ke suatu planet dalam sebuah kapal angkasa. Cadang dan terangkan bagaimana untuk melengkapkan kapal angkasa itu bagi memastikan perumpang dapat menjelajah secara selamat dalam perjalanan pergi dan balik dari destinasi planet. Dalam pernaraangan anda, huraikan aspek-aspek berikut:*

(i) Size and shape of the spacecraft.

*Saiz dan bentuk kapal angkasa.*

(ii) Design of the rocket to launch the spacecraft.

*Reka bentuk roket untuk melancarkan kapal angkasa.*

(iii) Electricity supply in the spacecraft.

*Bekalan elektrik dalam kapal angkasa.*

(iv) Food and water supply in the spacecraft.

*Bekalan makanan dan air dalam kapal angkasa.*

(v) Exercise equipment to overcome the effects of reduced gravity.

*Kelengkapan bersenam untuk mengatasi kesan kekurangan graviti.*

[10 marks/10 markah]

Suggestions	Explanations
Size and shape of the spacecraft : Have aerodynamic shape and bigger size	Can carry more cargo and passengers, less air resistance during launch
Design of the rocket to launch the spacecraft : Use rocket with at least three stages	Ensure the rocket carry enough fuel to bring the spacecraft for the to-and-fro journey
Electricity supply in the spacecraft : Sufficient number of solar panels are fixed on the spacecraft	Ensure the electricity supply in the spacecraft is sufficient
Food and water supply in the spacecraft: Use efficient system of food storage and recycling of water	Ensure the food and water supply in the spacecraft is sufficient
Exercise equipment to overcome the effects of reduced gravity : Availability of exercise equipment that can provide "artificial gravity such as mini gymnasium	Help passengers to overcome the effects of reduced gravity

3.

(d) (i) Anda merupakan seorang jurutera yang ditugaskan untuk menentukan satelit yang boleh digunakan sebagai GOES 'Geostationary Operational Environmental Satellite'. Dengan menggunakan pengetahuan anda tentang ciri-ciri sebuah satelit geopergun, pilih satelit yang paling sesuai untuk dijadikan GOES. Berikan justifikasi pilihan anda.

*You are an engineer whom is assigned to determine which satellite that can be used as GOES 'Geostationary Operational Environmental Satellite'. By using your knowledge on the characteristics of Geostationary satellite, choose the most suitable satellite to be used as GOES. Give justification for your choice.*

**KBAT Mencipta**

Satelit Satellite	Arah putaran satelit Direction of satellite rotation	Tempoh orbit Orbit period	Kedudukan orbit satelit Position of the satellite
Satelit A Satellite A	Mengikut arah berlawanan dengan arah putaran Bumi. <i>In the opposite direction of the Earth orbit.</i>	24 jam / hours	Mengorbit dari kutub ke kutub <i>Orbiting from pole to pole</i>
Satelit B Satellite B	Mengikut arah sama dengan arah putaran Bumi. <i>In the direction of the Earth orbit.</i>	24 jam / hours	Mengorbit di atas garisan Khatulistiwa <i>Orbiting above the Equator</i>
Satelit C Satellite C	Mengikut arah berlawanan dengan arah putaran Bumi. <i>In the opposite direction of the earth orbit.</i>	12 jam / hours	Mengorbit dari kutub ke kutub <i>Orbiting from pole to pole</i>
Satelit D Satellite D	Mengikut arah sama dengan arah putaran Bumi. <i>In the direction of the Earth orbit.</i>	12 jam / hours	Mengorbit di atas garisan Khatulistiwa <i>Orbiting above the Equator</i>

Aspek Aspect	Ciri Characteristics	Sebab Reason
Arah putaran satelit <i>Direction of satellite rotation</i>	Mengikut arah sama dengan arah putaran Bumi. <i>In the direction of the Earth rotation orbit.</i>	Satelit sentiasa berada pada kedudukan yang sama bagi pemerhati yang berada di permukaan bumi. <i>Satellite will always at the same position as observe by an observer on the surface of the earth.</i>
Tempoh orbit <i>Orbit period</i>	24 jam / hours	Sama dengan tempoh putaran bumi. <i>Same with the period of the earth rotation.</i>
Kedudukan orbit satelit <i>Position of the satellite</i>	Mengorbit di atas Khatulistiwa <i>Orbiting above the Equator</i>	Kedudukan ini membolehkan satelit untuk memerhatikan cuaca dan fenomena alam yang berubah pada skala masa yang singkat. <i>This position allows the satellite to observe weather and other phenomena that vary on short time scale.</i>

Satelit B dipilih kerana arah putaran satelit mengikut arah sama dengan arah putaran Bumi, tempoh orbit 24 jam dan kedudukan orbit satelit mengorbit di atas Khatulistiwa.  
*Satellite B is chosen because the direction of satellite rotation is in the direction of the Earth rotation orbit, orbit period is 24 hours and the position of the satellite is above the Equator.*

[8 markah/marks]

4.

(c) Jadual 11 menunjukkan spesifikasi bagi tiga satelit P, Q dan R.  
*Table 11 shows the specifications of three satellites P, Q and R.*

Satelit <i>Satellite</i>	Tempoh orbital / jam <i>Orbital period / hours</i>	Ketinggian orbit /m <i>Height of orbit /m</i>
P	24.04	$4.3 \times 10^7$
Q	40.45	$6.4 \times 10^7$
R	1.52	$7.6 \times 10^3$

Jadual 11

Table 11

Sebuah agensi angkasa ingin melancarkan sebuah satelit pengimejan yang boleh mengambil imej di beberapa lokasi di permukaan Bumi.

*A space agency wishes to launch an imaging satellite that able to capture images at various locations on the surface of the Earth.*

Berdasarkan Jadual 11, nyatakan dengan sebab bagi kesesuaian satelit untuk menjadi satelit pengimejan.

*Based on Table 11, state with reasons the suitability of the satellite to become an imaging satellite.*

Specification	Reason
The orbital period : Smaller than 24 hours	The satellites can be anywhere
The height of orbit : Low	Produce clearer images

5.

(d) You are required to give some suggestions to design a space probe which can be sent into space to orbit the Sun and study the activities of the Sun.

*Anda dikehendaki memberi beberapa cadangan untuk mereka bentuk sebuah kuar angkasa yang dapat dihantar ke angkasa lepas untuk mengorbit Matahari dan mengkaji aktiviti Matahari.*

Using the knowledge on motion, forces and properties of materials, state and explain your suggestions based on the following aspects:

*Menggunakan pengetahuan tentang gerakan, daya dan sifat bahan, nyatakan dan terangkan cadangan anda berdasarkan aspek-aspek berikut:*

- (i) The shape and size of the space probe  
*Bentuk dan saiz kuar angkasa*
- (ii) Materials used for making the heat shield  
*Bahan yang digunakan untuk membuat perisai haba*
- (iii) Electricity supply in the space probe  
*Bekalan elektrik dalam kuar angkasa*
- (iv) Design of rocket to launch the space probe  
*Reka bentuk roket untuk melancarkan kuar angkasa*
- (v) Method of sending information and pictures back to the Earth  
*Kaedah menghantar maklumat dan gambar kembali ke Bumi*

[10 marks/10 markah]

Aspect	Explanation
Has aerodynamic shape and compact size	Reduce air drag during launch and can carry essential equipment while keeping weight low
Use composite material of high specific heat capacity or high melting point	Good heat insulator to prevent heat destroying the space probe
Fix solar panels on the space probe	To generate electricity from solar energy
Use rocket with three or more stages	To carry enough fuel for sending the space probe to orbit the Sun
Use Deep Space Network (DSN)	To send and receive radio signals from the space probe

✓ Bab 4 Heat

1. Based on the table below, state the characteristic of a kettle that is suitable to boil water. Give reasons to your answers.

Model	P	Q
Specific heat capacity	$900 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$	$380 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$
The mass of the kettle	2.0 kg	1.5 kg

Characteristic	Reason
Specific heat capacity : Low	The kettle can be heated quickly
The mass of the kettle : Small	Light / Portable

2.

(c)  $P$ ,  $Q$  dan  $R$  adalah tiga cecair yang berbeza. Cecair ini boleh digunakan dalam sistem penyejukan bagi sebuah peti sejuk mudah alih. Jadual di bawah menunjukkan ciri-ciri bagi setiap cecair.

$P$ ,  $Q$  and  $R$  are three different liquids. These liquids can be used in a cooling system of a portable refrigerator. The table below shows the characteristics of each liquid.

Cecair Liquid	Haba pendam tentu pengewapan, $l_v$ Specific latent heat of vaporisation, $l_v$ ( $\text{J kg}^{-1}$ )	Ketumpatan, $\rho$ ( $\text{kg m}^{-3}$ ) Density, $\rho$ ( $\text{kg m}^{-3}$ )	Takat didih Boiling point ( $^{\circ}\text{C}$ )
$P$	$2.26 \times 10^6$	1 000	100
$Q$	$2.08 \times 10^5$	820	-33
$R$	$2.17 \times 10^5$	800	-30

Jadual/Table 2

Berdasarkan Jadual 2, nyatakan ciri-ciri yang sesuai bagi cecair yang akan digunakan dalam sistem penyejukan bagi sebuah peti sejuk mudah alih. Berikan sebab untuk kesesuaian ciri-ciri itu.

Based on Table 2, state the suitable characteristics of a liquid to be used on a cooling system of a portable refrigerator. Give reason for the suitability of the characteristics.

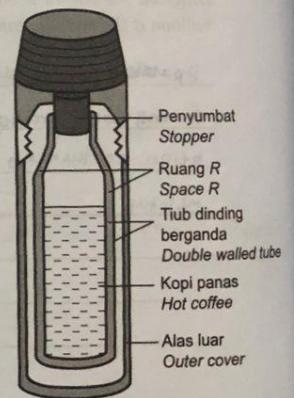
Characteristic	Explanation
Specific latent heat of vaporisation : Low	Quickly evaporates
Density : Low	Lighter
Boiling point : Low	Easily evaporates

3.

(c) Rajah 6.2 menunjukkan struktur sebuah kelalang termos yang dibeli oleh Abu dari sebuah pasaraya. Abu mengisi kelalang termos dengan kopi panas dan membawanya ke sekolah. Semasa waktu rehat, Abu mendapati kopi tersebut telah sejuk. Bincangkan beberapa cadangan tentang bagaimana untuk menjadikan kelalang termos berupaya mengekalkan suhu kopi panas dalam jangka masa yang lebih lama.

*Diagram 6.2 shows a structure of a thermos flask bought by Abu from a supermarket. Abu fills the thermos flask with hot coffee and bring it to school. During recess time, Abu found that the coffee is already cold. Discuss some suggestions on how to make the thermos flask able to maintain the temperature of the hot coffee for longer time.*

**KBAT Mencipta.**



Rajah/Diagram 6.2

120

Ciri-ciri / Characteristics	Sebab/Reason
Penyumbat diperbuat daripada plastik/gabus lopong. <i>Stopper made up from hollow plastics/cork.</i>	Penebat haba yang bagus. <i>Good heat insulator.</i>
Ruang di antara dinding berganda, $R$ mestilah vakum. <i>Space between the double wall, <math>R</math>, must be vacuum.</i>	Mengelakkan haba hilang ke persekitaran/Mengelakkan haba hilang melalui konduksi. <i>Prevent heat lost to the surrounding/Prevent heat lost by conduction.</i>
Gunakan kaca untuk tiub dinding berganda. <i>Use glass for the double walled tube.</i>	Muatan haba tentu yang lebih tinggi. <i>Higher specific heat capacity.</i>
Tiub dinding berganda harus berkilat atau dicat perak. <i>Double walled tube should be shiny or silver painted.</i>	Memantulkan cahaya <i>Reflect heat</i>
Alas luar yang berkemampuan rendah <i>Lower density of outer cover</i>	Ringan <i>Lighter</i>

[10 markah/marks]

4.

(c) Jadual 3 menunjukkan ciri-ciri logam. Sebagai penyelidik, anda diminta untuk menyiasat ciri-ciri bagi logam agar boleh digunakan untuk membuat peralatan memasak yang berkualiti tinggi.

*Table 3 shows the characteristics of metals. As a researcher, you are asked to investigate the characteristics of metals so that it can be used to make a high quality cooking utensils.* **KBAT Mencipta.**

Logam Metal	Kadar pengaratan Rate of rusting	Ketumpatan Density (kg m <sup>-3</sup> )	Takat lebur Melting point (°C)	Muatan haba tentu Specific heat capacity (J kg <sup>-1</sup> °C <sup>-1</sup> )
J	Tinggi/High	6 850	1 500	560
K	Rendah/Low	7 350	960	295
L	Tinggi/High	3 500	650	400
M	Rendah/Low	10 450	750	780

Jadual/Table 3

Aspek/Aspect	Ciri-ciri/Characteristics	Sebab/Reason
Kadar pengaratan / Rate of rusting	Rendah / Low	Tidak mudah berkarat/Does not rust
Ketumpatan / Density	Rendah / Low	Lebih ringan/Mudah dibawa Lighter/Easy to carry
Takat lebur / Melting point	Tinggi / High	Tidak mudah lebur/Not easily melt
Muatan haba tentu / Specific heat capacity	Rendah / Low	Lebih cepat panas/Heat up faster
K dipilih kerana mempunyai kadar pengaratan yang rendah, ketumpatan rendah, takat lebur tinggi dan muatan haba tentu rendah. <i>K is chosen because it has low rate of rusting, low density, high melting point and low specific heat capacity.</i>		

5.

(c) Diagram 4.3 shows the basic components of a car air-conditioner.  
*Rajah 4.3 menunjukkan komponen asas penyaman udara kereta.*

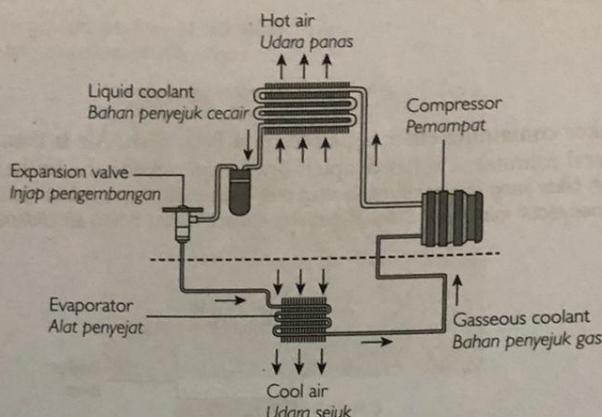


DIAGRAM 4.3/RAJAH 4.3

A car needs an efficient air-conditioner system to cool down the air temperature rapidly after parking under the hot sun.

