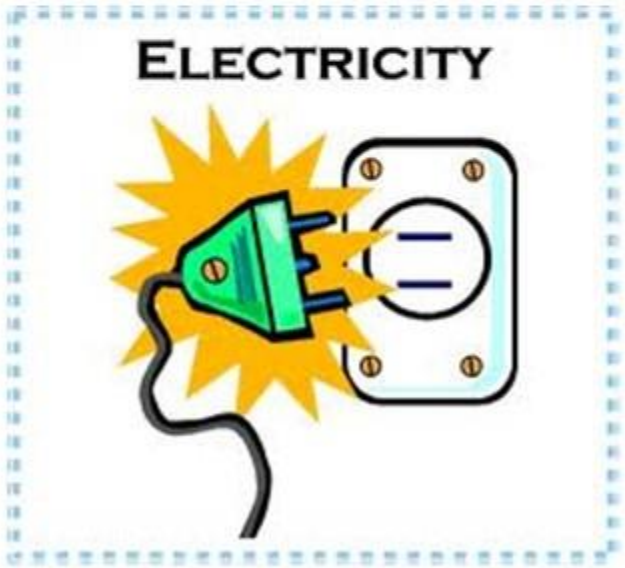
BAB 3

ELEKTRIK



TENAGA NASIONAL

3. ELEKTRIK

3. ELECTRICITY

3.1 Arus & Beza Keupayaan

3.1 Current & Potential Difference

B2003 B2010

3.2 Rintangan

3.2 Resistance

B2013 B2016 B2021

C2017

3.3 Daya Gerak Elektrik

3.3 Electromotive Force

3.4 Tenaga & Kuasa Elektrik

3.4 Electrical Energy & Power

B2012 B2009

Question 1

Figure 1.1 shows the scale of an ammeter.
Rajah 1.1 menunjukkan skala pada sebuah ammeter.

(a) Name the physical quantity measured by the ammeter.
Namakan kuantiti fizik yang diukur oleh ammeter.

Arus / current

[1 mark]

(b) In the space below, draw the symbol for an ammeter.
Pada ruang di bawah, lukiskan symbol bagi ammeter.

(c) What is the value of the smallest division on the scale?
Berapakah nilai bagi satu senggatan terkecil skala itu?

0.1 A

[1 mark]

(d) State the function of the mirror located under the scale.
Nyatakan fungsi cermin yang terdapat di bawah skala itu.

Elakkan ralat paralaks

Avoid parallax error

[1 mark]

SPM 2006

Section A,Question 1

Diagram 1.1 shows an electric circuit.

Rajah 1.1 menunjukkan satu litar elektrik.

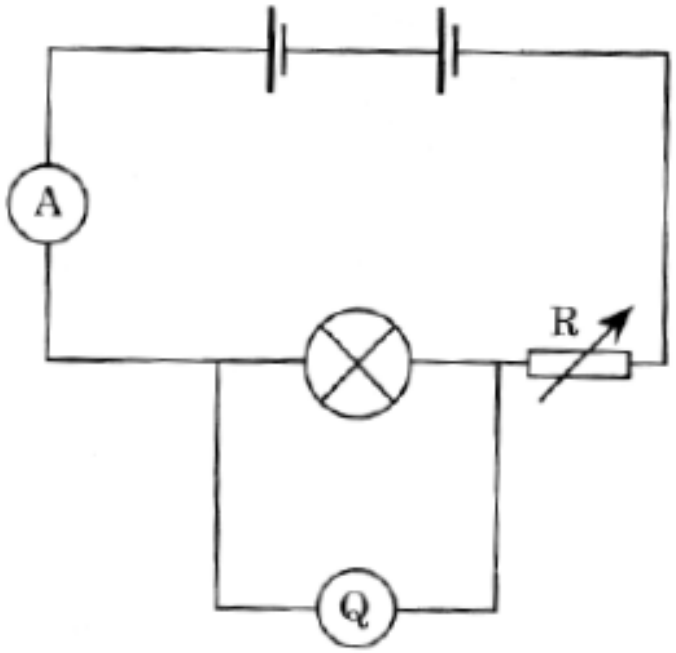


Diagram 1.1

(a) (i) **Name instrument Q.**

Namakan instrument Q.

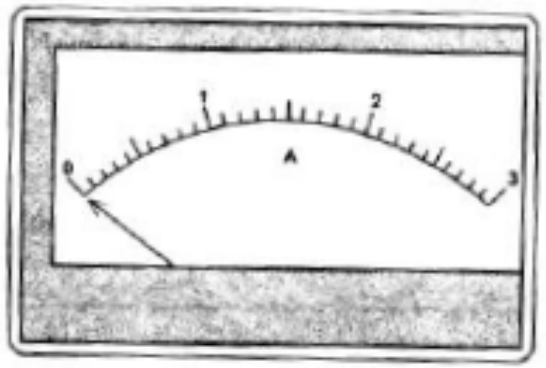
Voltmeter / *voltmeter*

(ii) **What is the function of R in the circuit?**

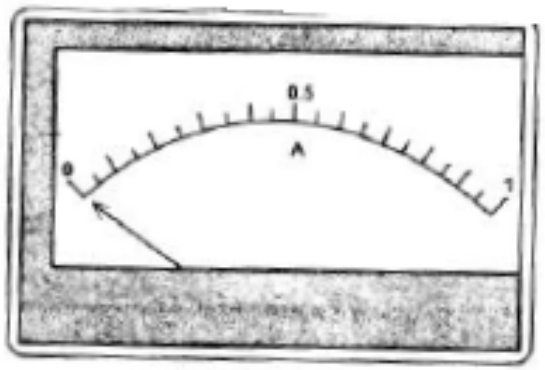
Apakah fungsi R dalam litar?

Control current/ *kawal arus*

(b) **Diagram 1.2 shows two types of ammeters, X and Y, that can be used in the circuit in Diagram 1.1.**
Rajah 1.2 menunjukkan dua jenis ammeter, X dan Y, yang boleh digunakan dalam litar di dalam Rajah 1.1.



Ammeter X



Ammeter Y

(i) **Which ammeter is more sensitive?**
Ammeter manakah yang lebih sensitive?

Ammeter Y

(ii) **State one reason for your answer in 1(b)(i).**
Beri sebab pada jawapan anda di 1(b)(i).

The scale is the smallest division

Skala paling kecil

Question 8

Diagram 8.1 shows a metal coated polystyrene ball hang between two metal plates, R and S.
Rajah 8.1 menunjukkan satu bola polisterina bersalut logam digantung antara dua plat logam R dan S.

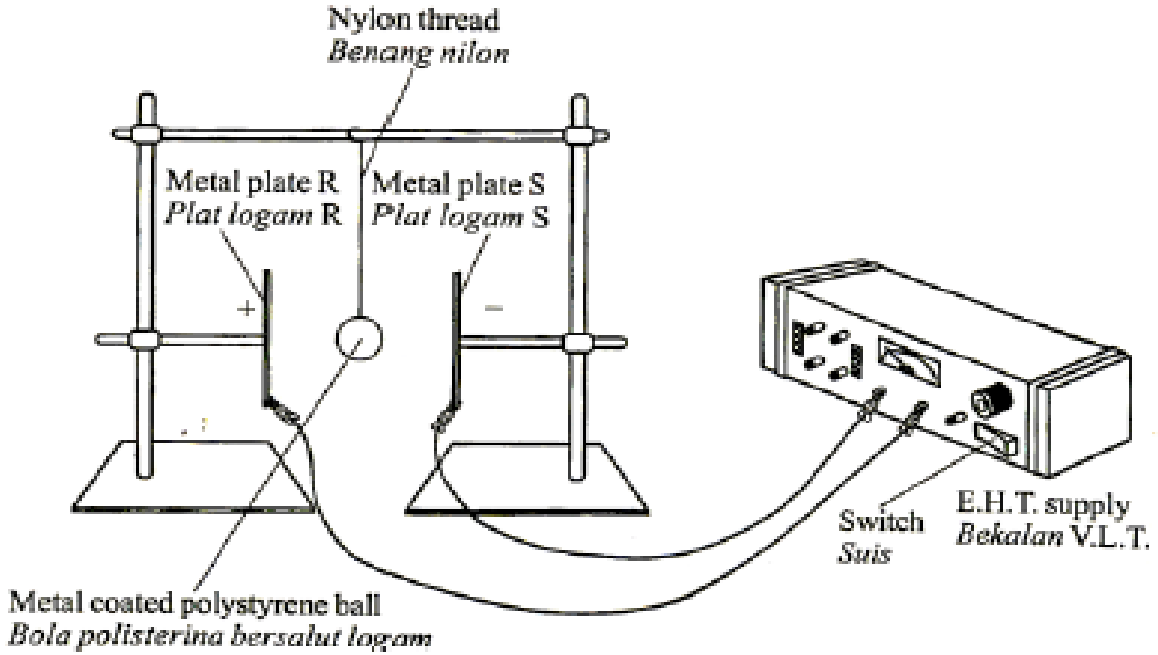


Diagram 8.1 / *Rajah 8.1*

The metal plates are connected to an Extra High Tension, E.H.T. supply. A strong electric field between metal plates R and S is produced when the switch is on.
Plat-plat logam itu disambung ke bekalan Voltan Lampau Tinggi, V.L.T. Satu medan elektrik yang kuat antara plat logam R dan S dihasilkan apabila suis dihidupkan.

(a) What is the meaning of electric field?
Apakah yang dimaksudkan dengan medan elektrik?

A region where an electric charge experience electric forces. **[1 mark]**
kawasan di mana cas mengalami daya elektrik.

(b) When the metal coated polystyrene ball oscillates between the two plates for 3 minutes, 0.3 A of current flows in the circuit. Calculate the total charge transfered between the two plates.
Apabila bola polisterina bersalut logam itu berayun antara dua plat selama 3 minit, 0.3 A arus mengalir dalam litar. Hitung jumlah cas yang dipindahkan antara dua plat itu.

[2 marks]

$$Q = It = 0.3 \times (3 \times 60) = 54 \text{ C}$$

(c) **The frequency of oscillation of the metal coated polystyrene ball can be increased by using one of the method listed in Table 8.1.**
Frekuensi ayunan bola polisterina bersalut logam itu boleh ditingkatkan dengan menggunakan satu daripada kaedah yang disenaraikan dalam Jadual 8.1.

Method *Kaedah*	**Distance between the two plates** *Jarak antara dua plat*	**Mass of the metal coated polystyrene ball** *Jisim bola polisterina bersalut logam*	**Voltage of E.H.T. supply** *Beza keupayaan bekalan V.L.T.*
X	**Long** *Jauh*	**Medium** *Sederhana*	**Low** *Rendah*
Y	**Medium** *Sederhana*	**High** *Tinggi*	**Medium** *Sederhana*
Z	**Short** *Dekat*	**Low** *Rendah*	**High** *Tinggi*

Based on Table 8.1, state the suitable method to increase the frequency of oscillation.
Berdasarkan Jadual 8.1, nyatakan kaedah yang sesuai untuk meningkatkan frekuensi ayunan.

(i) **Diameter between the two plates:**
Jarak antara dua plat:

Short distance / *jarak dekat*

Reason / *Sebab*:

Oscillate in short time / faster
masa pendek / berayun cepat **[2 marks]**

(ii) **Mass of the metal coated polystyrene ball:**
Jisim bola bersalut logam:

Low mass / *jisim rendah*

Reason / *Sebab*:

Increase acceleration / speed
Tambah pecutan / laju **[2 marks]**

(c) **The frequency of oscillation of the metal coated polystyrene ball can be increased by using one of the method listed in Table 8.1.**
Frekuensi ayunan bola polisterina bersalut logam itu boleh ditingkatkan dengan menggunakan satu daripada kaedah yang disenaraikan dalam Jadual 8.1.

Method *Kaedah*	**Distance between the two plates** *Jarak antara dua plat*	**Mass of the metal coated polystyrene ball** *Jisim bola polisterina bersalut logam*	**Voltage of E.H.T. supply** *Beza keupayaan bekalan V.L.T.*
X	**Long** *Jauh*	**Medium** *Sederhana*	**Low** *Rendah*
Y	**Medium** *Sederhana*	**High** *Tinggi*	**Medium** *Sederhana*
Z	**Short** *Dekat*	**Low** *Rendah*	**High** *Tinggi*

(iii) **Voltage of E.H.T. supply:**
Beza keupayaan bekalan V.L.T.:

High voltage E.H.T

.....

beza keupayaan bekalan V.L.T

Reason */ Sebab*:

Strong electric field

.....

Medan electric kuat

[2 marks]

(d) **Based on the answers in (c)(i), (c)(ii) and (c)(iii), choose the most suitable method to increase the frequency of oscillation.**
Berdasarkan jawapan dalam (c)(i), (c)(ii) dan (c)(iii), pilih kaedah yang paling sesuai untuk meningkatkan frekuensi ayunan.

Z

.....

[1 mark]

(e) **The nylon thread in Diagram 8.1 is replaced with a copper thread.**

Benang nilon di dalam Rajah 8.1 digantikan dengan benang kuprum.

(i) **What happen to the motion of the metal coated polystyrene ball?**

Apa yang berlaku kepada gerakan bola polisterina bersalut logam itu?

Stationary/ *Pegun*

[1 mark]

(ii) **Give a reason for your answer in (e)(i).**

Beri sebab untuk jawapan anda dalam (e)(i).

No charge on the metal coated ball / charged is earth

Tiada cas pada bola bersalut logam / cas telah mengalir ke bumi.

3. **Diagram 3.1 and Diagram 3.2 show two photographs of electrical circuits.**
Rajah 3.1 dan Rajah 3.2 menunjukkan dua fotograf litar elektrik.

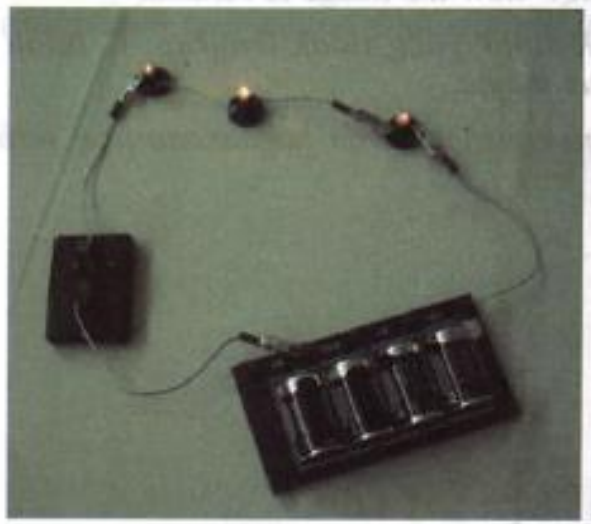


Diagram 3.1

Diagram 3.2

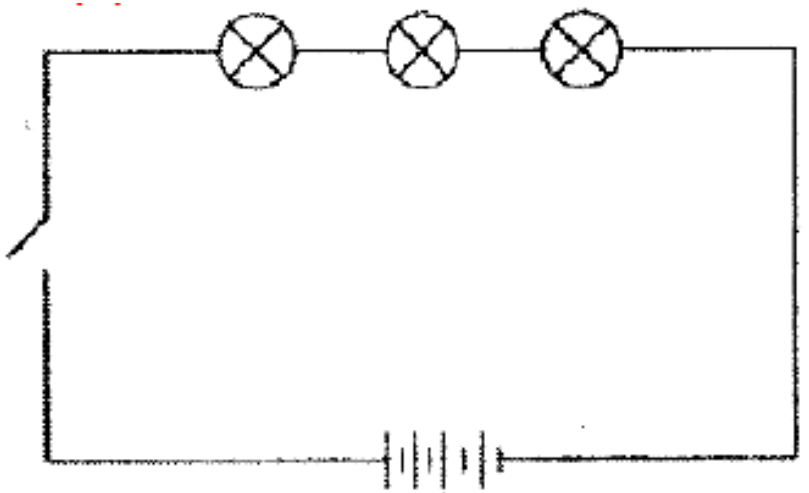
(a) **Which diagram shows a parallel circuit?**
Rajah manakah yang menunjukkan litar selari?

Diagram 3.2

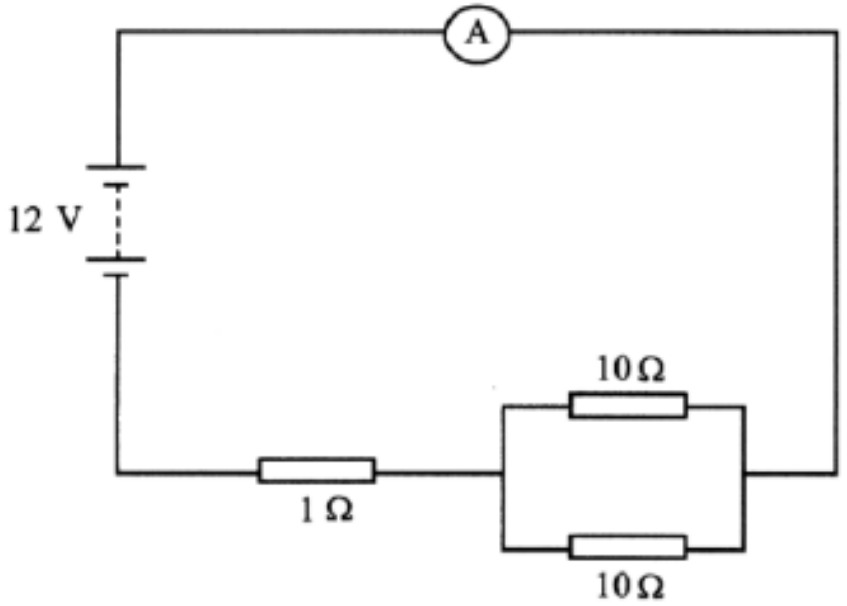
.....

[1 mark]

(b) **Draw an electrical circuit diagram for the photograph in Diagram 3.1. [2 marks]**
Lukis rajah litar elektrik bagi fotograf dalam Rajah 3.1.



(c) **Diagram 3.3 shows an electrical circuit. Assume that the internal resistance of the battery is negligible.**
Raiah 3.3 menuniukkan satu litar elektrik.



(i) **Calculate the effective resistance of the circuit.**
Hitung rintangan berkesan bagi litar itu.
[2 marks]

$\frac{1}{R} = \frac{1}{10} + \frac{1}{10}$ $R = 5\ \Omega$

Effective resisance:
R = 5 + 1 = 6 Ω

(ii) **What is the reading of the ammeter?**
Berapakah bacaan ammeter itu?
[1 mark]

$I = \frac{12}{6} = 2\ A$

(iii) **One of the 10 Ω resistors is removed from the circuit. What happens to the ammeter reading?**
Satu daripada perintang 10 Ω dikeluarkan dari litar itu. Apakah yang berlaku kepada bacaan ammeter itu?

decreased / berkurang

.....

[1 mark]

Question 6

Diagram 6.1 and Diagram 6.2 show two electrical circuits. The ammeters, dry cells and bulbs are identical in both diagrams. Assume the internal resistance of the dry cell is zero.

Rajah 6.1 dan Rajah 6.2 menunjukkan dua litar elektrik. Ammeter, sel kering dan mentol adalah serupa dalam kedua-dua rajah. Anggap rintangan dalam sel kering adalah sifar.

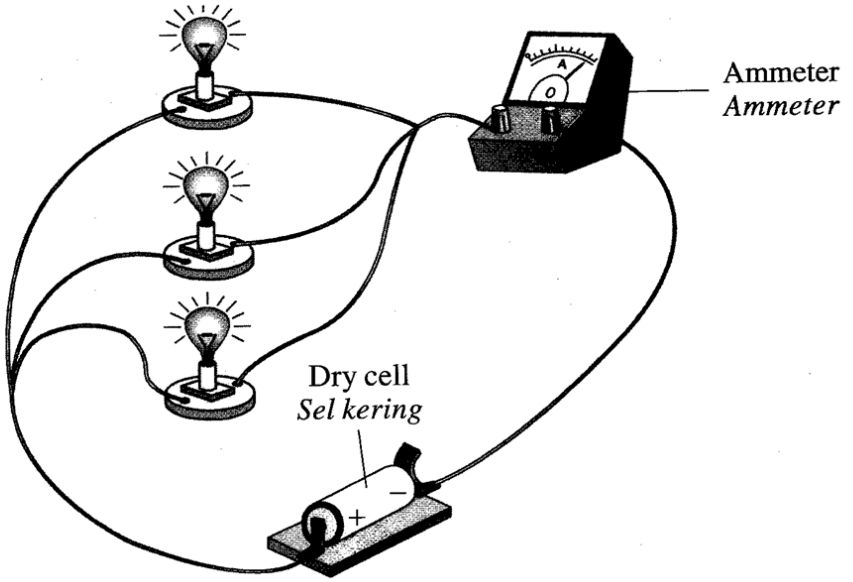


Diagram 6.1

(a) **Underline the correct answer in the bracket to complete the sentence below.**

Garis jawapan yang betul dalam kurungan untuk melengkapkan ayat di bawah.

[1 mark]

The bulbs in Diagram 6.1 and Diagram 6.2 are connected in (series, parallel).

Mentol-mentol dalam Rajah 6.1 dan Rajah 6.2 disambungkan secara (siri, selari).

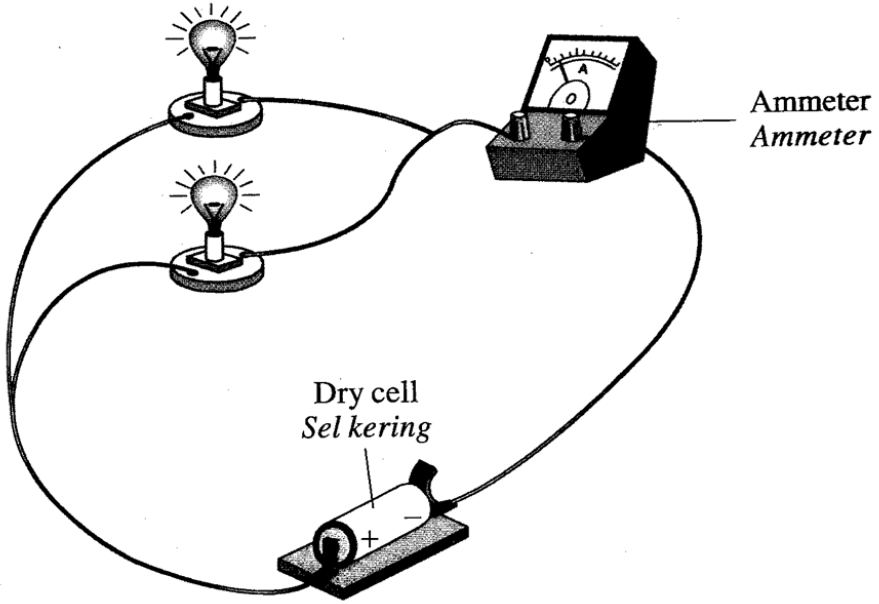


Diagram 6.2

(b) **Based on Diagram 6.1 and Diagram 6.2,**
Berdasarkan Rajah 6.1 dan Rajah 6.2,

(i) **compare the number of bulbs.**
Bandingkan bilangan mentol.

Diagram 6.1 has more bulbs

Rajah 6.1 lebih banyak mentol

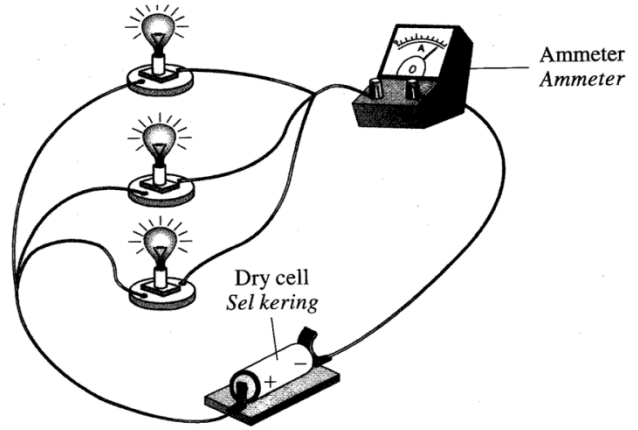


Diagram 6.1

(ii) **compare the readings of the ammeters.**
Bandingkan bacaan ammeter.

6.1 > 6.2

[1 mark]

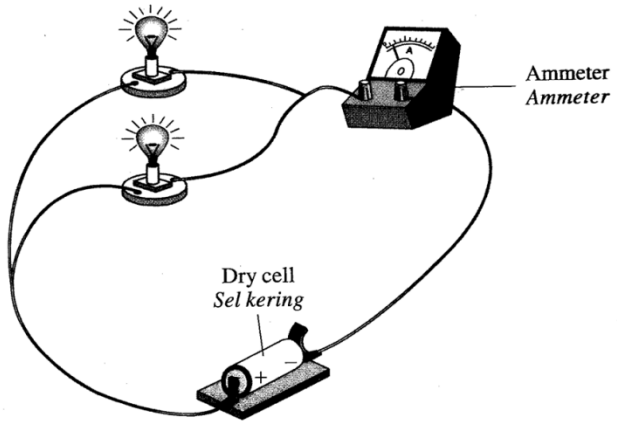


Diagram 6.2

(iii) **State the relationship between the number of bulbs and the readings of the ammeter.**
Nyatakan hubungan antara bilangan mentol dengan bacaan ammeter. *[1 mark]*

As the number of bulbs increases, the reading of the ammeter increases./ bilangan mentol bertambah, bacaan ammeter bertambah

(c) **Give one reason that causes the difference in the ammeter readings of Diagram 6.1 and Diagram 6.2.**
Beri satu sebab yang menyebabkan perbezaan bacaan pada ammeter dalam Rajah 6.1 dan Rajah 6.2. **[1 mark]**

Resistance 6.1 < 6.2 / current 6.1 > 6.2

Rintangan 6.1 < 6.2 / arus 6.1 > 6.2

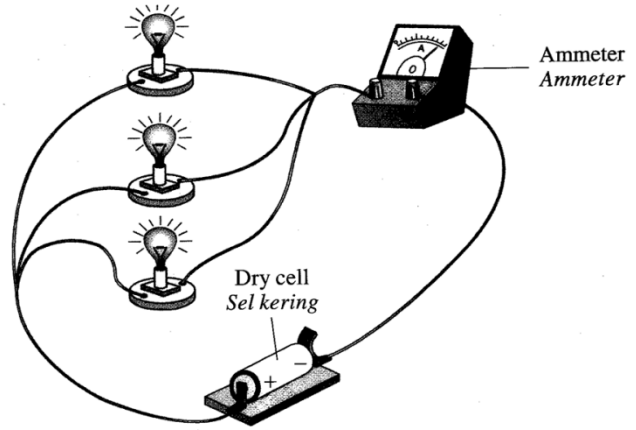


Diagram 6.1

(d) **Make a deduction relating the answer in 6(c) and the number of bulbs.**
Buat satu deduksi yang menghubungkaitkan jawapan (c) dengan bilangan mentol.

