

NAMA: .....

TINGKATAN: .....



**MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM)  
NEGERI PERAK**

**MODUL KECEMERLANGAN SPM 2024  
SET 1**

**KIMIA  
KERTAS 2  
2 JAM 30 MINIT**

**JANGAN BUKA KERTAS PEPERIKSAAN INI SEHINGGA DIBERITAHU**

**ARAHAN:**

1. Kertas soalan ini mengandungi tiga bahagian : **Bahagian A**, **Bahagian B** dan **Bahagian C**.
2. Jawab **semua** soalan daripada **Bahagian A**, pilih **satu** soalan daripada **Bahagian B** dan jawab **semua** soalan daripada **Bahagian C**
3. Jawapan hendaklah ditulis dalam kertas jawapan yang disediakan
4. Markah yang diperuntukkan bagi setiap soalan atau ceraihan soalan ditunjukkan dalam kurungan
5. Penggunaan kalkulator saintifik yang tidak boleh diprogramkan adalah dibenarkan

KEGUNAAN PEMERIKSA			
Bahagian	Soalan	Markah Penuh	Markah Diperoleh
A	1	5	
	2	5	
	3	6	
	4	7	
	5	8	
	6	9	
	7	10	
	8	10	
B	9	20	
	10	20	
C	11	20	
<b>JUMLAH</b>		<b>100</b>	

**Kertas ini mengandungi 25 halaman bercetak**

**Bahagian A**

[60 markah]

Jawab semua soalan.

- 1 Jadual 1 menunjukkan dua jenis kosmetik M dan N yang digunakan secara meluas oleh pengguna.

*Table 1 shows two types of cosmetics M and N which are widely used by consumers.*

Jenis kosmetik <i>Type of cosmetics</i>	Kegunaan <i>Use</i>
M	Sebagai pelembap kulit dan masker muka. <i>As skin moisturisers and facial masks.</i>
N	Sebagai deodoran dan minyak wangi. <i>As deodorants and perfumes.</i>

Jadual / Table 1

- (a) Apakah yang dimaksudkan dengan kosmetik?  
*What is meant by cosmetics?*

.....  
[1 markah / mark]

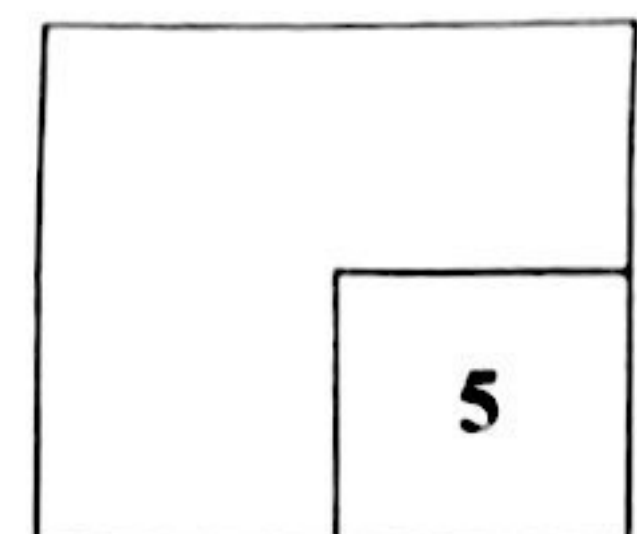
- (b) Berdasarkan Jadual 1, kenal pasti jenis kosmetik M dan N.  
*Based on Table 1, identify type of cosmetics M and N.*

M: .....

N: .....  
[2 markah / marks]

- (c) Terangkan mengapa nanoteknologi digunakan secara meluas dalam pembuatan bahan kosmetik.  
*Explain why nanotechnology is widely used in the manufacturing of cosmetics.*

.....  
.....  
[2 markah / marks]



- 2 Jadual 2 menunjukkan beberapa sifat fizik bagi unsur Kumpulan 17 dalam Jadual Berkala Unsur.

*Table 2 shows some physical properties of Group 17 elements in the Periodic Table of Elements.*

Unsur <i>Element</i>	Takat lebur (°C) <i>Melting point (°C)</i>	Takat didih (°C) <i>Boiling point (°C)</i>	Jejari atom (nm) <i>Atomic radius (nm)</i>
Klorin, Cl	-101	-34	0.099
Bromin, Br	-7	59	0.114
Iodin, I	114	184	0.133

Jadual / Table 2

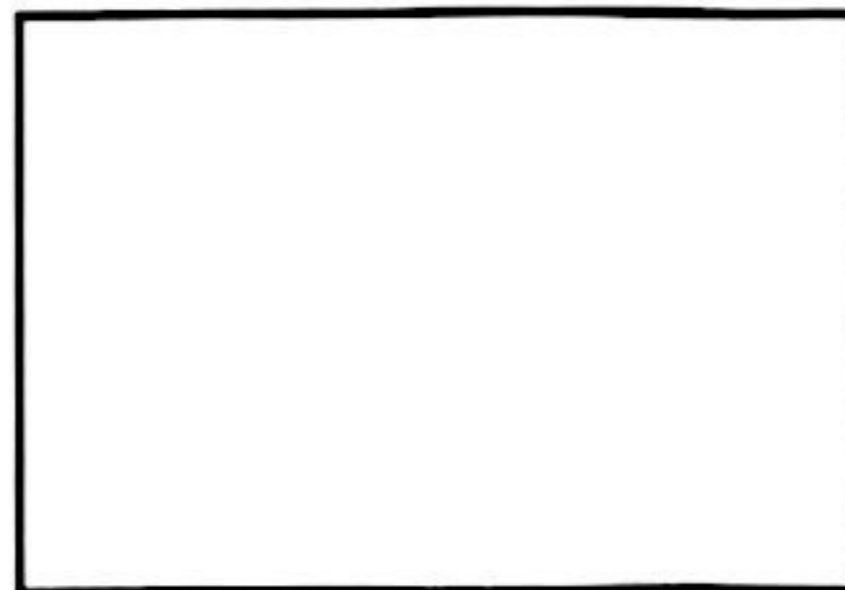
- (a) Nyatakan nama lain bagi unsur Kumpulan 17.  
*State the other name for Group 17 elements.*

.....  
[1 markah / mark]

- (b) Nyatakan perubahan jejari atom apabila menuruni Kumpulan 17. Terangkan.  
*State the change in atomic radius when going down Group 17. Explain.*

.....  
.....  
[2 markah / marks]

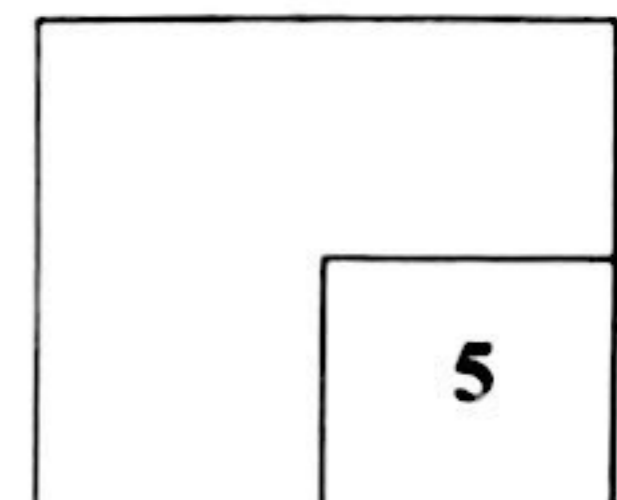
- (c) Lukiskan susunan zarah bagi bromin pada suhu bilik.  
*Draw the arrangement of particles for bromine at room temperature.*



[1 markah / mark]

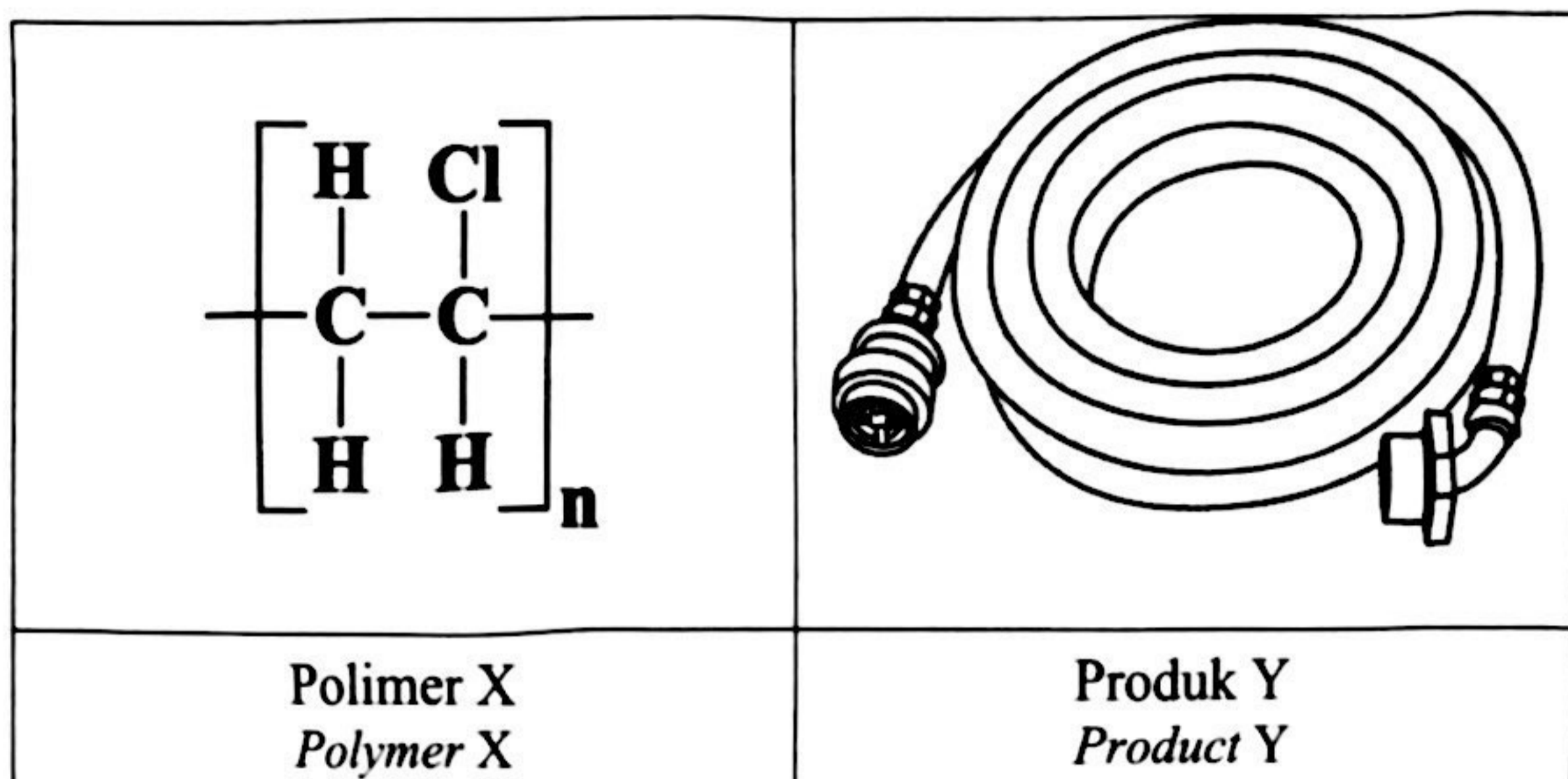
- (d) Nyatakan **satu** langkah keselamatan yang harus diamalkan apabila mengendalikan klorin dan bromin di makmal.  
*State **one** safety step that should be practised when handling chlorine and bromine in the laboratory.*

.....  
[1 markah / mark]



- 3 (a) Rajah 1 menunjukkan formula struktur polimer X yang digunakan untuk menghasilkan produk Y.