*Sebuah kereta memerlukan satu sistem penyaman udara yang cekap untuk menyekukan suhu udara selepas meletakkan kereta itu di bawah sinar matahari.*

Suggest and explain how an air-conditioner system that can function effectively can be built, based on the following aspects:

*Cadangkan dan terangkan bagaimana untuk membina satu sistem penyaman udara yang dapat berfungsi secara berkesan berdasarkan aspek-aspek berikut:*

- The type and characteristics of the coolant used.  
*Jenis dan sifat bahan penyejuk yang digunakan.*
- The size and characteristics of the transmission pipe for the coolant.  
*Saiz dan sifat paip penghantaran bagi bahan penyejuk.*
- The design of the main components of the air-conditioner system.  
*Reka bentuk komponen utama sistem penyaman udara itu.*

Modification	Reason
Specific latent heat of vaporisation of the coolant used : High	Able to remove a greater amount of heat at a faster rate.
Melting point of the coolant used : Low	Easier to change to vapor or gas
The diameter of the transmission pipe for the coolant : Big	To carry more coolant at a faster rate
Specific heat capacity of the transmission pipe : Low	Able to heat up or cool down faster and to conduct heat faster
The design of the main components of the air-conditioner system : The evaporator is installed with cooling fins which are painted black	To increase the surface area and facilitate heat radiation for heat loss to take place faster

6.

8 Table 2 shows two types of pot and its characteristics.

Jadual 2 menunjukkan dua jenis periuk dan ciri-cirinya.

Type of pot Jenis periuk	Clay pot Periuk tanah liat	Copper pot Periuk kuprum
	Clay handle Pemegang tanah liat  Heating plate Plat pemanas	Polymer handle Pemegang polimer  Heating plate Plat pemanas
Specific heat capacity Muatan haba tentu	900 Jkg <sup>-1</sup> °C <sup>-1</sup> Clay / Tanah liat	390 Jkg <sup>-1</sup> °C <sup>-1</sup> Copper / Kuprum
Mass / Jisim	3.5 kg	2.5 kg

Table 2  
Jadual 2

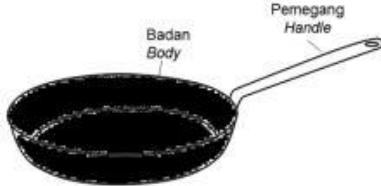
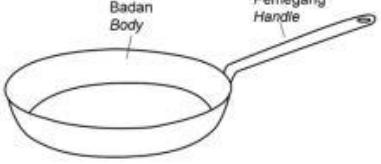
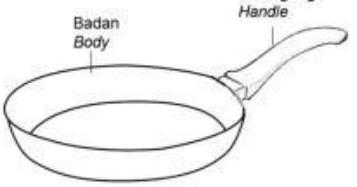
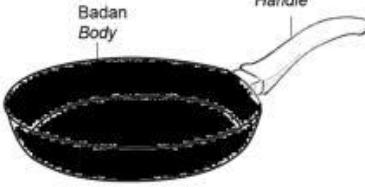
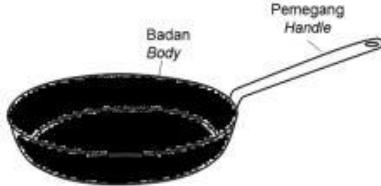
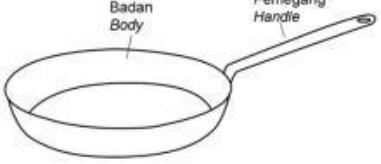
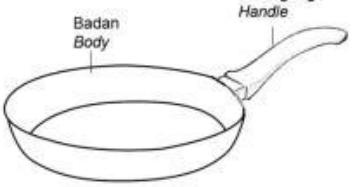
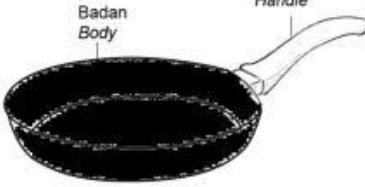
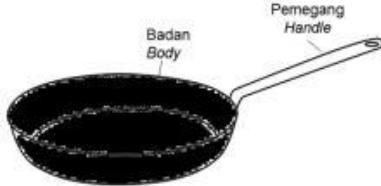
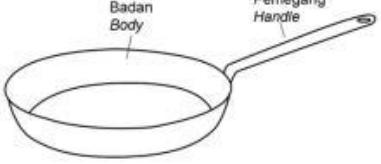
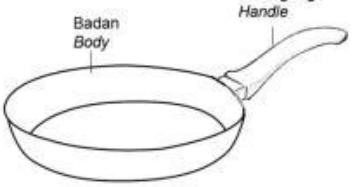
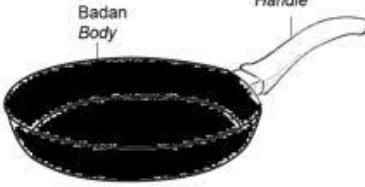
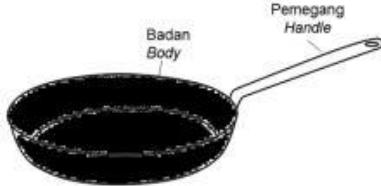
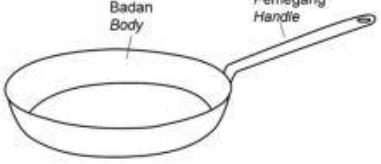
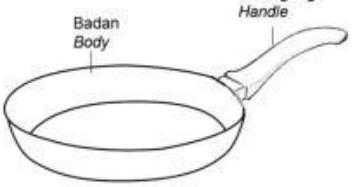
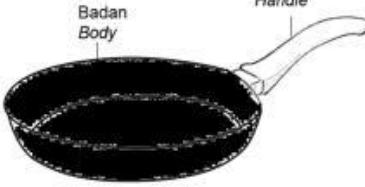
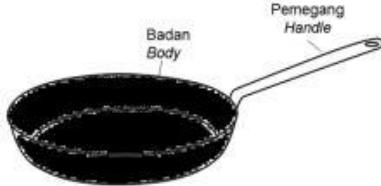
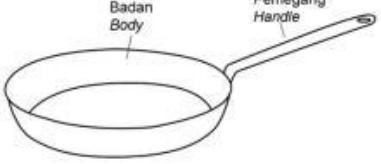
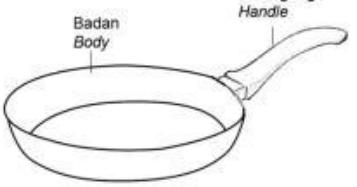
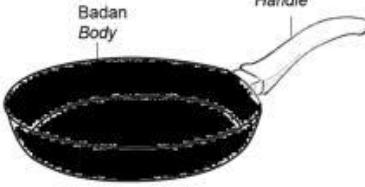
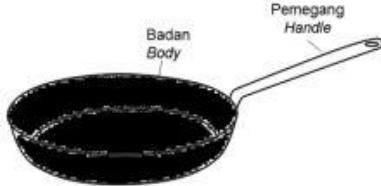
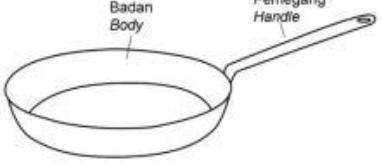
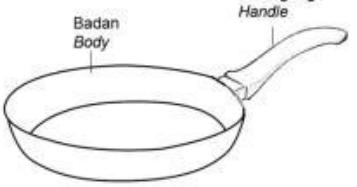
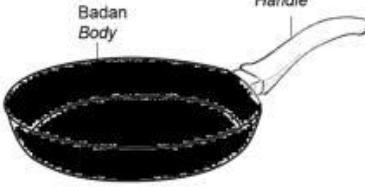
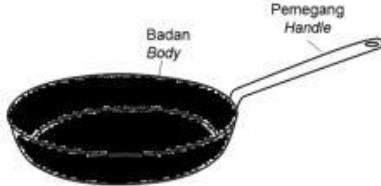
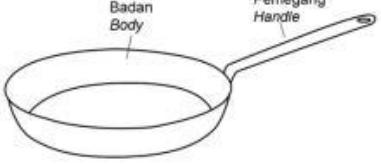
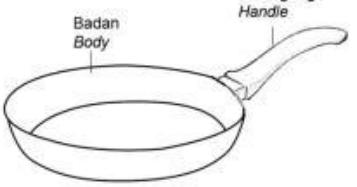
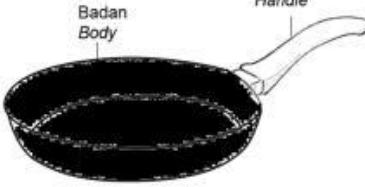
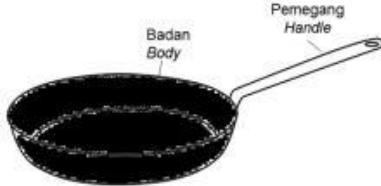
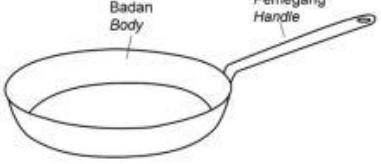
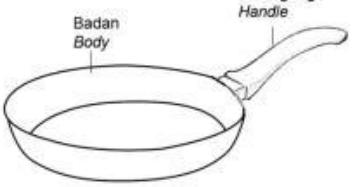
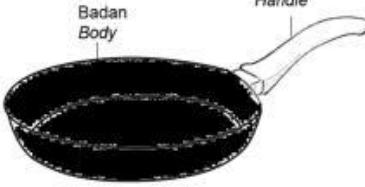
Characteristic	Reason
The material of the pot : Copper	Good heat conductor
The material of the pot holder : Polymer	Good heat insulator / heat up slower
The mass of the pot : Small	Lighter / portable

7.

(d) Restoran anda diminta untuk mencadangkan kuali pengoreng yang boleh digunakan untuk memasak masakan dengan lebih cepat dan selamat digunakan. Jadual 16 menunjukkan spesifikasi bagi empat kuali pengoreng A, B, C dan D

*Your restaurant is asked to suggest frying pan that can be used to cook dishes quickly and is safe to use.*

*Table 16 shows specifications of four frying pans A, B, C and D.*

 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Badan mempunyai muatan haba tentu tinggi <i>Body has high specific heat capacity</i>
	Permukaan badan gelap <i>Dark body surface</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Pemegang mempunyai muatan haba tentu rendah <i>Handle has low specific heat capacity</i>
	Pemegang berbentuk rod <i>Rod shaped handle</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Badan mempunyai muatan haba tentu tinggi <i>Body has high specific heat capacity</i>
	Permukaan badan cerah <i>Bright body surface</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Pemegang mempunyai muatan haba tentu tinggi <i>Handle has high specific heat capacity</i>
	Pemegang berbentuk rod <i>Rod shaped handle</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Badan mempunyai muatan haba tentu rendah <i>Body has low specific heat capacity</i>
	Permukaan badan cerah <i>Bright body surface</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Pemegang mempunyai muatan haba tentu rendah <i>Handle has low specific heat capacity</i>
	Pemegang berbentuk langsing <i>Slim shaped handle</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Badan mempunyai muatan haba tentu rendah <i>Body has low specific heat capacity</i>
	Permukaan badan gelap <i>Dark body surface</i>
 <p><b>MODEL A</b></p>  <p><b>MODEL B</b></p>  <p><b>MODEL C</b></p>  <p><b>MODEL D</b></p>	Pemegang mempunyai muatan haba tentu tinggi <i>Handle has high specific heat capacity</i>
	Pemegang berbentuk langsing <i>Slim shaped handle</i>

Jadual 16  
Table 16

Kaji spesifikasi dan justifikasi setiap aspek. Pilih kuali pengoreng yang paling sesuai. Anda perlu menyakinkan pelanggan dengan memberi mereka alasan mengapa mereka harus memilih kuali pengoreng yang dicadangkan.

*Study the specification and justify each aspect. Choose the most suitable frying pan. You have to convince the customer by giving them reason why they should choose the suggested frying pan.*

Suggestion	Reason
Handle has high specific heat capacity	Heat up slower / the temperature of the handle rising slowly
Slim shaped handle	Strong grip / avoid slipping
Body low specific heat capacity	Heat up quickly / the temperature of the body rising quickly
Dark body surface	Good heat absorber / weak heat reflector

8.

(b) Rajah 9.2 menunjukkan satu pemanas air solar.  
Diagram 9.2 shows a solar water heater.

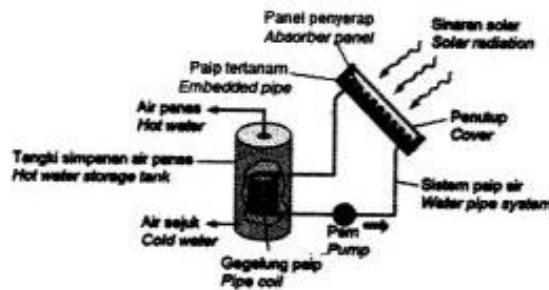
Kaji spesifikasi bagi setiap pemanas air solar dalam Jadual 9.

Terangkan kesesuaian setiap ciri dan tentukan pemanas air solar yang paling sesuai untuk menghasilkan air panas dengan cekap.  
Beri sebab-sebab untuk pilihan anda.

Study the specifications of each solar water heater in Table 9.

Explain the suitability of each characteristic and determine the most suitable solar water heater to produce hot water efficiently.  
Give reasons for your choice.

[10 markah]  
[10 marks]



Rajah 9.2  
Diagram 9.2

Pemanas solar itu perlu dipasang di atas sebuah bumbung sebuah hotel untuk memanaskan air di dalam sebuah tangki air simpanan.

Jadual 9 menunjukkan spesifikasi bagi empat reka bentuk pemanas air solar J, K, L dan M.

The solar water heater is required to install on the roof of a hotel to heat water in the water storage tank.

Table 9 shows the specifications of four solar water heater designs, J, K, L and M.