As the bulbs increase, the resistance decreases.

/ as the bulbs increase, the current increases.

Bilangan mentol bertambah, rintangan berkurang

Bilangan mentol bertambah, arus meningkat.

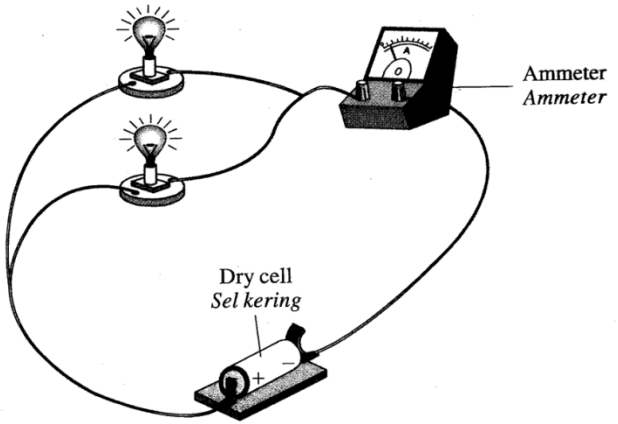
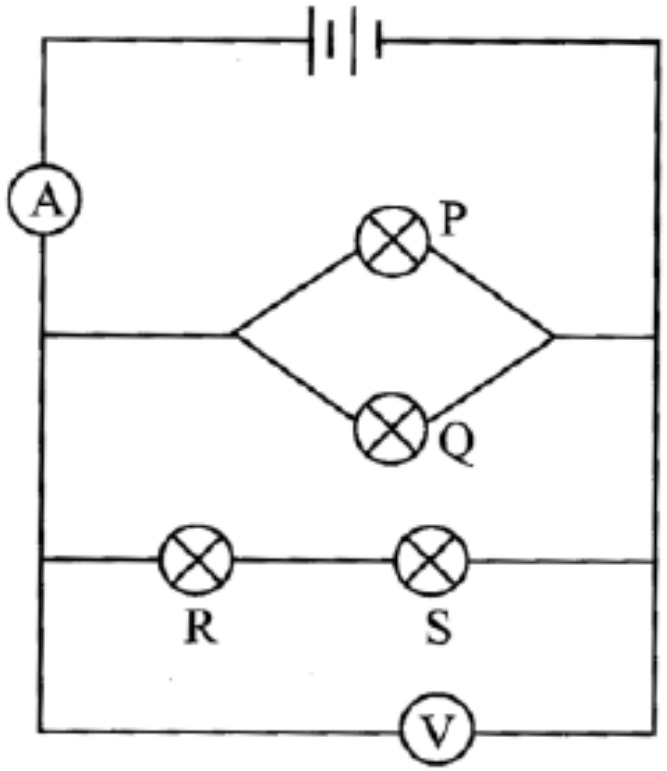


Diagram 6.2

(e) **Diagram 6.3 shows an electrical circuit. The bulbs P, Q, R and S are identical.**
Rajah 6.3 menunjukkan satu litar elektrik. Mentol-mentol P, Q, R dan S adalah serupa.



(i) **Which two bulbs light up brighter?**
Dua mentol yang manakah yang menyala dengan lebih cerah?

Bulb P and Q

.....

[1 mark]

(ii) **Give one reason for the answer in 6(e)(i).**
Beri satu sebab bagi jawapan di (e)(i).

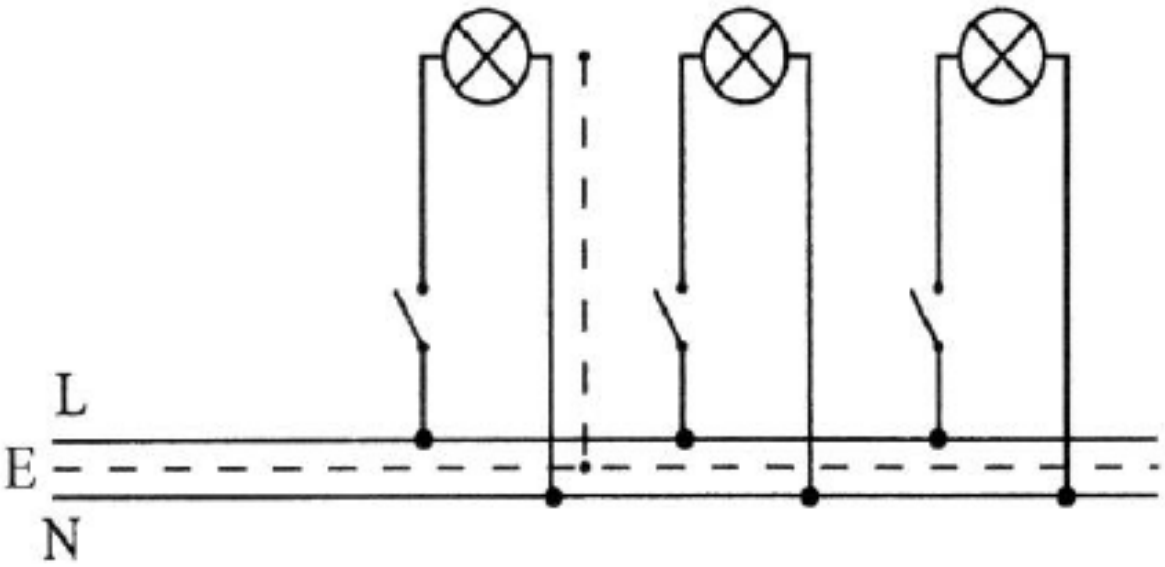
Resistance is low , current flow is high / voltage is higher

.....

[1 mark]

Rintangan rendah, arus mengalir tinggi / voltan tinggi

6. **Diagram 6 shows a lighting circuit of a house.**
Rajah 6 menunjukkan litar lampu sebuah rumah.



(a) (i) **Underline the correct answer in the bracket to complete the sentence below.**
Garis jawapan yang betul dalam kurungan untuk melengkapkan ayat di bawah.

The bulbs in Diagram 6 are connected in (series, parallel)
Mentol-mentol dalam Raja 6 disambung ssecara (siri, selari)

[1 mark]

(ii) **What will happen to the other bulbs if one bulb blows?**
Apakah yang berlaku kepada mentol-mentol lain jika satu mentol terbakar?

light up / menyala

(b) **All the bulbs in Diagram 6 are labeled '240 V, 60 W'.**
Semua mentol dalam Rajah 6 berlabel '240 V, 60 W'.

(i) **What is meant by '240 V, 60 W'?**
Apakah yang dimaksudkan dengan '240 V, 50 W'?

If connected to 240V power supply, it will release energy at 60 Joules per second **[1 mark]**

Jika disambung ke bekalan kuasa 240 V, ia akan bebaskan tenaga 60 J per saat.

(ii) **Calculate the current in the circuit when only one bulb is lit.**
Hitung arus dalam llitar bila hanya satu mentol dinyalakan..

$$I = \frac{60}{240} = 0.25\ A$$

[1 mark]

(iii) **Calculate the total resistance of the circuit when all bulbs are lit.**
Hitung jumlah rintangan dalam litar itu apabila semua mentol dinyalakan.

[3 marks]

$$R = \frac{240}{0.25} = 960\ \Omega$$

$$\frac{1}{R} = \frac{1}{960} + \frac{1}{960} + \frac{1}{960}$$

$$R = 320\ \Omega$$

(iv) **How can the bulbs be connected to increase the total resistance of the circuit?**
Bagaimanakah mentol-mentol itu boleh disambung untuk menambah jumlah rintangan bagi litar itu?

.....series / Selari.....

Question 8

Diagram 8 shows an electric stove which uses a heating element made of wire. The electric stove is labelled as 240 V, 2 kW.

Rajah 8 menunjukkan sebuah dapur elektrik yang menggunakan elemen pemanas yang diperbuat daripada dawai. Dapur elektrik itu dilabelkan sebagai 240 V, 2 kW.

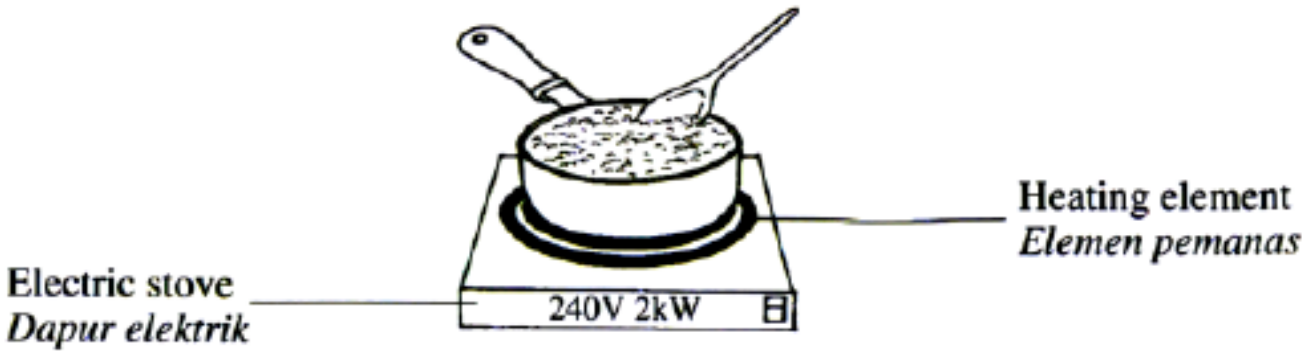


Diagram 8 / *Rajah 8*

(ii) What is the meaning of 240 V, 2 kW?

Apakah yang dimaksudkan dengan 240 V, 2 kW?

2 kJ of energy per second is dissipated when 240 V is supplied //

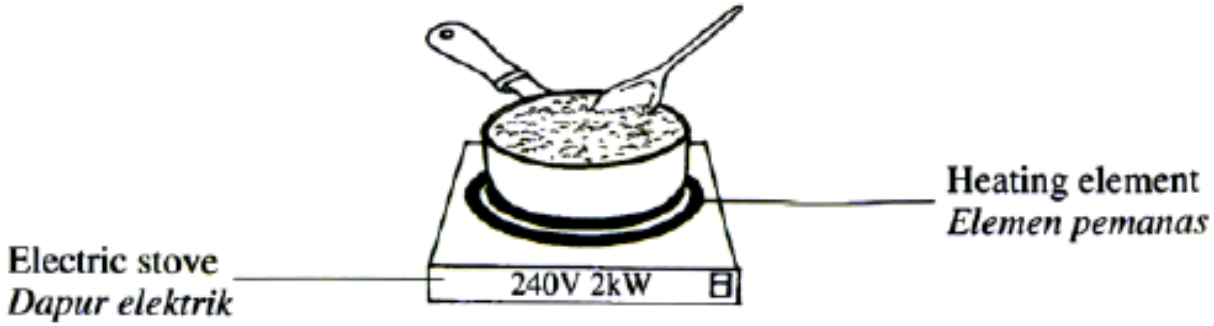
2 kJ tenaga per saat yang hilang apabila 240 V dibekalkan

[1 mark]

Question 8

Diagram 8 shows an electric stove which uses a heating element made of wire. The electric stove is labelled as 240 V, 2 kW.

Rajah 8 menunjukkan sebuah dapur elektrik yang menggunakan elemen pemanas yang diperbuat daripada dawai. Dapur elektrik itu dilabelkan sebagai 240 V, 2 kW.



(iii) **The electric stove is used for 5 hours per day.**
Dapur elektrik itu digunakan selama 5 jam sehari.

(i) **Calculate the energy used in unit kWh for 30 days.**
Hitung tenaga yang digunakan dalam unit kWj selama 30 hari.

[2 marks]

M1: 300 x 20
M2: 6000 / RM60.00

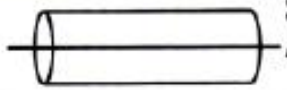
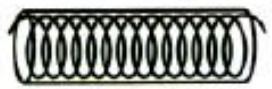
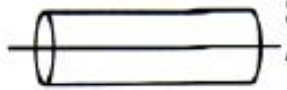
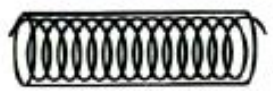
(ii) **If the cost of electrical energy is 20 sen per unit, calculate the cost of using the electric stove for 30 days.**
Jikalau kos tenaga elektrik ialah 20 sen seunit, hitungkan kos menggunakan dapur elektrik itu selama 30 hari.
[1 unit = 1 kWh / 1 unit = 1 kWj]

[2 marks]

M1: (2)(5)(30)
M2: 300 kWh

(iv) **The heating element in Table 1 is designed to produce a large quantity of heat. Table 1 shows four types of heating elements P, Q, R and S. The production of heat depends of the characteristics of the wire in the heating elements.**
Elemen pemanas pada Jadual 1 direka bentuk bagi menghasilkan kuantiti haba yang banyak. Jadual 1 menunjukkan empat jenis elemen pemanas berlainan iaitu P, Q, R dan S. Penghasilan haba bergantung kepada ciri-ciri dawai dalam elemen pemanas tersebut.

Based on Table 1, state the suitable characteristics of the heating element. Give one reason for the suitability of each characteristic.
Berdasarkan Jadual 1, nyatakan ciri yang sesuai bagi elemen pemanas itu. Beri satu sebab bagi kesesuaian setiap ciri tersebut.

Heating element ***Elemen pemanas***	**Structure of wire in the heating element** ***Struktur dawai dalam elemen pemanas***	**Type of wire** ***Jenis dawai***	**Cross-section area of wire** ***Luas keratan rentas dawai***
P	 Straight wire *Dawai lurus*	Nichrome *Nikrom*	Large *Besar*
Q	 Coiled wire *Dawai gegelung*	Constantan *Konstantan*	Large *Besar*
R	 Straight wire *Dawai lurus*	Constantan *Konstantan*	Small *Kecil*
S	 Coiled wire *Dawai gegelung*	Nichrome *Nikrom*	Small *Kecil*

(i) Structure of wire / *Struktur dawai*:

Coiled wire // *dawai gegelung*

Reason / *sebab*:

Longer wire/ high resistance

dawai panjang / rintangan tinggi

[2 marks]

(ii) Type of wire / *Jenis dawai*:

Nichrome// *nikrom*

Reason / *sebab*:

High resistance / high melting point

Rintangan tinggi / takat lebur tinggi

[2 marks]

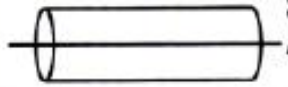
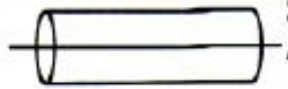
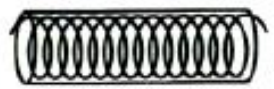
(iii) Cross-section of wire:
Luas keratin rentas dawai:

Small // *kecil*

Reason / *sebab*:

High resistance // *rintangan tinggi*

[2 marks]

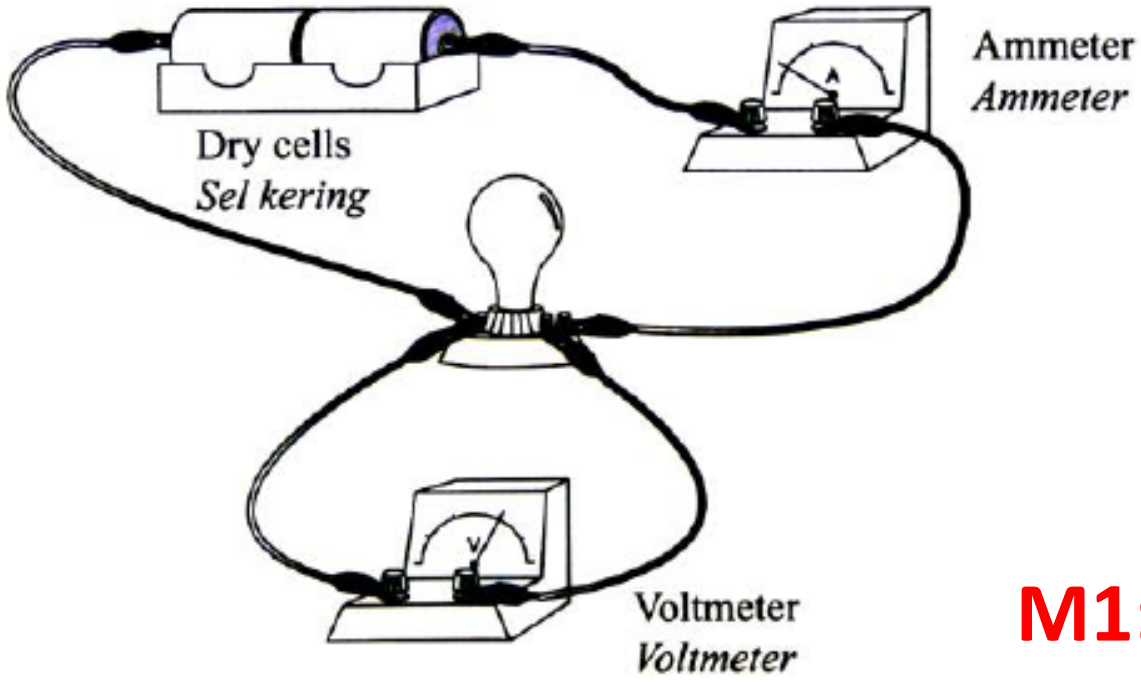
Heating element *Elemen pemanas*	Structure of wire in the heating element *Struktur dawai dalam elemen pemanas*	Type of wire *Jenis dawai*	Cross-section area of wire *Luas keratan rentas dawai*
P	 Straight wire *Dawai lurus*	Nichrome *Nikrom*	Large *Besar*
Q	 Coiled wire *Dawai gegelung*	Constantan *Konstantan*	Large *Besar*
R	 Straight wire *Dawai lurus*	Constantan *Konstantan*	Small *Kecil*
S	 Coiled wire *Dawai gegelung*	Nichrome *Nikrom*	Small *Kecil*

(iv) Based on the answer in 8(c), determine the most suitable heating element to produce the largest quantity of heat.
Berdasarkan jawapan di 8(c), tentukan elemen pemanas yang paling sesuai bagi menghasilkan kuantiti haba yang paling banyak.

S

[1 mark]

8. Diagram 8 shows a bulb is connected to an ammeter and a voltmeter in a circuit. The reading of the ammeter is 0.2 A and the reading of the voltmeter is 2.8 V.
Rajah 8 menunjukkan satu mentol disambungkan kepada satu ammeter dan satu voltmeter dalam sebuah litar. Baccan ammeter ialah 0.2 A dan bacaan voltmeter ialah 2.8 V.



(a) State the physical quantity measured by the voltmeter.
Nyatakan kuantiti fizik yang diukur oleh voltmeter.

Potential difference / voltage

.....

Beza keupayaan / voltan [1 mark]

(b) Calculate / *Hitung*:

(i) the resistance of the bulb
rintangan mentol itu.

M1: $\frac{2.8}{0.2}$ **M2: 14 Ω** [2 marks]

(ii) the total energy dissipated by the bulb in 5 minutes.
Jumlah tenaga yang dilesapkan oleh mentol itu dalam masa 5 minit.

[2 marks]

M1: $E = Vit / I^2Rt / V^2t/R$
// (2.8)(0.2)(5 x 60) // 2.8 x 0.2 x 5

M2: 168 J

(c) Table 2 shows three of elctric irons labelled 240 V, 1000 W.
Jadual 2 menunjukkan tiga mentol seterika elektrik berlabel 240 V, 1000 W.

Model R
Coiled wire heating element
Elemen pemanas wayar bergelung

Fuse : 5A
Fius : 5A

Heating element: Nichrome
Elemen pemanas: *Nikrom*

Model S
Straight wire heating element
Elemen pemanas wayar lurus

Fuse : 4A
Fius : 4A

Heating element: Constantan
Elemen pemanas: *Konstantan*

Model T

Fuse : 5A
Fius : 5A

Heating element: Constantan
Elemen pemanas: *Konstantan*

Based on the information in Table 2, state the suitable characteristics of the iron to remove creases on clothes. Give reason for the suitability of the characteristics.
Berdasarkan maklumat dalam Jadual 2, nyatakan ciri-ciri seterika yang sesuai digunakan untuk menghilangkan kedutan pada pakaian. Beri sebab bagi kesesuaian ciri-ciri tersebut.

(i) Shape of wire of the heating element:
Bentuk wayar elemen pemanas tersebut

Coiled wire / *dawai bergelung*

Reason / *sebab:*

Resistance increases /
rintangan bertambah [2 marks]

(ii) Material of heating element.
Bahan elemen pemanas.

nichrome/ *nikrom*

Reason / *sebab*:

High resistance / *Rintangan tinggi*

[2 marks]

(iii) Suitable fuse / *Fius yang sesuai.*

5 A

Reason / *sebab*:

The value a bit higher than the current flow in the circuit [2 marks]
//Nilainya lebih tinggi sedikit daripada arus yang mengalir dalam litar / I = 4.16 A

Choose R

Question 8

Figure shows an immersion heater with specification of 240V, 1 000 W.

Rajah menunjukkan satu pemanas rendam dengan label 240 V, 1 000 W.

(a) Name one suitable material to be used to a heating element in the immersion heater.

Namakan satu bahan yang sesuai untuk digunakan sebagai elemen pemanas dalam pemanas rendam.

Tungsten / Nichrome

[1 mark]

(b) The immersion heater is connected to a 240 V supply. Calculate:

Pemanas rendam disambung kepada bekalan kuasa 240 V. Hitung:

(i) the current that passes through the immersion heater.

Arus yang melalui pemanas rendam

[2 marks]

$$I = \frac{1000}{240} = 4.17 \text{ A}$$

(ii) the resistance of the immersion heater.

Rintangan pemanas rendam.

[2 marks]

$$R = \frac{240}{4.17} = 57.6\ \Omega$$

(c) **A student conducts an experiment to compare the heating effect of immersion heaters P,Q an R. The volume and initial temperature of the water is fixed. The following table shows the result of the experiment.**
Seorang pelajar menjalankan satu eksperimen untuk membandingkan kesan pemanasan oleh pemanas rendam P, Q dan R.

Immersion heater *pemanas*	**Potential difference/V** *Beza keupayaan/V*	**Current, A** *Arus / A*	**Time for the water to start boiling / minute** *Masa untuk air mula mendidih / minit*
P	**240**	**6.0**	**8.0**
Q	**240**	**5.0**	**10.0**
R	**240**	**4.0**	**9.0**

(i) **State the energy change that occurs when the immersion heater switched on.**
Nyatakan perubahan tenaga yang berlaku apabila pemanas rendam dihidupkan.

Tenaga elektrik ke haba

Electrical energy to heat **[1 mark]**

(ii) **Calculate the energy supplied by each of the immersion heaters P,Q and R to start boiling the water.**
Hitung tenaga yang dibekalkan oleh setiap pemanas rendam P, Q dan R untuk mula mendidihkan air.
[4 marks]

$E = VIt$

$E_P = 240 \times 6.0 \times 8.0 \times 60$

$= 691200\ J / 6.912 \times 10^5\ J$

$E_Q = 240 \times 5.0 \times 10.0 \times 60$

$= 720000\ J / 7.2 \times 10^5\ J$

$E_R = 240 \times 4.0 \times 9.0 \times 60$

$= 518400\ J / 5.184 \times 10^5\ J$

(iii) **Using your answer in (c)(ii) suggest which immersion heater is the most suitable to heat water. Give one reason for your answer.**
Menggunakan jawapan di (c)(ii) cadangkan pemanas rendam yang paling sesuai untuk memanaskan air. Beri satu sebab untuk jawapan anda.

Pemanas R. Ia guna tenaga paling sedikit / jimat kos

[1 mark]

Heater R is the most suitable because it uses the least amount of energy / save energy

Section B - 2012

A bulb has a power rating 6V, 18 W.
Sebuah mentol mempunyai perkadaran kuasa 6 V, 18 W.

(a) **What is the meaning of power?**
Apakah maksud kuasa? **[1 mark]**

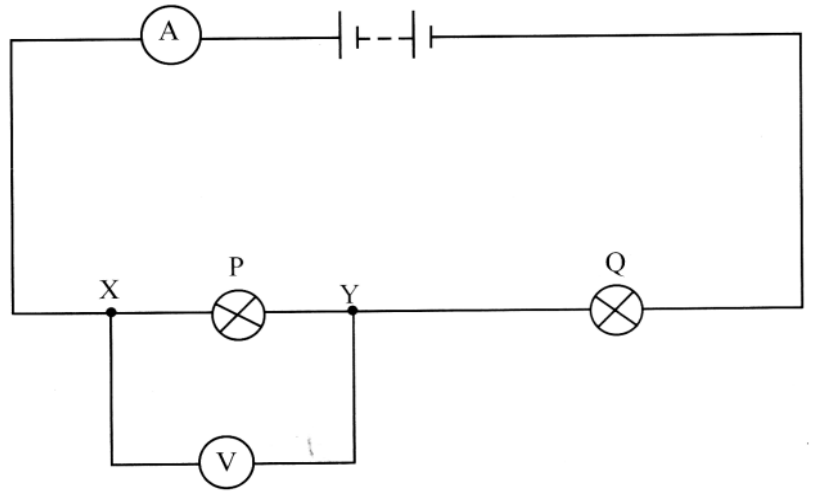
Rate of work done.// Energy per time

Kadar melakukan kerja tenaga/masa

(b) **Two identical bulbs, P and Q are connected in a circuit as shown in Diagram 12.1.**
Dua mentol yang serupa, P dan Q disambungkan dalam satu litar seperti ditunjukkan dalam Rajah 12.1

If another identical bulb is connected to XY parallel to bulb P, explain what happens to the reading of the ammeter and the voltmeter.
Jika sebuah mentol yang serupa disambungkan kepada XY selari dengan mentol P, terangkan apa yang berlaku kepada bacaan aeter dan bacaan voltmeter.