*Diagram 1 shows the structural formula of polymer X which is used to make product Y.*



Rajah / Diagram 1

- (i) Apakah maksud polimer?  
*What is the meaning of polymer?*

.....  
[1 markah / mark]

- (ii) Lukis formula struktur bagi monomer yang membentuk polimer X.  
*Draw the structural formula of the monomer that forms polymer X.*

[1 markah / mark]

- (b) Jadual 3 menunjukkan dua pemerhatian bagi keadaan lateks apabila ditambah bahan A dan bahan B.

*Table 3 shows two observations for the condition of latex when substances A and substances B are added.*

<b>Bahan Substance</b>	<b>Pemerhatian Observation</b>
A	Menggumpal Coagulates
B	Tidak menggumpal Does not coagulate

Jadual / Table 3

- (i) Namakan bahan yang ditambah ke dalam cecair lateks.

*Name the substances that are added to the liquid latex.*

Bahan A : .....  
Substance A

Bahan B : .....  
Substance B

[2 markah / marks]

- (ii) Terangkan secara ringkas proses penggumpalan lateks yang berlaku selepas terdedah kepada udara selama beberapa hari.

*Explain briefly the process of coagulation of latex that occurs after the latex is exposed to air for a few days.*

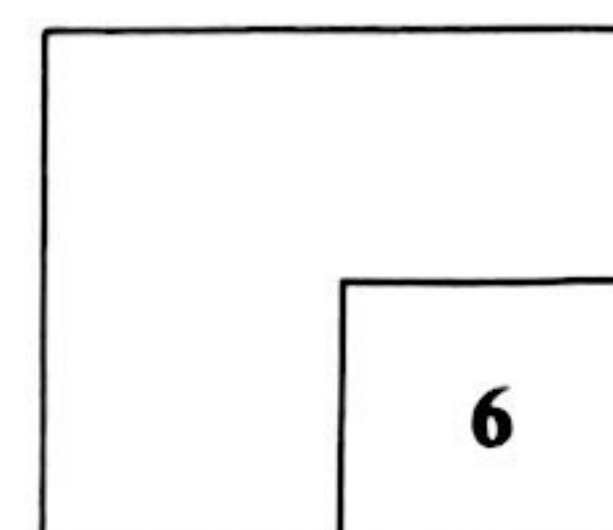
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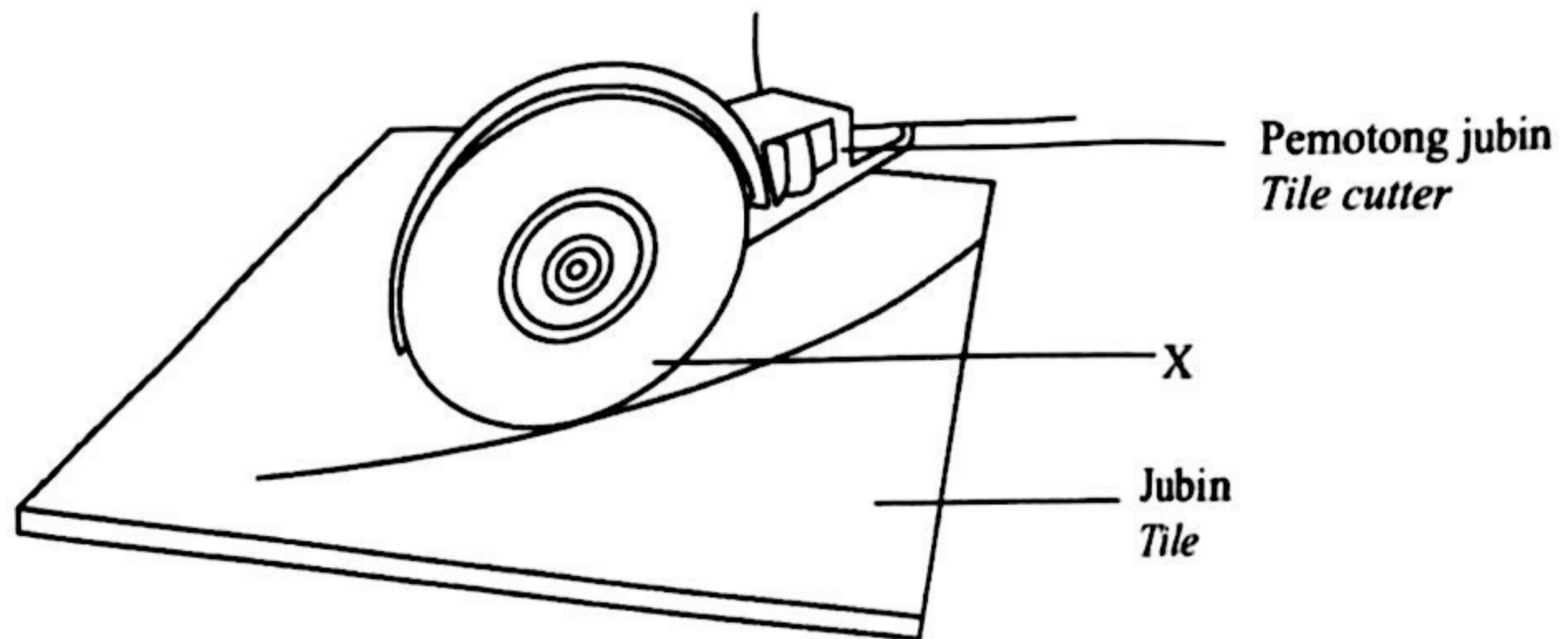
.....

[2 markah / marks]



- 4 (a) Rajah 2.1 menunjukkan satu alat yang lazim digunakan oleh pekerja binaan untuk memotong jubin.

*Diagram 2.1 shows a tool that is normally used by construction worker to cut tiles.*



Rajah / Diagram 2.1

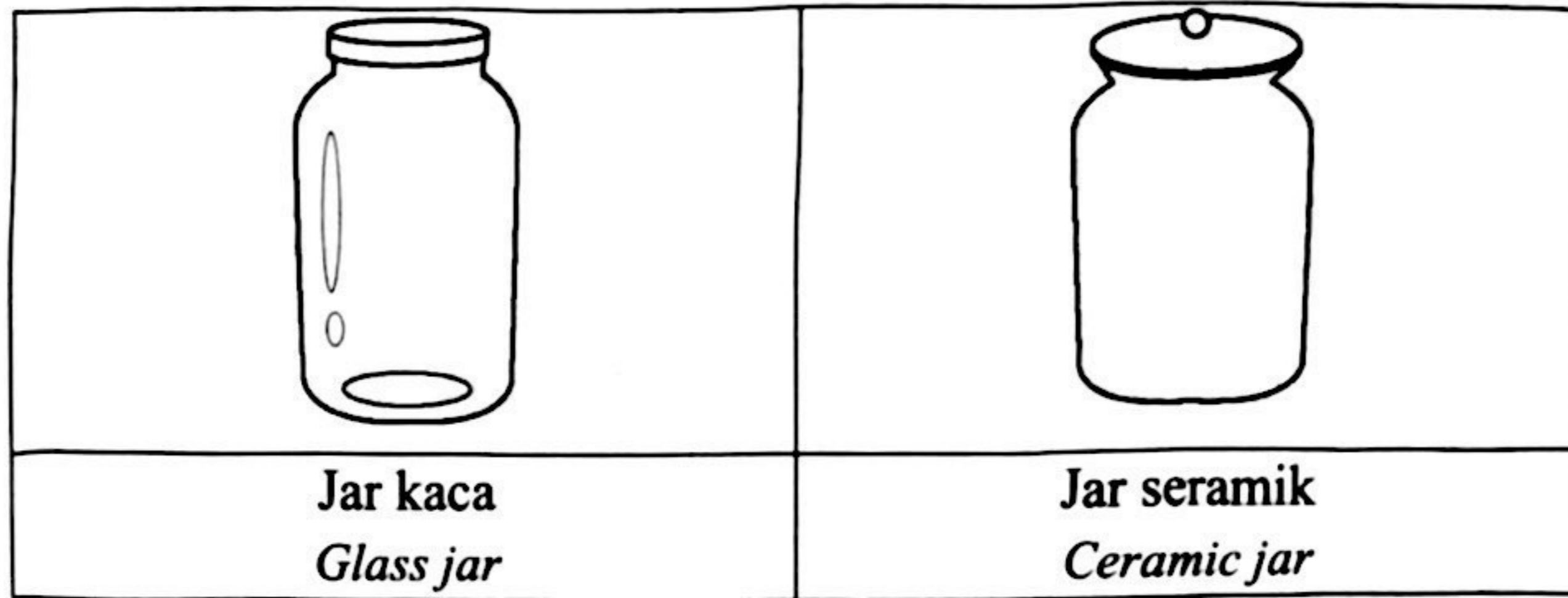
- (i) Nyatakan jenis seramik yang digunakan untuk menghasilkan jubin.  
*State the type of ceramic used to make tiles.*

.....  
 [1 markah / mark]

- (ii) Berdasarkan Rajah 2.1, namakan X dan nyatakan sifat X yang membolehkan ia digunakan untuk memotong jubin.  
*Based on Diagram 2.1, name X and the state the property of X that makes it be used as tiles cutter.*

.....  
 .....  
 [2 markah / marks]

- (b) Maya ingin memilih bekas yang sesuai untuk menyimpan jeruk buah. Rajah 2.2 menunjukkan bekas yang boleh digunakan untuk tujuan itu.  
*Maya wants to choose a suitable container to keep fruit pickles. Diagram 2.2 shows the containers that can be used for that purpose.*



Rajah / Diagram 2.2

- (i) Bekas manakah yang lebih sesuai? Wajarkan jawapan anda.  
*Which container is more suitable? Justify your answer.*

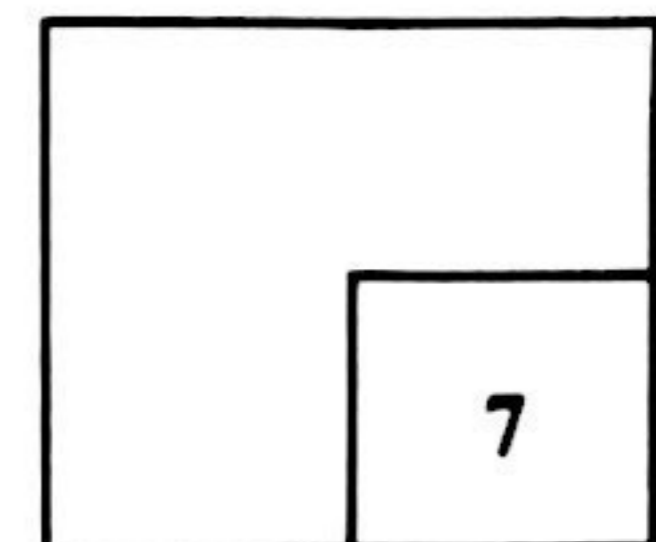
.....  
.....  
.....