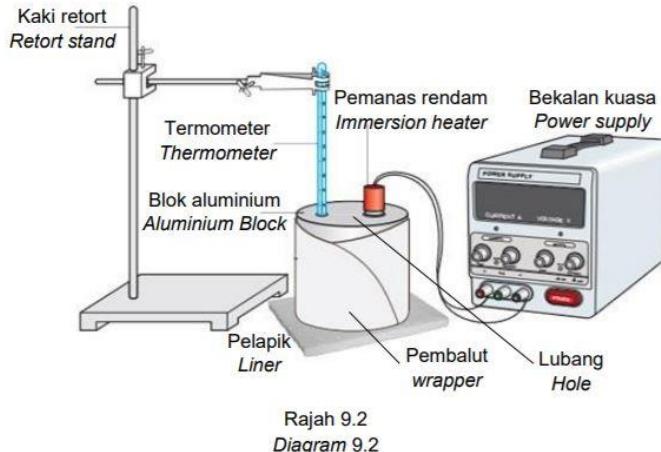
Pemanas air solar Solar water heater	Bahan untuk gegelung paip Material of the pipe coil	Bahan untuk penutup Material for cover	Jenis panel penyerap Type of absorber panel	Saiz paip tertanam Size of embedded pipe
J	Aluminium Aluminium	Plastik Plastic	Panel berkilat Shiny panel	Pendek Short
K	Kuprum Copper	Kaca Glass	Panel hitam Black panel	Panjang Long
L	Aluminium Aluminium	Kaca Glass	Panel hitam Black panel	Pendek Short
M	Kuprum Copper	Plastik Plastic	Panel berkilat Shiny panel	Panjang Long

Jadual 9  
Table 9

Specification	explanation
Material of the pipe coil : copper	Low specific heat capacity // heat up quickly// good heat conductor // high heat transfer rate
Material for cover : glass	Absorbs heat // high heat resistance
Type of absorber : black panel	absorbs heat / good heat conductor
Size of embedded pipe : long	Big surface area // absorbs heat quickly

9.

(d) Rajah 9.2 menunjukkan susunan radas untuk menentukan muatan haba tentu bagi blok aluminium.  
Diagram 9.2 shows the arrangement of the apparatus to determine the specific heat capacity of aluminium block.



Jadual 9.1 menunjukkan bahan-bahan yang boleh digunakan dalam susunan radas itu. Anda ditugaskan untuk menyiasat bahan-bahan yang ditunjukkan dalam Jadual 9.1.

Table 9.1 shows the materials that are able to be used in the arrangement of the apparatus. You are assigned to investigate the materials shown in Table 9.1.

Set radas Set of apparatus	Pembalut Wrapper	Pelapik Liner	Cecair dalam lubang Liquid in hole	Kuasa pemanas rendam Power of immersion heater
W	Kertas tisu Tissue paper	Kuprum Copper	Minyak oil	48 W
X	Kerajang aluminium Aluminium foil	Asbestos Asbestos	Minyak oil	24 W
Y	Kertas tisu Tissue paper	Asbestos Asbestos	Minyak oil	48 W
Z	Kerajang aluminium Aluminium foil	Kuprum Copper	Air Water	24 W

Jadual 9.1  
Table 9.1

Terangkan kesesuaian setiap bahan dalam Jadual 9.1 dan seterusnya tentukan set radas yang paling sesuai digunakan untuk menentukan muatan haba tentu blok aluminium itu.

Beri sebab untuk jawapan anda.

Explain the suitability of each material in Table 9.1, then determine the most suitable set of apparatus to be used to determine the specific heat capacity of aluminium block.

State the reason for your answer

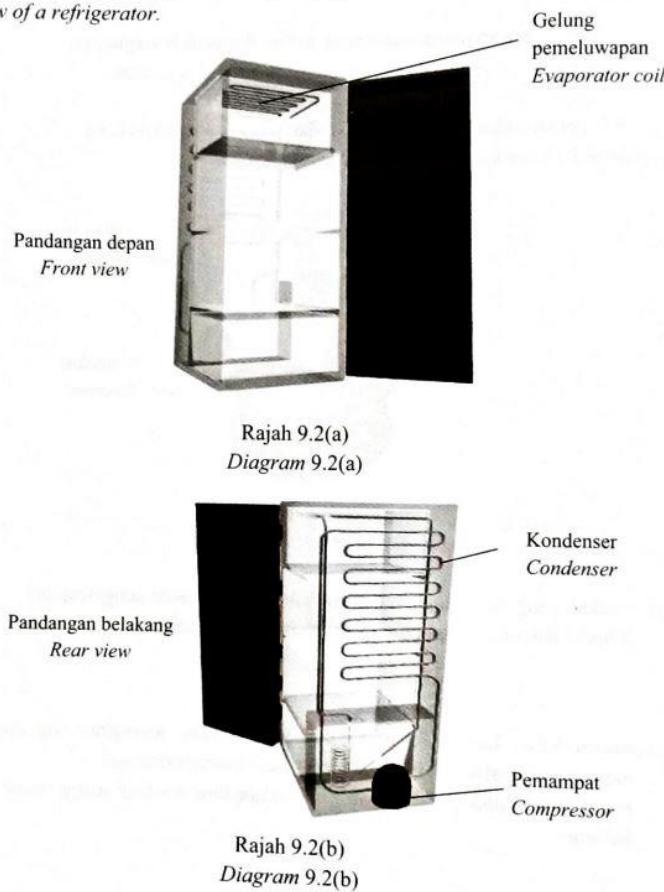
[10 markah]  
[10 marks]

Ciri-ciri // Characteristics	Sebab // Reason
Pembalut Wrapper	Kertas tisu Tissue paper Penebat haba / elak haba keluar // heat insulator / prevent heat loss
Pelapik Liner	Asbestos Penebat haba / elak haba keluar // heat insulator / prevent heat loss
Cecair dalam lubang Liquid in hole	Minyak oil Sentuhan termal yang baik // Good heat thermal contact
Kuasa pemanas rendam Power of immersion heater	Tinggi Lebih banyak haba terhasil / mempercepatkan masa pemanasan // More heat produced / heat up faster

10.

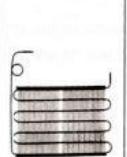
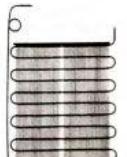
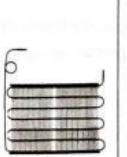
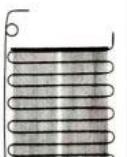
(c) Rajah 9.2(a) menunjukkan pandangan hadapan peti sejuk manakala Rajah 9.2(b) menunjukkan pandangan sisi belakang peti sejuk.

Diagram 9.2(a) shows front view of a refrigerator and diagram 9.2(b) shows rear view of a refrigerator.



Jadual 9 menunjukkan spesifikasi bagi sistem penyejukan empat peti sejuk J, K, L dan M, yang digunakan untuk menyejukkan makanan.

Table 9 shows the specifications for four refrigerators J, K, L and M refrigeration systems which can be used to refrigerate food.

Peti Sejuk Refrigerator	J	K	L	M
Bahan paip The material of pipe	Steel Keluli	Kuprum Copper	Aluminium Aluminium	Kuprum Copper
Muatan haba tentu gelung penyejuk Specific heat capacity evaporator coil ( $J \text{ kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$ )	420	389	903	430
Takat didih penyejuk Boiling point of coolant	Kecil Small	Kecil Small	Besar Large	Besar Large
Gegelung Kondenser Condenser coil				

Jadual 9  
Table 9

Anda dikehendaki untuk mengkaji spesifikasi bagi empat sistem penyejukan peti sejuk dan tentukan sistem penyejukan yang paling sesuai digunakan mengeluarkan haba dari makanan. Beri sebab bagi pilihan anda.

You are required to study the specification of four cooling systems of refrigerators and determine the most suitable cooling system to be used for the purpose of removing heat from the food. Give reasons for your choice.

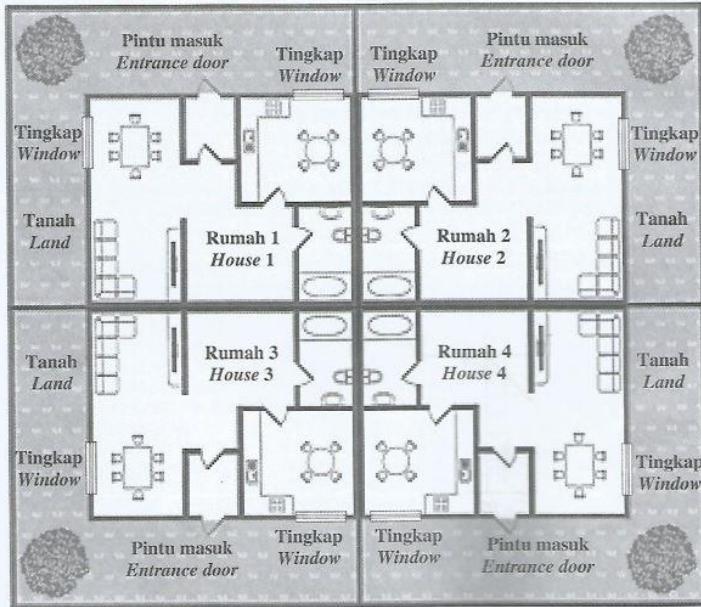
[10 markah]  
[10 marks]

Characteristic	Reason
Copper	Good heat conductor // low specific heat capacity
Low specific heat capacity evaporator coil	Coil will cool quickly
Low boiling point of coolant	Can change into gas with low temperature
More number of condenser coil	Release heat quickly // high releasing heat rate

## 11.

(e) Rajah 9.2 menunjukkan pelan lantai sebuah rumah kluster di Malaysia. Rumah kluster tersebut menyerupai rumah berkembar yang berkongsi dinding belakang dan sisi. Rumah ini hanya mempunyai satu pintu masuk, manakala tingkap hanya di bahagian hadapan dan tepi rumah. Reka bentuk rumah ini dapat meminimumkan penggunaan tanah.

Diagram 9.2 shows a floor plan of cluster house in Malaysia. A cluster house resembles a semi detached house which shares back wall and side wall. This house has only one entrance door, while the windows are only at the front and the side of the house. This house design can minimize the land used.



Rajah 9.2  
Diagram 9.2

Jadual 9 menunjukkan empat model rumah kluster P, Q, R dan S, yang akan dibangunkan di sebuah tapak perumahan.

Table 9 shows four models of cluster house, P, Q, R and S, to be developed on a residential site.

Model rumah kluster Cluster house model	Bilangan tingkap Number of windows	Jarak dari lantai ke siling Floor to ceiling distance (m)	Bahan dinding Material of the wall	Jenis bahan bumbung Material of the roof
P	5	3.2	Panel dinding kontena Container wall panel	Atap zink Zinc roof
Q	3	2.9	Blok konkrit Concrete block	Atap zink Zinc roof
R	4	3.3	Batu bata berongga Hollow bricks	Jubin konkrit Concrete tile
S	2	2.5	Kayu Wood	Jubin konkrit Concrete tile

Jadual 9  
Table 9

Terangkan kesesuaian setiap spesifikasi rumah dan tentukan model rumah kluster yang paling sesuai untuk memastikan dalam rumah tidak panas. Beri sebab bagi pilihan anda. Explain the suitability of each house specification and determine the most suitable cluster house model to ensure the inside of the house is not hot. Give reasons for your choice.

[10 markah]  
[10 marks]

Characteristic	Explanation
More number of windows	Allow more air to flow / save electrical energy used
Floor to ceiling distance : High	Better air ventilation inside the house
Material of the wall from hollow bricks / wood	High specific heat capacity / low in temperature changes / wall heat up slower
Material of the roof is from concrete tile	High specific heat capacity / low in temperature changes / good heat insulator / reduce heat transferred from outside into the house

12.

(c) An air fryer is designed to fry food without submerging it in oil.  
Table 10 shows four different types of air fryer.

*Sebuah pengoreng kering direka untuk mengoreng makanan tanpa merendamkannya ke dalam minyak.*  
*Jadual 10 menunjukkan empat buah pengoreng kering yang berbeza.*

Air fryer <i>Pengoreng kering</i>	Power (W) <i>Kuasa (W)</i>	Materials of Heater <i>Bahan pemanas</i>	Melting point of heater (°C) <i>Takat lebur pemanas (°C)</i>	Electronic component <i>Komponen elektronik</i>
W	1 400	Iron <i>Besi</i>	1 500	Thermostat <i>Termostat</i>
X	1 500	Nichrome <i>Nikrom</i>	1 400	Thermostat <i>Termostat</i>
Y	1 300	Iron <i>Besi</i>	1500	Thermistor <i>Termistor</i>
Z	1 200	Nichrome <i>Nikrom</i>	1 400	Thermistor <i>Termistor</i>

Table 10  
*Jadual 10*

You are required to study the characteristics of the air fryer shown in Table 10. Explain the suitability of each characteristic and determine the most efficient air fryer to cook food faster.

Give reasons for your choice.

*Anda dikehendaki mengkaji ciri-ciri pengoreng kering yang ditunjukkan dalam Jadual 10. Terangkan kesesuaian setiap ciri-ciri dan tentukan pengoreng kering yang paling cekap untuk memasak makanan dengan cepat.*

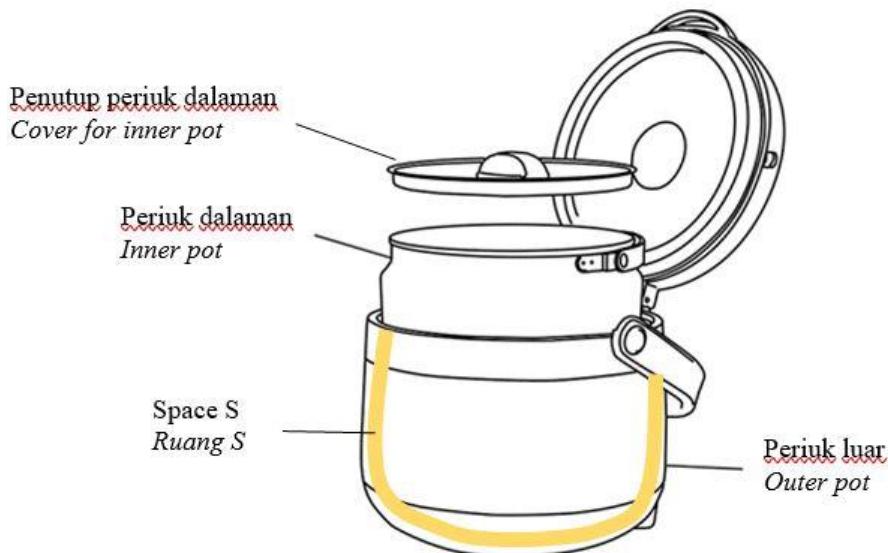
*Nyatakan sebab bagi pilihan anda.*

[10 marks]  
[10 markah]

Characteristic	Explanation
Power : high	To produce more electrical energy per second // Release more heat
Materials of heater : Nichrome	Has high resistance // high resistivity // Produce more heat // High melting point
Melting point of heater : high	Withstand high temperature // Not easy to melt
Electric component : Thermostat	Can control Heat / Temperature

13.