[4 marks]



- **Ammeter reading inceases / bacaan ammeter bertambah**
- **Effective resistance decreases Rintangan berkesan berkurang**
- **Voltmeter reading decreases Bacaan voltmeter berkurang**
- **Effective resistance between XY decreases / rintangan berkesan XY berkurang / voltage across Q increases/ voltan merentasi Q tambah**

(c) **Three identical bulbs labeled 6 V, 18 W are connected as shown in Diagram 12.2.**
Tiga mentol yang serupa berlabel 6 V, 18 W disambung seperti dalam Rajah 12.2.

Calculate *I Hitung*:

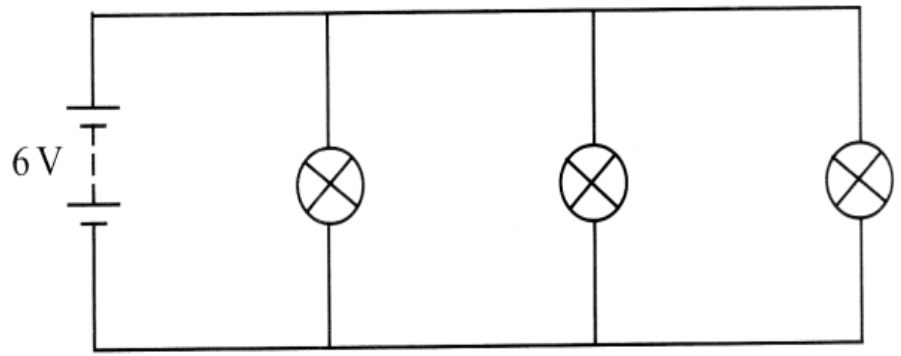
(i) **The resistance of one bulb**
Rintangan satu mentol.

(ii) **The total resistance in the circuit**
Jumlah rintangan dalam litar tersebut.

(iii) **The total energy dissipated by the bulbs in 2 minutes.**
Jumlah tenaga yang dilesapkan oleh mentol-mentol tersebut dalam masa 2 minit.

[5 marks]

$R = V^2/P = 6^2/18 = 2\ \Omega$



$1/R = ½ + ½ + ½$

$R = 0.67\ \Omega$

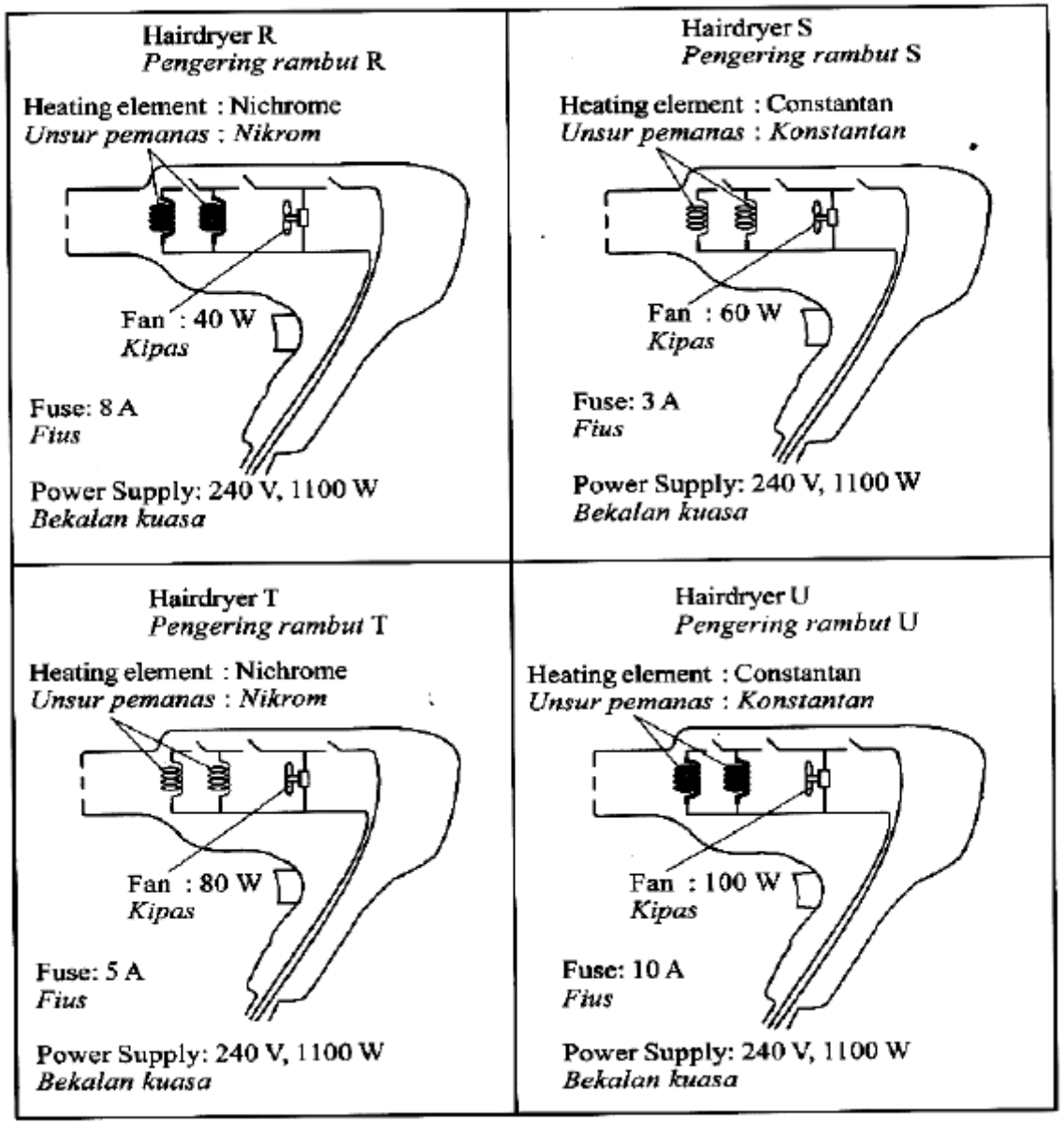
$E = Pt = 3 \times 18 \times 2 \times 60 = 6480\ J$

$E = V^2t/R = (6 \times 6 \times 2 \times 60)/0.67 = 6480\ J$

(d) **Diagram 12.3 shows four hairdryers R, S, T and U with different specifications. You are required to determine the most suitable hairdryer for drying hair quickly and safely. Study specifications of all the four hairdryers from the following aspects:**
Rajah 12.3 menunjukkan empat pengering rambut R, S, T dan U dengan spesifikasi yang berbeza. Anda dikehendaki menentukan pengering rambut yang paling sesuai untuk mengeringkan rambut dengan cepat dan selamat.

Kaji spesifikasi keempat-empat pengering rambut itu daripada aspek-aspek berikut:

- **The type of heating element**
  Jenis unsur pemanas
- **The thickness of wire of the heating element.**
  Ketebalan dawai unsur pemanas
- **The power of the fan**
  Kuasa kipas
- **The suitable fuse.**
  Fius yang sesuai

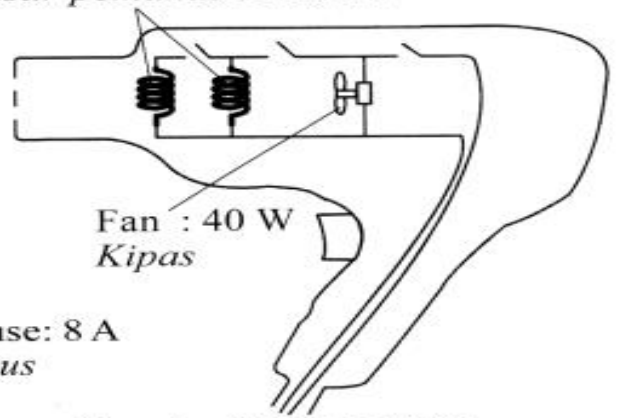


Explain the suitability of the aspects and determine the most suitable hairdryer. Give reason for your choice.
Terangkan kesesuaian aspek-aspek berikut dan tentukan pengering rambut yang paling sesuai.

[10 marks]

Hairdryer R
Pengering rambut R

Heating element : Nichrome
Unsur pemanas : Nikrom

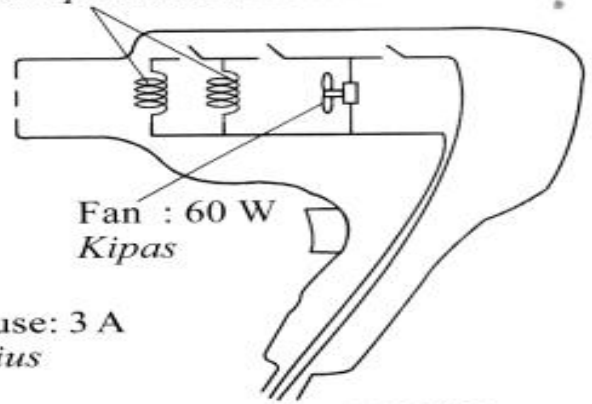


Fuse: 8 A
Fius

Power Supply: 240 V, 1100 W
Bekalan kuasa

Hairdryer S
Pengering rambut S

Heating element : Constantan
Unsur pemanas : Konstantan

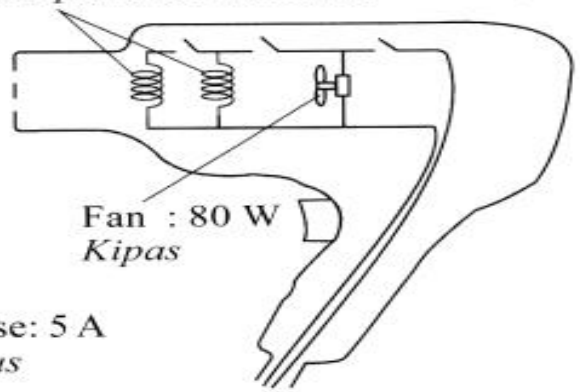


Fuse: 3 A
Fius

Power Supply: 240 V, 1100 W
Bekalan kuasa

Hairdryer T
Pengering rambut T

Heating element : Nichrome
Unsur pemanas : Nikrom

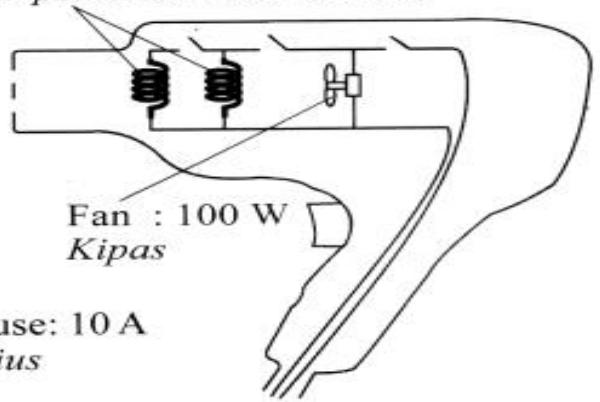


Fuse: 5 A
Fius

Power Supply: 240 V, 1100 W
Bekalan kuasa

Hairdryer U
Pengering rambut U

Heating element : Constantan
Unsur pemanas : Konstantan



Fuse: 10 A
Fius

Power Supply: 240 V, 1100 W
Bekalan kuasa

Nichrome wire Dawai nikrom	High resistance / produce more heat / rintangan tinggi / banyak haba
Thin wire Wayar nipis	High resistance / produce more heat / rintangan tinggi / banyak haba
High power of fan Kipas berkuasa tinggi	Blow more hot air / faster flow of hot air Tiup lebih banyak udara panas / tiup lebih cepat udara panas
Fuse 5 A	Current in fan = 1100/240 = 5 A
Choose T because use Nichrome wire, thin wire, high power of fan and fuse 5 A.// dawai nikrom, nipis, kuasa kipas tinggi / fius 5 A	

Section B - 2009

A potential difference of 240 V from the main power supply is applied to a filament lamp. The lamp lights up with normal brightness.

Beza keupayaan 240 V dari sesalur utama dibekalkan kepada sebiji lampu filamen. Lampu itu menyala dengan kecerahan normal.

(a) What is the meaning of potential difference?

Apakah maksud beza keupayaan?

[1 mark]

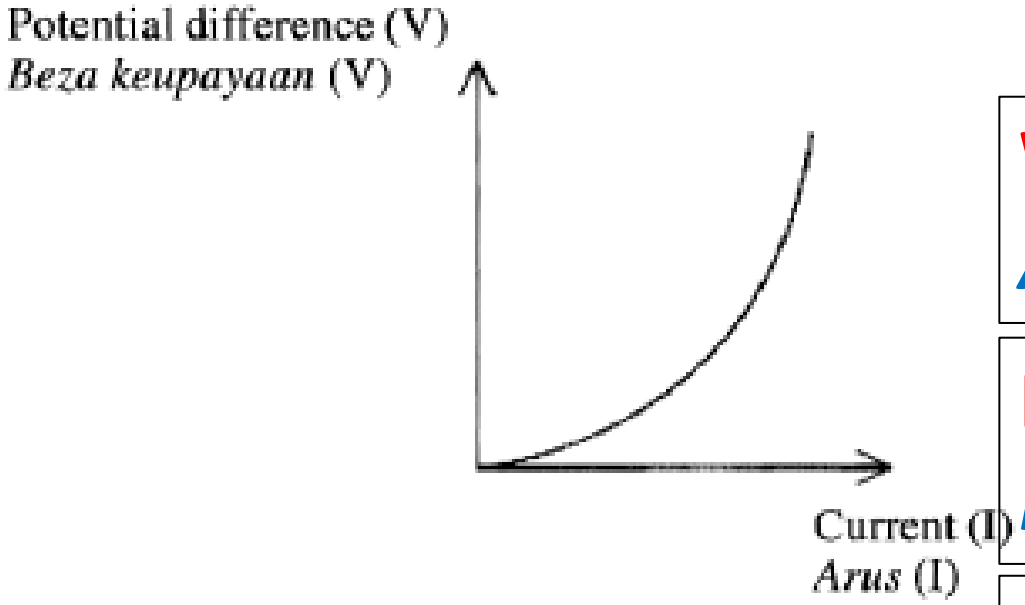
Work done to move 1 C of charge between 2 points in an electric field.

Kerja yang dilakukan untuk menggerakkan 1 C cas antara 2 titik dalam medan elektrik

$$\text{Work} = \text{energy}$$
$$\text{Charge} \quad \text{charge}$$

$$\textit{Kerja} = \textit{tenaga}$$
$$\textit{Cas} \quad \textit{Cas}$$

(b) **Diagram 12.1 shows a graph of potential difference, V, against current, I, for a filamer lamp.**
Rajah 12.1 menunjukkan graf beza keupayaan, V, melawan arus, I, untuk sebiji lampu filamen.



(i) **Based of the graph, state a relationship between V and I. What can you conclude about the resistance of the lamp? Give one reason for your answer.**
Berdasarkan graf, nyatakan satu hubungan antara V denan I. Apakah kesimpulan yang dapat anda buat tentang rintangan lampu tersebut? Beri satu sebab bagi jawapan anda.

[3 marks]

When I increases, V increases
Apabila I bertambah, V bertambah

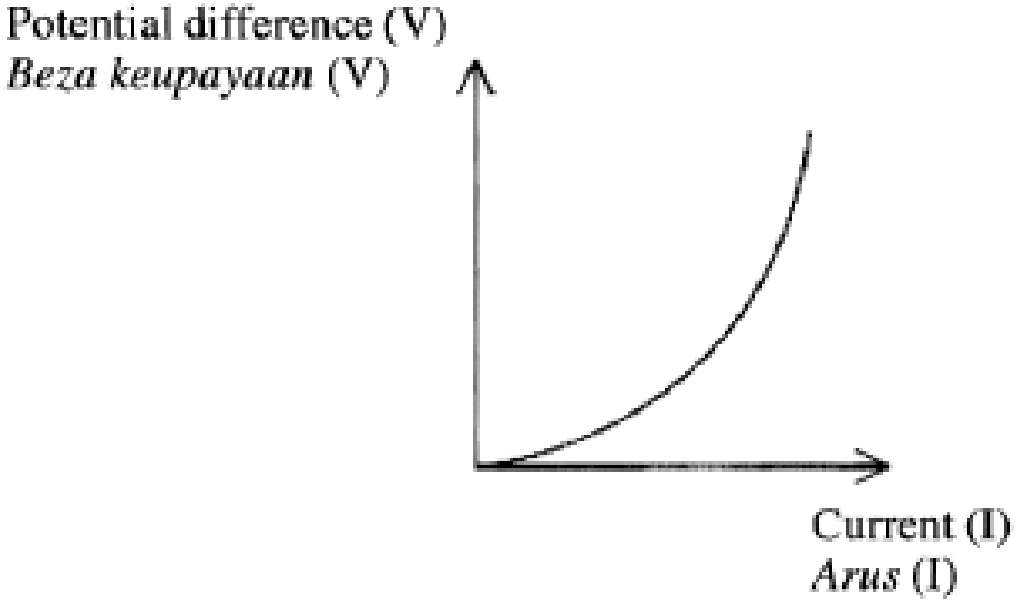
Resistance increases
Rintangan bertambah

Temperature increases
Suhu bertambah

Gradient increases
Kecerunan bertambah

Non-ohmic conductor which does not obey Ohm's law
Konduktor bukan Ohm yang tidak mematuhi hukum Ohm.

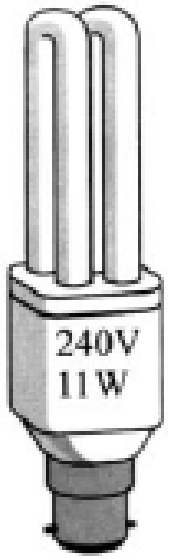
(b) **Diagram 12.1 shows a graph of potential difference, V, against current, I, for a filamer lamp.**
Rajah 12.1 menunjukkan graf beza keupayaan, V, melawan arus, I, untuk sebiji lampu filamen.



(ii) **What happens to the energy dissipated in the filament lamp when the current flowing is decreased? [1 mark]**
Apakah yang berlaku kepada tenaga yang dilesapkan di dalam lampu filamen itu apabila arus yang mengalir dikurangkan?

Decreases
berkurang

(c) **Diagram 12.3 shows an energy saving bulb. When it is connected to a 240 V power supply, the bulb produces 10 joules per second of light energy.**
Rajah 12.3 menunjukkan sebuah mentol jimat tenaga. Apabila disambungkan kepada bekalan kuasa 240 V, mentol itu menghasilkan 10 joule per saat tenaga cahaya.



Calculate / Hitung:

(i) **The current flows through the bulb.**
Arus yang mengalir melalui mentol.

(ii) **The heat energy lost in 1 second from the bulb.**
Tenaga haba yang hilang daripada mentol dalam 1 saat.

(iii) **The efficiency of the bulb.**
Kecekapan mentol itu.

[5 marks]

(d)(i) $\frac{11}{240}$ = 0.046 A

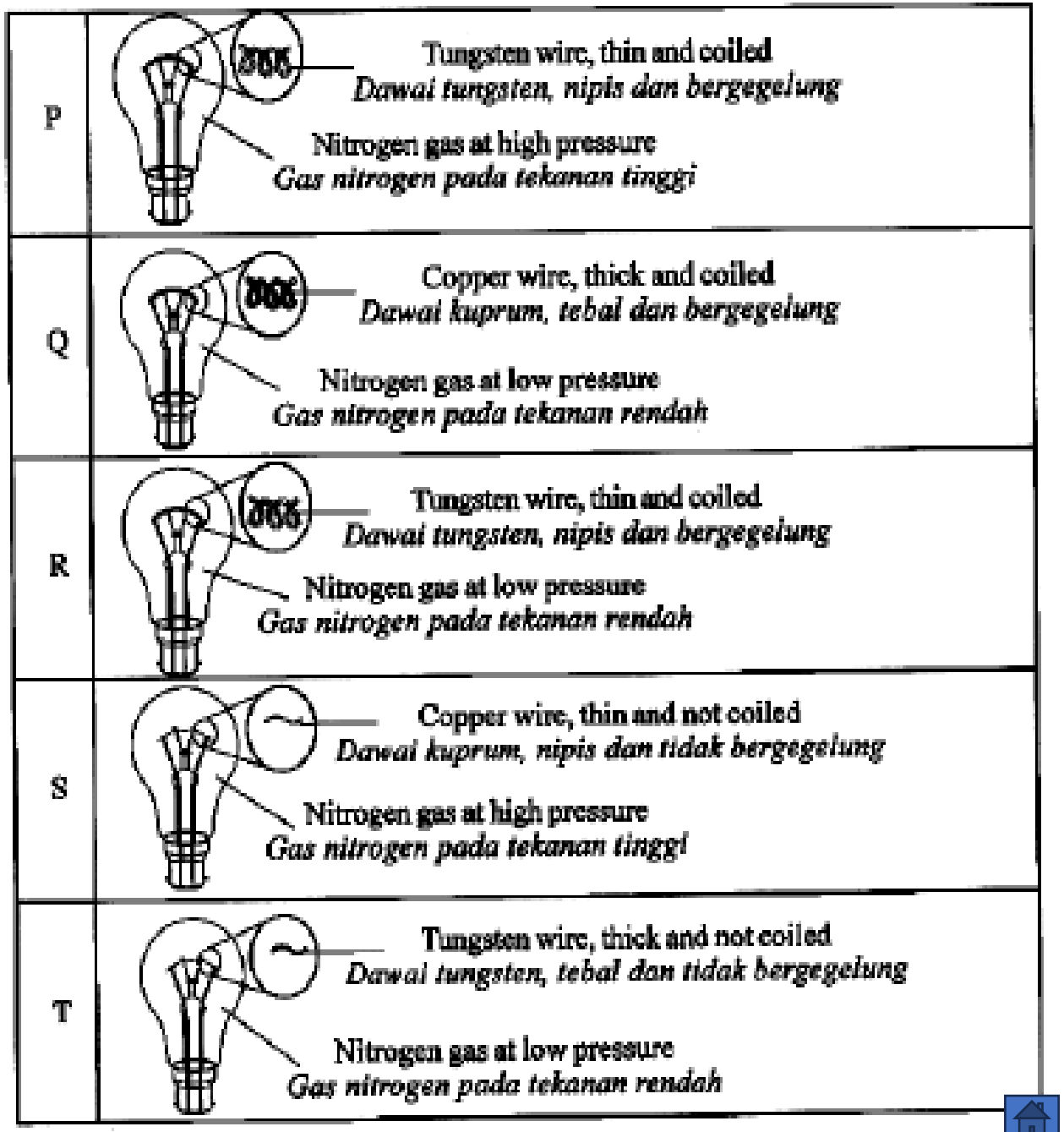
(d)(ii) 10 J // 11 – 10 J

(d)(iii) $\frac{10}{11}$ x 100% = 90.91%

(d) **You are asked to investigate the design and the characteristics of five filament lamps shown in Diagram 12.2. explain the suitability of each characteristics of the lamps and determine the lamp which can produce the brightest light. Give reasons for your choice.**

Anda ditugaskan untuk mengkaji reka bentuk dan ciri-ciri bagi lima lampu filamen seperti ditunjukkan dalam Rajah 12.2. Terangkan kesesuaian setiap ciri lampu itu dan tentukan lampu yang boleh menghasilkan cahaya yang paling cerah. Beri sebab untuk pilihan anda.

[10 marks]



coiled ***gegelung***	**Long wire / more heat / high resistance** ***Wayar Panjang / banyak haba / rintangan tinggi***
Thin ***nipis***	**High resistance / more heat** ***Rintangan tinggi / banyak haba***
tungsten ***tungsten***	**High melting point / long lasting / high resistance** ***Takat lebur tinggi / tahan lama / rintangan tinggi***
Low pressure gas ***Gas bertekanan rendah***	**Bulb will not explode after it lights a long time / *mentol tidak meletup setelah lama digunakan.***

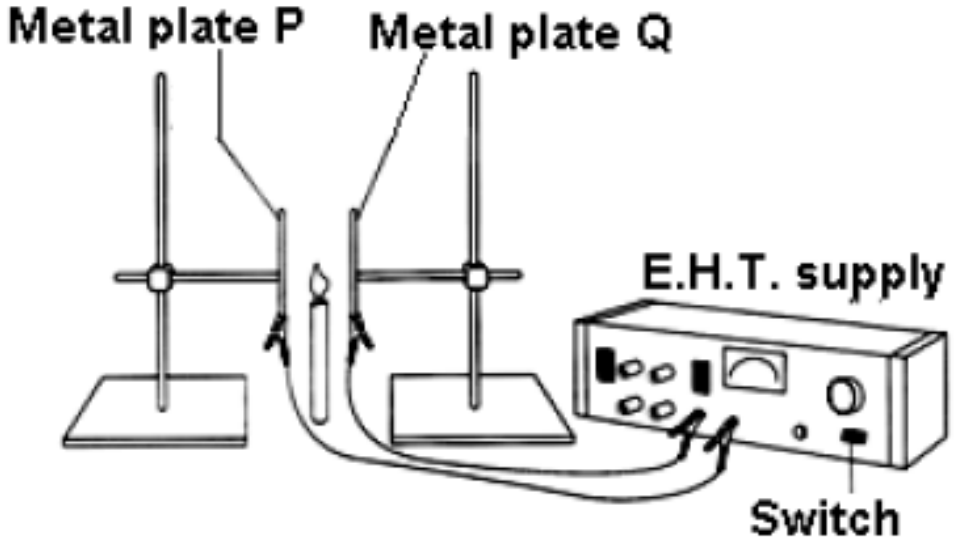
Choose R: coiled, thin, tungsten and low pressure gas

Pilih R: gegelung, nipis, tungsten dan gas bertekanan rendah.