[3 markah / marks]

- (ii) Nyatakan **satu** kekurangan bekas tersebut, berdasarkan jawapan anda di 4(b)(i).  
*State one disadvantage of the container, based on your answer in 4(b)(i).*

.....

[1 markah / mark]



- 5 Jadual 4 menunjukkan persamaan bagi dua tindak balas melibatkan oksida logam P dan logam Q. Formula empirik bagi oksida P dan oksida Q ditentukan melalui Kaedah I dan Kaedah II.

*Table 4 shows the equations for two reactions involving oxide of metal P and metal Q. The empirical formulae of P oxide and Q oxide are determined through Method I and Method II.*

<b>Kaedah Method</b>	<b>Persamaan Equation</b>
I	$H_2 + PO \rightarrow P + H_2O$
II	$2Q + O_2 \rightarrow 2QO$

Jadual / Table 4

- (a) Apakah yang dimaksudkan dengan formula empirik?

*What is meant by empirical formula?*

.....  
 .....

[1 markah / mark]

- (b) Cadangkan nama logam Q.

*Suggest name of metal Q.*

.....  
 .....

[1 markah / mark]

- (c) Apabila 4.5 g unsur Q terbakar dengan lengkap menghasilkan 7.5 g oksida Q. Apakah formula empirik bagi oksida logam tersebut?

[Jisim atom relatif : Q = 24, O = 16]

*When 4.5 g of element Q is burnt completely forming 7.5 g of oxide of Q. What is the empirical formula of the metal oxide?*

[Relative atomic mass : Q = 24, O = 16]

[4 markah / marks]



(d) Kaedah yang manakah lebih sesuai digunakan untuk menentukan formula empirik bagi kuprum(II) oksida, CuO? Terangkan.

*Which method is suitable to be used to determine the empirical formula of copper(II) oxide, CuO? Explain.*

.....

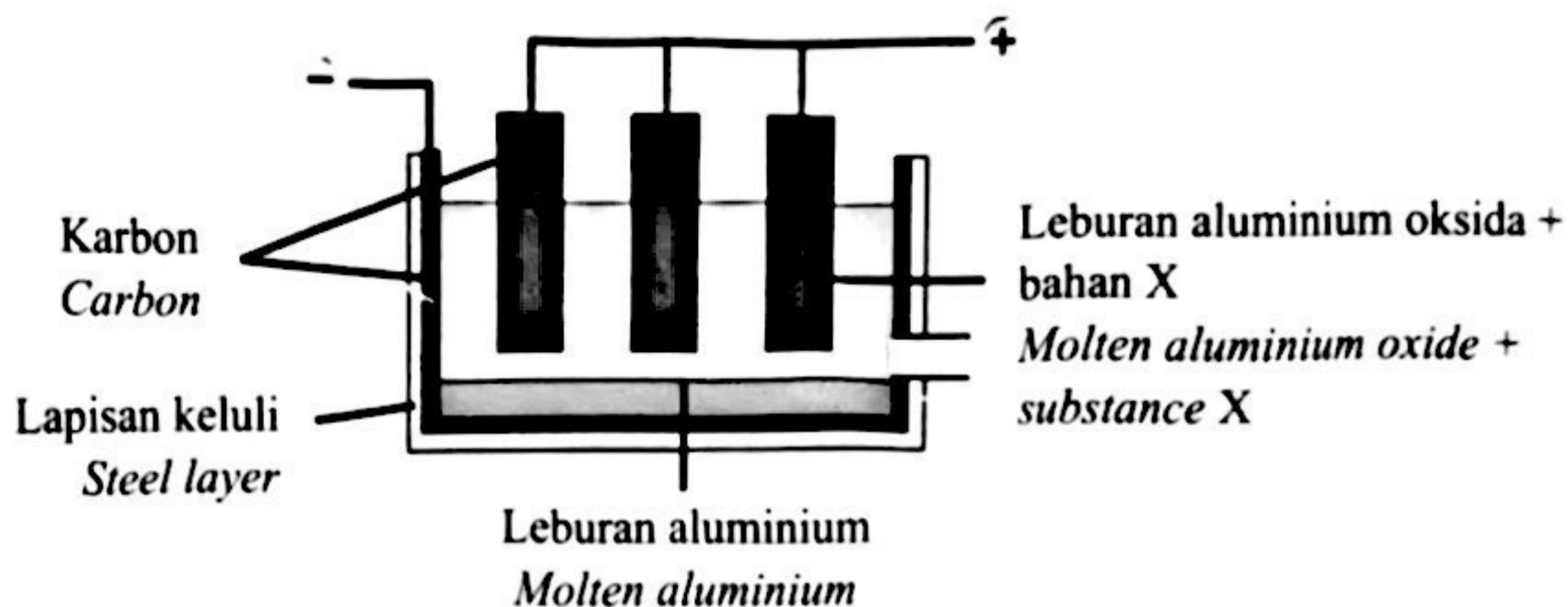
.....

[2 markah / marks]

<b>8</b>
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- 6 (a) Rajah 3 menunjukkan satu model susunan radas untuk pengekstrakan logam dalam industri.

Diagram 3 shows a model of apparatus set-up for the extraction of metal in the industry.



Rajah / Diagram 3

Berdasarkan Rajah 3,  
Based on Diagram 3,

- (i) Namakan proses untuk mengekstrak logam daripada bijihnya.  
Name the process to extract the metal from its ore.

.....  
[1 markah / mark]

- (ii) Bahan X ditambah untuk merendahkan takat lebur aluminium oksida.  
Apakah bahan X?  
Substance X is added to lower the melting point of aluminium oxide. What is substance X?

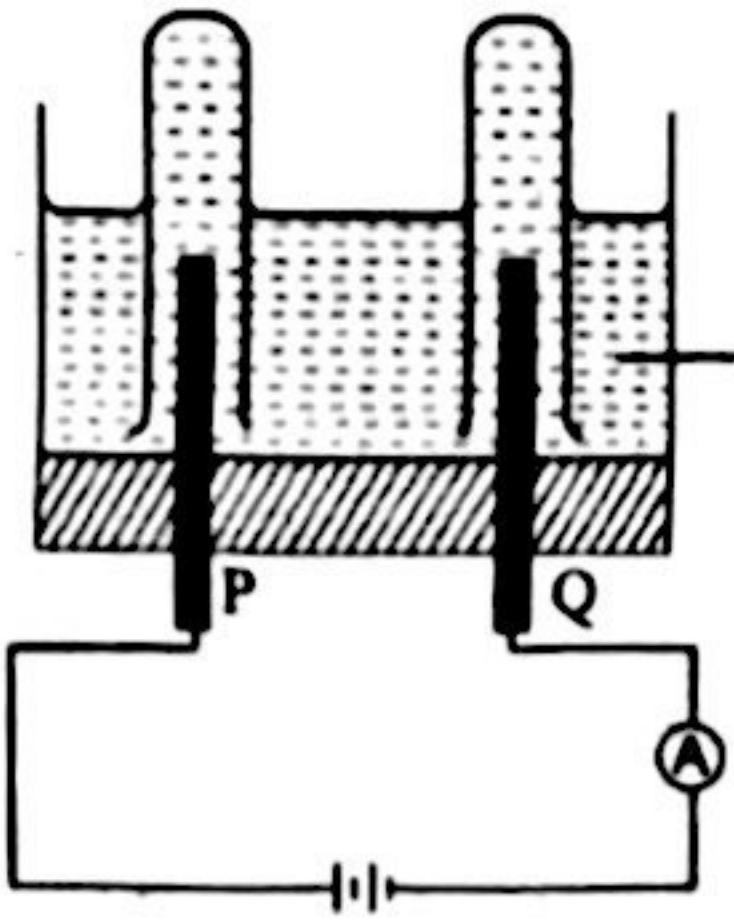
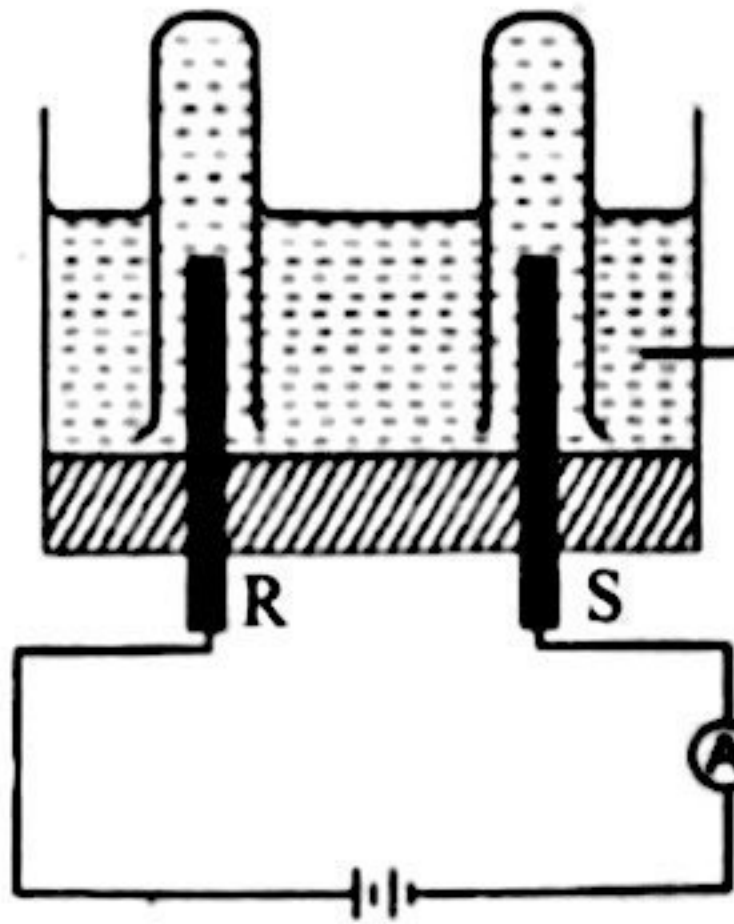
.....  
[1 markah / mark]

- (iii) Nyatakan **satu** kegunaan logam yang diekstrakkan.  
State **one** use of the extracted metal.

