

**PEPERIKSAAN PERCUBAAN  
SIJIL PELAJARAN MALAYSIA 2022  
DAERAH TANGKAK, JOHOR**

KIMIA

Kertas 2

November 2022

2 jam 30 minit

4541/2

**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU**

1. Tulis **nama dan kelas** anda pada ruang yang disediakan.
2. Kertas peperiksaan ini mengandungi **tiga** bahagian: **Bahagian A, Bahagian B dan Bahagian C.**
3. Jawapan hendaklah ditulis pada ruang jawapan yang disediakan di dalam kertas peperiksaan ini.
4. Kertas peperiksaan ini adalah dalam dwibahasa.
5. Jawapan boleh ditulis dalam bahasa Melayu atau bahasa Inggeris.
6. Rajah yang mengiringi soalan tidak dilukis mengikut skala kecuali dinyatakan.
7. Kerja mengira anda mesti ditunjukkan.
8. Kalkulator saintifik yang tidak boleh diprogramkan dibenarkan untuk digunakan.
9. **Kertas peperiksaan** ini hendaklah diserahkan kepada pengawas peperiksaan pada akhir peperiksaan.

Pemeriksa :

Bahagian	No. Soalan	Markah Sebenar	Markah Dapat
<b>A</b>	1	5	
	2	5	
	3	6	
	4	7	
	5	8	
	6	9	
	7	10	
	8	10	
<b>B</b>	9	20	
	10	20	
<b>C</b>	11	20	
<b>Jumlah</b>		<b>100</b>	

NAMA : .....

KELAS : .....

Kertas peperiksaan ini mengandungi 25 halaman bercetak

## Bahagian A

[ 60 markah]

Jawab **semua** soalan dalam bahagian ini.  
*Answer all questions in the section.*

- 1 Jadual 1 menunjukkan empat bahan dan formula kimianya.  
*Table 1 shows four substances and its chemical formula.*

Bahan <i>Substance</i>	Formula kimia <i>Chemical formula</i>
Helium <i>Helium</i>	He
Klorin <i>Chlorine</i>	Cl <sub>2</sub>
Naftalena <i>Naphtalene</i>	C <sub>10</sub> H <sub>8</sub>
Zink klorida <i>Zinc chloride</i>	ZnCl <sub>2</sub>

Jadual 1  
*Table 1*

Berdasarkan Jadual 1,

*Based on table 1,*

- (a) Senaraikan semua zarah subatom.  
*List all subatomic particle in an atom.*

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

- (b) Zink klorida adalah suatu bahan kimia. Nyatakan zarah yang hadir dalam bahan tersebut.  
*Zinc chloride is a chemical substance. State the particles present in the substance.*

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

- (c) Apakah keadaan fizik klorin pada keadaan bilik?  
*What is the physical state of chlorine in room condition?*

.....  
 [1 markah]

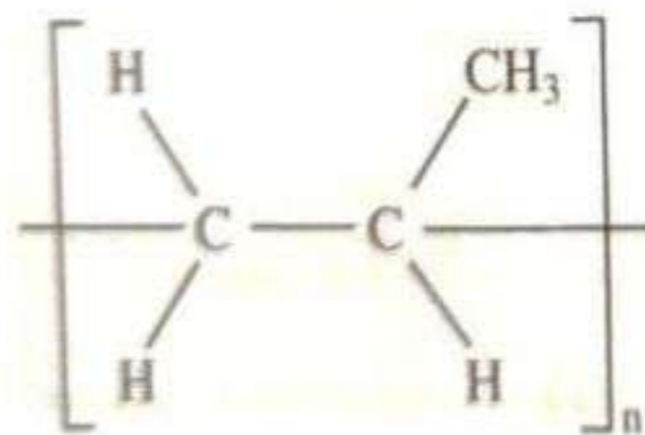
[1 mark]

- (d) Kelaskan bahan tersebut kepada unsur dan sebatian.  
*Classified the substance into element and compound.*

[2 markah]

[2 marks]