Section B - 2010

Diagram 12.1 shows a candle flame placed between two metal plates, P and Q.

Rajah 12.1 menunjukkan nyalaan lilin diletakkan di antara dua plat logam, P dan Q.



The metal plates are connected to an Extra High Tension, E.H.T., supply which produces a strong electric field between P and Q when the switch is on.

Plat-plat logam itu disambungkan kepada sebuah bekalan Voltan Lampau Tinggi, V.L.T. yang menghasilkan suatu medan elektrik yang kuat antara P dan Q apabila suis dihidupkan.

(a) (i) What is the meaning of electric field?

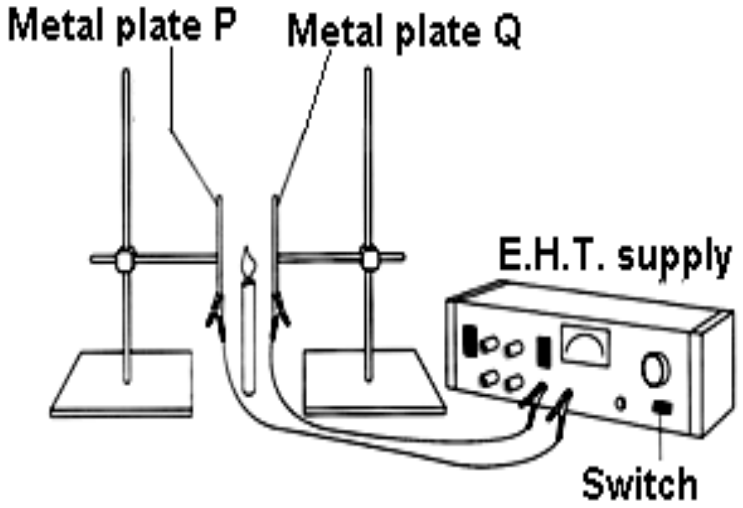
Apakah yang dimaksudkan dengan medan elektrik? [1 mark]

A region where electric charges experience forces.

Kawasan di mana cas elektrik mengalami daya.

(iv) What happens to the candle flame when the switch is on? Explain your answer.
Apakah yang berlaku kepada nyalaan lilin apabila suis dihidupkan. Terangkan jawapan anda. **[4 marks]**

The candle flame spreads out in two opposite directions, the spread towards the negative plate is wider
Nyalaan api tersebar kepada dua bahagian, nyalaan ke plat negatif lebih besar



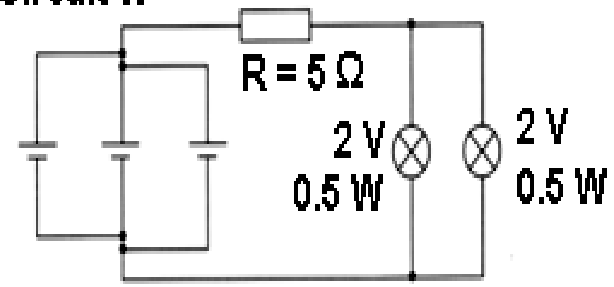
Heat ionize air molecules
Haba mengionkan molekul udara

+ve charge attracted to –ve plate
Cas +ve tertarik ke plat -ve

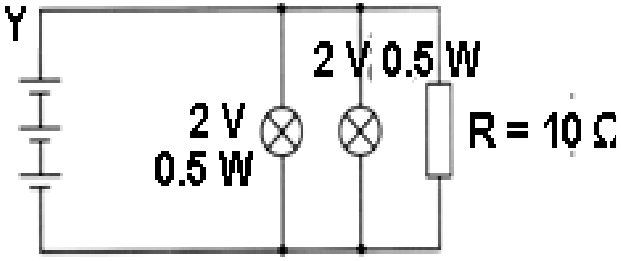
+ve ion is heavier
Ion +ve lebih berat

(c) **Diagram 12.2 shows four circuits, W, X, Y and Z, containing three dry cells of electromotive force, e.m.f., 1.5 V each, two bulbs, labelled 2 V, 0.5 W and resistor R.**
Rajah 12.2 menunjukkan empat litar, W, X, Y dan Z, yang mengandungi tiga sel kering dengan daya gerak elektrik, d.g.e, setiap satu 1.5 V, dua mentol berlabel 2 V, 0.5 W dan sebuah perintang R.

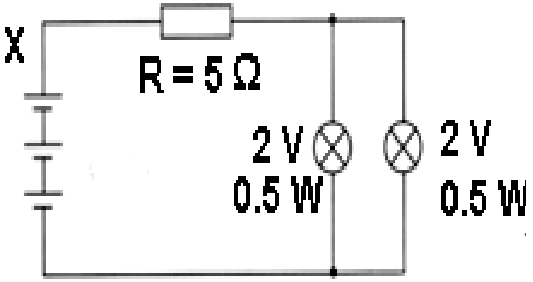
Circuit W



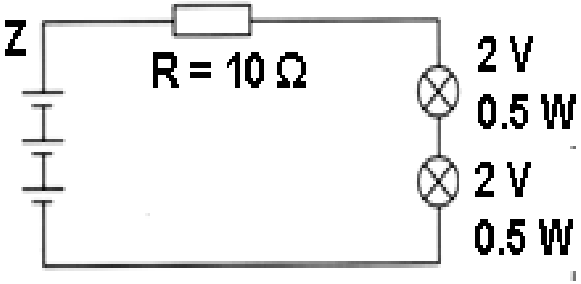
Circuit Y



Circuit X



Circuit Z



You are required to determine the most suitable circuit that can be used to light up the bulbs with normal brightness. You may need to do some calculation.
Anda dikehendaki menentukan litar yang paling sesuai untuk menyalakan mentol-mentol itu pada kecerahan normal. Anda mungkin perlu melakukan pengiraan.
Study the specifications of all the four circuits based on the following aspects:
Kaji spesifikasi keempat-empat litar itu berdasarkan aspek-aspek berikut:

(i) **The type of connection of the cells**
Jenis sambungan sel.

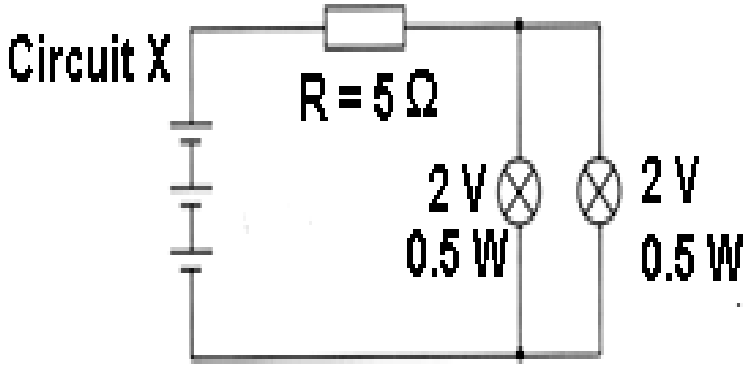
(ii) **The connection of the terminals of the cells.**
Sambungan terminal sel.

(iii) **The connection between the resistor and the bulbs.**
Sambungan antara perintang dengan mentol.

(iv) **The type of connection of the bulbs.**
Jenis sambungan mentol.

Characteristics	Reason
Dry cell in series Sel kering susun siri	Increase voltage To produce emf greater than 2 V Voltan bertambah. Hasilkan dge lebih besar dari 2 V
+ve terminal cell to –ve terminal next cell (+ve to –ve)	Current flow / bulb lights up Arus mengalir / mentol menyala

Characteristics	Reason
Connection resistor and bulb in series Sambungan rintangan dan mentol dalam siri	To ensure the voltage across the bulb does not exceed 2 V Bulb does not blown up. Total current is 0.5 A Pastikan voltan merentasi mentol tidak melebihi 2 V. Mentol tidak meletup / jumlah arus = 0.5 A



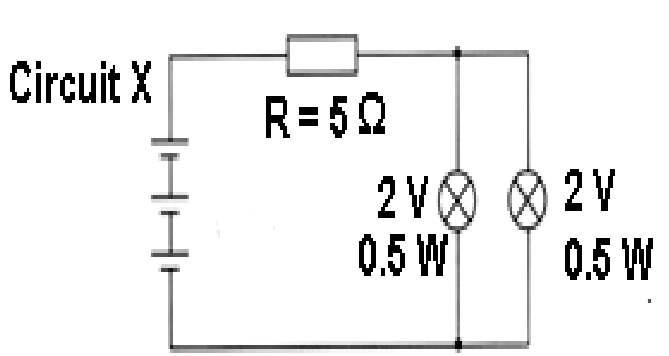
$I_{bulb} = P/V = 0.5 / 2 = 0.25$ A

$I_{total} = 0.25 \times 2 = 0.5$ A

$V_{bulb} = 2$ V

$V_R = (0.5)(5) = 2.5$ V

Characteristics	Reason
Connection of bulb is parallel Sambungan mentol secara selari	To produce voltage across each bulb is 2 V, Reduce resistance, Increase current If one bulb blow another bulb still function. Hasilkan voltan merentasi setiap mentol ialah 2 V. Kurangkan rintangan / tambah arus / jika satu mentol terbakar, mentol lain terus menyala V_{bulb} = 2 V, V_R = 2.5 V I_{bulb} = 0.25 A I_{total} = 0.5 A



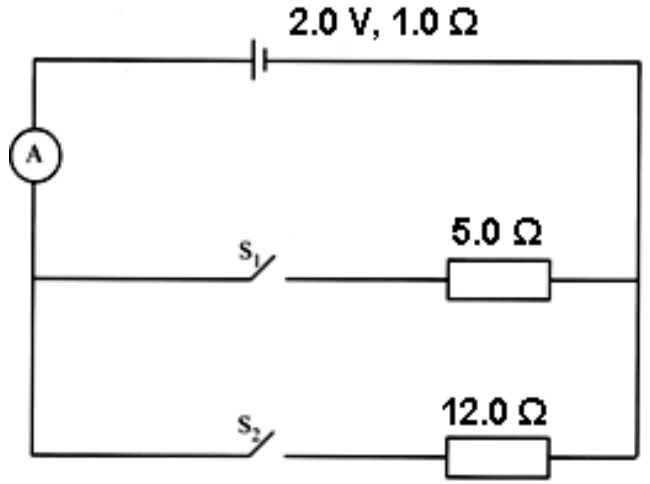
I_{bulb} = P/V = 0.5 / 2 = 0.25 A

I_{total} = 0.25 x 2 = 0.5 A

V_{bulb} = 2 V V_R = (0.5)(5) = 2.5 V

Characteristics	Reason
Choose X because the cells are connected in series, -ve terminal of cell is connected to the +ve terminal of the next cell, resistor is connected in series with bulb and bulbs are connected in parallel	

(b) Diagram 12.3 shows an electric circuit.
Rajah 12.3 menunjukkan litar elektrik.



The e.m.f. of the cell is 2.0 V and its internal resistance is 1.0 Ω. Calculate the reading of the ammeter when
D.g.e sel itu adalah 2.0 V dan rintangan dalam adalah 1.0 Ω. Hitung bacaan ammeter bila

(i) only switch S_1 is on, [2 marks]
hanya suis S_1 dihidupkan,

(ii) both switches, S_1 and S_2 are on.
kedua-dua suis S_1 dan S_2 dihidupkan.

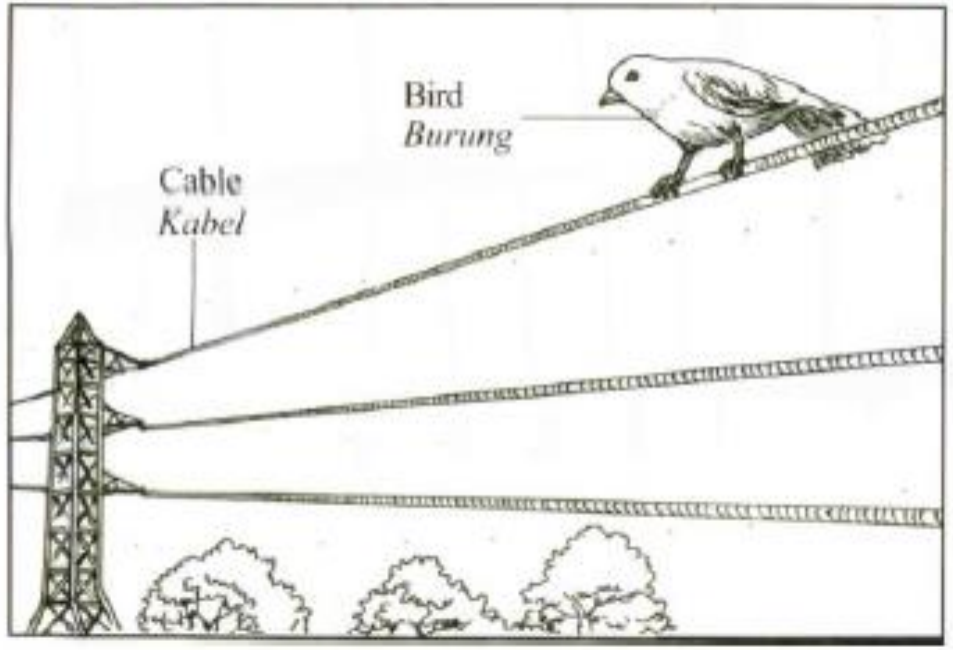
[3 marks]

(i) $2 = I\,(1 + 5)$
$I = 0.33$ A

(ii) $1/R = 1/5 + 1/12$
$R = 60/17 = 3.53\ \Omega$
$2 = I\,(1 + 3.53)$
$I = 2/4.53 = 0.4415$ A

Section B - 2016

Diagram 12.1 shows a bird perching on a high voltage cable that transmits electrical power to the consumer.
Rajah 12.1 menunjukkan seekor burung sedang hinggap di atas suatu kabel bervoltan tinggi yang menghantar kuasa elektrik kepada pengguna.



(a) (i) What is the meaning of power? [1 mark]
Apakah yang dimaksudkan dengan kuasa?

Energy / tenaga

Time masa

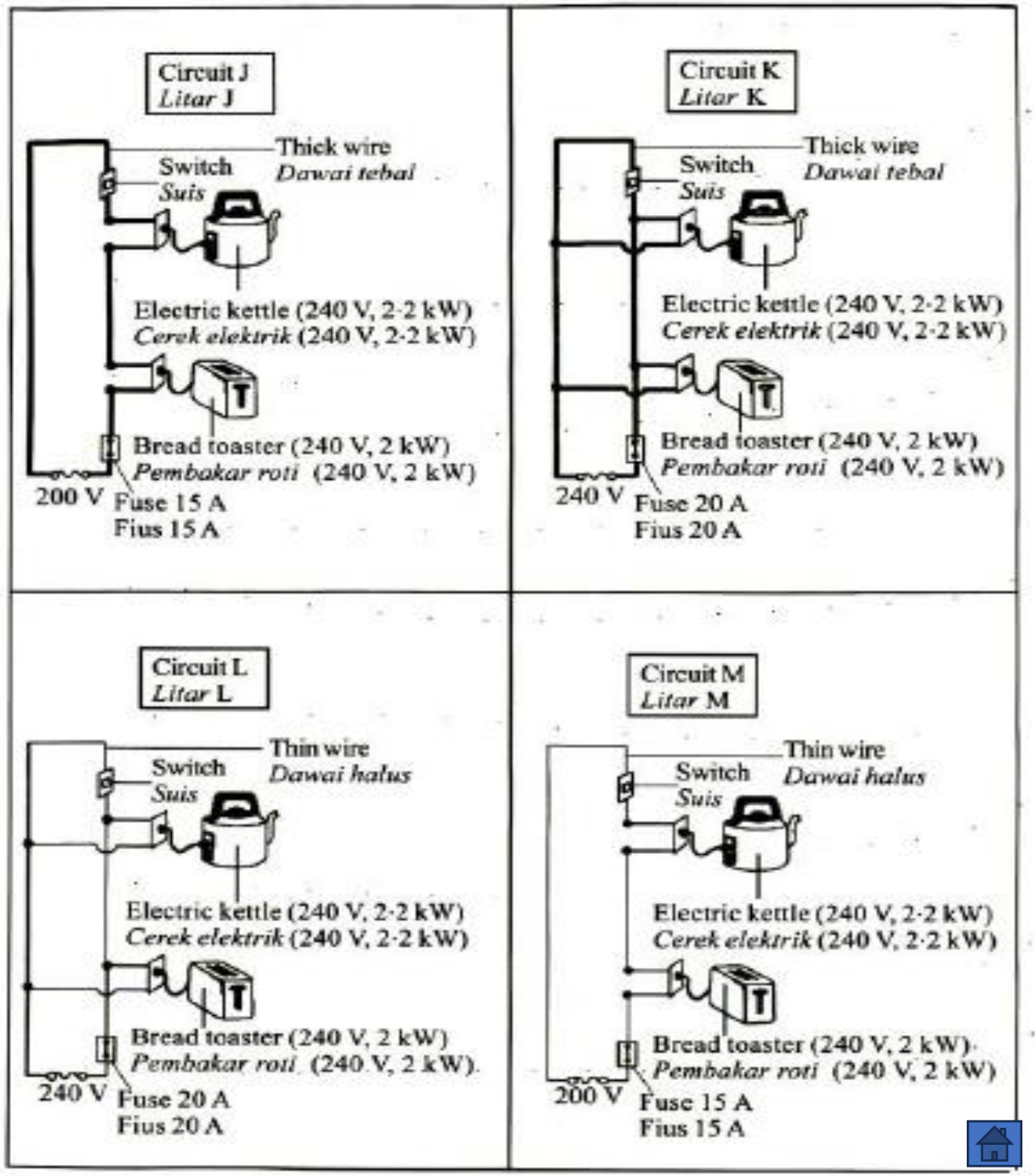
(ii) Based on Diagram 12.1, the bird does not experience an electric shock. Explain this situation in terms of the length of the cable between the bird's legs and the potential difference across the legs. [4 marks]
Berdasarkan Rajah 12.1, burung itu tidak mengalami sebarang kejutan elektrik. Terangkan situasi tersebut dalam konteks panjang kabel di antara kaki burung dengan beza keupayaan merentasi kaki burung itu.

- Short cable // *panjang kabel pendek*
- Low resistance / *rintangan rendah*
- Potential difference low/ *voltan rendah*
- Current low / *arus rendah*

- Poor conductor/ insulator// *penebat*
- High resistance on the bird's leg/ *rintangan tinggi pada kaki burung*
- Voltage = 0/ *voltan = 0*
- No Current flow / *tiada arus mengalir*

(b) **Diagram 12.2 shows the design and characteristics of four different circuits. Study the specifications of all the four circuits.. Explain the suitability of each design and characteristics of the circuits and determine the most suitable circuit to enable the electrical appliances to work efficiently. Give reason for your choice.**

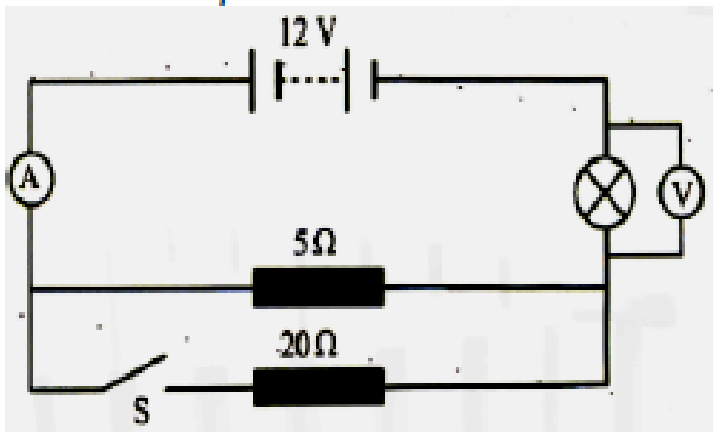
Rajah 12.2 menunjukkan reka bentuk dan ciri-ciri agi empat litar yang berbeza. Kaji spesifikasi keempat-empat litar itu. Terangkan kesesuaian bagi setiapp reka bentuk dan ciri-ciri litar dan tentukan litar yang paling sesuai untuk memboldhhkan alat-alat elektrik berfungsi dengan cekap. Beri sebab untuk pilihan anda. **[10 marks]**



Characteristics	reason
Thick // *Tebal*	Low resistance// *rintangan rendah*
240 V / high / tinggi	Voltage same with appliances rating / appliances at normal working/ *voltan sama spesifikasi alat / alat bekerja secara normal*
Parallel // *selari*	One not working, others still work/ *satu tidak berfungsi, alat lain masih berfungsi*
Fuse 20 A/ large / big / besar	17.5 A // (2200/240) + (200/240) = 9.17 + 8.33 = 17.5 A / break the circuit when the current flow bigger than fuse limit// *putuskan litar apabila arus yang mengalir lebih besar dari nilai fius*
K	Thick, parallel, 240 V and 20 A fuse/ *tebal, selari, 240 V dan fius 20 A*

(c) **Diagram 12.3 shows a circuit consisting of two resistors and a bulb. The reading of the ammeter is 1.5 A when the switch S is off.**

Rajah 12.3 menunjukkan suatu litaryang mengandungi duaperintang dan sebuah mentol. Bacaan ammeter ialah 1.5 A apabila suis S dimatikan.



Calculate/*Hitung*

(i) **the resistance of the bulb**
rintangan mentol

(ii) **the reading of ammeter and voltmeter when the switch S is on.**
bacaan ammeter dan voltmeter apabila suis S dihidupkan.

[5 marks]

(i) (12/1.5) – 5 = 8 – 5 = 3 Ω

(ii) 1/R = 1/5 + 1/20

R = 4 Ω

R total = 4 + 3 = 7 Ω

I = 12/7 = 1.7143 A

V = 1.7143 x 3 = 5.1429 V

Question 5

D10.4 (b) – the lamps are arranged in parallel

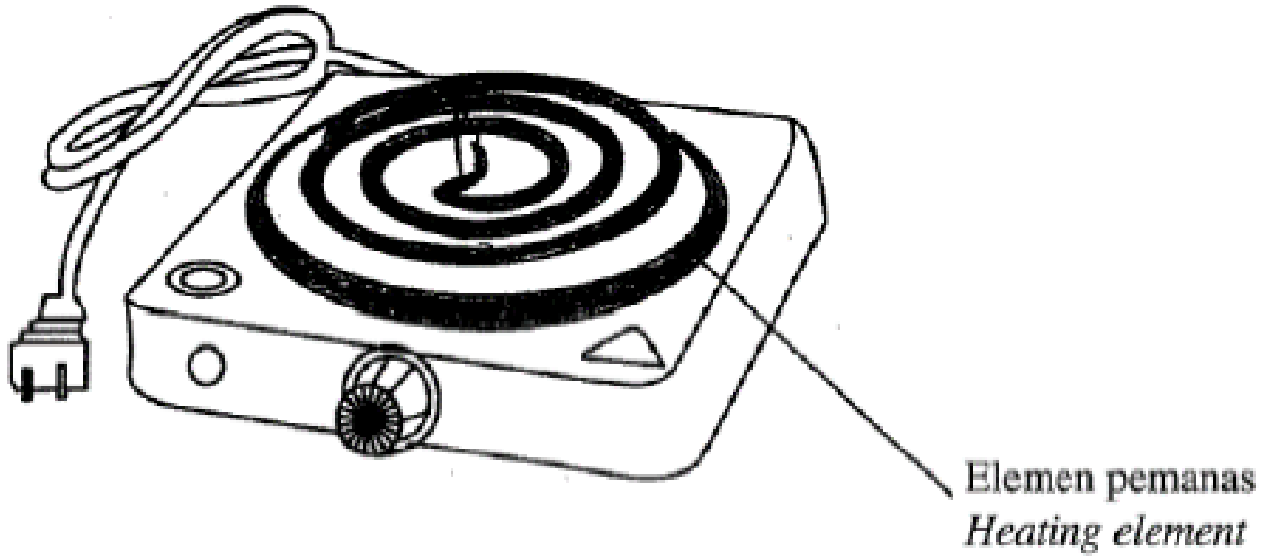
the voltage across each lamp is equals to the voltage of the supply voltage

more electric current flows through it.
(V= IR, R is the resistance of the filament).

more power output (P = V x I)

Section B - 2021

Rajah 10.1 menunjukkan sebuah dapur elektrik yang berlabel 1000 W 240 V.
Diagram 10.1 shows an electric cooker labelled as 100 W 240 V.



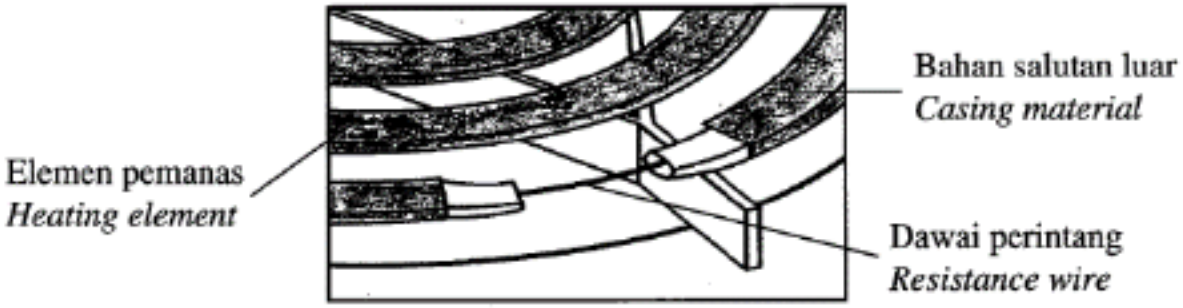
(a) Apakah maksud arus elektrik?
What is the meaning of electric current?

[1 markah]

Kadar pengaliran cas
// Rate of flow of charge

$$I = \frac{\text{cas}}{\text{masa}} \quad // \quad \frac{\text{cas}}{\text{time}}$$

(b) Rajah 10.2 menunjukkan keratan rentas elemen pemanas dalam dapur elektrik itu.
Diagram 10.2 shows the cross-section of the heating element in the electric cooker.