.....  
[1 markah / mark]

(b) Rajah 4 menunjukkan susunan radas elektrolisis larutan kalium hidroksida dan larutan kalium klorida dengan menggunakan elektrod karbon.

Diagram 4 shows the apparatus set-up for the electrolysis of potassium hydroxide solution and potassium chloride solution using carbon electrodes.

Sel Cell	Susunan radas Set-up of apparatus
I	 <p>Larutan kalium hidroksida, KOH 1.0 mol dm<sup>-3</sup> 1.0 mol dm<sup>-3</sup> potassium hydroxide, KOH solution</p>
II	 <p>Larutan kalium klorida, KCl 1.0 mol dm<sup>-3</sup> 1.0 mol dm<sup>-3</sup> potassium chloride, KCl solution</p>

Rajah / Diagram 4

Jadual 5 menunjukkan nilai keupayaan elektrod piawai.

Table 5 shows the standard electrode potential value.

Persamaan setengah sel Half-cell equations	Keupayaan elektrod piawai, E <sup>0</sup> /V(298 K) Standard electrode potential, E <sup>0</sup> /V(298 K)
$K^+ + e \rightleftharpoons K$	-2.92
$2H^+ + 2e \rightleftharpoons H_2$	0.00
$O_2 + H_2O + 4e \rightleftharpoons 4OH^-$	+0.40
$Cl_2 + 2e \rightleftharpoons 2Cl^-$	+1.36

Jadual / Table 5

Berdasarkan Rajah 4 dan Jadual 5,  
*Based on Diagram 4 and Table 5,*

- (i) Nyatakan semua kation yang hadir dalam kedua-dua sel elektrolisis.  
*State all the cations that present in both electrolytic cells.*

.....  
[1 markah / mark]

- (ii) Huraikan satu ujian kimia bagi menentusahkan hasil yang terbentuk pada elektrod Q dan S.  
*Describe a chemical test to verify the product formed at electrode Q and S.*

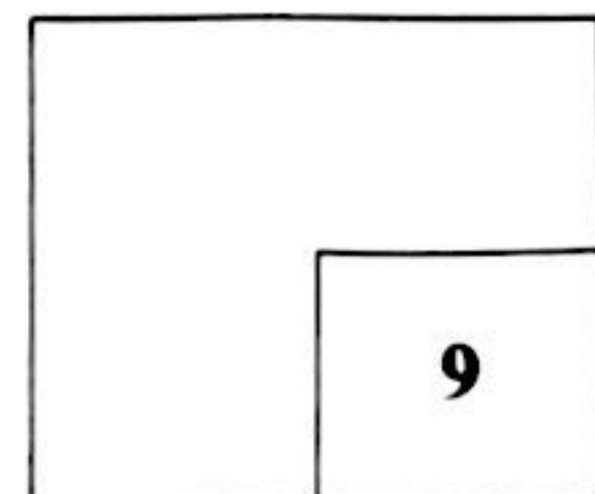
.....  
.....  
.....  
[2 markah / marks]

- (iii) Nyatakan nama hasil yang terbentuk pada elektrod R.  
*State the name of product formed at electrode R.*

.....  
[1 markah / mark]

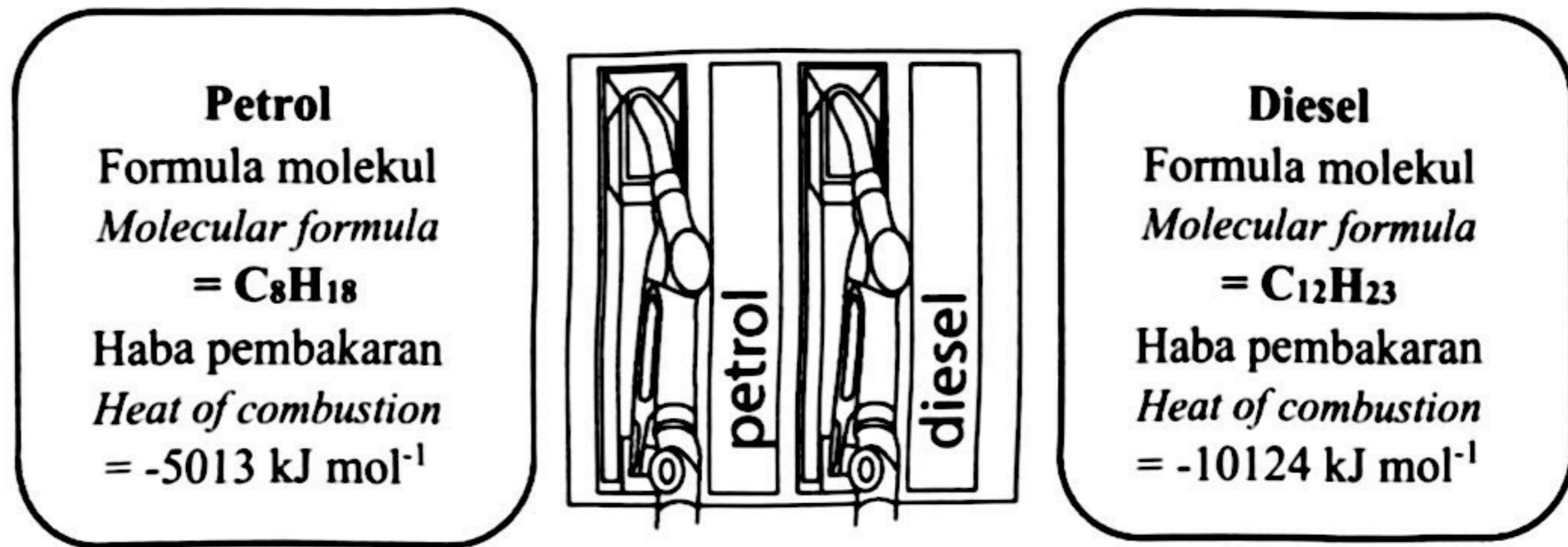
- (iv) Terangkan jawapan anda di 6(b)(iii).  
*Explain your answer in 6(b)(iii).*

.....  
.....  
.....  
[2 markah / marks]



- 7 (a) Rajah 5 menunjukkan dua bahan api yang berlainan yang boleh didapati dengan mudah di semua stesen petrol seluruh Malaysia.

*Diagram 5 shows two different fuels that are easily available at all petrol stations throughout Malaysia.*



Rajah / Diagram 5

- (i) Nyatakan maksud haba pembakaran.  
*State the meaning of heat of combustion.*

.....  
.....

[1 markah / mark]

- (ii) Bandingkan haba pembakaran bagi petrol dan diesel.  
*Compare the heat of combustion of petrol and diesel.*

.....  
.....

[1 markah / mark]

- (iii) Vishantan telah mengisi 2.28 liter petrol ke dalam tangki motosikalnya. Hitungkan haba yang terbebas jika petrol terbakar lengkap dalam oksigen berlebihan.  
[Jisim molekul relatif petrol = 114 ; Anggap 1 liter bersamaan 1000 g]  
*Vishantan had filled 2.28 liters of petrol into the tank of his motorcycle. Calculate the heat liberated if petrol burns completely in excess oxygen.*  
[The relative molecular mass of petrol = 114 ; Assume 1 liter equals 1000 g]

[3 markah / marks]

(b) Jadual 6 menunjukkan nilai bahan api bagi beberapa jenis bahan api.

*Table 6 shows the fuel value for several types of fuel.*

Bahan api <i>Fuel</i>	Nilai bahan api (kJ g <sup>-1</sup> ) <i>Fuel value (kJ g<sup>-1</sup>)</i>
Petrol <i>Petrol</i>	34
Metanol <i>Methanol</i>	30
Gas asli <i>Natural gas</i>	50
Gas hidrogen <i>Hydrogen gas</i>	143

Jadual / Table 6

Petrol telah digunakan secara meluas di dalam negara kita. Berdasarkan Jadual 6, pilih bahan api yang sesuai digunakan bagi menggantikan petrol. Wajarkan pilihan anda.

*Petrol has been widely used in our country. Based on Table 6, choose the appropriate fuel to be used to replace petrol. Justify your choice.*

.....

.....

.....

[2 markah / marks]

(c) Daziel dan rakan-rakan telah menyertai satu perkhemahan STEM. Mereka ditugaskan untuk memasak tanpa menggunakan api. Sebagai murid kimia, anda dikehendaki membantu Daziel untuk mereka cipta satu pek panas. Pilih bahan-bahan yang sesuai dan terangkan bagaimana ia berfungsi.

*Daziel and friends have participated in a STEM camp. They were assigned to cook without using fire. As a chemistry student, you are required to help Daziel to create a heat pack. Choose the appropriate ingredients and explain how they work.*

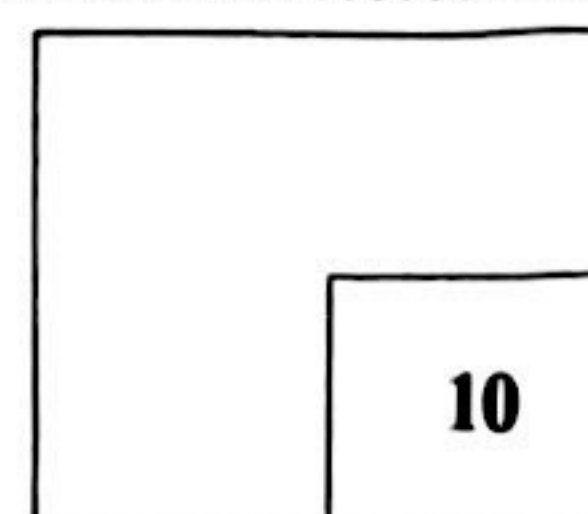
- Pek makanan  
*Food package*
- Air  
*Water*
- Besen  
*Basin*
- Ammonium nitrat  
*Ammonium nitrate*
- Kalsium oksida  
*Calcium oxide*

.....