- 2 Rajah 2 menunjukkan formula struktur bagi polipropena, iaitu polimer yang digunakan dalam beberapa jenis barangan plastik.  
*Diagram 2 shows the structural formula of polypropene, a polymer used in some type of plastic products*



Rajah 2  
 Diagram 2

- (a) Lukis dan namakan monomer bagi polipropena.  
*Draw and name the monomer of polypropene*

[2 markah]

[2 marks]

- (b) Nama tindak balas pempolimeran yang menghasilkan polipropena?  
*Name the type of polymerisation reaction that produces polypropene?*

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

- (c) Salah satu kegunaan polipropena adalah dalam bidang tekstil. Nyatakan **dua** pencapaian bidang tekstil yang dapat dicapai dalam bidang teknologi nano?  
*One of the uses of polypropylene is in the textiles industry. State **two** achievement of nano technology in textile industry?*

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

- 3 Rajah 3.1 menunjukkan piala yang dimenangi oleh sekolah Ali pada tahun 2021 dalam Pertandingan Saintis Muda. Piala yang mereka terima disimpan dalam galeri sekolah dan masih kelihatan berkilat.

*Diagram 3.1 shows the trophy won by Ali's school in 2021 in the Young Scientist Competition. The trophies they received are kept in the school gallery and still look shiny.*



Rajah 3.1  
*Diagram 3.1*

- (a) Piala tersebut diperbuat daripada gangsa.  
*The trophy is made from bronze.*  
(i) Nyatakan unsur utama dalam gangsa.  
*State the main element in bronze.*

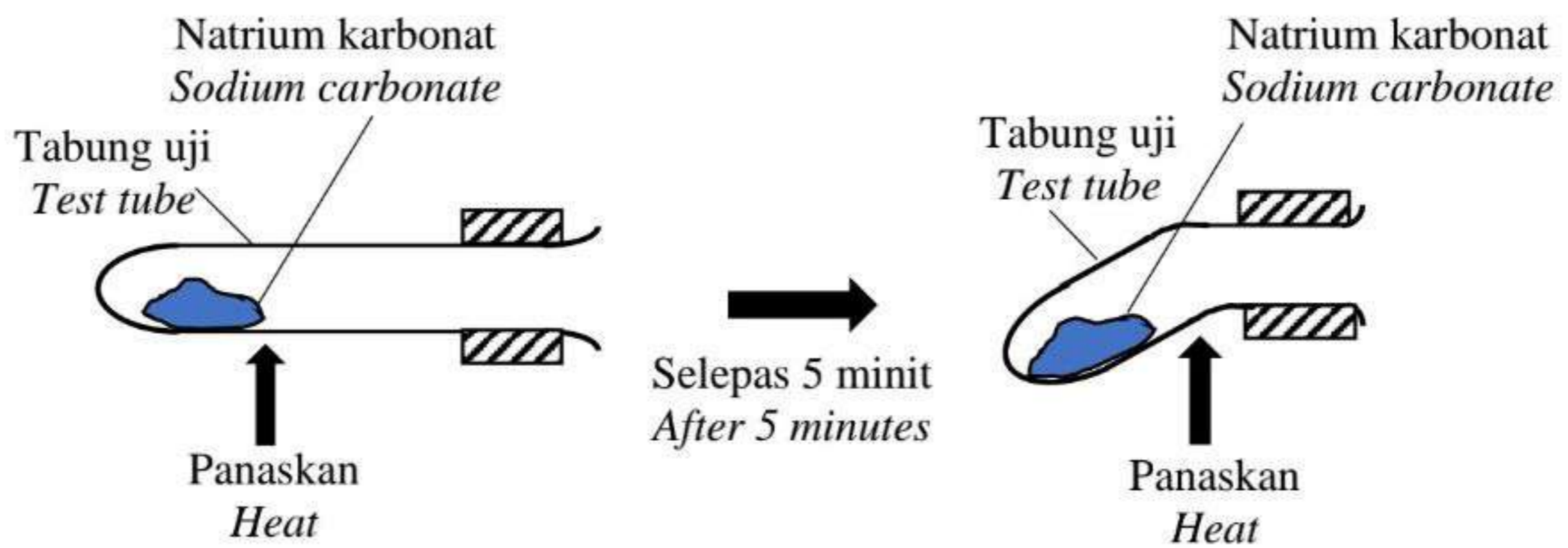
.....  
[1 markah]  
[1 mark]