Rajah 10.2
Diagram 10.2

(i) Kira rintangan dawai perintang tersebut.
Calculate the resistance of the resistance of the wire.

(ii) Arus elektrik yang mengalir dalam dawai perintang ialah 4.2 A. Kira kuasa yang dihasilkan oleh dawai perintang tersebut.
The electric current flows through the resistance wire is 4.2 A. Calculate the power produced by the resistance wire.

M1: Menulis rumus

$$P = \frac{V^2}{R}$$

M2: Penggantian yang betul

$$1000 = \frac{(240)^2}{R}$$

M3: Jawapan dengan unit betul

R = 57.6 ohm // 57.6 Ω

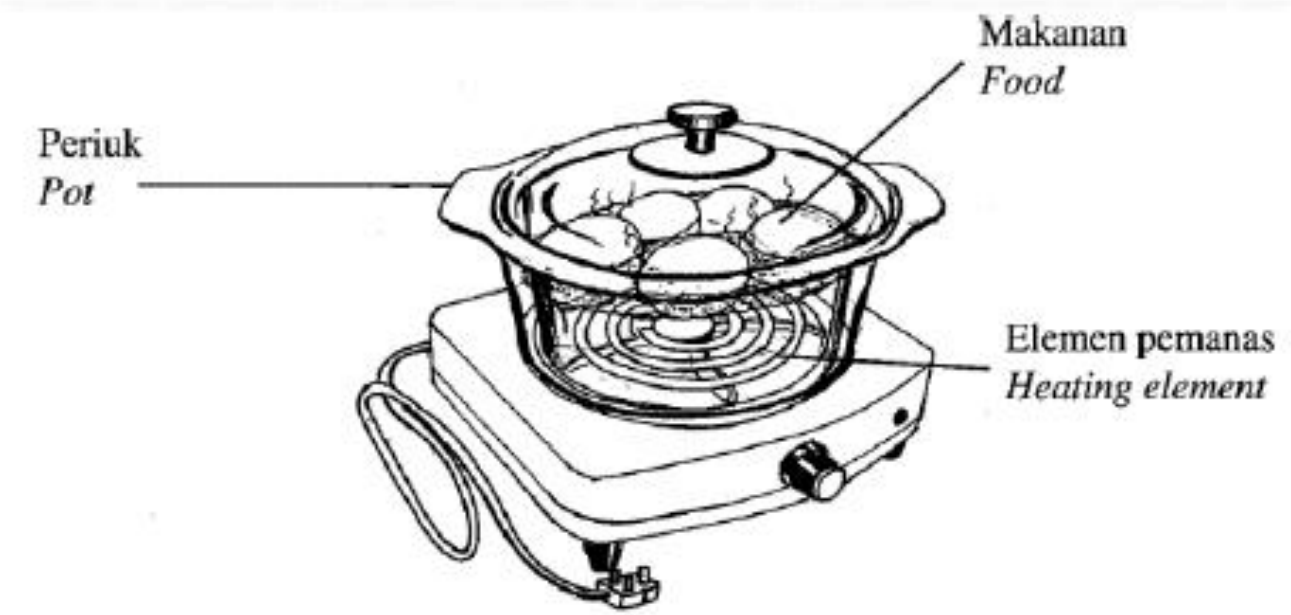
M1: $P = I^2R = (4.2)^2 \times 57.6$

M2: Jawapan dengan unit betul

P = 1016.06 W

(c) Rajah 10.3 menunjukkan sebuah periuk yang diletakkan di atas dapur elektrik.
Diagram 10.3 shows a pot is placed on top of the electric cooker.

Terangkan bagaimana elemen pemanas itu dapat digunakan untuk memanaskan makanan dalam periuk.
Explain how the heating element of the electric cooker can be used to heat up the food in the pot.



M1: Tenaga elektrik ditukar kepada tenaga haba.

Electrical energy change to heat energy

Tenaga elektrik → haba / Electrical energy → heat

M2: elemen pemanas: gegelung / coil heating element

M3: panjang bertambah (eleman pemanas) / long heating element

M4: Rintangan tinggi / high resistance

M5: Rintangan hasilkan haba / Resistance produce heat

M6: Haba tinggi (dihasilkan) / More heat / $P = I^2R$

M7: haba dipindahkan ke periuk

Heat energy transferred to the pot

Max: 4 markah

(d) Elemen pemanas dalam Rajah 10.2 didapati tidak tahan lama dan mengambil masa yang lama untuk memanaskan makanan. Jadual 2 menunjukkan ciri-ciri empat elemen pemanas K, L, M dan N.
The heating element in Diagram 10.2 does not last and needs longer time to heat up the food. Table 2 shows the characteristics of four heating elements K, L, M and N.

Elemen pemanas *Heating element*	Bentuk dawai perintang *Shape of resistance wire*	Kerintangan dawai perintang *The resistivity of resistance wire*	Bahan dawai perintang *Material of resistance wire*	Bahan salutan luar *Casing material*
K	Lurus *Straight*	Tinggi *High*	Aluminium *Aluminium*	Keluli *Steel*
L	Bergelung *Coiled*	Tinggi *High*	Nikrom *Nichrome*	Keluli *Steel*
M	Lurus *Straight*	Rendah *Low*	Nikrom *Nichrome*	Kuprum *Copper*
N	Bergelung *Coiled*	Rendah *Low*	Aluminium *Aluminium*	Kuprum *Copper*

Kaji setiap ciri elemen pemanas tersebut dan terangkan kesesuaian setiap ciri. Tentukan elemen pemanas yang tahan lama dan boleh memanaskan makanan dengan lebih cepat. Beri sebab untuk pilihan anda.
Study each characteristic of the heating elements and explain the suitability of each characteristics. Determine the heating element that is lasting and can heat up the food more faster. Give the reason for your choice.

[10 markah]

M1: Bergelung // coiled

M2: dawai panjang / long wire / banyak haba
more heat / rintangan tinggi / high resistance

M3: Kerintangan tinggi /
High resistivity

M4: banyak haba / Rintangan tinggi / more heat /
high resistance

M5: Nikrom / Nichrome

M6: Takat lebur tinggi / High melting point /
Rintangan tinggi / ρ tinggi / lebih haba / not melt
(easily)

M7: keluli / steel

M8: tidak teroksida / tahan suhu tinggi / non
oxidizing / can withstand high temperature
Tidak karat / not rust / Konduktor haba yang baik /
good heat conductor / Transfer heat easily
Transfer heat faster

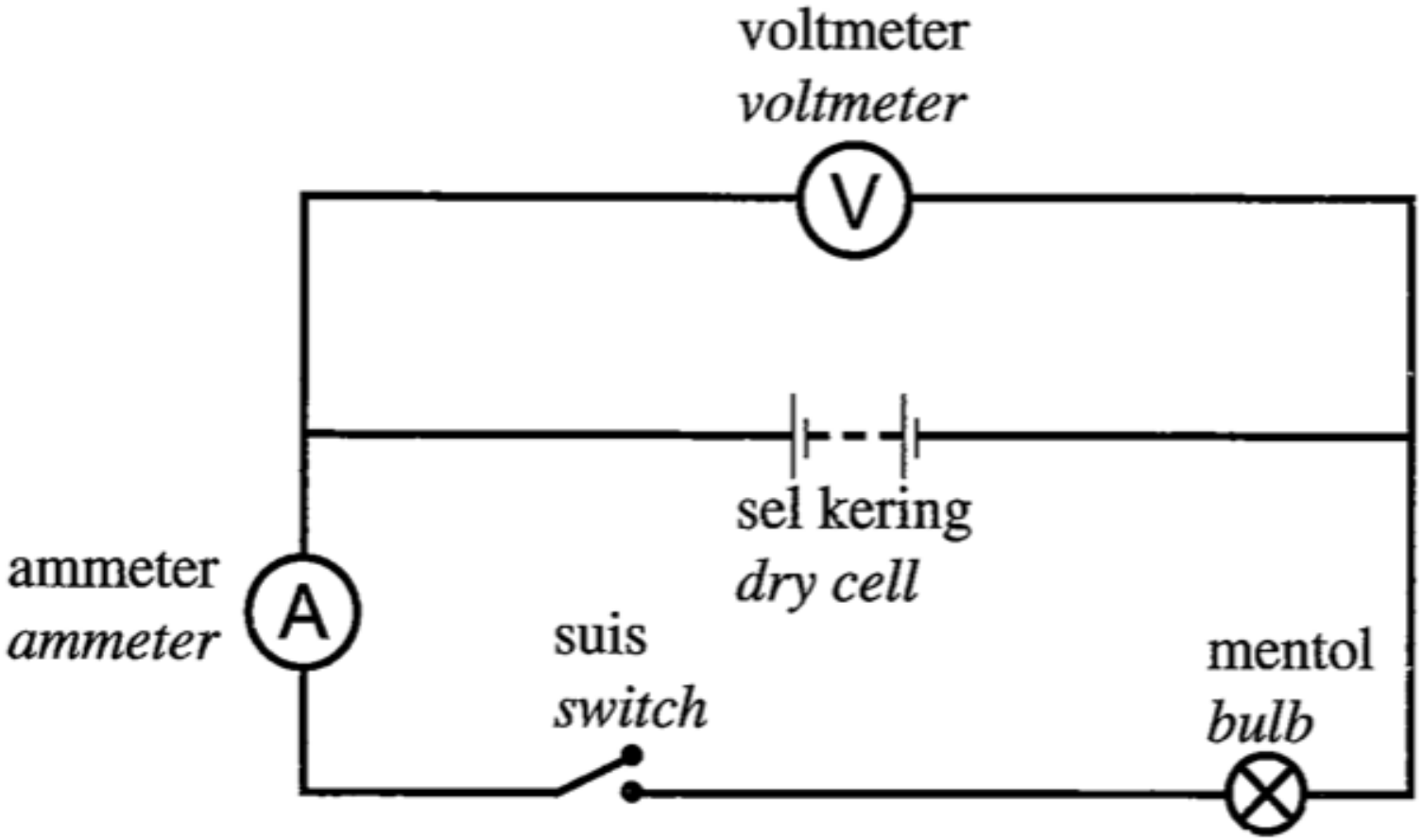
M9: Pilih L

M10: bergelung, kerintangan tinggi, nikrom, keluli
Coiled, high resistivity, nichrome, steel

Section B - 2022

10 Rajah 10.1 menunjukkan satu litar elektrik.

Diagram 10.1 *shows an electric circuit.*



Rajah 10.1

Diagram 10.1

(*a*) Nyatakan fungsi voltmeter. [1 *markah*]

State the function of voltmeter. [1 *mark*]

M1: √ Ukur beza keupayaan / voltan / d.g.e

Measure potential difference / voltage / e.m.f

(*b*) Berdasarkan Rajah 10.1,

Based on Diagram 10.1,

(i) apakah yang berlaku kepada bacaan ammeter dan bacaan voltmeter apabila suis dihidupkan.

what happened to the ammeter reading and the voltmeter reading when the switch is turned on.

[2 *markah*]

(b)(i) M1: √Ammeter menunjukkan bacaan

Ammeter shows reading

M2: √ Bacaan voltmeter berkurang Voltmeter reading decreases

(ii) Jelaskan jawapan anda di **10**(*b*)(i)

Explain your answer in **10**(*b*)(i)

[2 *markah*]
[2 *marks*]

M3: √ Arus mengalir / Current flows

✓Elektron @ cas mengalir / Electron @ charges flows

✓Beza keupayaan merentasi mentol

✓Potential difference across the bulb

M4: Tenaga daripada sel digunakan untuk mengatasi rintangan dalam sel

✓Energy from cells is used to overcome internal resistance of cell

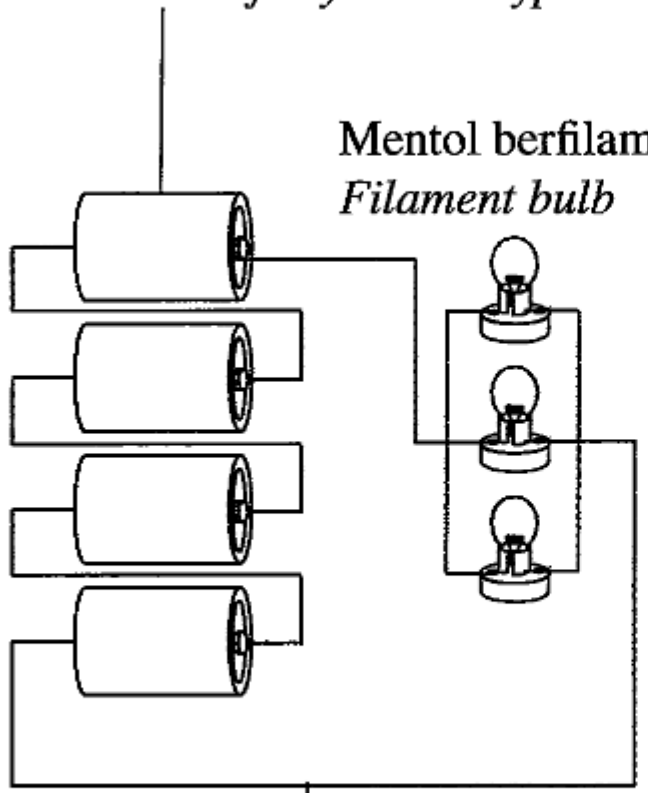
✓voltan susut @ kejatuhan voltan bila litar lengkap

✓voltage drop when circuit complete

(*c*) Rajah 10.2 menunjukkan empat jenis litar elektrik, P, Q, R dan S. Litar elektrik itu terdiri daripada empat biji sel kering yang serupa dan dua jenis sumber cahaya iaitu tiga mentol berfilamen dan tiga Diod Pemancar Cahaya (LED). Daya gerak elektrik (d.g.e) bagi setiap sel kering dan kadar kuasa setiap sumber cahaya adalah sama.

Diagram 10.2 *shows four types of electric circuits*, P, Q, R *and* S. *The electric circuits consist of four identical dry cells and two types of light sources which are three filament bulbs and three Light Emitting Diodes* (LED). *The electromotive force* (*e.m.f*) *for each dry cell and the power rating of each light source is the same.*

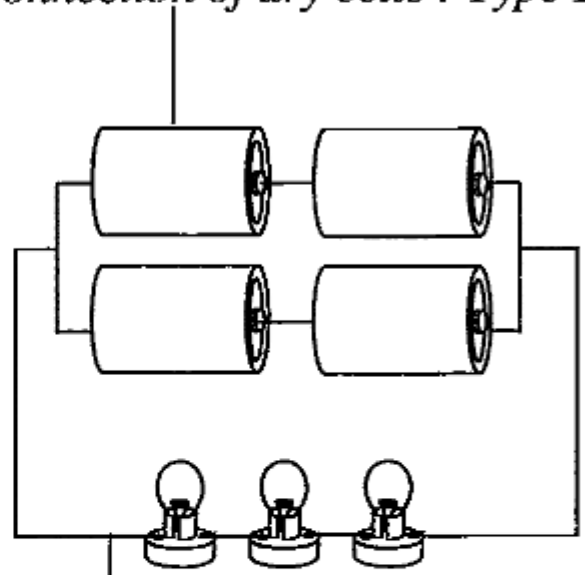
Sambungan sel kering : Jenis I
Connection of dry cells : Type I



Dawai kerintangan tinggi
High resistivity wire

Litar P
Circuit P

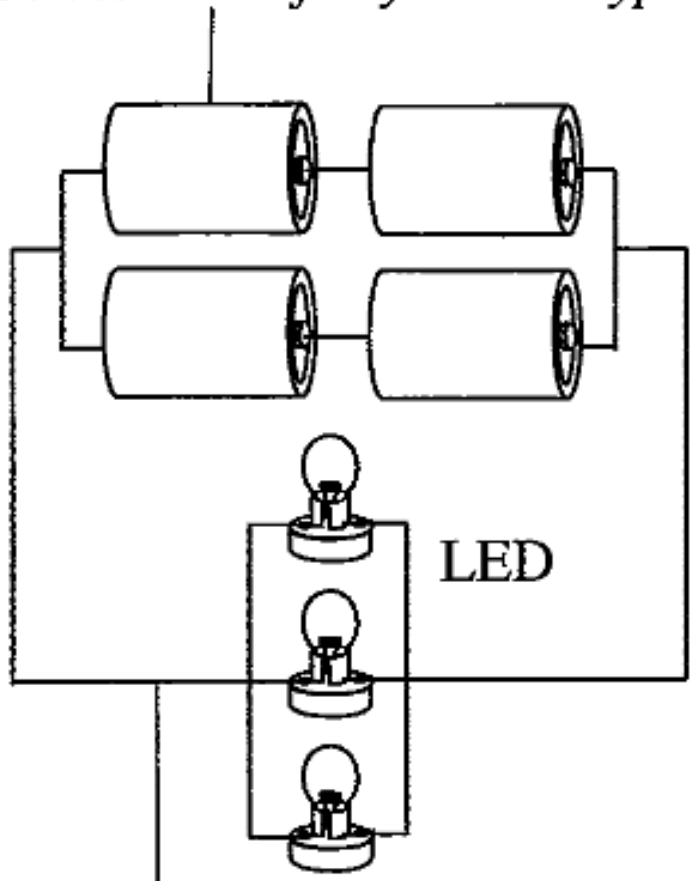
Sambungan sel kering : Jenis II
Connection of dry cells : Type II



Dawai kerintangan rendah
Low resistivity wire

Litar Q
Circuit Q

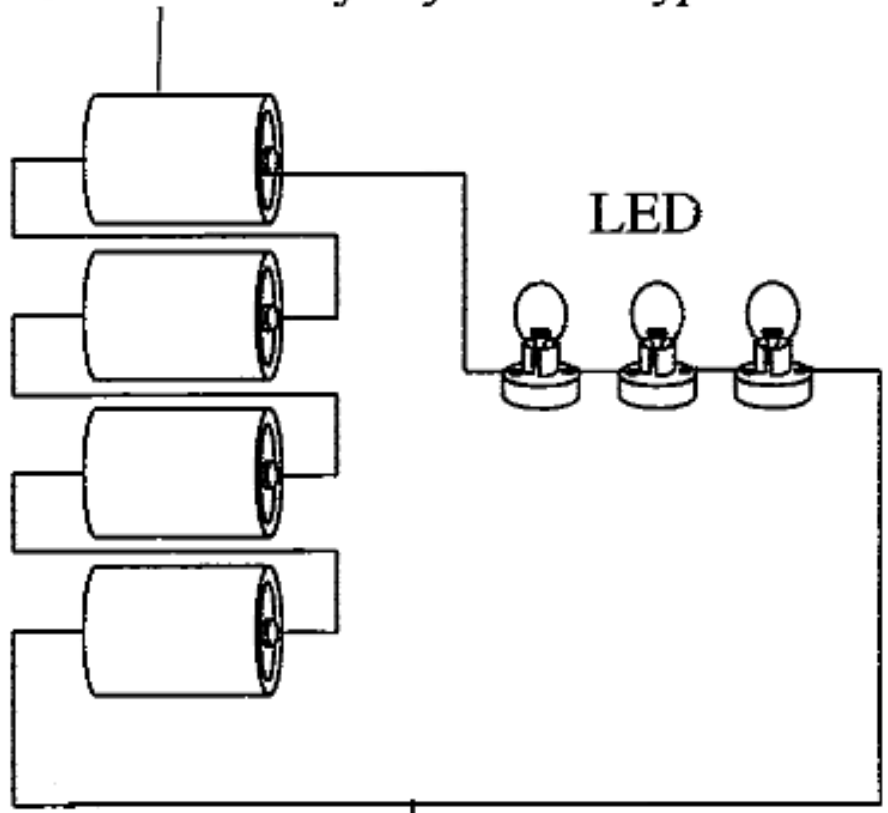
Sambungan sel kering : Jenis II
Connection of dry cells : Type II



Dawai kerintangan rendah
Low resistivity wire

Litar R
Circuit R

Sambungan sel kering : Jenis I
Connection of dry cells : Type I



Dawai kerintangan tinggi
High resistivity wire

Litar S
Circuit S

Kaji dan tentukan litar elektrik yang paling sesuai untuk menghasilkan cahaya yang lebih cerah dan sumber cahaya yang tidak mudah terbakar.

Study and determine the most suitable electric circuit that produce brighter light and is not easily flammable light source.

(i) Terangkan kesesuaian bagi setiap spesifikasi.

Explain the suitability for each specification.

[8 *markah*]
[8 *marks*]

(ii) Pilih litar yang paling sesuai. Berikan sebab untuk pilihan anda.

Choose the most suitable circuit. Give reason for your choice.

[2 *markah*]
[2 *marks*]

M1: Diod pemancar cahaya LED
Light emitting diode

M2: Kehilangan tenaga rendah
✓Low energy loss
✓Hilang kuasa rendah
✓Lower power loss

M3: Sumber cahaya selari / LED selari
LED parallel/Mentol selari/Parallel bulb

M4: Rintangan berkesan kecil
✓effective resistance small / Arus besar / current high / Beza keupayaan besar /High voltage / jika satu rosak / terbakar, yang lain masih berfungsi / menyala

M5: Dawai / wayar kerintangan rendah / Low resistivity wires.

M6:
✓Rintangan rendah
✓Low resistance

M7: Alt 1
Sel kering sesiri
Jenis 1/ Sambung 1

M7: Alt 2
Sel kering selari / jenis II
Sambungan II, sel kering gabungan
Sel kering selari dan siri

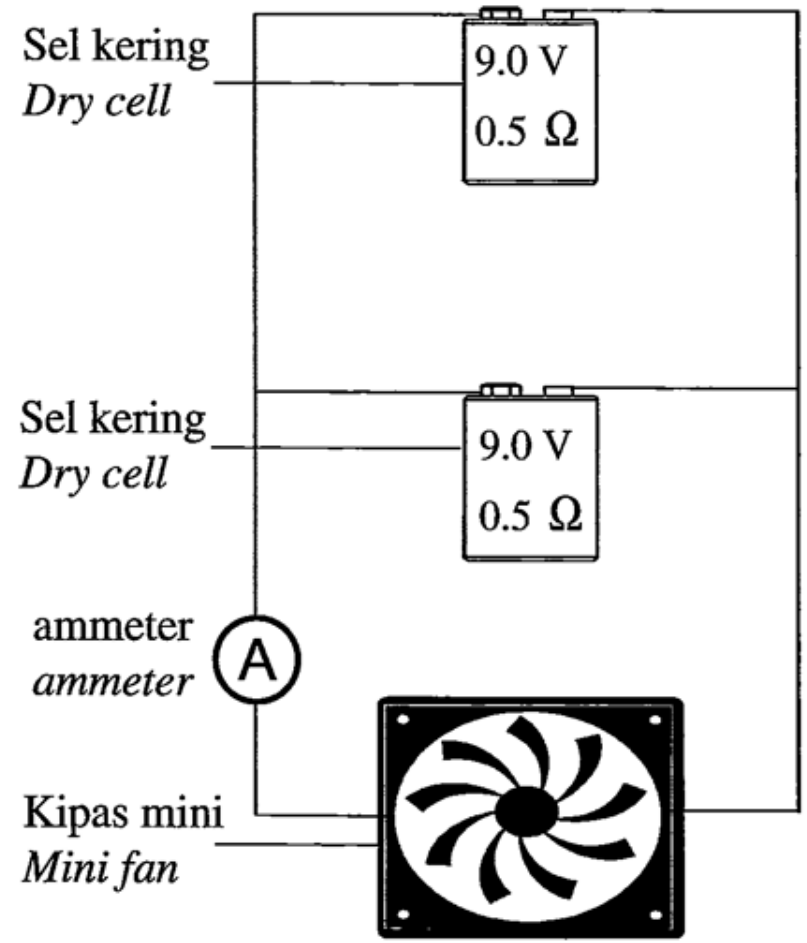
M8: Alt 1
- ✓ **Voltan tinggi / d.g.e tinggi**
- ✓ **Keamatan tinggi / Kuasa tinggi**
- ✓ **Tenaga tinggi**

M8: Alt 2
- ✓ **(jumlah) rintangan dalam berkurang / arus tinggi / keamatan tinggi / kuasa tinggi / keamatan tinggi / kuasa tinggi**
- ✓ **Tenaga tinggi**

M9: R

(d) Rajah 10.3 menunjukkan satu litar elektrik yang mengandungi dua sel kering 9 V setiap satu, ammeter dan satu kipas mini. Rintangan dalam sel kering ialah 0.5 Ohm dan rintangan kipas mini ialah 60 Ohm.

Diagram 10.3 *shows an electric circuit containing two* 9V *dry cell each, an ammeter and a mini fan. The internal resistance of each dry cell is* 0.5 Ohm *and the resistance of the mini fan is* 60 Ohm.



Berdasarkan Rajah 10.3, hitung
Based on Diagram 10.3, *calculate*

(i) rintangan dalam berkesan bagi sel-sel kering.
the effective internal resistance for dry cells.

(ii) bacaan ammeter.
the reading of the ammeter.

[5 *markah*]
[5 *marks*]

M1 Penggantian formula yang betul

$\frac{1}{r} = \frac{1}{0.5} + \frac{1}{0.5}$ / $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$ / $(r) = \frac{r_1 r_2}{r_1 + r_2}$

/ $(r) = \left[\frac{1}{r_1} + \frac{1}{r_2}\right]^{-1}$ / $r_e = \frac{r}{n}$ pg 120 teks

/ $\frac{(0.5)(0.5)}{0.5 + 0.5}$ / $\frac{0.5}{2}$

M2: Menyatakan jawapan dengan unit yang betul

r = 0.25 Ω

M1 menyatakan ringtangan berkesan dengan betul
(R) = 60 + 0.25 / 60.25 (Ω)
/ 60 + ecf d(i)

M2: Penggantian / formula yang betul
E = I(R + r) / ε = I(R + r)
9 = I(60.35)

M3: Menyatakan jawapan dengan unit yang betul
= 0.149 A minima 2 tp 0.15 √

Section C - 2017

Diagram 10.1 shows a circuit containing two dry cells, two metal rods and an ammeter.
Rajah 10.1 menunjukkan satu litar yang mengandungi dua sel kering, dua rod logam dan satu ammeter.