Rajah 9 menunjukkan keratan rentas sebuah periuk terma.  
*Diagram 9 shows the cross-section of a thermal cooker.*



Rajah 9  
*Diagram 9*

(c) Jadual 2 menunjukkan ciri-ciri sebuah periuk terma.  
*Table 2 shows the characteristics of a thermal cooker.*

Periuk terma Thermal cooker	Bahan digunakan untuk periuk dalaman <i>Material used for the inner pot</i>	Lapisan dalam periuk dalaman disalut dengan <i>Inner layer of inner pot coated with</i>	Bahan digunakan untuk periuk luar <i>Material used for the outer pot</i>	Ruang S <i>Space S</i>
P	Aluminium Aluminium	Cat berkilat Shiny paint	Besi Iron	Vakum Vacuum
Q	Aluminium Aluminium	Cat hitam Black paint	Plastik Plastic	Udara Air
R	Keluli tahan karat Stainless steel	Cat berkilat Shiny paint	Plastik Plastic	Vakum Vacuum
S	Keluli tahan karat Stainless steel	Cat hitam Black paint	Besi Iron	Udara Air

Jadual 2

Anda dikehendaki menentukan kesesuaian periuk terma untuk mengekalkan haba makanan untuk beberapa jam. Terangkan kesesuaian setiap spesifikasi. Pilih periuk terma yang paling sesuai dan beri sebab untuk pilihan anda.

*You are required to determine the most suitable thermal cooker that can be used to keep the food warm for a few hours. Explain the suitability of each specification. Choose the most suitable thermal cooker and give reasons for your choice.*

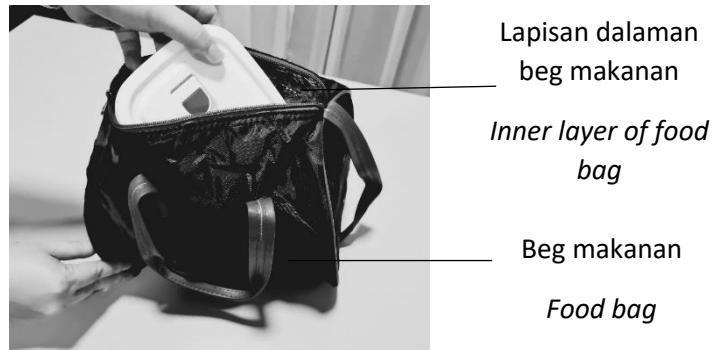
[10 markah]  
[10 marks]

Ciri	Penerangan
Material used for the inner pot : Stainless steel	Good heat conductor / anti-rust
Inner layer of inner pot coated with : Shiny paint	Can reflect heat and food will be easily cooked
Material used for the outer pot : plastic	High specific capacity / Good heat insulator / Decrease the heat loss
Space S : vacuum	Avoid heat loss / heat will not release to the surrounding / heat cannot transferred through vacuum

14.

Rajah 9.2 menunjukkan beg makanan yang diguna oleh seorang murid untuk membawa makanan ke sekolah. Dia mendapati bahawa makanan sudah menjadi sejuk semasa waktu rehat.

*Diagram 9.2 shows a food bag used by a student to bring his food to the school. He noticed that the food become cold during recess time.*



Rajah 9.2  
Diagram 9.2

Jadual 2 menunjukkan spesifikasi empat jenis beg makanan tengah hari P, Q, R dan S, yang boleh digunakan oleh murid tersebut untuk membawa makanan ke sekolah.

*Table 2 shows the specification of four types of lunch bag P, Q, R and S, that can be used by the student to bring his food to school.*

Jenis beg <i>Type of bag</i>	Bahan beg makanan <i>Material of food bag</i>	Lapisan dalam beg makanan <i>Inner layer of food bag</i>	Muatan haba tentu Beg makanan <i>Specific heat capacity of food bag (J kg<sup>-1</sup> °C<sup>-1</sup>)</i>	Ketumpatan beg makanan <i>Density of food bag</i>
P	Plastik <i>Plastic</i>	Permukaan berkilat <i>Shiny surface</i>	1670	Rendah <i>Low</i>
Q	Kain <i>Cloth</i>	Permukaan pudar <i>Dull surface</i>	1340	Rendah <i>Low</i>
R	Kain <i>Cloth</i>	Permukaan berkilat <i>Shiny surface</i>	925	Tinggi <i>High</i>
S	Plastik <i>Plastic</i>	Permukaan pudar <i>Dull surface</i>	2500	Tinggi <i>High</i>

Jadual 2  
Table 2

Anda dikehendaki menentukan kesesuaian beg makanan untuk mengekalkan haba selama beberapa jam. Terangkan kesesuaian setiap spesifikasi. Pilih beg makanan yang paling sesuai dan beri sebab untuk pilihan anda.

*You are required to determine the most suitable food bag that can be used to keep the food warm for a few hours. Explain the suitability of each specification. Choose the most suitable food bag and give reasons for your choice.*

[10 markah]  
[10 marks]

<b>Ciri-ciri</b>	<b>Sebab</b>
Material of food bag : plastic	Good heat insulator / high specific heat capacity / low heat conduction / waterproof
Inner layer of food bag ; shiny surface	Good heat reflector / slow cooling
Specific heat capacity : high	Decrease the heat loss to the surrounding
Density of food bag : low	Lighter

15.

(d) Rajah 9.4 menunjukkan daging beku diletakkan di atas pinggan kaca untuk dinyahbekukan. Masa yang diambil untuk menyahbeku adalah melebihi satu jam. Jadual 9 menunjukkan spesifikasi pinggan nyahbeku. *Diagram 9.4 shows frozen meat is put on a glass plate to defrost. The time taken to defrost the meat is more than an hour. Table 9 shows the specifications of the defrost plates used.*

KERTAS MODEL SPM 2



Rajah 9.4 / Diagram 9.4

Pinggan nyahbeku Defrost plate	Muatan haba tentu Specific heat capacity	Warna pinggan Colour of plate	Luas permukaan pinggan The surface area of the plate	Cara susunan pinggan Arrangement of plate
P	Rendah Low	Putih White	Rendah Low	Guna satu pinggan Use one plate
Q	Rendah Low	Hitam Black	Rendah Low	Guna dua pinggan, atas dan bawah. <i>Use two plates, top and bottom.</i>
R	Tinggi High	Putih White	Tinggi High	Guna satu pinggan Use one plate
S	Tinggi High	Hitam Black	Tinggi High	Guna dua pinggan, atas dan bawah. <i>Use two plates, top and bottom.</i>

Jadual 9 / Table 9

Kaji spesifikasi keempat-empat pinggan berdasarkan aspek-aspek berikut:  
*Study the specifications of the four defrost plate based on the following aspects:*

- muatan haba tentu / specific heat capacity
- warna pinggan / colour of plate
- luas permukaan pinggan / surface area of plate
- cara susunan pinggan / arrangement of plate

Terangkan kesesuaian setiap ciri pinggan nyahbeku tersebut. Tentukan pinggan yang paling sesuai digunakan untuk menyahbeku lebih banyak daging dalam masa yang singkat. Beri sebab-sebab untuk pilihan anda.

*Explain the suitability of each feature of the defrost plate. Determine the most suitable plate to use to defrost more meat in a short amount of time. Give reasons for your choice.*

[10 markah / 10 marks]

Specification	Explanation
Specific heat capacity : low	Heat up easily
Colour of plate : black	Can absorbs a lot of heat
Surface area of plate : high	Can put a lot of meat
Arrangement of plate : use two plates, top and bottom	Can absorbs a lot of heat

16.

(d) Diagram 10.3 shows the model of a house in Malaysia.  
*Rajah 10.3 menunjukkan model sebuah rumah di Malaysia.*

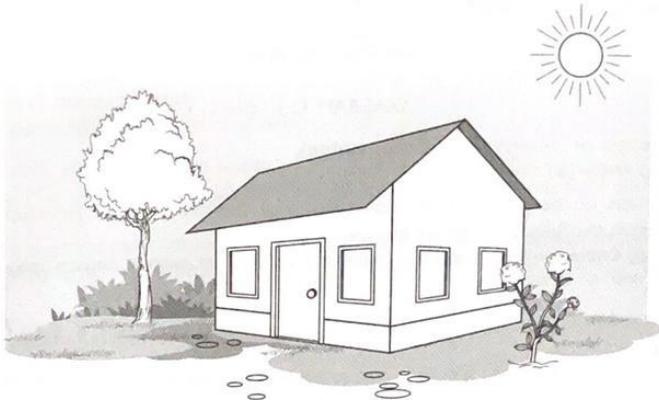


DIAGRAM 10.3/RAJAH 10.3

Using appropriate physics concepts, explain the use of suitable materials and designs to improve the ventilation of the house to keep the temperature inside the house not too high. Your answer should include the following aspects:

*Menggunakan konsep fizik yang sesuai, terangkan kegunaan bahan-bahan yang sesuai dan reka bentuk tertentu bagi meningkatkan lagi sistem peredaran udara untuk mengekalkan suhu yang tidak terlalu tinggi di dalam rumah itu. Jawapan anda hendaklah merangkumi aspek-aspek berikut:*

- (i) The number of windows  
*Bilangan tingkap*
- (ii) The size of the windows  
*Saiz tingkap*
- (iii) The specific heat capacity of materials for the walls  
*Mutan haba tentu bagi bahan untuk dinding*
- (iv) The type of materials for the roof  
*Jenis bahan untuk bumbung*
- (v) Additional feature that can cool the house  
*Ciri tambahan yang boleh menyekarkan rumah itu*

[10 marks/10 markah]

Aspect	Explanation
Increase the number of windows	To facilitate the exchange of cool air into the house and warm air out of the house.
Has bigger windows	To allow more cool air to enter and warm air to exit
Use material of high specific heat capacity	Does not heat up easily / good heat insulator
Use heat insulator and opaque material	Prevent heat transfer into the house and sunlight entering to heat up the air inside
Walls have ventilation holes and painted with light colour paint	To allow hot air flowing out by convection and reduce absorption of heat by the walls

✓ Bab 5 Waves

1.

(c) Rajah 8.2 menunjukkan seekor ikan lumba-lumba menggunakan gelombang untuk mengesan mangsanya.

*Diagram 8.2 shows a dolphin uses wave to detect its prey.*



Rajah 8.2

Diagram 8.2

Berdasarkan aspek-aspek berikut, beri cadangan bagaimana ikan lumba-lumba itu dapat mengesan mangsanya dengan lebih berkesan.

Beri **satu** sebab bagi kesesuaian setiap aspek tersebut.

*Based on the following aspects, give suggestions on how the dolphin is able to detect its prey efficiently.*

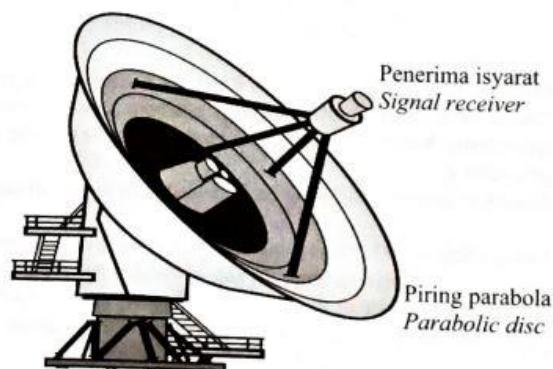
*Give one reason for the suitability of each aspect.*

Aspect	Explanation
Type of wave : ultrasonic wave	High frequency / high energy
Wave frequency : high	High energy / spread wider

2.

(d) Rajah 11.4 menunjukkan satu sistem radar di sebuah lapangan terbang. Isyarat akan dipancarkan daripada sistem radar untuk menentukan kedudukan sebuah kapal terbang.

*Diagram 11.4 shows a radar system at an airport. Signals will be transmitted from the radar system to determine the location of an aeroplane.*



Rajah 11.4

Diagram 11.4

Menggunakan konsep fizik yang sesuai, terangkan pengubahsuaian yang perlu dilakukan untuk memperbaiki sistem radar tersebut.

Jawapan anda mestilah meliputi ciri-ciri piring parabola, kedudukan piring parabola, jarak antara penerima isyarat dari pusat piring parabola dan jenis gelombang yang dipancarkan.

*Using appropriate physics concept, explain the modifications that need to be done to improve the radar system.*

*Your answer should include the characteristics of the parabolic disc, position of the parabolic disc, distance of the signal receiver from the centre of the parabolic disc and type of wave transmitted.*

[10 markah]

[10 marks]

Characteristic	Explanation
Parabolic disc is made from strong material	Not easily broken that caused by strong wind
Diameter of parabolic disc : big	Receive more signal
High position from earth surface	Signal will not be blocked
Distance of the signal receiver from the centre of the parabolic disc : equal to focal length of parabolic disc	All signal that received by parabolic disc will be reflected to the signal receiver
Type of wave transmitted : microwave	High energy / high frequency / low wavelength / easy to be reflected

3.

(d) Rajah 11.4 menunjukkan jumlah kenderaan yang banyak menggunakan jambatan pada waktu puncak.

*Diagram 11.4 shows large number of vehicles using a bridge during peak hour.*



Rajah 11.4  
Diagram 11.4

Menggunakan konsep fizik yang sesuai, cadangkan pengubahsuaian pada struktur jambatan tersebut supaya ia lebih selamat berdasarkan ciri-ciri bagi kabel, menara dan tiang.

*Using appropriate physics concepts, suggest the modification of the bridge structure so that it is safer based on the characteristics of cable, tower and pillar.*

[10 markah]  
[10 marks]

Characteristic	Explanation
Steel / strong cable	Not easily rusted // not easily break // withstand bigger force
Concrete / strong pillar	Not easily break // withstand bigger force
Steel / strong tower	Not easily rusted // not easily break // withstand bigger force
Many numbers of cable	Withstand more force/load // increase equilibrium
High tension of cable	Not easily break // bigger force
Higher height of pillar	Avoid water spill on bridge
Bigger diameter of pillar	Increase stability
More pillars	Support more force/weight // increase stability // withstand strong wave/erosion

4.