- (ii) Lukiskan susunan atom dalam gangsa.  
*Draw the arrangement of atoms in bronze.*



[2 markah]  
 [2 marks]

- (b) Rajah 3.2 menunjukkan susunan radas pemanasan garam natrium karbonat.  
*Diagram 3.2 shows shows a set up apparatus of heating sodium carbonate salt.*



Rajah 3.2  
 Diagram 3.2

- (c) Izan memanaskan garam natrium karbonat di dalam tabung uji. Selepas 5 minit didapati tabung uji berubah bentuk. Sebagai seorang pelajar kimia, cadangkan alat radas yang lebih sesuai digunakan bagi menggantikan tabung uji tersebut dan terangkan kenapa. Beri **satu** sebab.

*Izan heats the sodium carbonate salts in the test tube. After 5 minutes it was found that the test tube changed its shape. As a chemistry student, suggest a more suitable apparatus to be used to replace the test tube and explain why. Give **one** reason.*

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

[3 markah]  
 [3 marks]

- 4 Jadual 4 menunjukkan monomer yang membentuk polimer semulajadinya serta formula molekul untuk monomer tersebut.

*Table 4 shows examples of monomers that form its natural polymers and molecular formula for the monomer.*

<b>Monomer</b> <i>Monomer</i>	<b>Formula molekul</b> <i>Molecular formula</i>	<b>Polimer</b> <i>Polymer</i>
Glukosa <i>Glucose</i>	$C_6H_{12}O_6$	Kanji dan selulosa <i>Starch and cellulose</i>
Isoprena <i>Isoprene</i>	$C_5H_8$	Getah asli <i>Natural rubber</i>
Asid amino <i>Amino acid</i>	$C_2H_4NH_2COOH$	Protein <i>Protein</i>

Jadual 4  
Table 4

- (a) Nyatakan maksud formula molekul.  
*State the meaning of empirical formula.*

.....

.....

[1 markah]

[1 mark]

- (b) Nyatakan formula empirik bagi glukosa.  
*State the empirical formula for glucose.*

.....

[1 markah]

[1 mark]

- (c) Glukosa diperlukan oleh tubuh badan manusia untuk menghasilkan tenaga melalui proses aerobik. Persamaan kimia keseluruhan untuk respirasi aerobik ialah *Glucose is needed by the human body to produce energy through aerobic processes. The overall chemical equation for aerobic respiration is*



Nyatakan maklumat kualitatif yang boleh diperolehi berdasarkan persamaan kimia tersebut.

*State the qualitative information that can be obtained based on the chemical equation.*

.....

.....

[1 markah]

[1 mark]

- (d) Farid ingin mempelbagaikan produk kilang berasaskan getah milik keluarganya daripada sarung tangan pembedahan kepada tayar kereta. Sebagai pelajar kimia, terangkan bagaimana anda boleh membantu Farid menghasilkan getah yang lebih kuat dan kenyal? Terangkan mengapa getah yang dihasilkan mempunyai sifat yang begitu berbeza berbanding dengan sifat asal getah?

*Farid wants to diversify his family's rubber-based factory products from surgical gloves to car tires. As a chemistry student, explain how you can help farid produce stronger and more elastic rubber? Explain why the produced rubber has properties that are so different compared to the original properties of the rubber?*

.....

.....

.....

.....

[4 markah]  
[4 marks]

- 5 Jadual 5 menunjukkan maklumat unsur dalam Jadual Berkala Unsur. Huruf yang digunakan bukan merupakan simbol sebenar unsur.