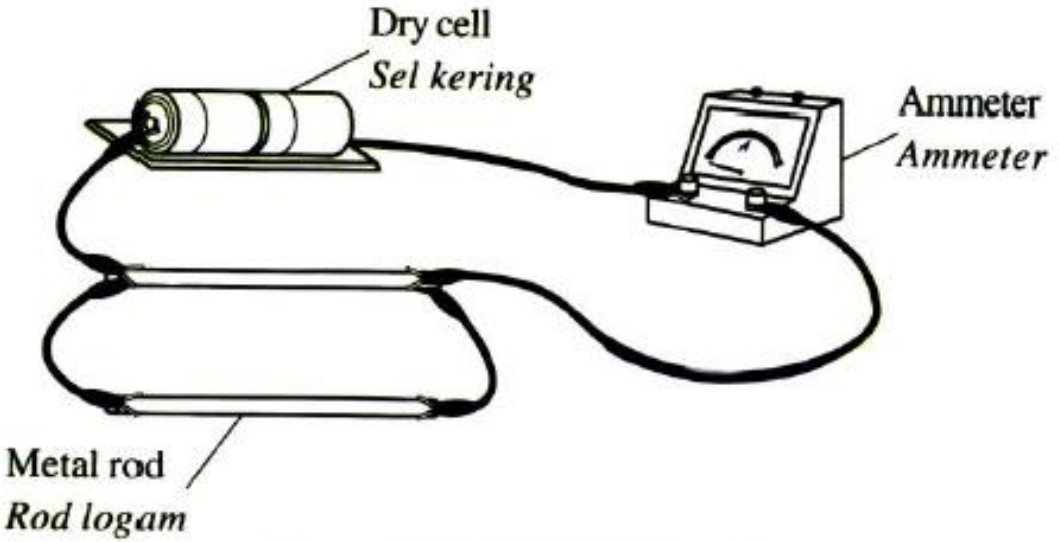


Diagram 10.1 / *Rajah 10.1*

Diagram 10.2 shows a circuit containing two dry cells, three metal rods and an ammeter.
Rajah 10.2 menunjukkan satu litar yang mengandungi dua sel kering, tiga rod logam dan satu ammeter.

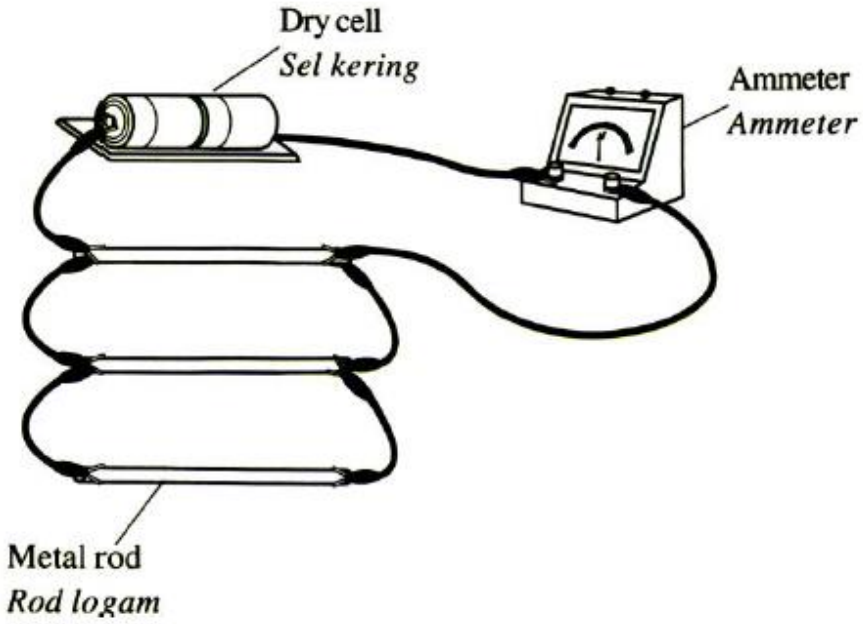


Diagram 10.2 / *Rajah 10.2*

(a) What is the meaning of resistance?
Apakah maksud rintangan?

[1 mark]

Voltage // voltan

Current arus

(b) Based on Diagram 10.1 and Diagram 10.2
Berdasarkan Rajah 10.1 dan Rajah 10.2,

(i) Compare the reading of the ammeter.
Bandingkan bacaan pada ammeter.

[1 mark]

(ii) Compare the number of metal rods.
Bandingkan bilangan rod logam. **[1 mark]**

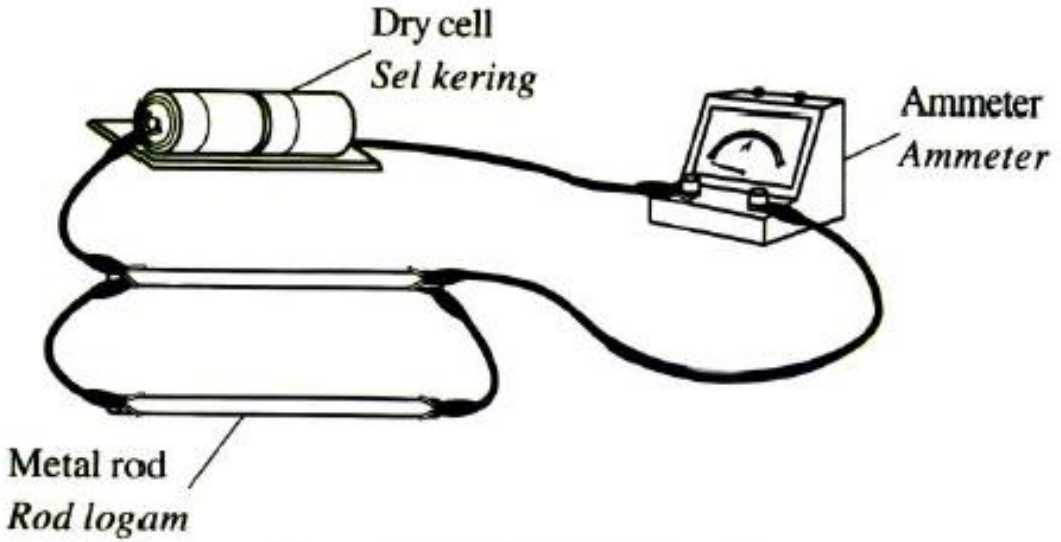


Diagram 10.1 / *Rajah 10.1*

Bacaan 10.1 rendah // reading 10.1 low

Number of metal rods 10.1 low
Bilangan rod logam 10.1 sedikit

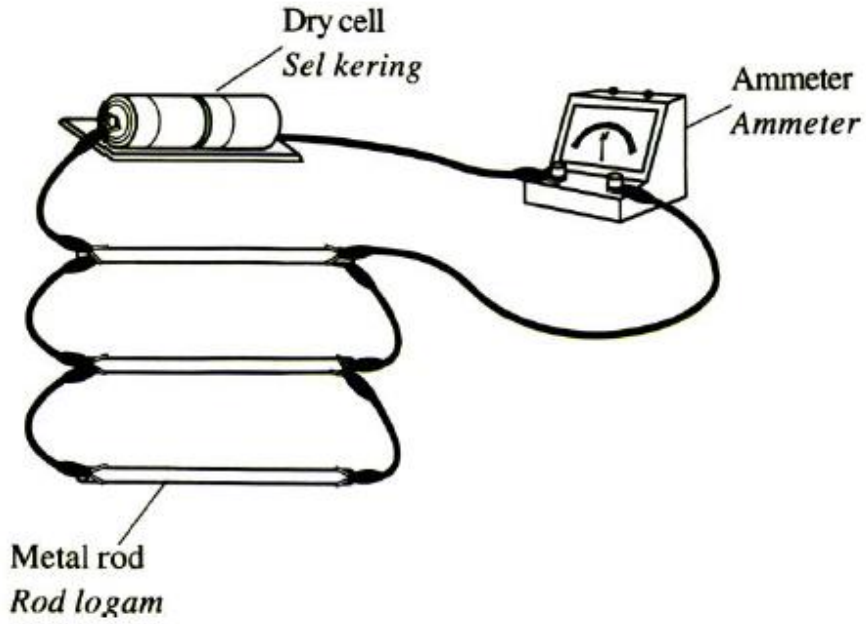


Diagram 10.2 / *Rajah 10.2*

(c) Each metal rod for both circuits has a value of 2.0 Ω. Calculate the effective resistance for
Setiap rod logam bagi kedua-dua litar bernilai 2.0 Ω. Hitung rintangan berkesan bagi

(i) Metal rods in Diagram 10.1 by using the formula:
Rod logam dalam Rajah 10.1 dengan menggunkan formula:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

[1 mark]

1/R = ½ + ½ // R = 1

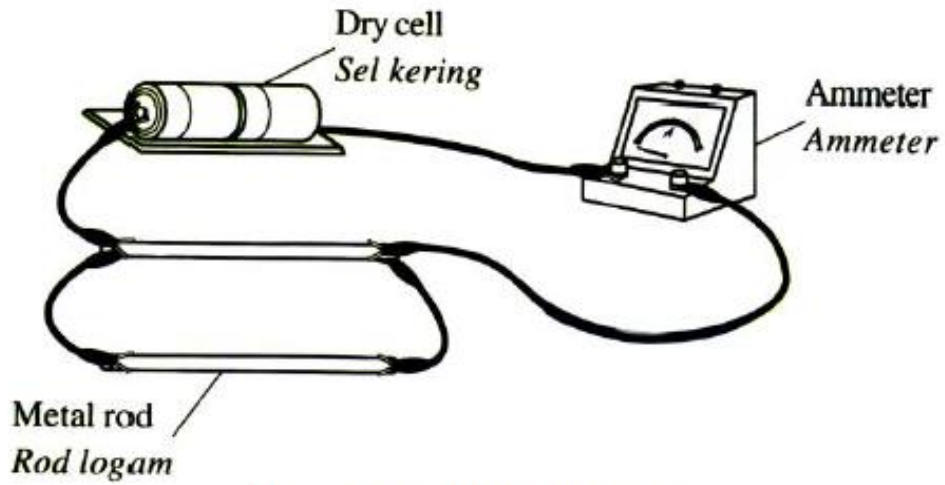


Diagram 10.1 / *Rajah 10.1*

(ii) Metal rods in Diagram 10.2 by using the formula:
Rod logam dalam Rajah 10.2 dengan menggunakan formula:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

[1 mark]

1/R = ½ + ½ + ½ // R = 0.67

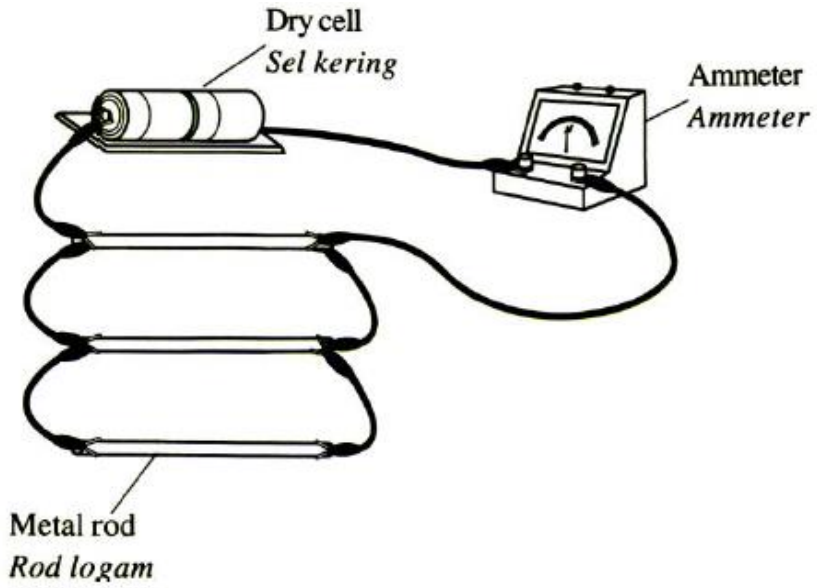


Diagram 10.2 / *Rajah 10.2*

(d) By using your answer in 10(b) and 10(c),
Dengan menggunakan jawapan di 10(b) dan 10(c),

(i) Compare the effective resistance for both diagrams.
Bandingkan rintangan berkesan untuk kedua-dua rajah.

(ii) State the relationship between the number of metal rods and the effective resistance.
Nyatakan hubungan antara bilangan rod logam dengan rintangan berkesan.

[2 marks]

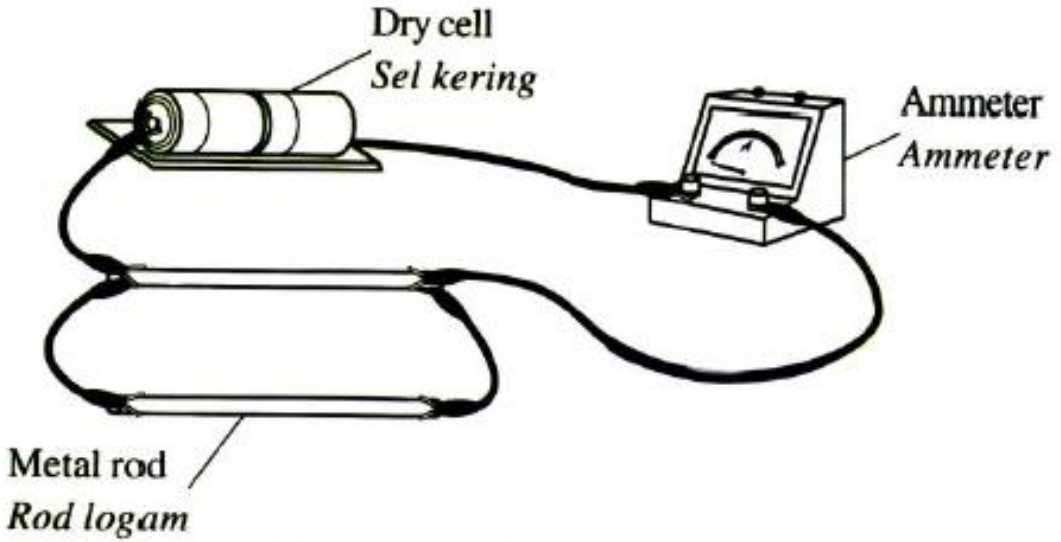


Diagram 10.1 / *Rajah 10.1*

Rintangan berkesan 10.2 lebih kecil

Rintangan berkesan berkadar songsang dengan bilangan rod logam

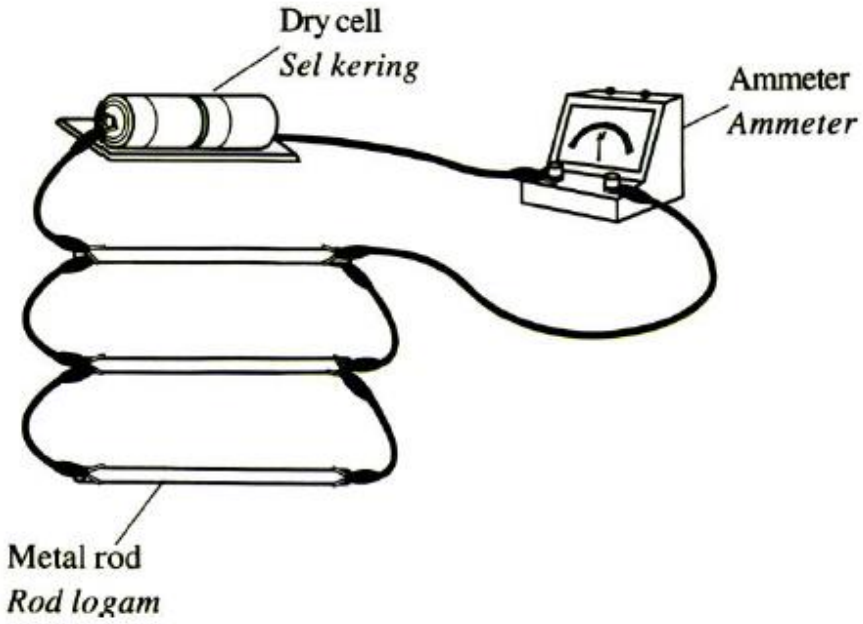
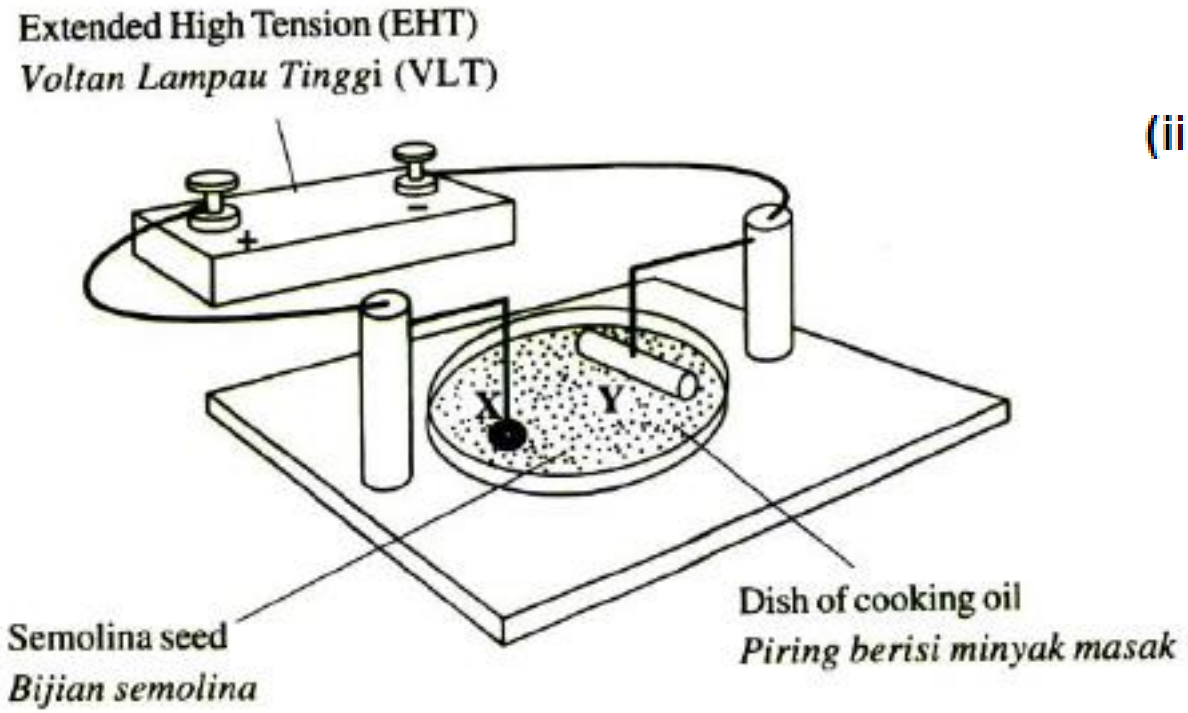


Diagram 10.2 / *Rajah 10.2*

(e) **Diagram 10.3 shows the apparatus used to produce electric field between two electrodes, X and Y.**
Rajah 10.3 menunjukkan alat radas yang digunakan untuk menghasilkan medan elektrik di antara dua elektrod, X dan Y.



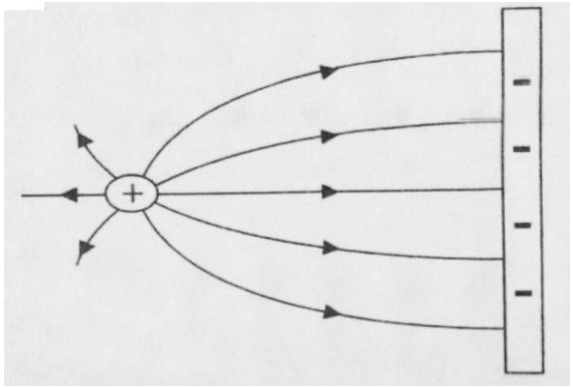
Based on Diagram 10.3,
Berdasarkan Rajah 10.3,

(i) **Draw the pattern of the electric field that is formed between the two electrodes.**
Lukis corak bagi medan elektrik yang terbentuk di antara dua elektrod itu.

[2 marks]

(ii) **Explain why EHT is used.**
Terangkan mengapa VLT digunakan.

[1 mark]



Strong electric field

Medan magnet lebih besar

(f) **Diagram 10.4 shows an electric iron labelled 240 V, 1000 W.**
Rajah 10.4 menunjukkan satu seterika elektrik berlabel 240 V, 1000 W.

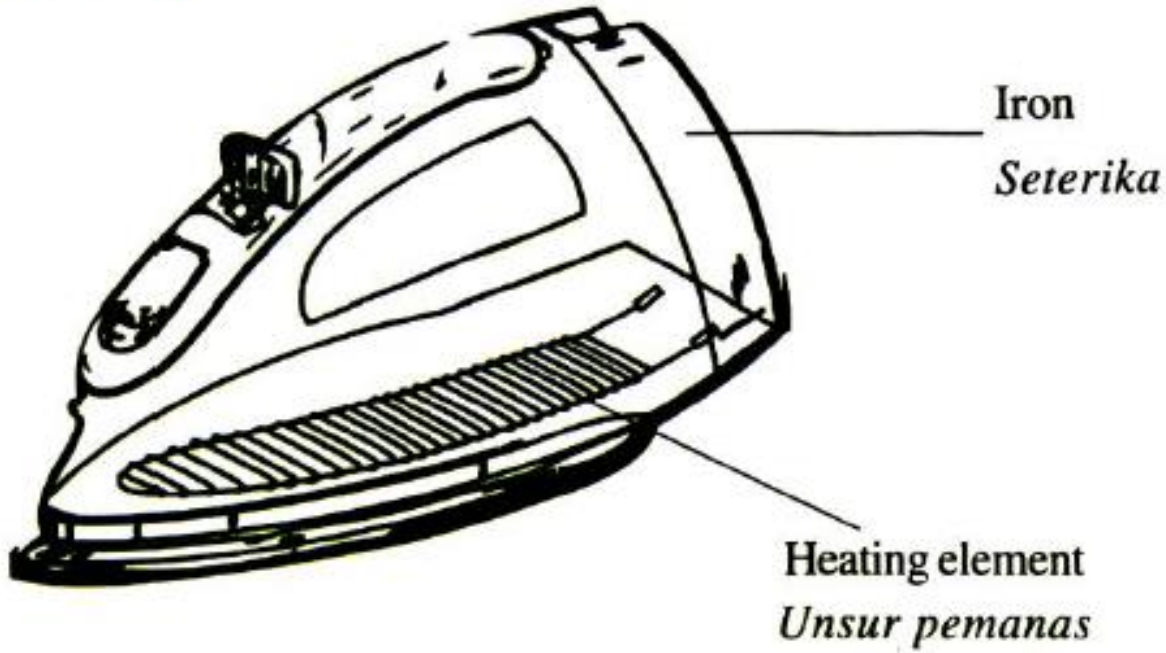


Diagram 10.4 / *Rajah 10.4*

Suggest and explain how to improve the electric iron so that it can function effectively and efficiently based on the characteristics of material which is used for heating element and the handle of the iron, the electronic component to control the heat and the safety of the electric iron.
Cadang dan terangkan bagaimana untuk menambah baik seterika elektrik itu supaya ia dapat berfungsi dengan berkesan dan cekap berdasarkan ciri-ciri bahan yang digunakan untuk unsur pemanas dan pemegang seterika, komponen elektronik untuk mengawal haba dan keselamatan seterika elektrik tersebut.

[10 marks]

√1 material of heating element:
Nichrome //Tungsten //Wolfram

√2 Reason:
High resistance //high melting point //more heat //low specific heat capacity // rintangan tinggi //takat lebur tinggi //cepat panas // muatan haba tentu rendah

√3 Type of material of the handle
High specific heat capacity // plastic //penebat haba //poor heat conductor //heat insulator

√4 Reason: Not heat easily //high specific heat capacity //difficult to heat //difficult to hot //heat insulator //poor heat conductor //tidak mudah panas //muatan haba tentu Tinggi //susah panas //lambat panas //penebat haba

√5 Thermostat // thermostat

√6 Reason:

Control temperature // prevent overheat //kawal suhu // elak lampau panas

√7 The connection

Earthed wire // wire to earth // earthing //wayar bumi //wayar ke bumi //pembumian //earthed //dibumikan

√8 Reason:

Excessive current to earth //avoid electric shock //avoid short circuit // arus berlebihan ke bumi //elak litar pintas //elak renjatan elektrik //elak kejutan elektrik

√9 The safety method

Fuse // circuit breaker // pemutus litar

√10 reason:

//putuskan litar bila arus berlebihan //cut down/off the current once the current overload

avoid excessive current //avoid from overload //protect from damage //melindungi dari arus berlebihan /beban lampau //melindungi dari rosak //arus berlebihan tidak mengalir //tiada arus berlebihan //arus mengalir 4.17 A //I = 1000/240 //prevent big/huge/enormous current.

√11 Heating element:

Thin //nipis //small diameter //small cross sectional area

√12 Reason:

High resistance // more heat // rintangan tinggi //lebih haba

√13 Heating element:

Coil // long //gegelung //panjang

√14 Reason:

High resistance // more heat

Section C - 2013

Diagram 10.1(a) and Diagram 10.2(a) show two identical Van de Graaff generators being charged for 1 minute and 5 minutes respectively. Diagram 10.1(b) and Diagram 10.2(b) show the deflection of the microammeter pointer when the metal dome is connected to the microammeter and a metal tap.

Rajah 10.1(a) dan Rajah 10.2(a) menunjukkan dua penjana Van de Graaff yang serupa, masing-masing dicaskan dalam masa 1 minit dan 5 minit. Rajah 10.1(b) dan Rajah 10.2(b) menunjukkan pesongan penunjuk micrometer apabila kubah logam disambungkan kepada mikroammeter dan sebuah paip logam.

(a) **What is the physical quantity that can be measured by a microammeter?**
Apakah kuantiti fizik yang boleh diukur dengan mikroammeter?