.....

.....

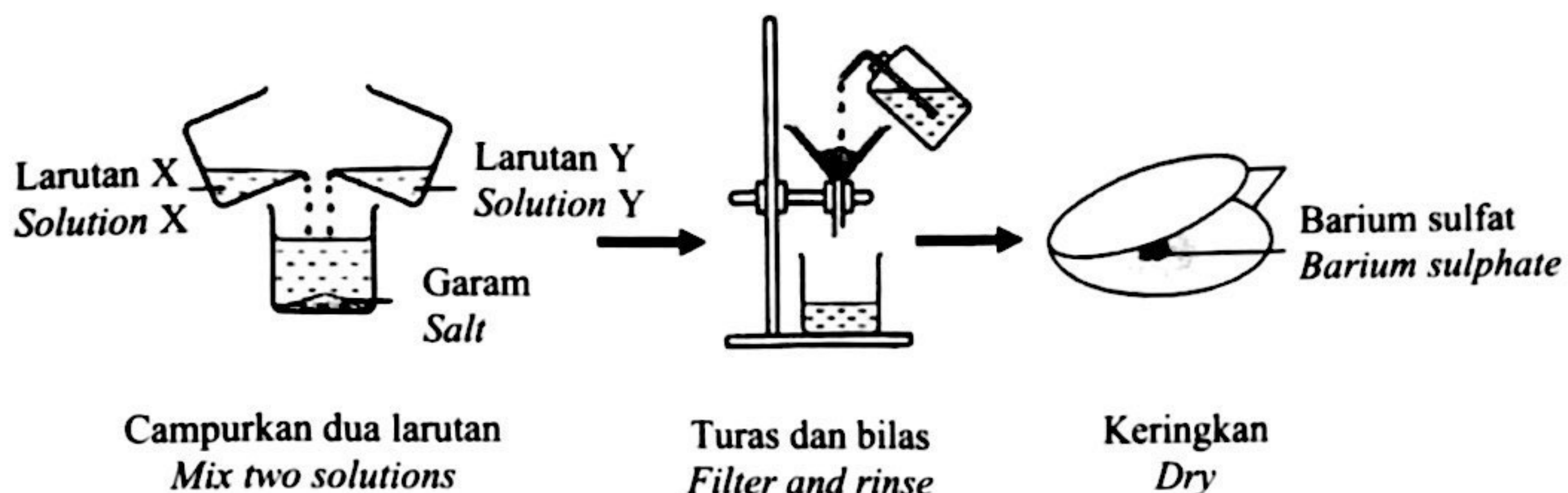
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[3 markah / marks]

8 (a) Rajah 6 menunjukkan kaedah penyediaan garam barium sulfat.

Diagram 6 shows the method of preparing barium sulphate salt.



Rajah / Diagram 6

Berdasarkan Rajah 6,  
Based on Diagram 6,

(i) Namakan jenis tindak balas ini.  
Name the type of reaction.

.....  
[1 markah / mark]

(ii) Cadangkan larutan X dan Y yang digunakan di dalam tindak balas tersebut.  
Suggest solution X and Y used in the reaction.

Larutan X: .....  
Solution X  
Larutan Y: .....  
Solution Y

[2 markah / marks]

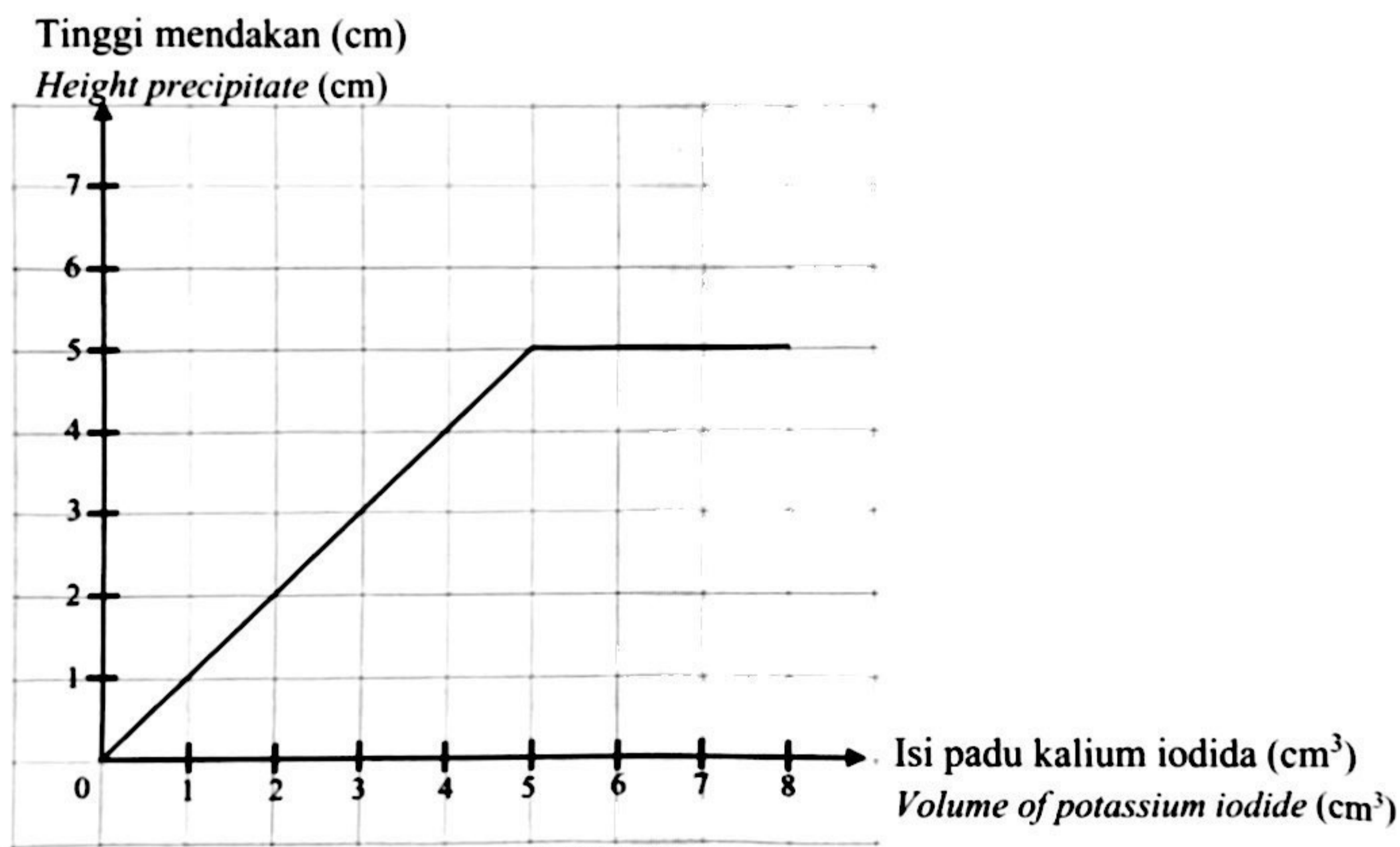
(iii) Tuliskan persamaan kimia untuk tindak balas tersebut.  
Write the chemical equation for the reaction.

.....  
[2 markah / marks]

- (b) Satu eksperimen dijalankan untuk membina persamaan ion bagi pembentukan plumbum(II) iodida menggunakan kaedah perubahan berterusan.
- Isi padu tetap  $5.00 \text{ cm}^3$  larutan plumbum(II) nitrat,  $\text{Pb}(\text{NO}_3)_2$   $0.5 \text{ mol dm}^{-3}$  diisikan ke dalam setiap 8 tabung uji yang sama saiz.
  - Isi padu yang berbeza larutan kalium iodida,  $\text{KI}$   $1.0 \text{ mol dm}^{-3}$  ditambahkan ke dalam setiap tabung uji.
  - Tinggi mendakan kuning plumbum(II) iodida yang terbentuk dalam setiap tabung uji diukur dan direkod. Satu graf tinggi mendakan melawan isi padu kalium iodida diplot.

*An experiment is carried out to construct an ionic equation for the formation of lead(II) iodide by using continuous variation method.*

- *A fixed volume of  $5.00 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  lead(II) nitrate,  $\text{Pb}(\text{NO}_3)_2$  solution is placed into each of the 8 test tube of the same size.*
- *Different volumes of  $1.0 \text{ mol dm}^{-3}$  potassium iodide solution,  $\text{KI}$  is added into each test tube.*
- *The height of the yellow precipitate, lead(II) iodide formed in each test tube is measured and recorded. A graph of height of precipitate against volume of potassium iodide is plotted.*



Rajah / Diagram 7



Berdasarkan Rajah 7,  
Based on Diagram 7,

- (i) Hitung bilangan mol ion iodida yang bertindak balas dengan 1 mol ion plumbum(II).  
Calculate the number of mole of iodide ion that reacts with 1 mole of lead(II) ion.

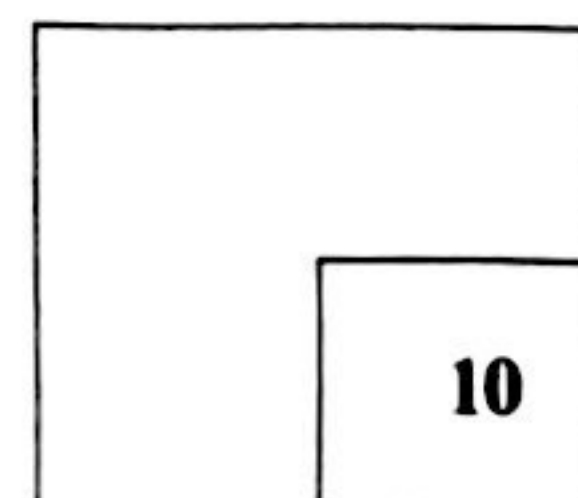
[3 markah / marks]

- (ii) Berdasarkan jawapan di 8(b)(i), bina persamaan ion bagi pembentukan plumbum(II) iodida.  
Based on the answer in 8(b)(i), construct an ionic equation for the formation of lead(II) iodide.

.....  
[1 markah / mark]

- (iii) Terangkan mengapa kelapan-lapan tabung uji yang digunakan adalah bersaiz sama.  
Explain why the eight test tubes used are the same size.