*Table 5 shows the information of elements in the Periodic Table of Elements. The letters shown are not the actual symbols of the elements.*

<b>Unsur</b> <i>Element</i>	P	Q	R	S	T	U	V
<b>Nombor proton</b> <i>Proton number</i>	11	12	13	14	15	16	17
<b>Sifat oksida</b> <i>Property of oxide</i>	Bes <i>Basic</i>	Bes <i>Basic</i>	.....	Asid <i>Acidic</i>	Asid <i>Acidic</i>	Asid <i>Acidic</i>	Asid <i>Acidic</i>

Jadual 5  
Table 5

Berdasarkan Jadual 5,  
*Based on Table 5,*

- (a) Nyatakan sifat oksida bagi oksida R.  
*State the property of oxide for R oxide.*

.....

[1 markah]  
[1 mark]

- (b) Nyatakan kala bagi unsur-unsur ini.  
*State the period for these elements.*

.....

[1 markah]  
[1 mark]

- (c) (i) Nyatakan perubahan bagi saiz atom bagi unsur-unsur tersebut merentasi kala dari kiri ke kanan dalam Jadual Berkala Unsur.  
*State the change in the atomic size of the elements from left to right in Periodic Table of An Element.*

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

- (ii) Berikan sebab bagi jawapan anda di 2 (c) (i).  
*Give reasons for your answer in 2 (c) (i).*

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

- (d) P bertindak balas dengan V membentuk suatu sebatian.  
*P reacts with V to form a compound.*

- (i) Namakan jenis ikatan yang terbentuk.  
*Name the type of bond formed.*

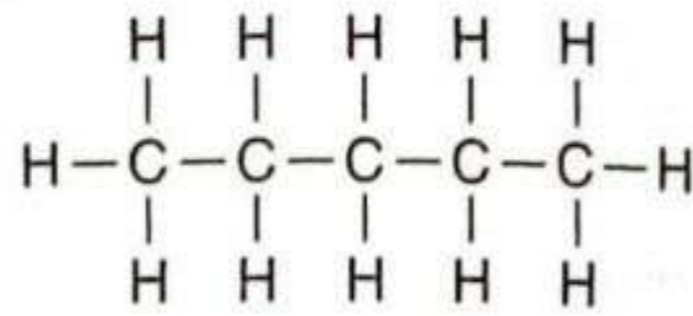
.....  
[1 markah ]  
[1 mark]

- (ii) Tulis persamaan kimia bagi pembentukan sebatian yang terbentuk.  
*Write the chemical equation for the formation of the formed compound.*

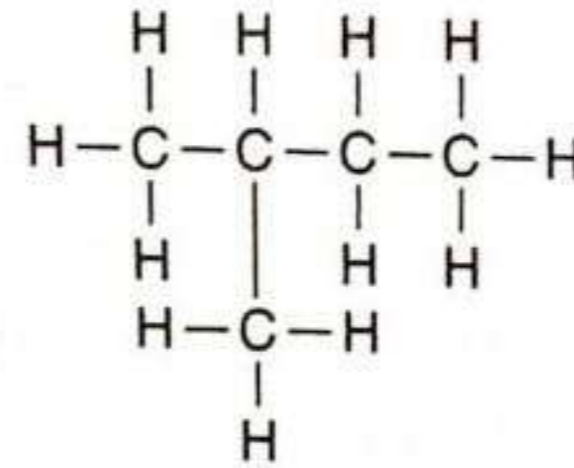
.....  
[2 markah ]  
[2marks]



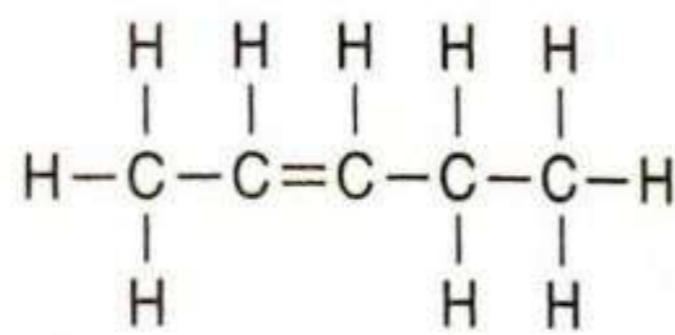
- 6 Rajah 6 menunjukkan formula struktur bagi sebatian P, Q, R dan T.  
Diagram 6 shows the structural formulae of compounds P, Q, R and T.