(c) Diagram 9.2 shows a mobile unit vehicle to deliver information on the Movement Control Order (MCO) during the Covid-19 pandemic among residents. However, the sound produced is not clear.

Rajah 9.2 menunjukkan kenderaan unit bergerak untuk menyampaikan maklumat mengenai Perintah Kawalan Pergerakan (PKP) semasa pandemik Covid-19 dalam kalangan penduduk. Walaubagaimanapun, bunyi yang dihasilkan adalah tidak jelas.



Diagram 9.2  
Rajah 9.2

You are required to investigate the speaker set up J, K, L and M as shown in Table 9.

Anda dikehendaki untuk mengkaji susun atur pembesar suara J, K, L dan M seperti yang ditunjukkan di dalam Jadual 9.

(c) Study the specification of all the speaker set up.

Explain the suitability and determine the most suitable speaker set up to be used on the vehicle so that the sound produced can be heard clearly.

Give reasons for your choice.

Kaji spesifikasi kesemua susun atur pembesar suara.

Terangkan kesesuaian dan tentukan susun atur pembesar suara yang paling sesuai digunakan pada kenderaan supaya bunyi yang terhasil dapat didengari dengan jelas.

Berikan sebab bagi pilihan anda.

[10 marks]  
[10 markah]

J		Frequency of the speaker = 5000 Hz Frekuensi pembesar suara = 5000 Hz
K		Frequency of the speaker = 10000 Hz Frekuensi pembesar suara = 10000 Hz
L		Frequency of the speaker = 5000 Hz Frekuensi pembesar suara = 5000 Hz
M		Frequency of the speaker = 10000 Hz Frekuensi pembesar suara = 10000 Hz

Table 9

Characteristic	Explanation
Distance between speakers : large/ far	Distance between consecutive loud sound produced is smaller
Diameter of the speaker : big /large	Spread wider, higher amplitude/more air molecules can be compressed.
Frequency of the sound wave from speaker : low / small	High wavelength, diffraction more
Number of speakers : more	Louder sound, travel far, propagate to many directions

5.

(b)

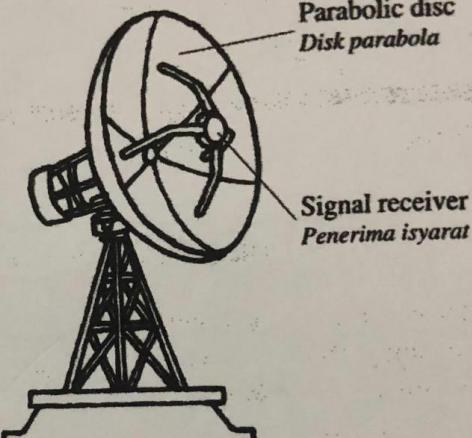


Diagram 13.2 Rajah 13.2

Diagram 13.2 shows a radar system at an airport. Signals are transmitted to enable communication between airplanes and the radar system.

Table 1 shows the features of four radar systems, *P*, *Q*, *R* and *S*.

Rajah 13.2 menunjukkan sistem radar dalam sebuah lapangan terbang. Isyarat dipancarkan untuk membolehkan komunikasi antara kapal terbang dengan sistem radar.

Jadual 1 menunjukkan ciri-ciri bagi empat sistem radar, *P*, *Q*, *R*, dan *S*.

Types of radar system Jenis sistem radar	Diameter of the parabolic disc/m Diameter disk parabola/m	Types of wave transmitted Jenis gelombang yang dipancar	Distance of the signal receiver from the parabolic disc Jarak penerima isyarat dari disk parabola	Height of the parabolic disc Ketinggian disk parabola
<i>P</i>	10	Radiowave Gelombang radio	Focal length Panjang fokus	Low Rendah
<i>Q</i>	3	Microwave Gelombang mikro	Less than the focal length Kurang dari-pada panjang fokus	High Tinggi
<i>R</i>	9	Microwave Gelombang mikro	Focal length Panjang fokus	High Tinggi
<i>S</i>	5	Radiowave Gelombang radio	More than the focal length Lebih daripada panjang fokus	Low Rendah

Table 1 Jadual 1

Study the specifications of all the four radar systems based on the following aspects and choose the most suitable radar system.

Mengkaji spesifikasi untuk keempat-empat sistem radar berdasarkan aspek yang berikut dan pilihkan sistem radar yang paling sesuai.

- The diameter of the parabolic disc.  
*Diameter disk parabola.*
- The distance of the signal receiver from the parabolic disc.  
*Jarak penerima isyarat dari disk parabola.*
- The type of the wave transmitted.  
*Jenis gelombang yang dipancar.*
- The height of the parabolic disc from the ground.  
*Ketinggian disk parabola dari tanah.*
- Give reasons for your choice.  
*Berikan sebab untuk pilihan anda.*

Specification	Explanation
The diameter of parabolic disc : Big	Can receive a lot of signal
The distance of the signal receiver from the parabolic disc : focal length	Creates parallel grooves / signal can sent straight to receiver
Type of the wave transmitted : microwave	High frequency
The height of the parabolic disc from the ground : high	Easy to detects signals

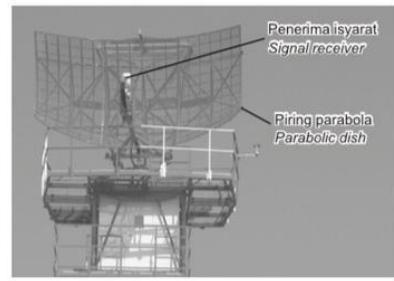
6.

(c) Rajah 7.2 menunjukkan sebuah sistem radar di sebuah lapangan terbang yang digunakan untuk menentukan kedudukan kapal terbang. Jadual 2 menunjukkan lima sistem radar, R1, R2, R3 dan R4 yang boleh digunakan untuk menentukan kedudukan kapal terbang.

Diagram 7.2 shows a radar system at an airport used to determine the position of an aeroplane. Table 2 shows of five radar systems, R1, R2, R3 and R4 that can be used to determine the position of an aeroplane.

Kaji spesifikasi keempat-empat sistem radar tersebut. Terangkan kesesuaian setiap spesifikasi untuk kesemua sistem radar dan tentukan sistem yang paling sesuai digunakan untuk menentukan kedudukan kapal terbang.

Study the specifications of all the four radar systems. Explain the suitability of each specification of the radar system and determine the most suitable system to be used to determine the position of an aeroplane.



Rajah / Diagram 7.2

Jadual 2

Table 2

Sistem radar Radar system	Diameter piring parabola/ m Diameter of the parabolic disc/ m	Jarak penerima isyarat dari pusat piring parabola Distance of the signal receiver from the center of the parabolic disc	Jenis gelombang yang dipancar Type of wave transmitted	Ketinggian piring parabola dari bumi Height of the parabolic disc from the ground
R1	12	Kurang daripada panjang fokus Less than the focal length	Gelombang radio Radio wave	Tinggi High
R2	6	Kurang daripada panjang fokus Less than the focal length	Gelombang mikro Microwave	Rendah Low
R3	11	Sama dengan panjang fokus Same as focal length	Gelombang mikro Microwave	Tinggi High
R4	7	Sama dengan panjang fokus Same as focal length	Gelombang radio Radio wave	Rendah Low

Jadual / Table 2

Aspek Aspect	Ciri Characteristics	Sebab Reason
Diameter piring parabola Diameter of the parabolic disc	Besar Bigger	Mampu menerima lebih banyak isyarat/gelombang Able to receive more signal/waves
Jarak penerima isyarat dari piring parabola Distance of the signal receiver from parabolic disc	Sama dengan panjang fokus Same as focal length	Isyarat akan ditumpukan ke penerima/ menghasilkan alur yang selari The signal will converge to the receiver/ produce parallel ray
Jenis gelombang Type of wave	Gelombang mikro Microwave	Mempunyai frekuensi yang tinggi/tenaga yang tinggi Have higher frequency/Have higher energy
Ketinggian piring parabola Height of the parabolic disc	Tinggi High	Isyarat tidak akan terhalang/mudah untuk mengesan isyarat/kurang gangguan isyarat The signal not blocked/Easy to detect the signal/Less disturbance of signal
Radar R3 dipilih kerana diameter piring yang besar, jarak penerima isyarat sama dengan panjang fokus, guna gelombang mikro dan kedudukan piring yang tinggi R3 is selected because has bigger disc diameter, distance signal receiver same as focal length, use microwave and the position of disc is higher.		

[10 markah/marks]

7.

(e) Rajah 6.4 menunjukkan dewan sebuah sekolah.  
*Diagram 6.4 shows a school hall.*



Rajah / Diagram 6.4

Anda telah ditugaskan sebagai pakar perunding untuk memasang sistem pembesar suara untuk memperbaiki kualiti bunyi di sebuah dewan sekolah. Dengan menggunakan konsep fizik yang sesuai, terangkan bagaimana pemasangan peralatan tersebut dan pengubahsuaian lain yang boleh dilakukan untuk menghasilkan bunyi yang jelas dan baik.

*You have been assigned as a consultant to assemble a speaker and to improve the quality of sound at a school hall. Using the appropriate physics concept, explain how the speaker system must be installed and what other modifications can be made to produce clearer and better sound.*

Modifikasi <i>Modification</i>	Penerangan <i>Explanation</i>
Jarak antara dua pembesar suara lebih jauh <i>Bigger distance between two speakers</i>	Mengurangkan jarak antara dua bunyi kuat yang berturutan/ lebih banyak tempat bunyi kuat berlaku <i>Produce low distance between two consecutive loud sound/ more places of loud sound</i>
Pasangkan permaidani tebal / langsing <i>Place (thick) carpet / curtain</i>	Menyerap/menghalang pantulan gelombang bunyi / mengelakkan gema <i>Absorb/prevent reflection of sound wave / avoid echo</i>
Letakkan kerusi berhampiran dengan pentas <i>Seat place near to the stage</i>	Jarak antara dua bunyi kuat berturutan kecil / x berkurang <i>Distance between two consecutive loud sound decrease / x decrease</i>
Dinding diperbuat daripada bahan yang lembut <i>Wall made of soft material</i>	Menyerap pantulan bunyi/kurangkan bunyi bising/kurangkan gema <i>Absorb reflection of sound wave/reduce noise/reduce echo</i>
Dinding yang kasar / tidak rata <i>Rough wall/uneven wall</i>	Menyerap pantulan bunyi/kurangkan bunyi bising/kurangkan gema <i>Absorb reflection of sound wave/reduce noise/reduce echo</i>
Gunakan pembesar suara yang berkuasa tinggi <i>Assemble a higher power speaker system</i>	Untuk menghasilkan bunyi yang lebih kuat/lebih jelas <i>To produce a louder/clearer sound.</i>

8.

7 Table 7 shows the characteristics of two types of sonar used in ships to locate underwater objects. The sonar sends out a sound wave which is a longitudinal wave and receives echoes from underwater objects.  
 Jadual 7 menunjukkan ciri-ciri bagi dua jenis sonar yang digunakan dalam kapal untuk mengesan objek di bawah laut. Sonar itu menghantar satu gelombang bunyi yang merupakan gelombang membrujur dan menerima gema daripada objek di bawah laut.

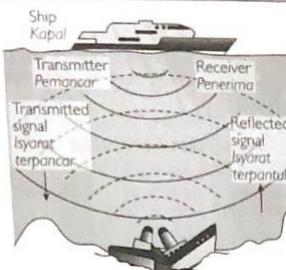
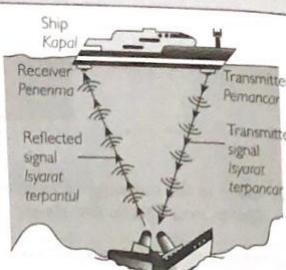
Characteristics Ciri-ciri	Sonar V	Sonar W
Type of sonar Jenis sonar		
Type of wave used Jenis gelombang yang digunakan	Sound wave Gelombang bunyi	Ultrasound wave Gelombang ultrasound
Frequency of wave Frekuensi gelombang	15 kHz	40 kHz
Time measuring instrument Alat pengukur masa	Digital stopwatch Jam randik digital	Cathode ray oscilloscope (CRO) Osiloskop sinar katod (OSK)

TABLE 7/JADUAL 7

Characteristic	Explanation
Type of wave used : ultrasound wave	High energy / can penetrate deep water
Frequency of wave : high	Have enough energy / not easily diffracted in water
Time measuring instrument : Cathode ray oscilloscope (CRO)	Can measure short time interval accurately

9.

(d) Table 12 shows four different specifications of sound system in a lecture hall. Study the specifications of all four sound systems.  
*Jadual 12 menunjukkan empat spesifikasi berlainan bagi sistem bunyi dalam sebuah dewan kuliah. Kaji spesifikasi keempat-empat sistem bunyi.*

Sound system <i>Sistem bunyi</i>	Position of loudspeakers <i>Kedudukan pembesar suara</i>	Distance between two loudspeakers <i>Jarak antara dua pembesar suara</i>	Position of microphone <i>Kedudukan mikrofon</i>	Material used to cover the wall <i>Bahan yang digunakan untuk menutup dinding</i>
U	Low <i>Rendah</i>	Smaller <i>Lebih kecil</i>	In front of the speaker <i>Di hadapan pembesar suara</i>	Softboard <i>Papan lembut</i>
V	High <i>Tinggi</i>	Smaller <i>Lebih kecil</i>	Behind the speaker <i>Di belakang pembesar suara</i>	Hardwood <i>Kayu keras</i>
W	Low <i>Rendah</i>	Greater <i>Lebih besar</i>	In front of the speaker <i>Di hadapan pembesar suara</i>	Hardwood <i>Kayu keras</i>
X	High <i>Tinggi</i>	Greater <i>Lebih besar</i>	Behind the speaker <i>Di belakang pembesar suara</i>	Softboard <i>Papan lembut</i>

TABLE 12/JADUAL 12

Explain the suitability of each sound system and its specifications. Determine the most suitable sound system to be used in the lecture hall. Justify your choice.

*Terangkan kesesuaian bagi setiap sistem bunyi dan spesifikasinya. Tentukan sistem bunyi yang paling sesuai digunakan dalam dewan kuliah tersebut. Wajarkan pilihan anda.* [10 marks/10 markah]

Aspect	Explanation
Position of loudspeakers : high	To prevent the sound being blocked by the people in the front
Distance between two loudspeakers : greater	To reduce the effects of interference of sound waves
Position of microphone : behind the speaker	To avoid feedback
Material used to cover the wall : softboard	Can absorb sound and prevent echo formation

10.