.....  
.....  
[1 markah / mark]



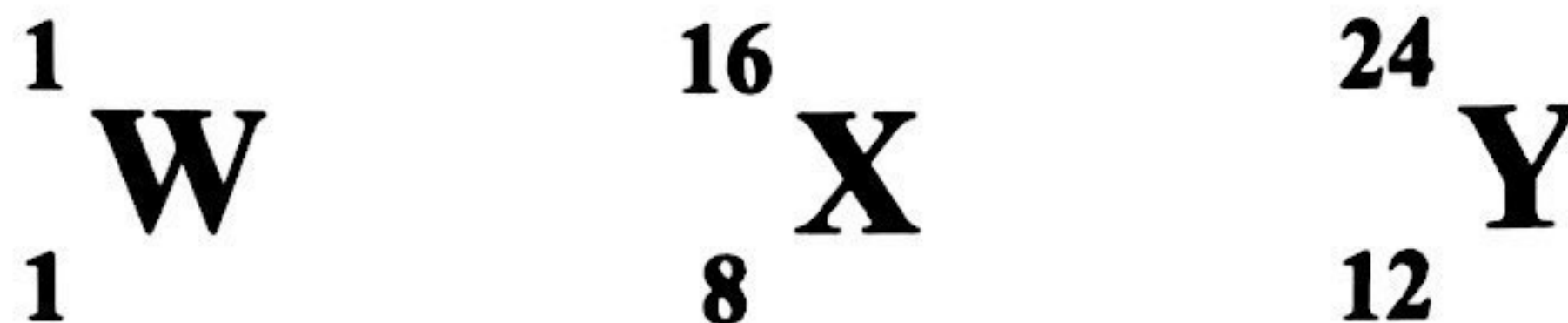
**Bahagian B**

[20 markah]

*Bahagian ini mengandungi dua soalan. Jawab satu soalan.*

- 9 Rajah 8.1 menunjukkan perwakilan piawai bagi tiga unsur W, X dan Y. Huruf-huruf ini bukan simbol sebenar unsur dalam Jadual Berkala Unsur.

*Diagram 8.1 show the standard representative for three elements W, X and Y. These letters are not the actual symbols of the elements in The Periodic Table of Elements.*

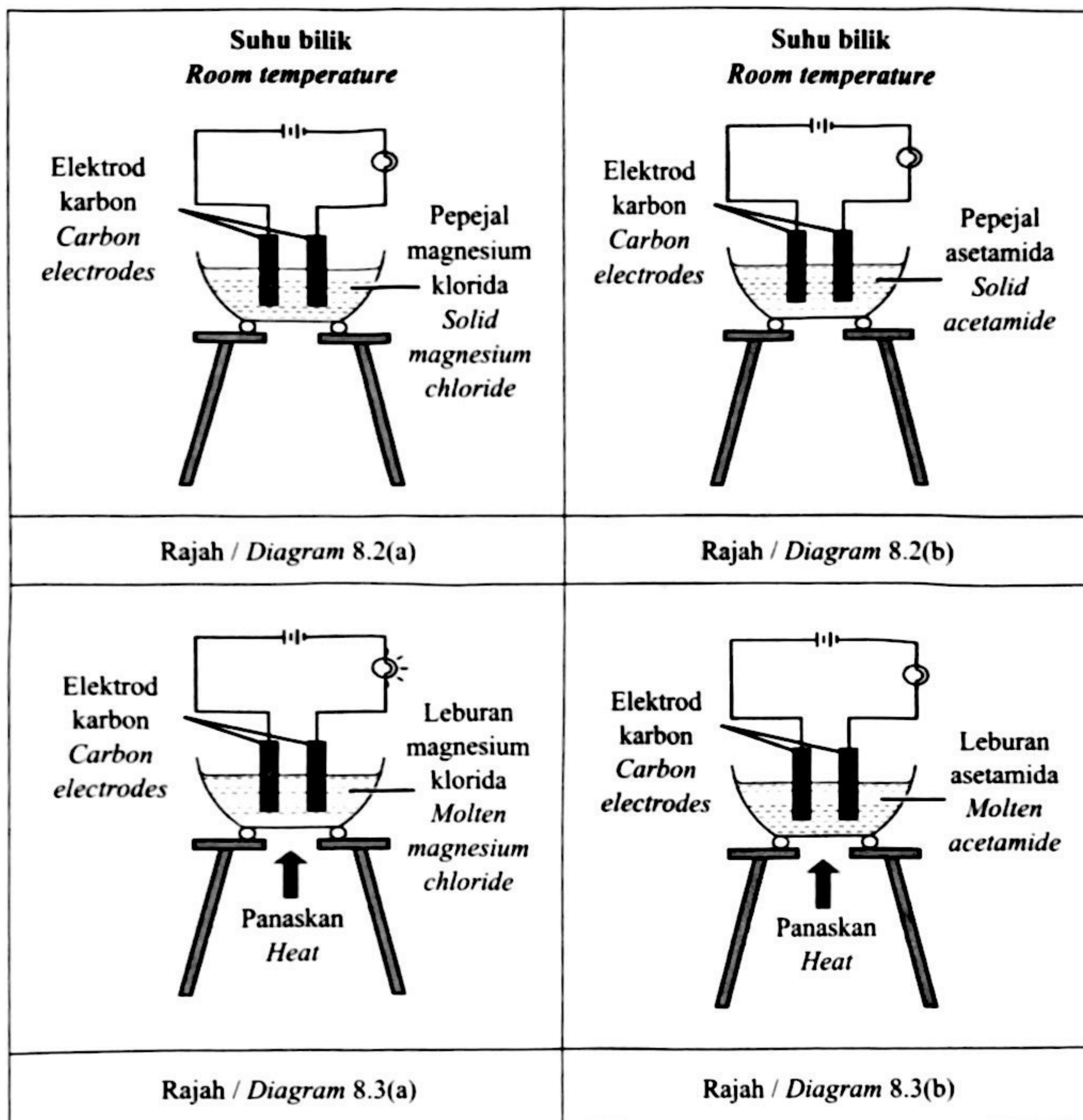


Rajah / Diagram 8.1

- (a) (i) Apakah maksud ikatan kovalen?  
*What is the meaning of covalent bond?* [1 markah / mark]
- (ii) Berdasarkan Rajah 8.1, pilih dua jenis unsur yang berlainan untuk membentuk satu sebatian kovalen. Terangkan pembentukan sebatian tersebut, sertakan formula molekul dan rajah susunan elektron.  
*Based on Diagram 8.1, choose two different elements to form a covalent compound. Explain the formation of the compound, include the molecular formula and the electron arrangement diagram of the compound.* [7 markah / marks]
- (b) Molekul ammonia boleh membentuk ikatan datif dengan ion hidrogen. Lukis struktur Lewis bagi ion yang terbentuk dan labelkan ikatan datif.  
*Ammonia molecule can form dative bond with hydrogen ion. Draw the Lewis structure for the ion formed and label the dative bond.* [2 markah / marks]

(c) Rajah 8.2 dan 8.3 menunjukkan susunan radas dan pemerhatian bagi satu eksperimen untuk mengkaji kekonduksian elektrik dan takat lebur dua jenis sebatian.

Diagram 8.2 and 8.3 shows the apparatus set-up and observations for an experiment to study the electrical conductivity and melting point of two types of compounds.



Berdasarkan pemerhatian dalam Rajah 8.2 dan Rajah 8.3, nyatakan jenis sebatian bagi magnesium klorida dan asetamida. Jelaskan perbezaan pemerhatian bagi kedua-dua jenis sebatian ini berdasarkan aspek berikut:

- Kekonduksian elektrik
- Takat lebur

Based on the observations in Diagram 8.2 and Diagram 8.3, state the type of compound for magnesium chloride and acetamide. Explain the difference in the observations for both compounds in term of:

- *Electrical conductivity*
- *Melting point*

[10 markah / marks]

- 10 (a)** Maklumat berikut menunjukkan dua situasi untuk melarutkan garam di dalam air.  
*The following information shows two situations to dissolve salt in water.*

<b>Situasi I</b>	: Garam halus lebih mudah larut di dalam air panas berbanding dengan air sejuk.
<i>Situation I</i>	: <i>Fine salt is easier to dissolve in hot water compared to cold water.</i>
<b>Situasi II</b>	: Garam halus lebih mudah larut berbanding garam kasar di dalam air sejuk.
<i>Situation II</i>	: <i>Fine salt is easier to dissolve compared to coarse salt in cold water.</i>

Berdasarkan situasi tersebut, nyatakan dua faktor yang terlibat. Dengan memilih salah satu situasi, jelaskan bagaimana faktor tersebut mempengaruhi keterlarutan garam.

*Based on the situations, state the two factors involved. By choosing one of the situations, explain how the factor affects the solubility of salt.*

[4 markah / marks]

- (b) Jadual 7 menunjukkan tiga set eksperimen yang dijalankan untuk mengkaji kadar tindak balas antara zink dengan asid nitrik.

*Table 7 shows three sets of experiment that are carried out to study the rate of reaction between zinc and nitric acid.*

Set	Bahan tindak balas <i>Reactants</i>	Suhu (°C) <i>Temperature (°C)</i>
I	9 g serbuk zink + 25 cm <sup>3</sup> asid nitrik 0.2 mol dm <sup>-3</sup> <i>9 g zinc powder + 25 cm<sup>3</sup> of 0.2 mol dm<sup>-3</sup> nitric acid</i>	30
II	9 g serbuk zink + 25 cm <sup>3</sup> asid nitrik 0.2 mol dm <sup>-3</sup> <i>9 g zinc powder + 25 cm<sup>3</sup> of 0.2 mol dm<sup>-3</sup> nitric acid</i>	50
III	9 g serbuk zink + 25 cm <sup>3</sup> asid nitrik 0.2 mol dm <sup>-3</sup> + larutan kuprum(II) sulfat <i>9 g zinc powder + 25 cm<sup>3</sup> of 0.2 mol dm<sup>-3</sup> nitric acid + copper(II) sulphate solution</i>	30

Jadual / Table 7

- (i) Tuliskan persamaan kimia bagi tindak balas antara zink dan asid nitrik. Hitung isi padu maksimum gas yang terbebas dalam Set I.  
[Jisim atom relatif : Zn = 65; Isi padu molar gas = 24 dm<sup>3</sup> mol<sup>-1</sup> pada keadaan bilik]

*Write the chemical equation for the reaction between zinc and nitric acid. Calculate the maximum volume of gas produced in Set I.*

*[Relative atomic mass : Zn = 65; Molar volume of gas = 24 dm<sup>3</sup> mol<sup>-1</sup> at room condition]*

[6 markah / marks]

- (ii) Bandingkan kadar tindak balas bagi:  
*Compare the rate of reaction for:*

- Set I dan Set II  
*Set I and Set II*
- Set I dan Set III  
*Set I and Set III*

Terangkan jawapan anda berdasarkan Teori Pelanggaran.