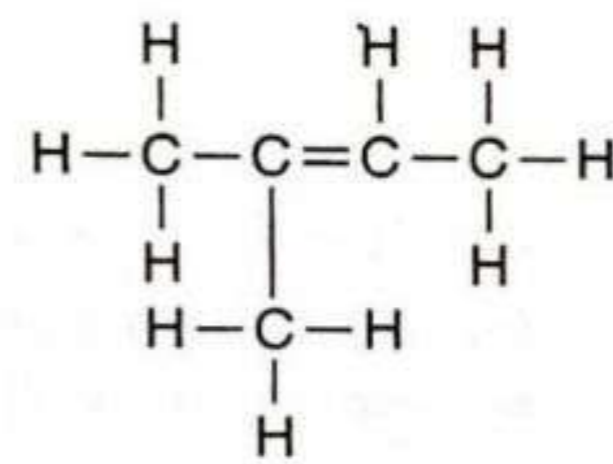
Sebatian P  
Compound P



Sebatian Q  
Compound Q



Sebatian R  
Compound R



Sebatian T  
Compound T

Rajah 6  
Diagram 6

Sebatian P dan Q merupakan isomer bagi sebatian hidrokarbon tepu manakala sebatian R dan T pula adalah isomer bagi suatu sebatian hidrokarbon tidak tepu.  
Compounds P and Q are isomers of a saturated hydrocarbon compounds while compounds R and T are isomers of an unsaturated hydrocarbon compound.

Berdasarkan rajah 6,  
Based on Diagram 6,

- (a) Apakah dimaksudkan dengan isomer?  
What is meant by isomer?

.....  
.....

[1 markah]  
[1mark]

- (b) Namakan sebatian T mengikut penamaan IUPAC.  
Name compound T according to the IUPAC nomenclature.

.....

[1 markah ]  
[1mark]

- (c) Lukis formula struktur bagi satu isomer lain bagi sebatian karbon P dan Q.  
*Draw the structural formula for another isomer of carbon compounds P and Q.*

[1 markah]

[1 mark]

- (d) Sebatian R boleh ditukar kepada sebatian P. Tuliskan persamaan kimia bagi tindakbalas penambahan yang berlaku.  
*Compound R can be converted to compound P. Write the chemical equation for the addition reaction occur.*

[2 markah]

[2 marks]

- (e) Persamaan kimia dibawah menunjukkan tindak balas pembakaran lengkap bagi 300 cm<sup>3</sup> sebatian P.  
*The chemical equation below shows a complete combustion reaction of 300cm<sup>3</sup> of compound P.*



Seimbangkan persamaan kimia tersebut dan hitung jisim gas karbon dioksida yang terbentuk.

[Jisim atom relatif: C=12, O=16, Isipadu molar = 24 dm<sup>3</sup> mol<sup>-1</sup> pada keadaan bilik]

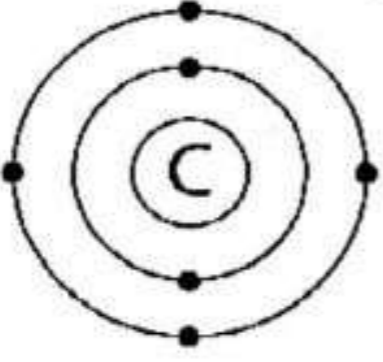
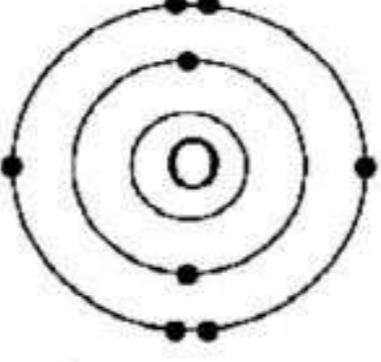
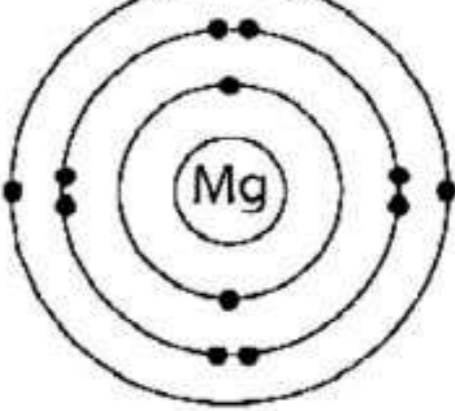
*Balance the chemical equation and calculate the mass of carbon dioxide gas formed.*