(c) Diagram 5.3 shows a radar system at the Kuala Lumpur International Airport (KLIA). Signals are transmitted from the radar system to determine the position of an aeroplane.  
*Rajah 5.3 menunjukkan satu sistem radar di Lapangan Terbang Antarabangsa Kuala Lumpur (KLIA). Isyarat dihantar dari sistem radar untuk menentukan kedudukan sesebuah kapal terbang.*

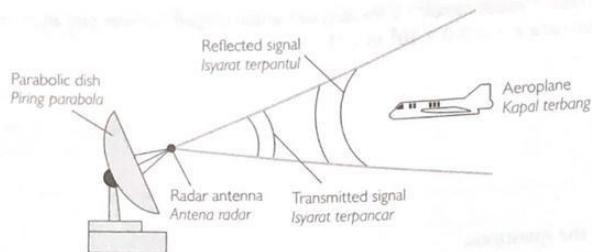


DIAGRAM 5.3/RAJAH 5.3

Table 5.3 shows the specifications of four radar systems, U, V, W and X that can be used to determine the position of an aeroplane.

*Jadual 5.3 menunjukkan spesifikasi empat sistem radar, U, V, W dan X yang boleh digunakan untuk menentukan kedudukan sesebuah kapal terbang.*

Radar system Sistem radar	Type of wave transmitted Jenis gelombang terpancar	Diameter of parabolic dish Diameter piring parabola	Distance of antenna from the centre of the dish Jarak antena dari pusat piring	Height of the dish from the ground Ketinggian piring dari bumi
U	Microwave Gelombang mikro	8 m	Less than the focal length Kurang daripada panjang fokus	Low Rendah
V	Radio wave Gelombang radio	5 m	Equals the focal length Bersamaan dengan panjang fokus	High Tinggi
W	Microwave Gelombang mikro	10 m	Equals the focal length Bersamaan dengan panjang fokus	High Tinggi
X	Radio wave Gelombang radio	12 m	More than the focal length Lebih daripada panjang fokus	Low Rendah

TABLE 5.3/JADUAL 5.3

Day: ..... Date: .....

Study the specifications of all four radar systems. Explain the suitability of each specification and determine the most suitable radar system that can function efficiently. Justify your answer.

**HOTS** Analysing

*Kaji spesifikasi keempat-empat sistem radar tersebut. Terangkan kesesuaian bagi setiap spesifikasi dan tentukan sistem radar yang paling sesuai yang boleh berfungsi dengan cekap. Wajarkan jawapan anda.*

[10 marks/10 markah]

Aspect	Explanation
Type of wave transmitted : microwave	Have high frequency and high energy / not easily diffracted
Diameter of parabolic dish : big	Can capture or receive more signals
Distance of antenna from the centre of the dish: equals the focal length	So that all signals can be focused of converged onto the antenna
Height of the dish from the ground: high	To have wider receiving range

11.

(c) Diagram 10.4 shows an undeveloped coastal region where a new holiday resort consisting of chalets and a jetty is to be build.



Diagram 10.4 / Rajah 10.4

Using your knowledge about waves, suggest and explain how the holiday resort is to be build based on the following aspects:

- (i) The location of the chalets.
- (ii) The location of the jetty.
- (iii) Materials used for the building of the resort.
- (iv) Features to enable tourist enjoying calm water.
- (v) Others relevant safety features.

[10 marks]

Aspect	Explanation
Chalets located at bay	Calm water region
Jetty located at bay	Wave energy at bay smaller
Use wood or stone	Resist corrosion
Build retaining wall with small gaps	Enable diffraction of wave occurs
Build lifeguard tower	Lifeguard on duty can view further distance

12. Kompleks Pendaratan Ikan LKIM is a place where fishermen anchor their ship and bring ashore their catch. The river estuary becomes the entrance for ships to dock at the complex. Photograph 1 shows an example of a river estuary.



*Photograph 1*

(Source: Image ©2019 TerraMetrics, Image ©2019 Maxar Technologies)

Assume you are an engineer who is an expert in reflection, refraction and diffraction of waves. You are required to propose characteristics of the design of the building structure to ensure the fishermen's ships can pass through the river estuary safely based on the following aspects: 🧐

- (a) building structure that can reduce the height of waves
- (b) characteristics of the building structure that can reduce the effects of erosion
- (c) depth of the river estuary to enable ships to pass through the estuary safely

Adjustments	Explanation
Build an embankment that has a gap at the river estuary	Enables diffraction to occur to reduce the amplitude of water waves which enter the river estuary. This will ensure that the water in the region of the river estuary is calmer for ships to dock.
Build a high wall at the river estuary	Prevents sea waves of high amplitude from entering the estuary.
Build a wall of rocks or concrete with holes all along the beach near the river estuary	Diffraction decreases the energy carried by sea waves to reduce erosion of the beach.
Deepen the river estuary	Produces a large wavelength of low amplitude. Ensures docked ships are stationary and not rolling and pitching.
Widen the river estuary	Widens the passage for ships.

## ➤ Bab 6 Light and Optics

### 1.

20

4531/2 M1

(b) Diagram 9.2 shows one arrangement of the lenses used by Ahmad to construct the simple astronomical telescope.

Rajah 9.2 menunjukkan satu susunan kanta yang digunakan oleh Ahmad bagi membina sebuah teleskop astronomi ringkas.

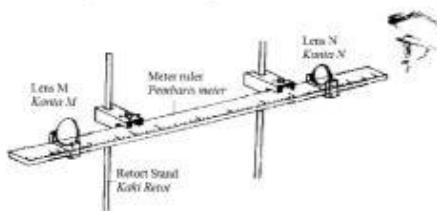


Diagram 9.2

Rajah 9.2

You are asked to investigate the arrangement and the characteristics of the lenses used by Ahmad in constructing the simple astronomical telescope as in Table 3.

Anda ditugaskan untuk menyiasat susunan kanta dan sifat-sifat kanta yang digunakan oleh Ahmad bagi membina sebuah teleskop astronomi ringkas seperti dalam Jadual 3.

Arrangement of lenses <i>Susunan kanta</i>	Focal length of objective lens, $f_o$ compare to focal length of eyepiece, $f_e$ <i>Panjang fokus kanta objek, <math>f_o</math> berbanding panjang fokus kanta mata, <math>f_e</math></i>	Magnification of image, m <i>Pembesaran imej, m</i>	Distance between objective lens and eyepiece, D / cm <i>Jarak antara kanta objek dengan kanta mata, D / cm</i>	Diameter of objective lens, d / cm <i>Diameter kanta objek, d / cm</i>
P	$f_o > f_e$	$>1$	$f_o + f_e$	Bigger <i>Besar</i>
Q	$f_o > f_e$	$<1$	$> f_o + f_e$	Smaller <i>Kecil</i>
R	$f_o > f_e$	$>1$	$f_o + f_e$	Bigger <i>Besar</i>
S	$f_o > f_e$	$<1$	$> f_o + f_e$	Smaller <i>Kecil</i>

Table 3  
*Jadual 3*

You are asked to explain the suitability of the arrangements and each characteristic of the lenses and determine the arrangement which can produce the brightest and sharpest image at normal adjustment.

Anda diminta untuk menerangkan kesesuaian susunan dan sifat-sifat kanta dan tentukan susunan yang dapat menghasilkan imej yang paling terang dan paling tajam pada pelarasannya normal.

[10 marks / 10 markah]

Aspect	Explanation
Longer focal length // $f_o > f_e$ <i>Panjang fokus yang panjang</i>	To produce real, inverted and smaller image <i>Hasilkan imej nyata, songsang dan lebih kecil</i>
High magnification // $>1$ <i>Pembesaran tinggi</i>	Produce bigger image <i>Hasilkan imej lebih besar</i>
Distance = $f_o + f_e$	Produce sharp image at normal adjustment // image at infinity <i>Hasilkan imej tajam pada pelarasannya normal</i>
Bigger diameter <i>Diameter lebih besar</i>	More light can enter objective lens // more brighter <i>Lebih banyak cahaya dapat masuk// lebih cerah</i>
P is chosen <i>P dipilih</i>	Longer focal length, higher magnification, Distance between two lenses = $f_o + f_e$ and bigger diameter <i>Panjang fokus yang panjang, Pembesaran tinggi, jarak antara kanta = <math>f_o + f_e</math> dan diameter lebih besar</i>

2.

(d) Kanta objek digunakan dalam binokular itu supaya objek boleh dilihat dengan lebih jelas.

Jadual 7 menunjukkan ciri-ciri tiga kanta.

*Objective lens is used in the binoculars so that the object can be seen clearer.*

*Table 7 shows the characteristics of three lenses.*

Kanta Lens	$f_o : f_e$	Diameter kanta <i>Diameter of lens</i>
X	10 cm : 20 mm	Kecil <i>Small</i>
Y	14 cm : 20 mm	Besar <i>Big</i>
Z	24 cm : 24 mm	Besar <i>Big</i>

Jadual 7

Table 7

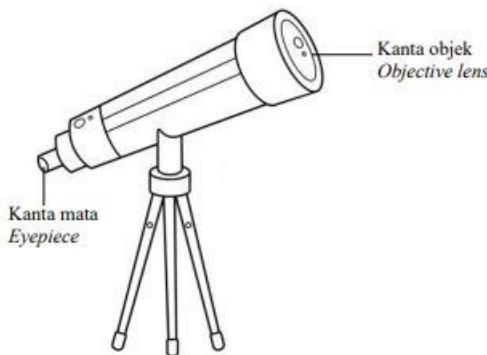
Berdasarkan Jadual 7, nyatakan kesesuaian ciri-ciri kanta untuk digunakan sebagai kanta objek. Berikan satu sebab untuk kesesuaian ciri itu. Berikan **SATU** sebab untuk kesesuaian ciri tersebut.

*Based on Table 7, state the suitable characteristics of the lens to be used as the objective lens. Give **ONE** reason for the suitable characteristics.*

Characteristic	Reason
$f_o : f_e$ : Big	Higher magnification
Diameter of lens : Big	Brighter image / more light can refracted by the lens

3.

(d) Rajah 9.4 menunjukkan sebuah teleskop astronomi.  
*Diagram 9.4 shows an astronomical telescope.*



Rajah 9.4  
*Diagram 9.4*

Jadual 9 menunjukkan empat set kanta cembung J, K, L dan M dengan spesifikasi yang berbeza.

*Table 9 shows four sets of convex lenses J, K, L and M with different specifications.*

Set kanta Set of lenses	Kanta objek Objective lens		Kanta mata Eyepiece	
	Panjang fokus/ cm Focal length/ cm	Diameter/ cm Diameter/ cm	Jenis kanta Type of lens	Kuasa/ D Power/ D
J	50.0	6.0	Cembung Convex	30
K	30.0	3.0	Cembung Convex	25
L	50.0	3.0	Cekung Concave	25
M	30.0	6.0	Cekung Concave	30

Jadual 9  
*Table 9*

Anda dikehendaki menentukan set kanta yang paling sesuai untuk membina sebuah teleskop astronomi yang boleh menghasilkan imej yang jelas.

*You are required to determine the most suitable set of lenses to construct an astronomical telescope that can produce a clear image.*

Terangkan kesesuaian aspek-aspek itu dan tentukan set kanta yang paling sesuai. Beri sebab bagi pilihan anda.

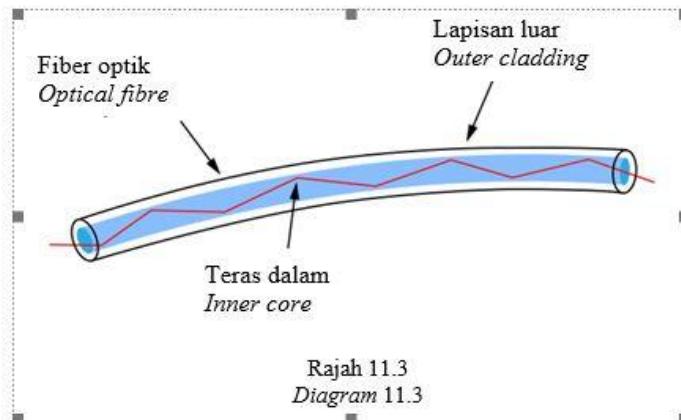
*Explain the suitability of the aspects and determine the most suitable set of lenses. Give reasons for your choice.*

[10 markah]  
[10 marks]

Aspek	Penerangan
Panjang fokus kanta objek adalah panjang <i>Longer focal length of objective lens</i>	To produce real, inverted and smaller image// To produce a higher magnification <i>Untuk menghasilkan nyata, terbalik, dikecilkan// Untuk menghasilkan pembesaran yang lebih tinggi</i>
Diameter kanta objek besar <i>Bigger diameter of the objective lens</i>	Lebih banyak cahaya boleh masuk ke dalam kanta objek dan imej lebih jelas. <i>More light can enter objective lens and a clearer image is seen.</i>
Kanta cembung sebagai kanta mata <i>Convex lens for eyepiece</i>	Sebagai kanta pembesar// untuk membesarkan imej yang dihasilkan oleh kanta objek <i>As a magnifying glass// to magnify the image produced by the objective lens</i>
Kuasa kanta mata yang tinggi <i>Higher power of eyepiece</i>	Kuasa kanta mata yang tinggi mempunyai panjang fokus yang pendek, maka pembesaran adalah tinggi// Untuk menghasilkan imej yang besar. <i>High power lens has a shorter focal length, ie, higher magnification// To produce bigger/magnified image</i>

4.

(c) Rajah 11.3 menunjukkan struktur satu fiber optik.  
*Diagram 11.3 shows the structure of an optical fiber..*



Rajah 11.3  
*Diagram 11.3*

Anda dikehendaki untuk mencadangkan ciri-ciri yang sesuai supaya fiber optik itu dapat digunakan dalam komunikasi dan perubatan.