*Explain your answer based on Collision Theory.*

[10 markah / marks]

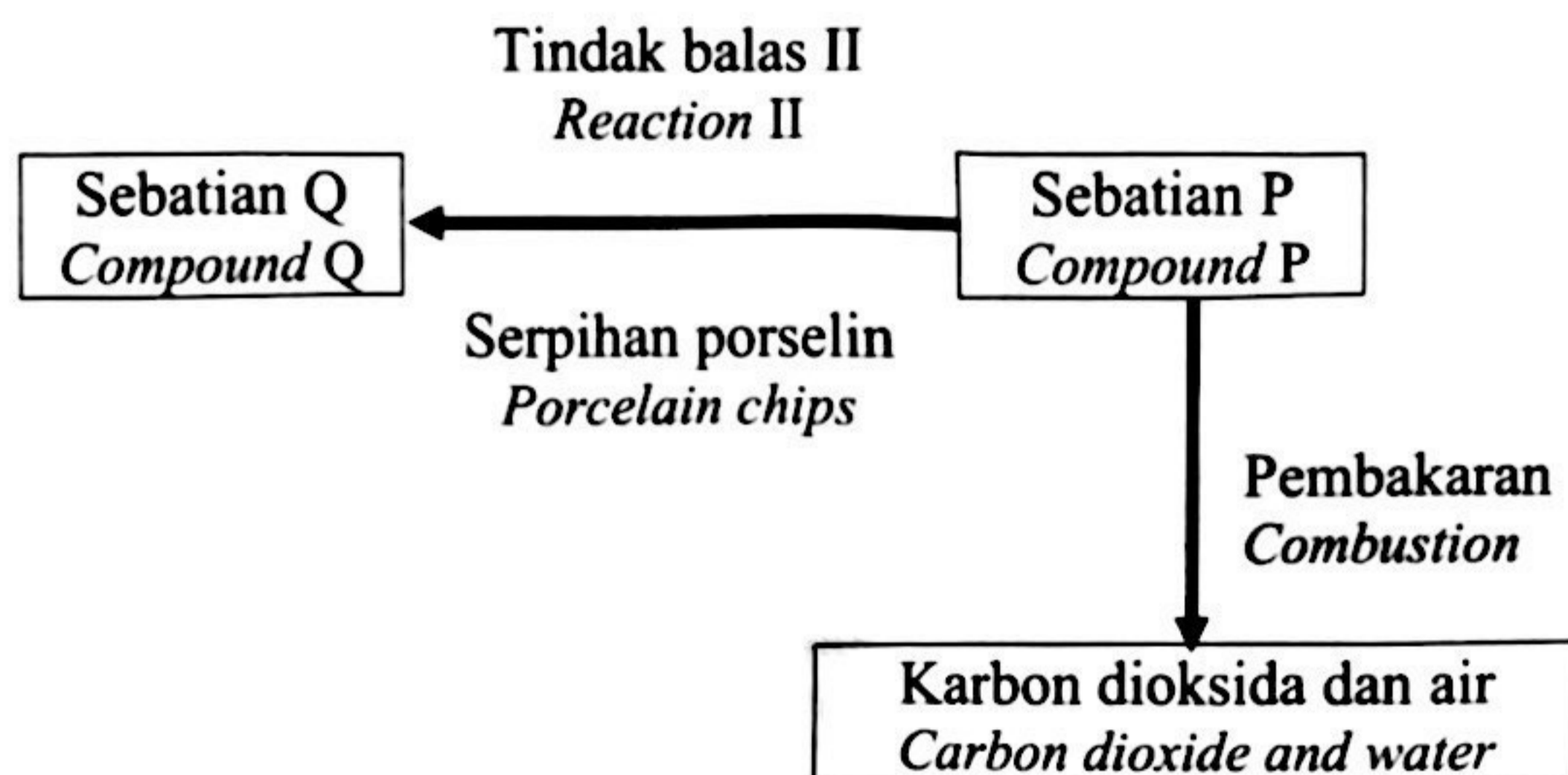
**Bahagian C**

[20 markah]

*Soalan ini mesti dijawab.*

- 11 (a) Rajah 9.1 menunjukkan pertukaran sebatian P kepada sebatian Q. Sebatian P mempunyai formula molekul  $C_4H_{10}O$ .

*Diagram 9.1 shows the conversions of compound P to compound Q. Compound P has a molecular formula of  $C_4H_{10}O$ .*



Rajah / Diagram 9.1

Berdasarkan Rajah 9.1,

*Based on Diagram 9.1,*

- (i)
- Nyatakan siri homolog bagi sebatian P.  
*State the homologous series of compound P.*
  - Sebatian P boleh membentuk isomer. Lukiskan formula struktur bagi **satu** isomer itu dan namakannya mengikut sistem penamaan IUPAC.  
*Compound P can form isomers. Draw the structural formula for **one** of the isomer and name it according to the IUPAC system.*
  - Namakan tindak balas II dan lukis gambar rajah berlabel bagi menunjukkan susunan radas penyediaan sebatian Q dalam makmal.  
*State the name of the reaction II and draw a labelled diagram to show apparatus set-up in order to prepare compound Q in laboratory.*

[6 markah / marks]

- (ii) Tulis persamaan kimia seimbang bagi pembakaran lengkap 2.1 g sebatian P dan hitung isipadu gas karbon dioksida yang terhasil.

[Jisim atom relatif:  $H = 1$ ,  $C = 12$ ,  $O = 16$ ; 1 mol bagi sebarang gas menempati  $24 \text{ dm}^3$  pada keadaan bilik]

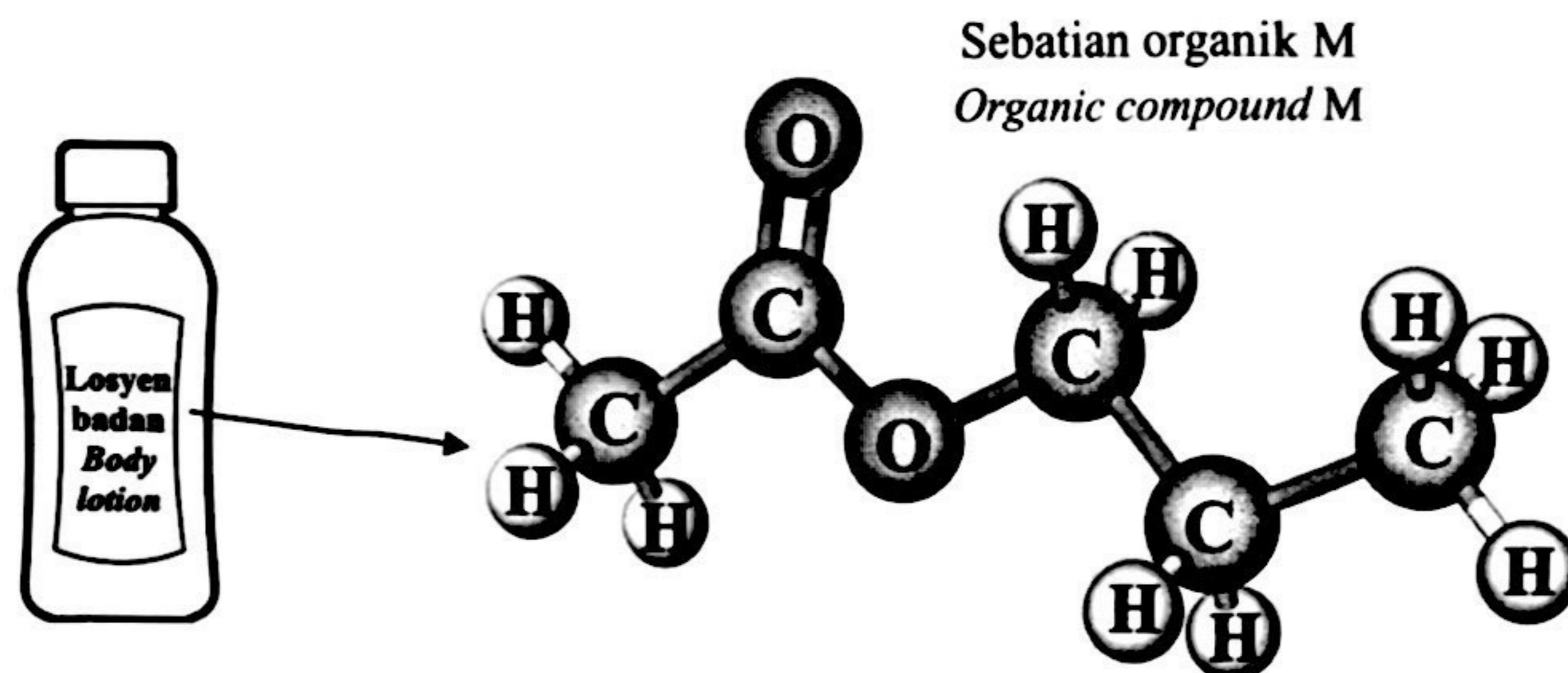
*Write a balanced chemical equation for the complete combustion of 2.1 g of compound P and calculate the volume of carbon dioxide gas released.*

[Relative atomic mass :  $H = 1$ ,  $C = 12$ ,  $O = 16$ ; 1 mole of any gas occupies  $24 \text{ dm}^3$  at room conditions]

[5 markah / marks]

- (b) Rajah 9.2 menunjukkan formula struktur bagi sebatian organik M yang terkandung dalam losyen badan.

*Diagram 9.2 shows the structural formula of organic compound M contained in a body lotion.*



Dengan menggunakan bahan dan radas yang sesuai, huraikan penyediaan sebatian organik M di dalam makmal. Dalam penerangan anda, nyatakan pemerhatian bagi hasil yang terbentuk dan tulis persamaan kimia bagi tindak balas itu.