[1 mark]

Current / arus elektrik

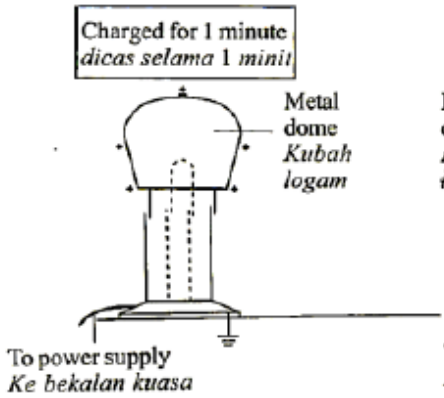


Diagram 10.1(a)
Rajah 10.1(a)

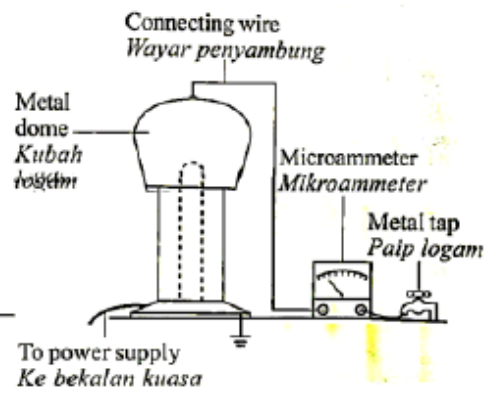


Diagram 1(b)
Rajah 1(b)

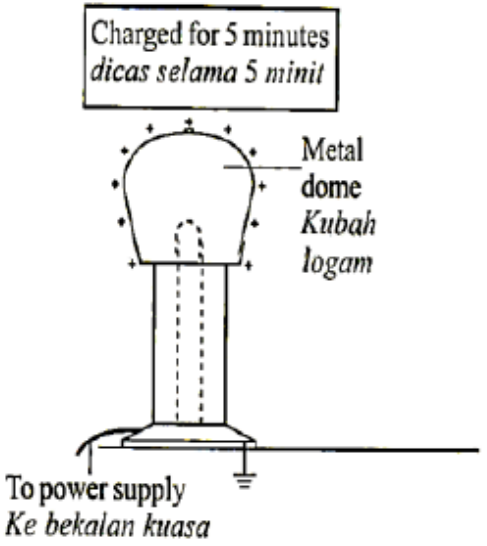


Diagram 10.2(a)

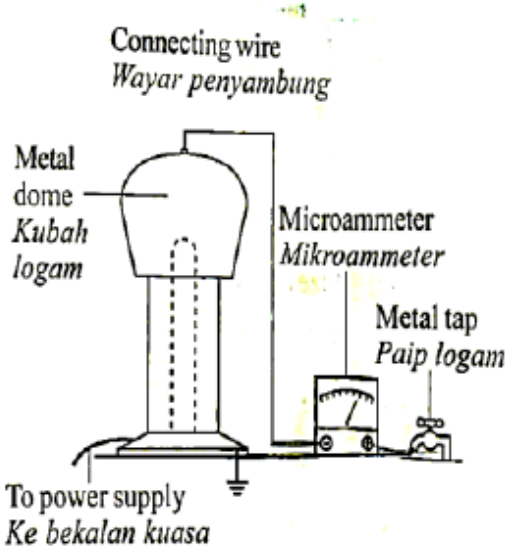


Diagram 10.2(b)

(b) (i) **Using Diagram 10.1 and 10.2, compare the time taken to charge the Van de Graaff generator, quantity of charge produced on the dome and the angle of deflection of the microammeter pointer.**
Menggunakan Rajah 10.1 dan Rajah 10.2, bandingkan masa yang diambil untuk mengecas janakuasa Van de Graaff, kuantiti cas yang dihasilkan pada kubah dan sudut pesongan penunjuk mikroammeter.

[3 marks]

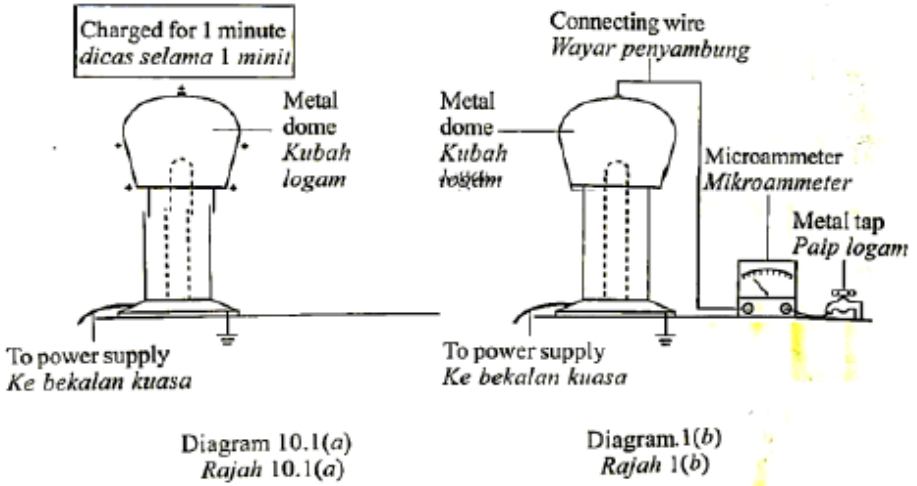


Diagram 10.1(*a*) *Rajah* 10.1(*a*)

Diagram.1(*b*) *Rajah* 1(*b*)

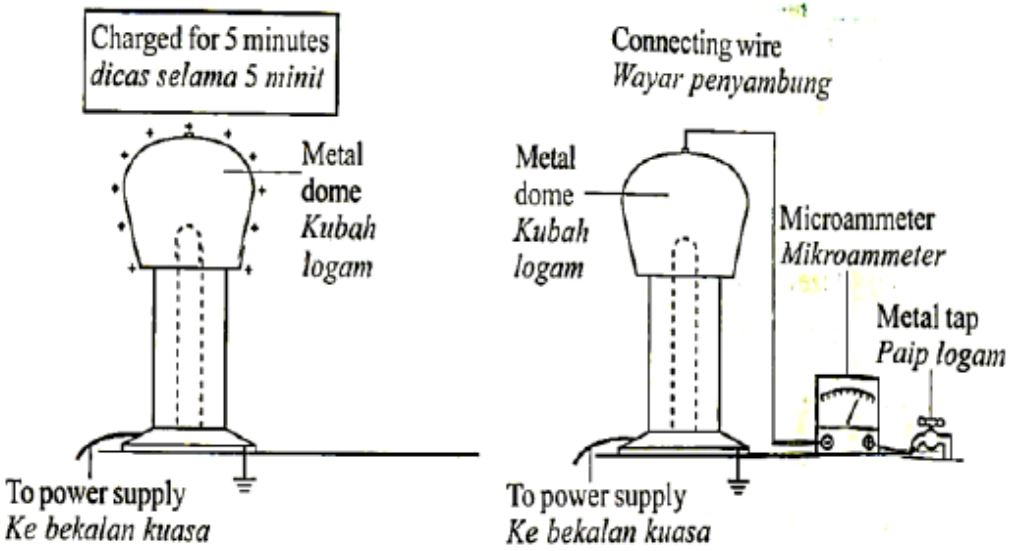


Diagram 10.2(*a*)

Diagram 10.2(*b*)

√1 **The time taken to charge: 10.2 > 10.1**
masa diambil untuk mengecas: 10.2 > 10.1

√2 **The quantity of charge: 10.2a > 10.1a**
kuantiti cas dihasilkan : 10.2a > 10.1a

√3 **The angle of deflection of the micrometer pointer :10.2(b) > 10.1(b)**
sudut pesongan penunjuk mikroammter: 10.2(b) > 10.1(b)

(ii) **State the relationship between:**
Nyatakan hubungan antara:

The time taken to charge the Van de Graaff generator and the quantity of charge produced on the dome.
Masa yang diambil untuk mengecas janakuasa Van de Graaff dengan kuantiti cas yang dihasilkan pada kubah.

[1 mark]

The quantity of charge produced on the dome and the current produced.
Kuantiti cas yang dihasilkan pada kubah dengan arus yang terhasil.

[1 mark]

√4 Time increase, charge increase // time α charge // Q α t
/ masa bertambah, cas bertambah

√5 charge increase, current increase
cas bertambah, arus bertambah

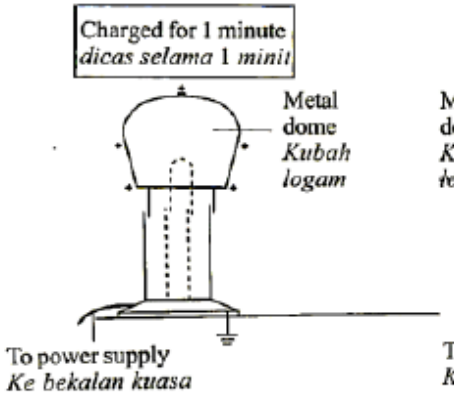


Diagram 10.1(*a*)
Rajah 10.1(*a*)

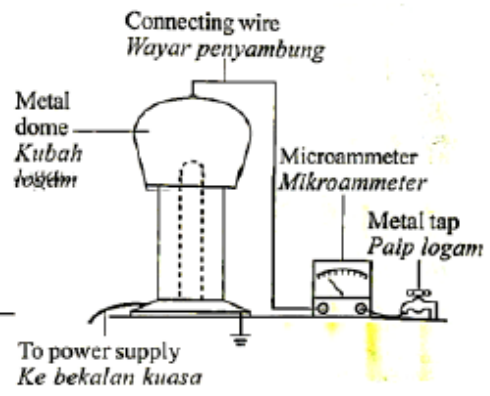


Diagram 1(*b*)
Rajah 1(*b*)

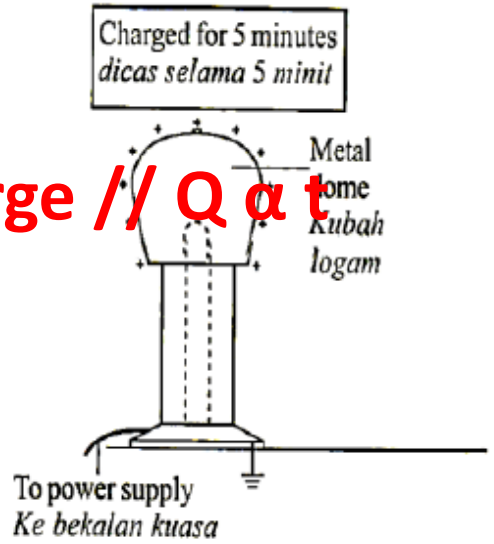


Diagram 10.2(*a*)

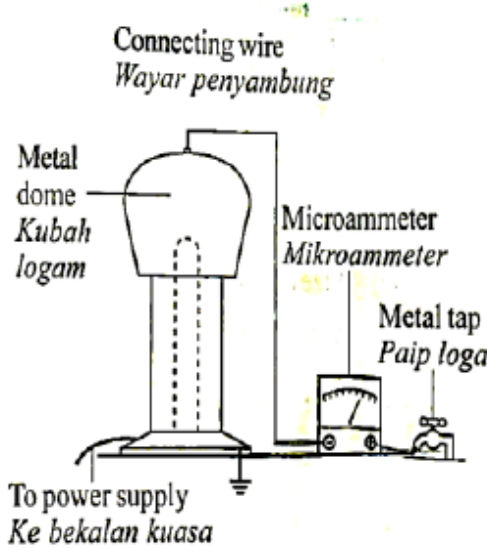


Diagram 10.2(*b*)

(c) **Diagram 10.3 shows a filament lamp. Explain why the filament in coiled shape produces more light.**
Rajah 10.3 menunjukkan sebuah lampu berfilamen. Terangkan mengapa filamen dalam bentuk yang bergelung menghasilkan lebih cahaya.

[4 marks]

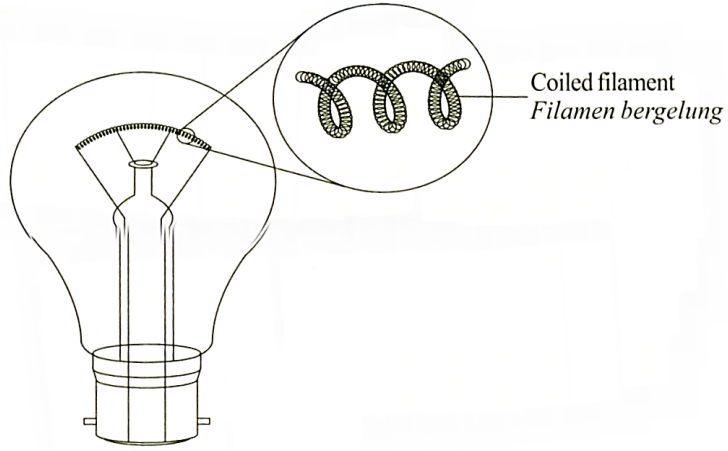


Diagram 10.3
Rajah 10.3

√1 Length high / long / panjang

√2 high resistance / rintangan tinggi

√3 (produce / release) heat /energy / power //
bebaskan haba / tenaga $E = I^2Rt / (V^2/R)t$ // $P = I^2R$ / $P = (V^2/R)$

√4 heat to light // Electric → light // Electrical → light //
heat → light / haba ke cahaya / elektrik → haba → cahaya

(d) **Diagram 10.4 shows the design of a wire-wrapped variable resistor made by a student to control the amount of current flowing through a circuit. The resistance of the variable resistor can be varied to a maximum of 10 Ω.**

Rajah 10.4 menunjukkan reka bentuk sebuah perintang boleh laras lilitan dawai yang dibuat oleh seorang murid untuk mengawal jumlah arus melalui suatu litar. Rintangan perintang boleh laras ini boleh diubah sehingga nilai maksimum 10 Ω.

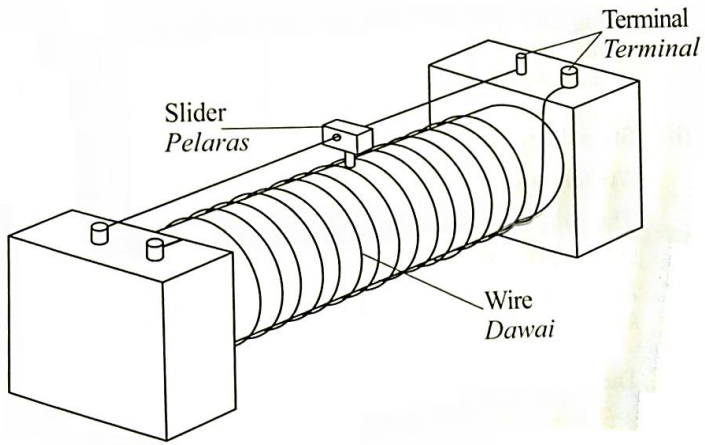


Diagram 10.4
Rajah 10.4

You are required to modify the design in Diagram 10.4 so that the maximum resistance is greater than 10 Ω. State and explain the modification based on following aspects:

Anda dikehendaki untuk mengubahsuai reka bentuk dalam Rajah 10.4 supaya rintangan maksimum lebih besar dari 10 Ω. Nyata dan terangkan pengubahsuaian berdasarkan aspek-aspek berikut:

(i) Cross-sectional area of wire used.
Luas keratan rentas dawai yang digunakan.

(ii) Length of wire used. *l*
Panjang dawai yang digunakan.

(iii) Number of turns of the wire
Bilangan lilitan dawai

(iv) Conductivity of the slider
Kekonduksian pelaras

(v) Type of wire used.
Jenis dawai yang digunakan.

[10 marks]

Small cross sectional area
Luas keratan rentas kecil

High resistance / rintangan tinggi

Longer wire / Wayar panjang

High resistance / rintangan tinggi

Higher number of turns of wire / bilangan lilitan dawai banyak

increase resistance
Tambah rintangan

High conductivity of the slider
Kekonduksian pelaras tinggi

To allow current flow from the terminal to the coil / arus boleh mengalir dari terminal ke gegelung

Brass / nichrome / nikrom

High resistance / rintangan tinggi

Section C - 2003

10. **Figure (a) and Figure (b) show photographs for two circuit. Each circuit contains four identical bulbs connected to four identical new dry cells.**
Rajah (a) dan Rajah (b) menunjukkan fotograf untuk dua litar. Setiap litar mengandungi empat mentol yang serupa yang disambungkan kepada empat bateri baru yang serupa.

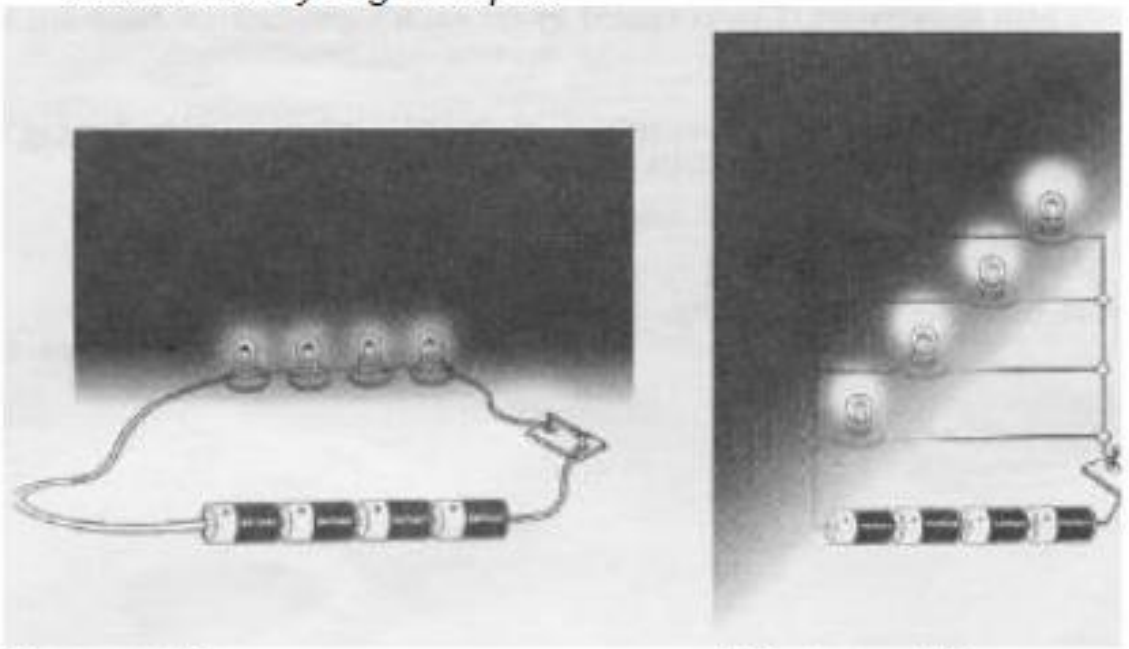


Figure 16

Figure (a)

Figure 17

Figure (b)

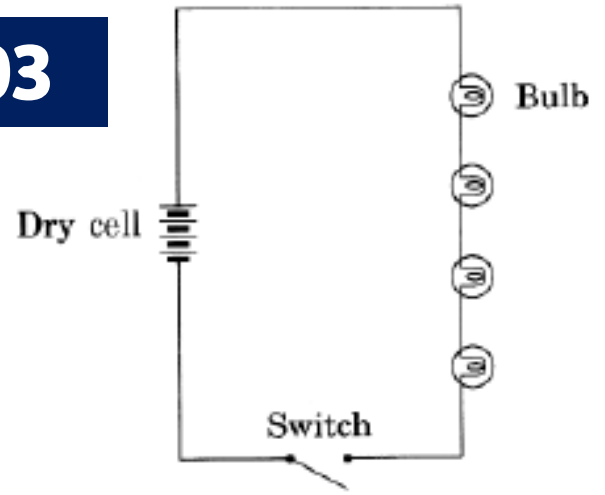
(a)(i) State the energy transformations that take place in the bulb.
Nyatakan perubahan tenaga yang berlaku dalam mentol.

Tenaga elektrik → cahaya + haba

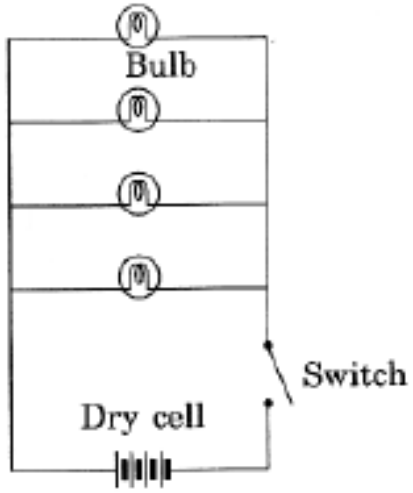
Electric energy → light + heat

c) Draw a circuit diagram for each photograph.
Lukis litar untuk setiap fotograf.

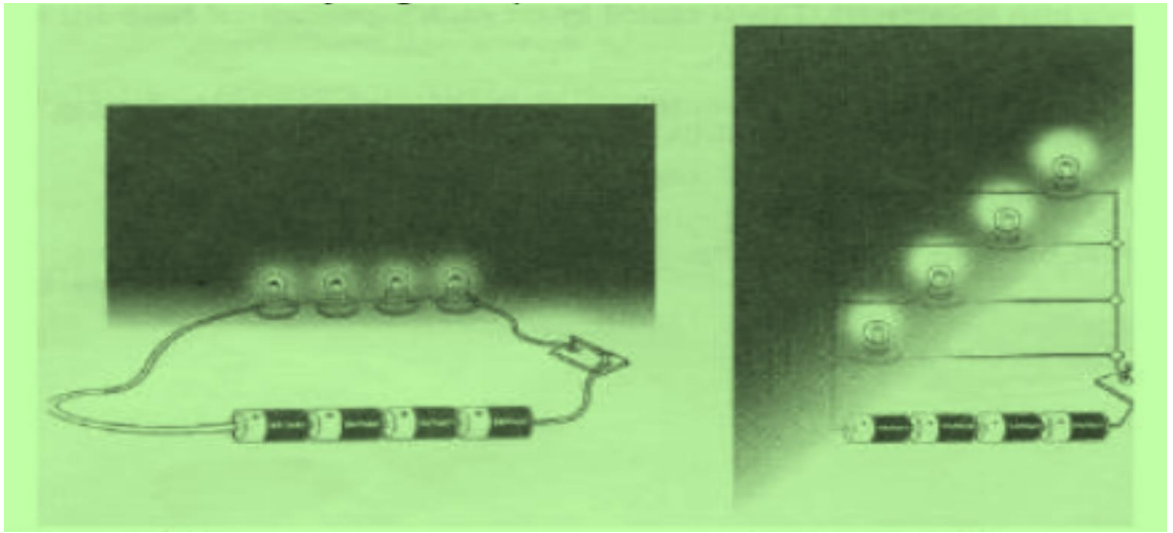
(ii) circuit



For Figure 17:



(c) **Observe the photographs in Figure (a) and Figure (b) to deduce a concept in physics with regard to the potential difference and the current flow for the bulbs in series and parallel circuits.**
Perhatikan fotograf dalam Rajah (a) dan Rajah (b) untuk mendeduksikan satu konsep fizik yang berkaitan dengan beza keupayaan dan arus yang mengalir melalui mentol dalam litar sesiri dan selari.
[5 markah]



Mentol dalam Rajah 17 menyala lebih cerah
Light bulbs in Diagram 17 is brighter

Semua mentol dalam kedua-dua litar menyala sama cerah.
All the bulbs in both circuits have the same brightness

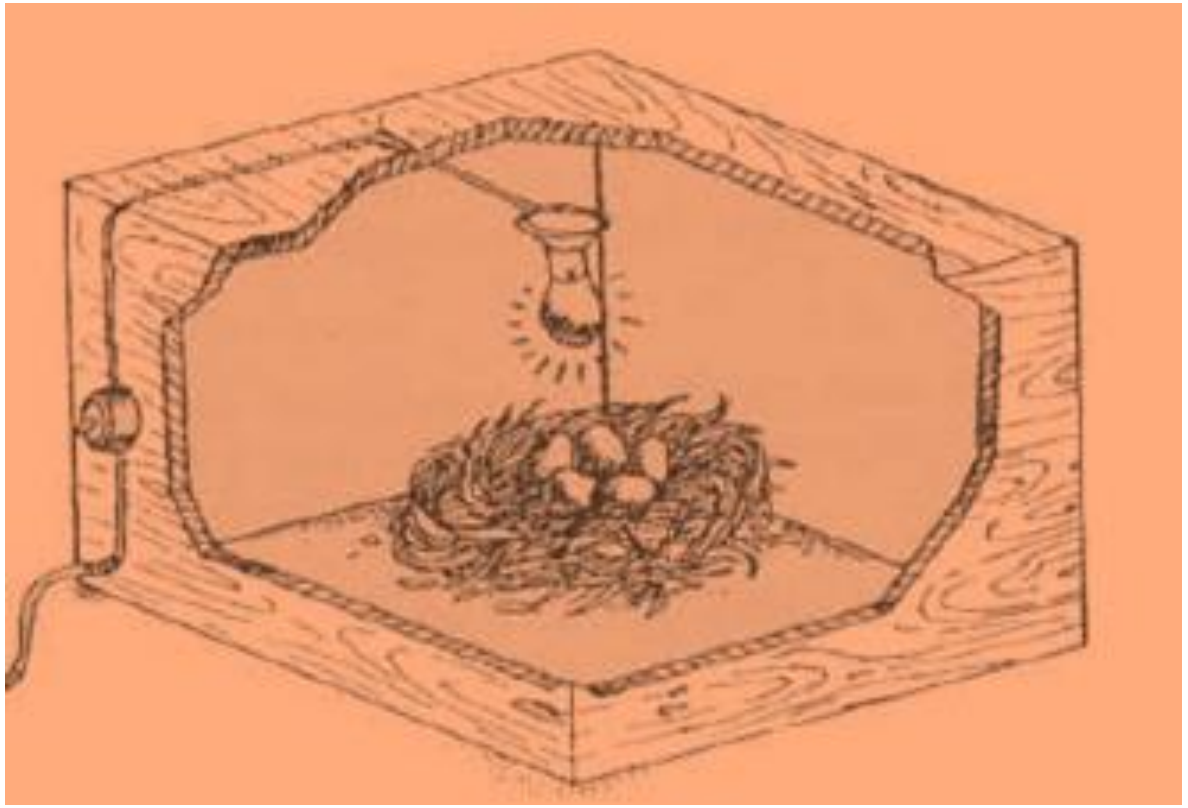
Litar sesiri / *Series circuit*
$V = V_1 + V_2 + V_3 + V_4$

Litar selari / *Parallel circuit*
$V = V_1 = V_2 = V_3 = V_4$

Litar sesiri / *Series circuit*
$I = I_1 = I_2 = I_3 = I_4$

Litar selari / *Parallel circuit*
$I = I_1 + I_2 + I_3 + I_4$

(d) **Figure 18 shows a model of an incubator used to hatch eggs. The temperature in the incubator must be maintained around 39 ° C. Every part of the eggs must receive uniform heat. The eggs are hatched in about 20 days.**
Rajah 18 menunjukkan satu model sebuah inkubator yang digunakan untuk menetaskan telur. Suhu dalam inkubator mesti ditetapkan sekitar 39 ºC. Setiap bahagian telur mesti menerima haba yang sekata. Telus ditetaskan dalam 20 hari.