[Relative atomic mass: C=12, O=16, Molar volume = 24 dm<sup>3</sup> mol<sup>-1</sup> at room temperature].

[4 Markah]

[4 marks]

- 7 Rajah 7.1 menunjukkan susunan elektron bagi atom karbon, oksigen dan magnesium.  
Diagram 7.1 shows the arrangement of carbon atom, oxygen atom and magnesium atom.

		
Atom karbon <i>Carbon atom</i>	Atom oksigen <i>Oxygen atom</i>	Atom magnesium <i>Magnesium atom</i>

Rajah 7.1  
Diagram 7.1

Berdasarkan Rajah 7.1,  
*Based on Diagram 7.1,*

- (a) Atom oksigen bertindak balas dengan atom magnesium untuk membentuk suatu sebatian.  
*Oxygen atom reacts with magnesium atom to form a compound.*

- (i) Apakah jenis sebatian yang terbentuk?  
*What is the type of compound formed?*

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

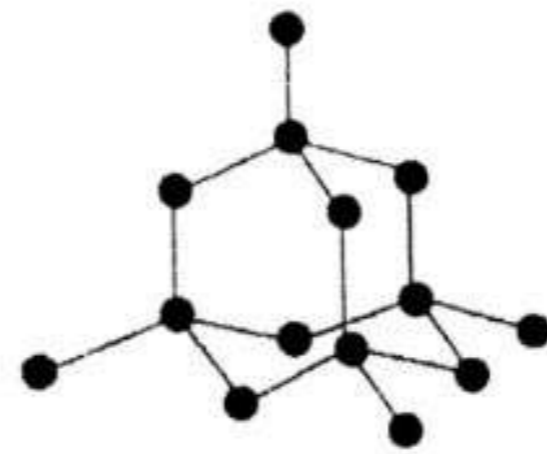
- (ii) Lukiskan rajah susunan elektron bagi sebatian yang terbentuk.  
*Draw a diagram of the electron arrangement of the compound formed..*

[2 markah]  
[2 marks]

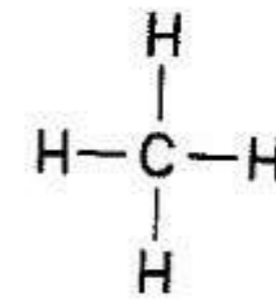
- (b) Nyatakan sifat fizik sebatian kovalen?  
*State the physical properties of covalent compound?*

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

- (c) Rajah 7.2 menunjukkan struktur berlian dan struktur metana. Berlian dan metana merupakan sebatian kovalen.  
*Diagram 7.2 shows the diamond structure and methane structure. Diamond and methane are covalent compounds.*