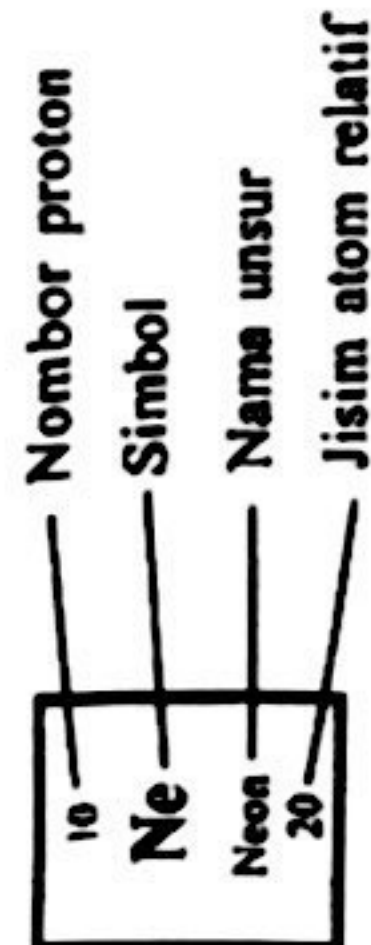
*By using suitable materials and apparatus, describe the preparation of organic substance M in the laboratory. In your explanation, state the observation for the product formed and write the chemical equation for the reaction.*

[9 markah / marks]

**KERTAS PEPERIKSAAN TAMAT**  
**END OF QUESTION PAPER**

JADUAL BERKALA UNSUR

1 <b>H</b> Hidrogen 1																	2 <b>He</b> Helium 4					
3 <b>Li</b> Litium 7	4 <b>Be</b> Berilium 9															10 <b>Ne</b> Neon 20						
11 <b>Na</b> Natrium 23	12 <b>Mg</b> Magnesium 24															18 <b>Ar</b> Argon 40						
19 <b>K</b> Kalium 39	20 <b>Ca</b> Kalsium 40	21 <b>Sc</b> Skandium 45	22 <b>Ti</b> Titanium 48	23 <b>V</b> Vanadium 51	24 <b>Cr</b> Kromium 52	25 <b>Mn</b> Mangan 55	26 <b>Fe</b> Feram 56	27 <b>Co</b> Kobak 59	28 <b>Ni</b> Nikel 59	29 <b>Cu</b> Kuprum 64	30 <b>Zn</b> Zink 65	31 <b>Ga</b> Galium 70	32 <b>Ge</b> Germanium 73	33 <b>As</b> Arsenik 75	34 <b>Se</b> Selenium 79	35 <b>Br</b> Bromin 80	36 <b>Kr</b> Kripton 84					
37 <b>Rb</b> Rubidium 86	38 <b>Sr</b> Strontium 88	39 <b>Y</b> Itrium 89	40 <b>Zr</b> Zirkonium 91	41 <b>Nb</b> Niobium 93	42 <b>Mo</b> Molibdenum 96	43 <b>Tc</b> Teknium 98	44 <b>Ru</b> Rutenium 101	45 <b>Rh</b> Rodium 103	46 <b>Pd</b> Paladium 106	47 <b>Ag</b> Argentum 108	48 <b>Cd</b> Kadmium 112	49 <b>In</b> Indium 115	50 <b>Sn</b> Stannum 119	51 <b>Sb</b> Antimoni 122	52 <b>Te</b> Telurium 128	53 <b>I</b> Iodin 127	54 <b>Xe</b> Xenon 131					
55 <b>Cs</b> Sesium 133	56 <b>Ba</b> Barium 137	57 <b>La</b> Lantanum 139	72 <b>Hf</b> Hafnium 179	73 <b>Ta</b> Tantalum 181	74 <b>W</b> Tungsten 184	75 <b>Re</b> Reniun 186	76 <b>Os</b> Osmium 190	77 <b>Ir</b> Iridium 192	78 <b>Pt</b> Platinum 195	79 <b>Au</b> Aurum 197	80 <b>Hg</b> Mercuri 201	81 <b>Tl</b> Thallium 204	82 <b>Pb</b> Plumbum 207	83 <b>Bi</b> Bismut 209	84 <b>Po</b> Polonium 210	85 <b>At</b> Astatin 210	86 <b>Rn</b> Radon 222					
87 <b>Fr</b> Francium 223	88 <b>Ra</b> Radium 226	89 <b>Ac</b> Aktinium 227	104 <b>Uuq</b> Unnilquadium 257	105 <b>Uup</b> Unnilpentium 260	106 <b>Uuh</b> Unnilheksium 263	107 <b>Uns</b> Unnilseptium 262	108 <b>Uno</b> Unniloktium 265	109 <b>Uue</b> Unnilennium 266														
																		67 <b>Hb</b> Holmium 165	68 <b>Er</b> Erbium 167	69 <b>Tm</b> Thulium 169	70 <b>Yb</b> Iterbium 173	71 <b>Lu</b> Lutetium 175
																		99 <b>Es</b> Einsteinium 254	100 <b>Fm</b> Fermium 253	101 <b>Md</b> Mendelevium 256	102 <b>No</b> Nobelium 254	103 <b>Lr</b> Lawrensium 257
																		98 <b>Cf</b> Kalifornium 249	97 <b>Bk</b> Berkelium 247	96 <b>Cm</b> Kurium 247	95 <b>Am</b> Americium 243	94 <b>Pu</b> Plutonium 244
																		96 <b>Cf</b> Kalifornium 249	95 <b>Bk</b> Berkelium 247	94 <b>Cm</b> Kurium 247	93 <b>Np</b> Neptunium 237	92 <b>U</b> Uranium 238
																		97 <b>Bk</b> Berkelium 247	96 <b>Cm</b> Kurium 247	95 <b>Am</b> Americium 243	94 <b>Pu</b> Plutonium 244	93 <b>Np</b> Neptunium 237
																		98 <b>Cf</b> Kalifornium 249	97 <b>Bk</b> Berkelium 247	96 <b>Cm</b> Kurium 247	95 <b>Am</b> Americium 243	94 <b>Pu</b> Plutonium 244
																		99 <b>Es</b> Einsteinium 254	98 <b>Cf</b> Kalifornium 249	97 <b>Bk</b> Berkelium 247	96 <b>Cm</b> Kurium 247	95 <b>Am</b> Americium 243
																		100 <b>Fm</b> Fermium 253	99 <b>Es</b> Einsteinium 254	98 <b>Cf</b> Kalifornium 249	97 <b>Bk</b> Berkelium 247	96 <b>Cm</b> Kurium 247
																		101 <b>Md</b> Mendelevium 256	100 <b>Fm</b> Fermium 253	99 <b>Es</b> Einsteinium 254	98 <b>Cf</b> Kalifornium 249	97 <b>Bk</b> Berkelium 247
																		102 <b>No</b> Nobelium 254	101 <b>Md</b> Mendelevium 256	100 <b>Fm</b> Fermium 253	99 <b>Es</b> Einsteinium 254	98 <b>Cf</b> Kalifornium 249
																		103 <b>Lr</b> Lawrensium 257	102 <b>No</b> Nobelium 254	101 <b>Md</b> Mendelevium 256	100 <b>Fm</b> Fermium 253	99 <b>Es</b> Einsteinium 254





THE PERIODIC TABLE OF ELEMENTS

Proton number	Symbol	Name of element	Relative atomic mass
1	H	Hydrogen	1
2	He	Helium	4
3	Li	Lithium	7
4	Be	Beryllium	9
5	B	Boron	11
6	C	Carbon	12
7	N	Nitrogen	14
8	O	Oxygen	16
9	F	Flourine	19
10	Ne	Neon	20
11	Na	Sodium	23
12	Mg	Magnesium	24
13	Al	Aluminium	27
14	Si	Silicon	28
15	P	Phosphorus	31
16	S	Sulfur	32
17	Cl	Chlorine	35
18	Ar	Argon	40
19	K	Potassium	39
20	Ca	Calcium	40
21	Sc	Scandium	45
22	Ti	Titanium	48
23	V	Vanadium	51
24	Cr	Chromium	52
25	Mn	Manganese	55
26	Fe	Iron	56
27	Co	Cobalt	59
28	Ni	Nickel	59
29	Cu	Copper	64
30	Zn	Zinc	65
31	Ga	Gallium	70
32	Ge	Germanium	73
33	As	Arsenic	75
34	Se	Selenium	79
35	Br	Bromine	80
36	Kr	Krypton	84
37	Rb	Rubidium	85
38	Sr	Strontium	88
39	Y	Yttrium	89
40	Zr	Zirconium	91
41	Nb	Niobium	93
42	Mo	Molybdenum	96
43	Tc	Technetium	98
44	Ru	Ruthenium	101
45	Rh	Rhodium	103
46	Pd	Palladium	106
47	Ag	Silver	108
48	Cd	Cadmium	112
49	In	Indium	115
50	Sn	Tin	119
51	Sb	Antimony	122
52	Te	Tellurium	128
53	I	Iodine	127
54	Xe	Xenon	131
55	Cs	Cesium	133
56	Ba	Barium	137
57	La	Lanthanum	139
58	Ce	Cerium	140
59	Pr	Praseodymium	141
60	Nd	Neodymium	144
61	Pm	Promethium	147
62	Sm	Samarium	150
63	Eu	Europium	152
64	Gd	Gadolinium	157
65	Tb	Terbium	159
66	Dy	Dysprosium	163
67	Hf	Hafnium	165
68	Er	Erbium	167
69	Tm	Thulium	169
70	Yb	Ytterbium	173
71	Lu	Lutetium	175
72	Hf	Hafnium	179
73	Ta	Tantalum	181
74	W	Tungsten	184
75	Re	Rhenium	186
76	Os	Osmium	190
77	Ir	Iridium	192
78	Pt	Platinum	195
79	Au	Gold	197
80	Hg	Mercury	201
81	Tl	Thallium	204
82	Pb	Lead	207
83	Bi	Bismuth	209
84	Po	Polonium	210
85	At	Astatine	210
86	Rn	Radon	222
87	Fr	Francium	223
88	Ra	Radium	226
89	Ac	Actinium	227
90	Th	Thorium	232
91	Pa	Protactinium	231
92	U	Uranium	238
93	Np	Neptunium	237
94	Pu	Plutonium	244
95	Am	Americium	243
96	Cm	Curium	247
97	Bk	Berkelium	247
98	Cf	Californium	249
99	Es	Einsteinium	253
100	Fm	Fermium	253
101	Md	Mendelevium	256
102	No	Nobelium	254
103	Lr	Lawrencium	257
104	Rf	Rutherfordium	261
105	Db	Dubnium	262
106	Sg	Seaborgium	266
107	Bh	Berkelium	264
108	Hs	Hassium	265
109	Uue	Ununennium	266
110	Uuh	Ununhexium	263
111	Uuh	Ununhexium	263
112	Uue	Ununennium	266
113	Uuh	Ununhexium	263
114	Uuq	Ununquadium	257
115	Uup	Ununpentium	260
116	Uuq	Ununquadium	257
117	Uus	Ununseptium	262
118	Uuo	Ununoctium	265
119	Uue	Ununennium	266
120	Uuo	Ununoctium	265