Using an appropriate concept in physics , explain the modification required to the above incubator so as to efficiently hatch about 200 eggs.
Dengan menggunakan konsep fizik, terangkan pengubahsuaian yang diperlukan oleh incubator di atas supaya dapat menetaskan 200 telur dengan berkesan.

[10 *marks*]

Modification / pengubahsuaian	Sebab / reason
Guna kipas *Use fan*	Pastikan setiap telur dapat haba sama *To ensure every egg receive uniform heat*
Guna thermometer/ termostat *Use thermometer / thermostat*	Untuk mengawal suhu *To control the temperature*
Guna penebat haba/balut telur *Use heat insulator/wrap the egg*	Elak hilang haba *Prevent heat lost*
Bahan berkilat/perak/cermin *Shiny / silver material / mirror*	Boleh pantul haba *Can reflect heat*
Susun mentol dalam litar selari *Bulb arrange in parallel circuit*	Haba dibekalkan berterusan wpun satu bulb rosak/ *Heat can be provided continuously even if one bulb burned out*
Susun telur di rak bertingkat *Arrange the egg in multi storey racks.*	Boleh menampung 200 telur. *Can accommodate 200 eggs.*

Section C - 2014

Question 10 Section B

Diagram 10.1 and Diagram 10.2 shows two electrical circuits. The ammeter, voltmeter and dry cells are identical in both diagrams.

Rajah 10.1 dan Rajah 10.2 menunjukkan dua litar elektrik. Ammeter, voltmeter dan sel kering adalah sama dalam kedua-dua rajah.

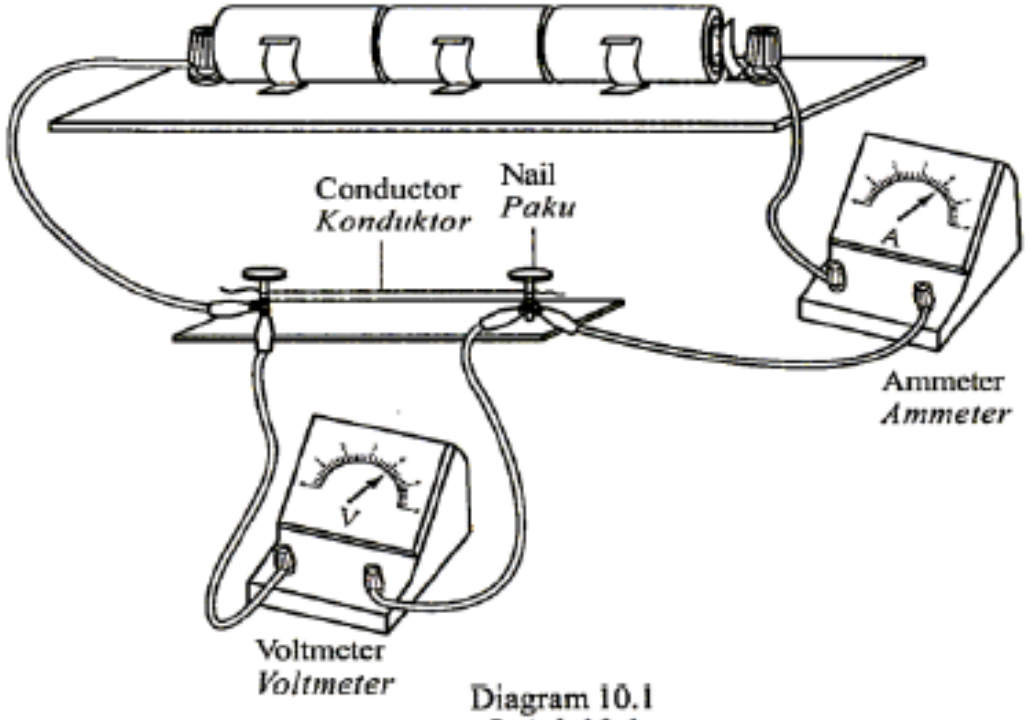


Diagram 10.1
Rajah 10.1

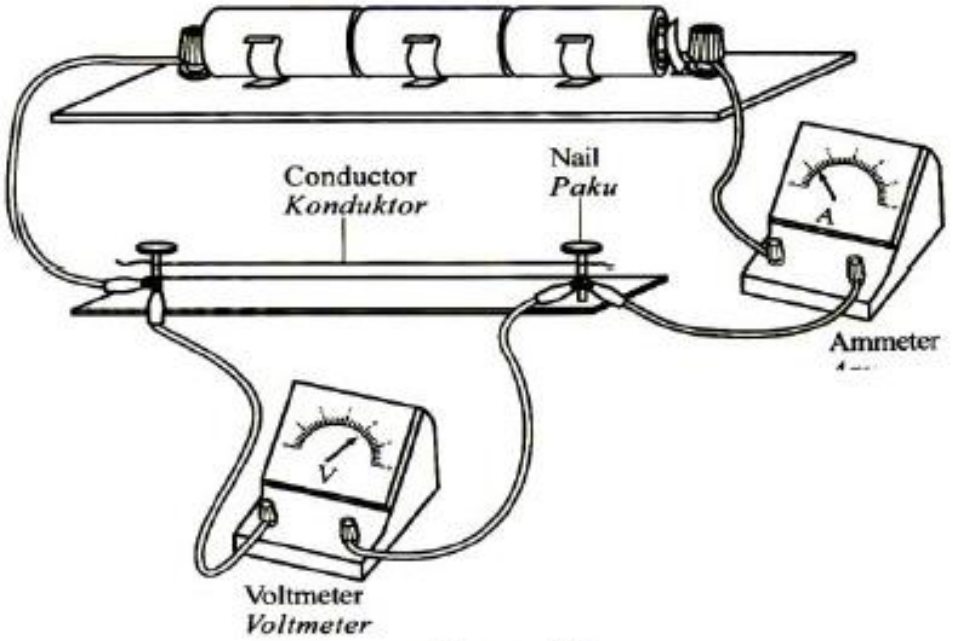


Diagram 10.2
Rajah 10.2

(a) **State the physical quantity measured by ammeter.** **[1 mark]**
Nyatakan kuantiti fizik yang diukur oleh ammeter.

(b) **By using Diagram 10.1 and 10.2,**
Dengan menggunakan Rajah 10.1 dan Rajah 10.2,

i. **Compare the length o the conductor, the reading of ammeter and the reading of voltmeter.** **[3 marks]**
Bandingkan panjang konduktor, bacaan ammeter dan bacaan voltmeter.

Length of the conductor 10.2 > 10.1

Panjang konduktor 10.2 > 10.1

The ammeter reading 10.2 < 10.1

Bacaan ammeter 10.2 < 10.1

Voltmeter reading 10.2 = 10.1

Bacaan voltmeter 10.2 = 10.1

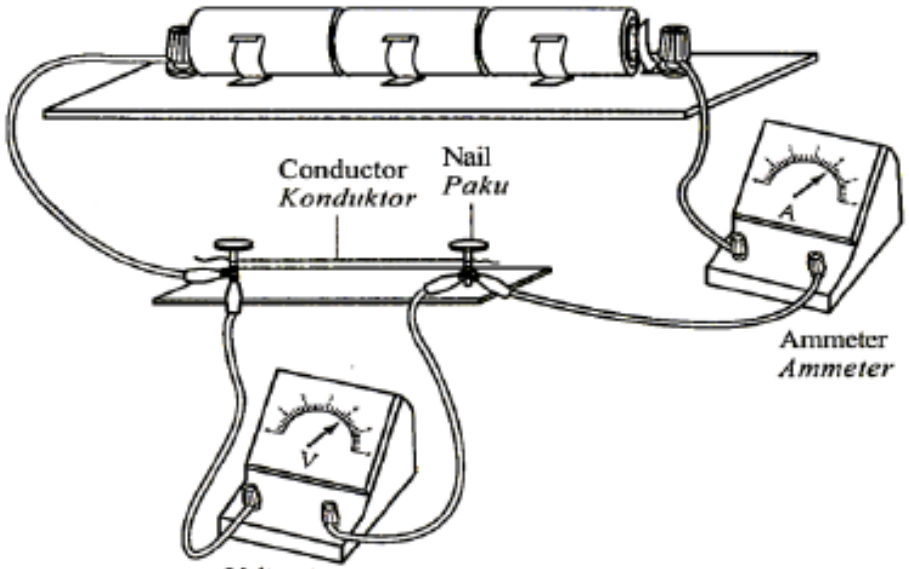


Diagram 10.1
Rajah 10.1

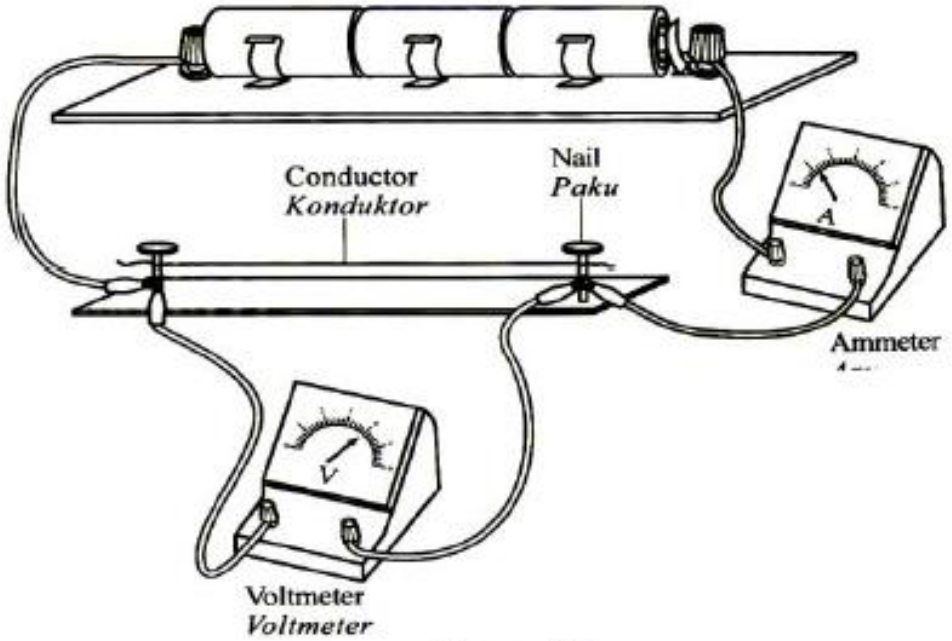


Diagram 10.2
Rajah 10.2

ii. **Relate the length of the conductor with the resistance of the conductor.**
Hubungkaitkan panjang konduktor dengan rintangan konduktor itu.

[3 marks]

Length of conductor is directly proportional to the resistance of the conductor

Panjang konduktor berkadar terus dengan rintangan konduktor.

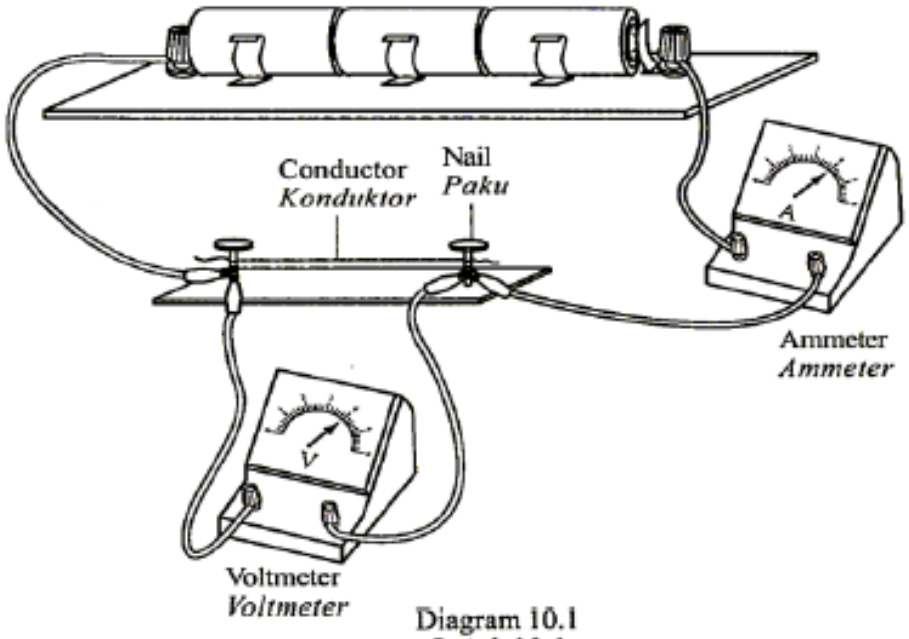


Diagram 10.1
Rajah 10.1

iii. **Relate the length of the conductor with the reading of the ammeter.**
Hubungkaitkan panjang konduktor dengan rintangan konduktor itu.

[1 mark]

Length of conductor is inversely proportional to the reading of the ammeter

Panjang konduktor berkadar songsang dengan bacaan ammeter.

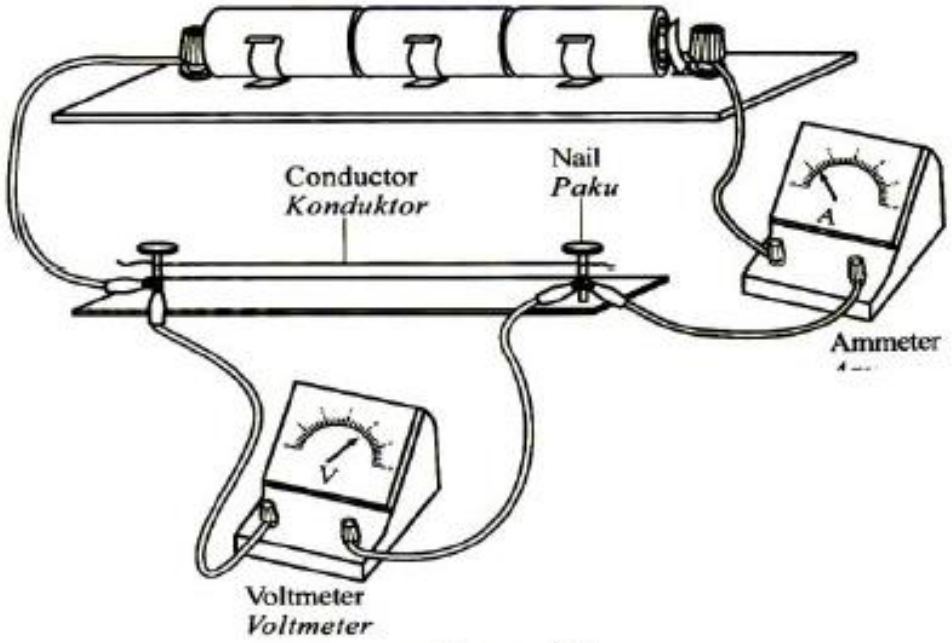


Diagram 10.2
Rajah 10.2

iv. **Deduce a relationship between resistance of the conductor with current flows in the circuit.**
Deduksikan hubungan antara rintangan bagi konduktor dengan arus yang mengalir dalam luar.

[1 mark]

Resistance of the conductor is inversely proportional with current flows

Rintangan berkadar songsang dengan arus.

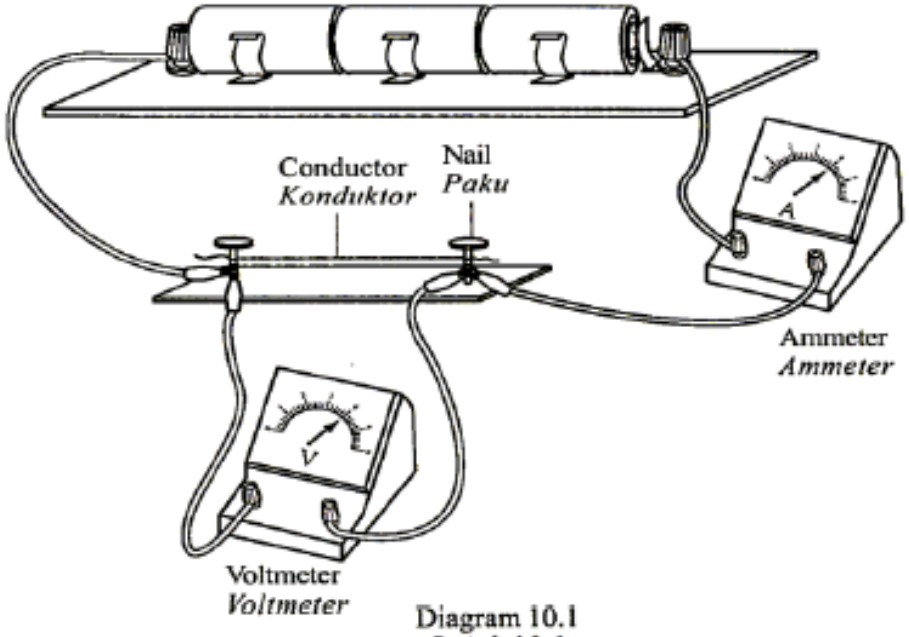


Diagram 10.1
Rajah 10.1

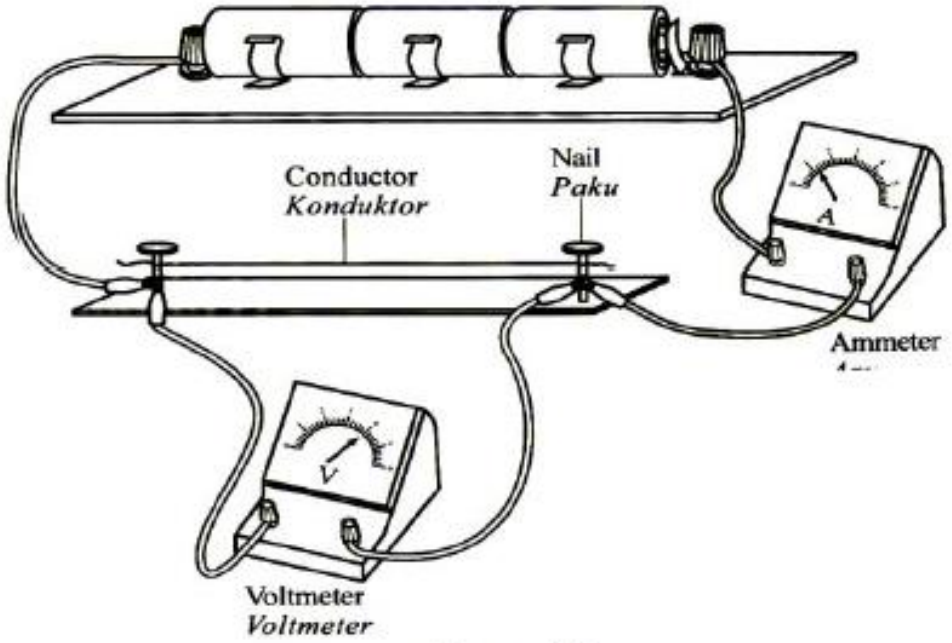
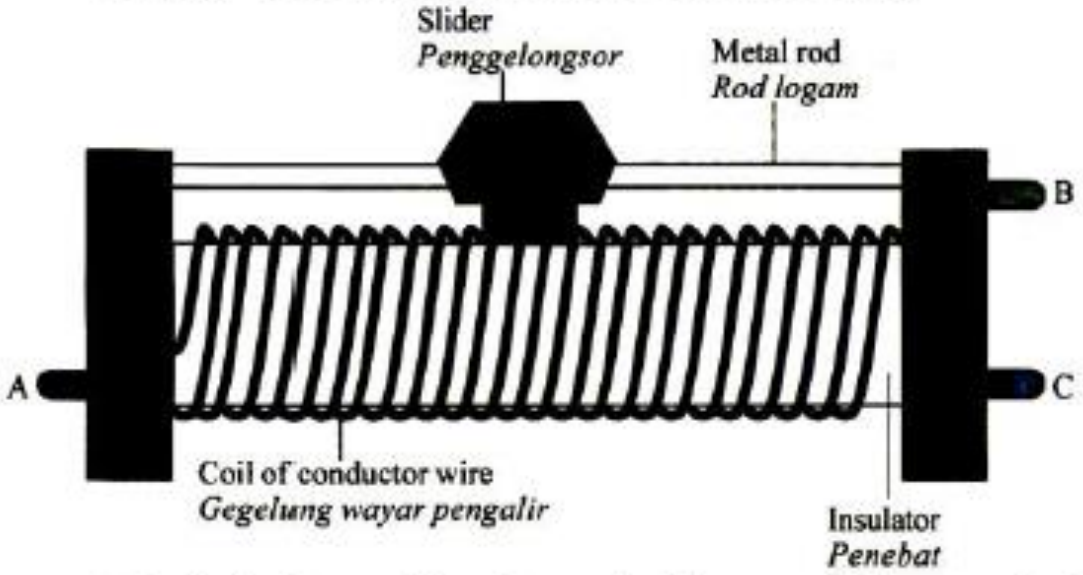


Diagram 10.2
Rajah 10.2

(c) **Diagram 10.3 shows a rheostat.**
Rajah 10.3 menunjukkan satu reostat.

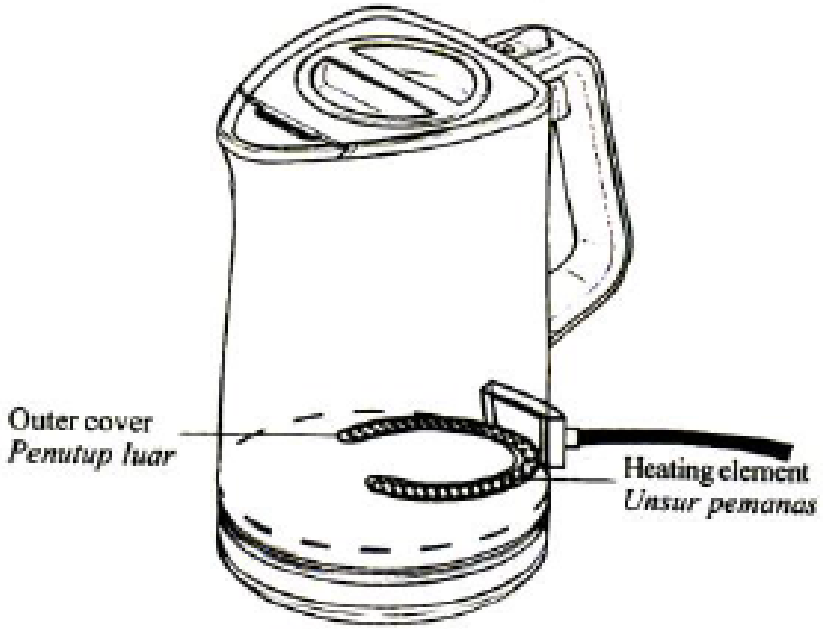


Explain how the rheostat is used to control the current flows in an electric circuit.
Terangkan bagaimana reostat itu digunakan untuk mengawal aliran arus dalam litar elektrtik.

[3 marks]

- **Connect terminal A and B**
  Sambungkan terminal A dan B
- **Move / push the slider**
  Gerakkan atau tolak penggelongsor
- **Resistance varies with length. The longer the length, the higher the resistance and the lower the current.**
  rintangan berubah dengan panjang. Semakin panjang wayar, semakin bertambah rintang dan semakin kecil arus.

(d) **Diagram 10.4 shows a heating element used to boil the water in an electric kettle.**
Rajah 10.4 menunjukkan satu unsur pemanas yang digunakan untuk mendidihkan air sebuah cerek elektrik.



You are required to modify the electic kettle so that is can boil the water faster, easy to carry and safer.
Anda dikehendaki untuk mengubahsuai cerek elektrik itu supaya ia dapat mendidihkan air dengan lebih cepat, senang dibawa dan lebih selamat.

State and explain the modifications based on the following aspects:
Nyata dan terangkan pengubahsuaian berdasarkan aspek berikut:

(i) **The number o turns of the coil of the heating element.**
Bilangan lilitan pada gegelung unsur pemanas tersebut.

(ii) **The density of material of the heating element.**
Ketumpatan bahan bagi unsur pemanas tersebut.

(iii) **The rate of oxidation of the heating element.**
Kadar pengoksidaan bagi unsur pemanas tersebut.

(iv) **The diameter of the wire of the coil**
Diameter wayar bagi gegelung.

(v) **The type of material used as heating element.**
Jenis bahan yang digunakan sebagai unsur pemanas tersebut.

[10 marks]

Characteristics	reason
Increase the number of turns of coil *Tambah bilangan lilitan gegelung*	Increase the length / high resistance *Tambah panjang / rintangan tinggi*
Material has low density *Bahan berketumpatan rendah.*	Lighter / *ringan*
Rate of oxidation is lower *Kadar pengoksidaan rendah*	Difficult to oxidised / water does not pollute /*susah untuk dioksida / air tidak tercemar*
Smaller Diamter of wire of the coil *diameter wayar kecil*	High resistance *Rintangan tinggi*
Material heating element: Tungstein / nikrom / *bahan unsur pemanas: tungstein*	High resistance / *Rintangan tinggi*