Nyata dan terangkan cadangan anda berdasarkan aspek-aspek berikut:

*You are assigned to give suggestions on the characteristic of the optical fiber so that it can be used in communications and medicine.*

*State and explain your suggestion based on the following aspects.*

(i) Sifat fiber optic.  
*Features of optical fiber.*

(ii) Perbandingan indeks biasan teras dalam dan lapisan luar.  
*Comparison between refractive index of inner core and the outer cladding.*

(iii) Kelenturan.  
*Flexibility.*

(iv) Ketulenan teras dalam.  
*Purity of inner core.*

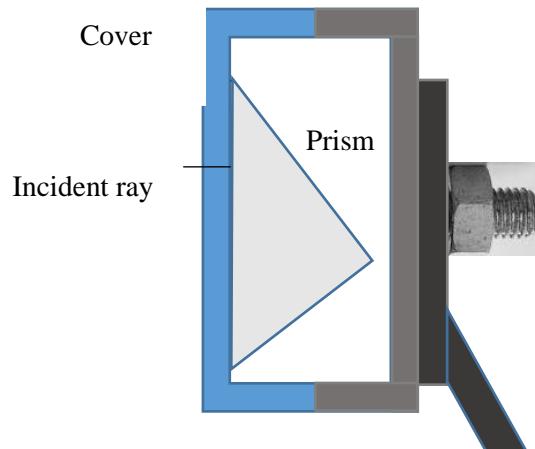
(v) Ciri tambahan.  
*Additional features.*

[10 markah]  
[10 marks]

Aspect	Reason
Bundle of fiber optic	More signal can be reflected
Refractive index of inner core is higher than the outer cladding	Produces total internal reflection
High flexibility	Easy to bent
High purity of inner core	Can reduce signal lost / increase the distance of signal transmission
Camera// Light source	To view internal organs // Brighter image

5.

(c) Diagram 11.3 shows the structure of a rear reflector of a bicycle created by student. The reflector consists of a prism which have critical angle  $42^\circ$ .



Rajah 11.3

You are assigned to give suggestions on the characteristic of the reflector so that it can be used to reflect high intensity of light.

State and explain your suggestion based on the following aspects.

- (i) angle of prism used
- (ii) material of the prism
- (iii) characteristic of the cover
- (iv) number of prism
- (v) position of the reflector

[10 marks]

Aspect	Reason
45 – 90 - 45	Total internal reflection happened
Glass // plastic // transparent	Allow more light to enter the prism
Waterproof	Water will not enter the prism
More than one	More light to be reflected
Higher position	Easy to see //not blocked

6.

(c) Convex lens J acts as an eyepiece lens and need to be combined with another convex lens that acts as objective lens to build an astronomical telescope. Convex lenses P, Q, R and S can be used as the objective lens.

Kanta cembung J bertindak sebagai kanta mata dan perlu digabungkan dengan kanta cembung yang lain yang bertindak sebagai kanta objektif untuk membina sebuah teleskop astronomi. Kanta cembung P, Q, R dan S boleh digunakan sebagai satu kanta objektif.

Based on the information in Table 7, state the suitable characteristics of the objective lens which can produce larger and clearer image.

Give reason for the suitability of the characteristics.

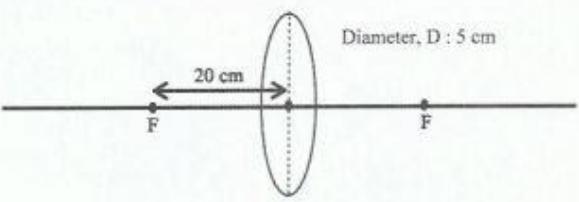
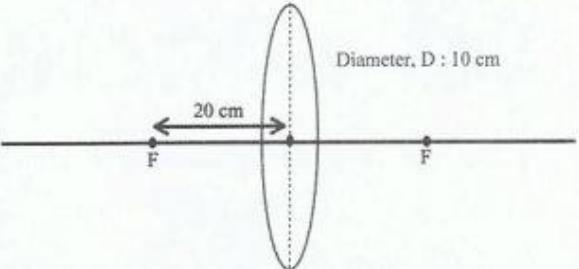
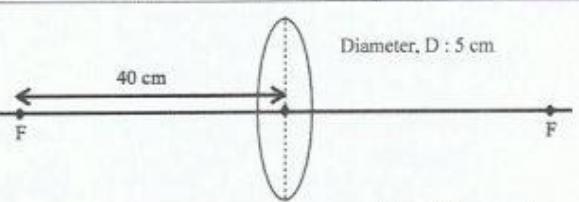
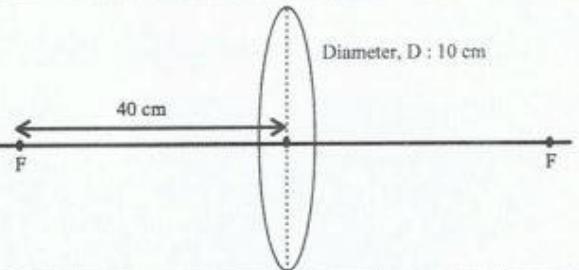
Berdasarkan maklumat pada Jadual 7, nyatakan ciri-ciri yang sesuai bagi kanta objektif yang dapat menghasilkan imej yang lebih besar dan jelas.

Beri sebab untuk kesesuaian ciri-ciri tersebut.

Characteristic	Reason
Focal length : Bigger	High magnification / larger image
Diameter : Bigger	Brighter / allow more light enter the lens / clearer

Table 7 shows characteristics of four convex lenses P, Q, R and S.

Jadual 7 memperukkan ciri-ciri empat kanta cembung P, Q, R dan S.

Convex lens P Kanta cembung P	
Convex lens Q Kanta cembung Q	
Convex lens R Kanta cembung R	
Convex lens S Kanta cembung S	

7.

Anda ditugaskan untuk menyiasat susunan kanta dan sifat-sifat kanta yang digunakan oleh Adam bagi membina sebuah teleskop astronomi ringkas seperti dalam Jadual 9.

*You are asked to investigate the arrangement and the characteristics of the lenses used by Adam in constructing the simple astronomical telescope as in Table 9.*

Susunan kanta <i>Arrangement of lenses</i>	Panjang fokus kanta objek, $f_o$ berbanding panjang fokus kanta mata, $f_e$ <i>Focal length of objective lens, <math>f_o</math> to focal length of eyepiece lens, <math>f_e</math></i>	Pembesaran imej, $M$ <i>Magnification of image, M</i>	Jarak di antara kanta objek dan kanta mata, $D$ /cm <i>Distance between objective lens and eyepiece, D /cm</i>	Diameter kanta objek, $d$ /cm <i>The diameter of the objective lens, d /cm</i>
P	$f_o > f_e$	$> 1$	$f_o + f_e$	Besar <i>Bigger</i>
Q	$f_o > f_e$	$< 1$	$> f_o + f_e$	Kecil <i>Smaller</i>
R	$f_e > f_o$	$> 1$	$f_o > f_e$	Besar <i>Bigger</i>
S	$f_e > f_o$	$< 1$	$> f_o + f_e$	Kecil <i>Smaller</i>

Jadual 9 / Table 9

Anda diminta untuk menerangkan kesesuaian susunan dan sifat-sifat kanta. Seterusnya, tentukan susunan yang dapat menghasilkan imej yang paling terang dan paling tajam.

*You are asked to explain the suitability of the arrangement and each characteristics of the lenses. Then, determine the configuration to produce the brightest and sharpest image.*

[10 markah / 10 marks]

Characteristic	Reason
Focal length of objective lens to focal length of eyepiece lens : $f_o > f_e$	Produces first image : real, inverted and diminished
Magnification of image, M: $> 1$	Produces magnified image
distance between objective lens and eyepiece, D/cm : $f_o + f_e$	Produces sharp image
The diameter of the objective lens, d/cm : B	Brighter

8.

(d) Jadual 6.3 menunjukkan ciri-ciri bagi tiga prisma yang boleh digunakan di dalam sebuah periskop.  
*Table 6.3 shows the characteristics of three prisms that can be used in a periscope.*

Prisma <i>Prism</i>	Indeks biasan <i>Refractive index</i>	Saiz <i>Size</i>
P	1.46	Besar <i>Big</i>
Q	1.52	Kecil <i>Small</i>
R	1.43	Besar <i>Big</i>

Jadual 6.3  
*Table 6.3*

Berdasarkan Jadual 6.3, nyatakan kesesuaian ciri-ciri pada prisma untuk digunakan di dalam sebuah periskop. Berikan satu sebab untuk kesesuaian ciri itu.  
*Based on Table 6.3, state the suitable characteristics of the prism to be used in a periscope. Give one reason for the suitable characteristics.*

Characteristic	Reason
Refractive index : High	Produces small critical angle
Size : Big	More light can enter

9.

(b) Anda dikehendaki untuk mencadangkan ciri-ciri bagi sebuah kanta cembung untuk digunakan sebagai kanta objektif dalam sebuah teleskop.  
*You are required to give suggestions on the characteristics of a convex lens to be used as an objective lens in a telescope.*

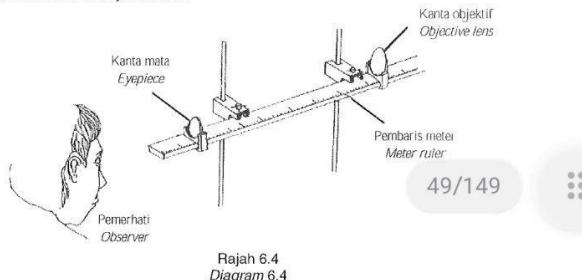
Aspect	Reason
Diameter of the lens : Big	Clearer image
The focal length of the lens : High	Higher linear magnification

10.

Terangkan kesesuaian susunan dan sifat-sifat kanta dan tentukan susunan yang dapat menghasilkan teleskop astronomi ringkas yang efektif.

*Explain the suitability of the arrangement and characteristics of the lenses and determine the arrangement which can produce an effective simple astronomical telescope.*

cm and convex lens G is 10 cm. One of the convex lenses will act as an eye piece and the other as objective lens.



Rajah 6.4  
Diagram 6.4

Anda ditugaskan untuk menyiasat susunan kanta dan sifat-sifat kanta yang akan digunakan untuk membina sebuah teleskop astronomi ringkas seperti dalam Jadual 6.4. You are asked to investigate the arrangement and characteristics of the lenses used to construct the simple astronomical telescope as shown in Table 6.4.

Susunan kanta <i>Arrangement of lenses</i>	Panjang fokus kanta objek, $f_o$ /cm <i>Focal length of objective lens, <math>f_o</math>/cm</i>	Pembesaran imej <i>Magnification of image</i>	Jarak antara kanta objek dengan kanta mata, $D$ /cm <i>Distance between objectives lens and eyepiece, <math>D</math>/cm</i>	Diameter kanta objek, $d$ /cm <i>Diameter of objectives lens, <math>d</math>/cm</i>
J	40.0	4.00	50.0	Besar <i>Large</i>
K	40.0	0.25	60.0	Kecil <i>Small</i>
L	10.0	4.00	50.0	Besar <i>Large</i>
M	10.0	0.25	60.0	Kecil <i>Small</i>

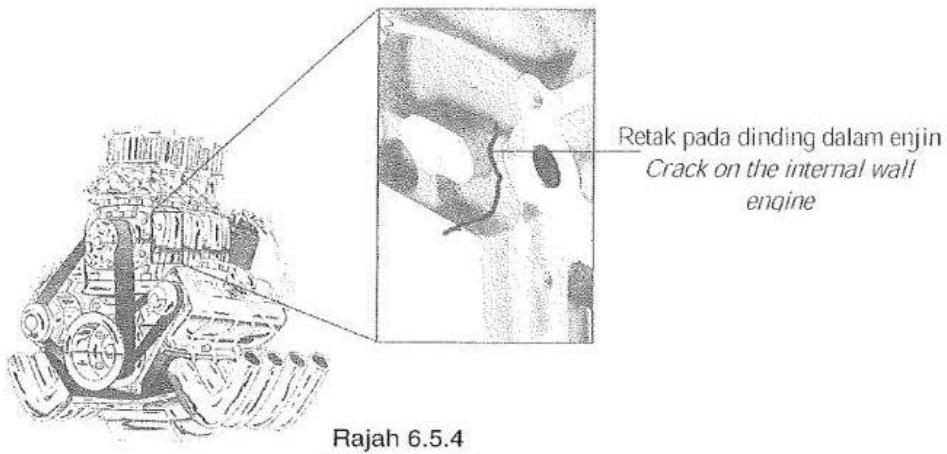
Jadual 6.4  
Table 6.4

Characteristic	Reason
Longer focal length of objective lens	Produces real, inverted and diminished image
Higher magnification of image	Produces a magnified image
Distance = $f_o + f_e$	Produces image at the infinity
Bigger diameter	Clearer image

11.

(d) Rajah 6.5.4 menunjukkan satu retakan di permukaan dinding dalam sebuah enjin kereta. Retakan itu tidak dapat dilihat dari luar.

*Diagram 6.5.4 shows a crack on an internal wall surface of a car engine. The crack cannot be seen from the outside.*



Rajah 6.5.4  
Diagram 6.5.4

Cadangkan satu reka bentuk alat yang boleh dimasukkan ke dalam enjin kereta. Dengan menggunakan alat tersebut, mekanik boleh melihat permukaan dinding dalam enjin kereta bagi mengesan kawasan yang rosak seperti retak dan karat tanpa perlu membuka keseluruhan komponen enjin.

*Suggest a design of a device that can be inserted into the car engine. By using the device, mechanic can see the internal wall surface of the car engine to detect the fault area such as crack or rust without the need to dismantle the engine components.*

Nyatakan dan terangkan pengubahsuaian berdasarkan aspek-aspek seperti jenis kabel, ciri-ciri kabel yang digunakan dan ciri-ciri tambahan yang diperlukan untuk memaparkan imej yang jelas dan boleh dikendalikan dalam ruang yang berlingkar dalam enjin kereta.

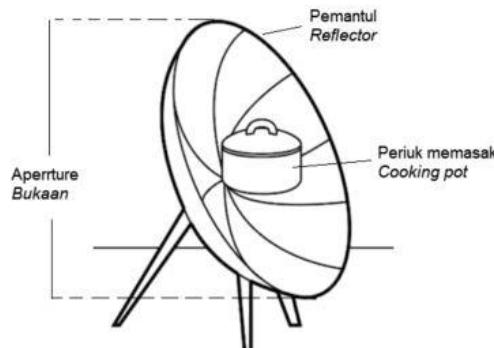
*State and explain the modifications based on the aspects such as the type of cable, the characteristics of the cable used, and the additional features needed to display clear image and manoeuvrable in the coiled space of the car engine.*

[10 markah]

Modifications	Reason
Type of cable : Fiber optic	Produces total internal reflection
Cable length : Long	Can go through the internal space of the engine
Cable diameter : Small	Can enter the narrow space in the engine
Cable characteristic : Flexible	Can bend and formed according to shape of the space in the engine
The lamp power at the end of the cable : High	Clearer image

12.

(c) Rajah 10.3 menunjukkan struktur sebuah dapur solar parabolik.  
*Diagram 10.3 shows a structure of a parabolic solar cooker.*



Rajah 10.3  
 Diagram 10.3

Jadual 10 menunjukkan tiga kedudukan periuk memasak dan saiz buaan pemantul yang berbeza bagi dapur solar tersebut.

*Table 10 shows three position of the cooking and different sizes of the aperture for the reflector of the solar cooker.*

Dapur solar <i>Solar cooker</i>	Kedudukan periuk memasak <i>Position of cooking pot</i>	Saiz buaan bagi pemantul <i>Size of the aperture of the reflector</i>
K	Di titik fokus pemantul <i>At the focal point of the reflector</i>	Besar <i>Big</i>
L	Kurang daripada titik fokus pemantul <i>Less than the focal point of the reflector</i>	Kecil <i>Small</i>
M	Lebih daripada titik fokus pemantul <i>More than the focal point of the reflector</i>	Besar <i>Big</i>

Jadual 10

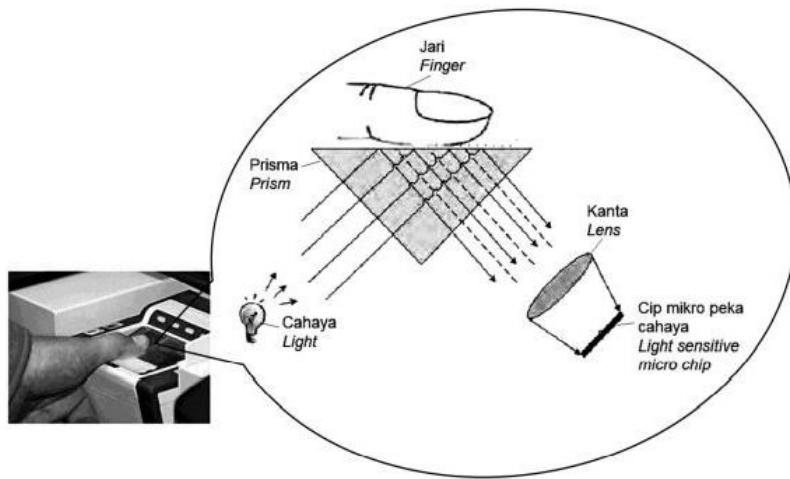
Berdasarkan Jadual 10, nyatakan ciri-ciri dapur solar yang sesuai bagi membolehkan makanan dimasak dengan cepat.  
 Beri sebab untuk kesesuaian ciri-ciri itu.

*Based on Table 10, state the suitable characteristics of the solar cooker to enable food cooked quickly.  
 Give reason for the suitability of the characteristic.*

Characteristic	Reason
Position of cooking pot : At the focal point of the reflector	Produces a lot of heat
Size of the aperture of the reflector : Big	More light can be collected and reflected

13.

(b) Rajah 18.2 menunjukkan pengimbas cap jari optik.  
*Diagram 18.2 shows an optical fingerprint scanner.*



Rajah 18.2  
Diagram 18.2

Pengimbas itu tidak dapat mengenalpasti imej cap jari dengan baik.  
Anda diminta untuk mencadangkan pengimbas cap jari optik yang dapat  
menghasilkan imej dengan lebih jelas.  
Jadual 18 menunjukkan spesifikasi bagi empat pengimbas cap jari optik K, L, M dan  
N.

*The scanner cannot identify the fingerprint image very well.  
You are asked to suggest an optical fingerprint scanner which able to produced a  
clearer image.  
Table 18 shows the specifications of four optical fingerprint scanners K, L, M and N.*

Scanner Pengimbas	Sudut prisma Angle of prism	Keamatan cahaya Intensity of light	Jarak fokus kanta Focal length of lens	Ketumpatan optik bagi prisma Optical density of prism
K	30° – 90° – 60°	Tinggi High	Panjang Long	Rendah Low
L	45° – 90° – 45°	Tinggi High	Pendek Short	Tinggi High
M	30° – 90° – 60°	Rendah Low	Panjang Long	Rendah Low
N	45° – 90° – 45°	Rendah Low	Pendek Short	Tinggi High

Jadual 18  
Table 18

Kaji spesifikasi dan justifikasi setiap aspek. Pilih pengimbas cap jari optik yang paling sesuai. Anda perlu menyakinkan pelanggan anda dengan memberi sebab untuk pilihan anda.

*Study the specifications and justification each aspect. Choose the most suitable optical fingerprint scanner. You have to convince the clients by given them reason for your choice.*

[10 markah]  
[10 marks]

Characteristic	Reason
Angle of prism : $45^\circ$ - $90^\circ$ - $45^\circ$	Produces total internal reflection
Intensity of light : High	Brighter and clearer image
Focal length of lens : Short	Produces magnified image
Optical density of prism : Low	Produces a smaller critical angle

14.

(c) Jadual 1 menunjukkan spesifikasi bagi empat keping cermin melengkung, J, K, L dan M yang boleh digunakan sebagai cermin cegah kecurian dalam pasar raya.

*Table 1 shows the specifications of four curved mirrors, J, K, L and M, that can be used as an anti-theft mirror in a supermarket.*

Cermin melengkung Curved mirror	Spesifikasi cermin melengkung Specifications of curve mirror			
	Bentuk Type	Berat (N) Weight (N)	Diameter (cm) Diameter (cm)	Jejari kelengkungan (cm) Radius of curvature (cm)
J	Concave / Cekung	95	40	10
K	Concave / Cekung	80	60	20
L	Convex / Cembung	65	60	20
M	Convex / Cembung	70	80	10

Jadual / Table 1

Terangkan kesesuaian setiap ciri cermin melengkung. Tentukan cermin melengkung yang paling sesuai untuk digunakan supaya keseluruhan bahagian dalam pasar raya jelas kelihatan. Berikan sebab-sebab untuk pilihan anda.

*Explain the suitability of each characteristic of the curved mirrors. Determine the most suitable curved mirror to give a clear view of the interior of the supermarket. Give reasons for your choice.*

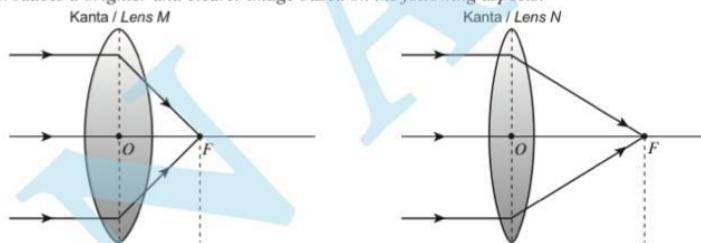
Ciri-ciri Characteristics	Penjelasan Explanation
Cermin cembung Convex mirror	Medan pandangan lebih luas / Cahaya boleh dipantulkan pada sudut yang lebih besar ke dalam mata pemerhati. <i>Wider field of view/ Light can be reflected at larger angle into the observer's eye.</i>
Berat yang rendah Low weight	Lebih ringan dan mudah dilekatkan pada dinding. <i>Lighter and easier to be fixed to the wall.</i>
Diameter besar Large diameter	Memberikan medan pandangan yang lebih luas. <i>Provides wider field of view.</i>
Jejari kelengkungan besar Long radius of curvature	Diameter lebih besar/Medan penglihatan lebih luas <i>Bigger diameter/Wider field of view</i>
Kanta L dipilih kerana ia adalah cermin cembung, berat yang rendah, mempunyai diameter besar dan panjang fokus yang pendek. <i>Lens L is chosen because it is a convex mirror, has low weight, large diameter and short focal length.</i>	

[10 markah/marks]

15.

(c) Rajah 6.3 menunjukkan dua buah kanta M dan N dengan panjang fokus yang berbeza. Dengan menggunakan kanta M dan N, cadang dan terangkan bagaimana anda membina sebuah mikroskop yang menghasilkan imej yang lebih cerah berdasarkan aspek-aspek berikut:

*Diagram 6.3 shows two lenses M and N with different focal length. Using lenses M and N, suggest and explain how to build a microscope which produces a brighter and clearer image based on the following aspects:*



Rajah / Diagram 6.3

- Pemilihan kanta-kanta untuk dijadikan kanta objek dan kanta mata.  
*The choice of lenses to become the objective and eyepiece lens.*
- Kedudukan objek daripada kanta objektif. / *Position of the object from the objective lens.*
- Kedudukan imej pertama. / *Position of the first image.*
- Jarak antara kedua-dua kanta. / *Distance between the two lenses.*
- Keadaan yang sesuai untuk menyimpan mikroskop. / *A suitable condition for storing the microscope.*

Ciri-ciri <i>Characteristics</i>	Sebab <i>Reason</i>
M ialah kanta objek dan N ialah kanta mata. <i>M is objective lens and N is eyepiece lens.</i>	Untuk menjadikan imej pertama membesar. <i>To make the first image magnified.</i>
Objek mestilah di antara $f_o$ dan $2f_o$ kanta objek. $f_o < u < 2f_o$ <i>Object must be between <math>f_o</math> and <math>2f_o</math> of objective lens.</i> $f_o < u < 2f_o$	Untuk membentuk imej yang nyata, songsang dan membesar. <i>To form a real, inverted and magnified image.</i>
Imej pertama mestilah kurang daripada panjang fokus kanta mata. <i>First image must be less than the focal length of eyepiece lens.</i>	Untuk menjadikan imej terakhir membesar. <i>To make the final image magnified.</i>
Jarak antara kanta lebih besar daripada $(f_o + f_m)$ . <i>Distance between the lenses is greater than <math>(f_o + f_m)</math>.</i>	Untuk menghasilkan imej terakhir yang maya, songsang dan membesar. <i>To produce virtual, inverted and magnified final image.</i>
Tempatkan di dalam kabinet yang dilengkapi lampu / tempat kering. <i>Store in a cabinet which is fitted with lamp/ dry place</i>	Mengelakkan kanta daripada kulat. <i>Prevent the lenses from fungus.</i>

[10 markah/marks]

16.

(b) The position of two prisms on one side of the prism binoculars is shown in Diagram 8.2.  
*Kedudukan bagi dua prisma pada satu sisi binokular berprisma ditunjukkan dalam Rajah 8.2.*

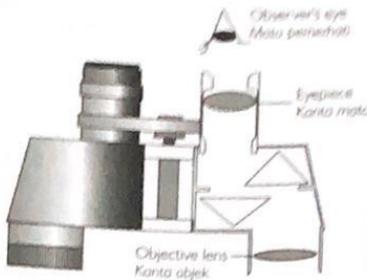


DIAGRAM 8.2/RAJAH 8.2

On Diagram 8.2, draw the light ray path entering both prisms. In your drawing, indicate the direction of the light ray path using arrows.  
*Pada Rajah 8.2, lukiskan lintasan sinar cahaya yang memasuki kedua-dua prisma itu. Dalam lukisan anda, tunjukkan arah lintasan sinar cahaya dengan menggunakan anak panah.*

[2 marks/2 markah]

(c) Objective lenses are used in the binoculars to enable objects to be seen more clearly. Table 8 shows the characteristics of three lenses, X, Y and Z.  
*Kanta objek digunakan dalam binokular itu untuk membolehkan objek dilihat dengan lebih jelas. Jadual 8 menunjukkan ciri-ciri tiga kanta, X, Y dan Z.*

Lens Kanta	Focal length Panjang fokus (cm)	Diameter of the lens Diameter kanta
X	1.0	Small Kecil
Y	10.0	Big Besar
Z	20.0	Big Besar

TABLE 8/JADUAL 8

Based on Table 8, state the suitable characteristics of the lens to be used as the objective lens. Give **one** reason for each suitable characteristic.  
*Berdasarkan Jadual 8, nyatakan ciri-ciri kesesuaian kanta untuk digunakan sebagai kanta objek. Beri satu sebab untuk setiap kesesuaian ciri tersebut.*

Characteristic	Reason
Focal length : Longer	Gives higher magnification
Diameter of the lens : Big	To refract more light to produce brighter image

17.

(c) The optical fibre in Diagram 4.1 can be used in telecommunications and medicine. You are asked to investigate the characteristics of optical fibre for the use in these fields as shown in Table 4.

Gentian optik dalam Rajah 4.1 boleh digunakan dalam telekomunikasi dan perubatan. Anda dikehendaki untuk mengkaji ciri-ciri gentian optik yang digunakan dalam bidang-bidang ini seperti yang ditunjukkan dalam Jadual 4.

Optical fiber Gentian optik	Comparison between refractive index of the inner core, $n_i$ and the outer cladding, $n_o$ Perbandingan antara indeks biasan teras dalam, $n_i$ dan pembalut luar, $n_o$	Density/ kg m <sup>-3</sup> Ketumpatan/ kg m <sup>-3</sup>	Purity of the inner core Ketulenan teras dalam	Strength and flexibility Kekuatan dan kelenturan
J	$n_o > n_i$	2 400	Pure Tulen	Strong and rigid Kuat dan tegar
K	$n_i > n_o$	2 300	Pure Tulen	Strong and flexible Kuat dan mudah lentur
L	$n_i > n_o$	2 450	Impure Tidak tulen	Strong and flexible Kuat dan mudah lentur
M	$n_o > n_i$	2 500	Impure Tidak tulen	Brittle Rapuh
N	$n_i > n_o$	3 000	Pure Tulen	Strong and rigid Kuat dan tegar

TABLE 4/JADUAL 4

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Explain the suitability of each characteristic of the optical fibre shown in Table 4 for use in telecommunications and medical field. Determine the most suitable optical fibre for use in these fields.

Give reasons for your choice.

Terangkan kesesuaian bagi setiap ciri gentian optik dalam Jadual 4 untuk digunakan dalam telekomunikasi dan perubatan. Tentukan jenis gentian optik yang paling sesuai digunakan dalam bidang-bidang ini.

Beri sebab untuk pilihan anda.

[10 marks/10 markah]

Characteristic	Reason
Comparison between refractive index of the inner core and outer cladding: $n_i > n_o$	Produces total internal reflection when light travels inside the optical fibre
Density : Low	Lighter
Purity of the inner core: Pure	An inner core that is not pure will cause the light ray to scatter that leads to signal degradation
Strength and flexibility : Strong and flexible	Does not break easily and can be bent

\* the translation might have inaccuracy \*