Berlian  
*Diamond*



Metana  
*Methane*

Rajah 7.2  
*Diagram 7.2*

Berdasarkan Rajah 7.2,  
*Based on Diagram 7.2,*

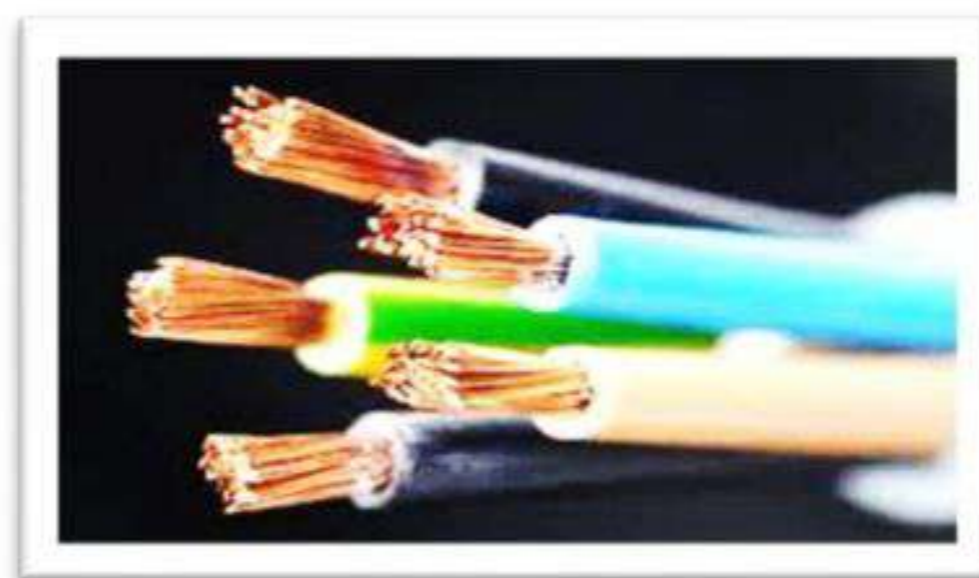
- (i) Bandingkan takat lebur dan takat didih bagi berlian dan metana.  
 Compare the melting point and boiling point of diamonds and methane.

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

- (ii) Ramalkan kekonduksian elektrik berlian. Justifikasikan jawapan anda.  
*Predict the electrical conductivity of diamonds. Justify your answer.*

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

- (d) Kuprum, Cu merupakan logam yang lazim digunakan dalam pembuatan wayar elektrik.  
*Copper, Cu is a metal that is commonly used in the manufacturing of electric wires.*



Terangkan secara ringkas bagaimana logam ini berupaya mengkonduksikan elektrik.

*Explain briefly how this metal can conduct electricity.*

.....

.....

.....

[3 markah]

[3 marks]

- 8 Jadual 8 menunjukkan maklumat yang diperolehi dalam menentukan haba pemendakan plumbum(II) sulfat. Eksperimen dijalankan dengan mencampurkan 25 cm<sup>3</sup> larutan plumbum(II) nitrat 0.5 mol dm<sup>-3</sup> dengan 25 cm<sup>3</sup> larutan kalium sulfat 0.5 mol dm<sup>-3</sup>.  
*Table 8 shows the information obtained in determining the heat of precipitation of lead(II) sulfate. The experiment was conducted by mixing 25 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> lead(II) nitrate solution with 25 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> potassium sulfate solution*

Suhu awal larutan plumbum(II) nitrat <i>Initial temperature of lead(II) nitrate solution</i>	28.0 <sup>0</sup> C
Suhu awal larutan kalium sulfat <i>Initial temperature of potassium sulfate solution</i>	29.0 <sup>0</sup> C
Suhu tertinggi campuran <i>The highest temperature of the mixture</i>	33.0 <sup>0</sup> C

Jadual 8

*Table 8*

- (a) Apakah yang dimaksudkan dengan haba pemendakan bagi eksperimen tersebut.  
*What is meant by the heat of precipitation for the experiment.*

.....

.....

[1 markah ]

[1 mark]

- (b) Tuliskan persamaan ion bagi tindak balas ini.  
*Write the ionic equation for this reaction.*

.....

[1 markah]

[1 mark]

- (c) Hitungkan bilangan mol ion plumbum(II) dan ion sulfat yang wujud dalam setiap larutan tersebut  
*Calculate the number of moles of lead(II) ions and sulphate ions present in each solution*

(i) ion plumbum(II)  
*lead(II) ion*

(ii) ion sulfat  
*sulphate ion*

[2 markah]  
[2 marks]

- (d) Hitungkan perubahan haba yang berlaku di dalam tindak balas ini.  
[Muatan haba tentu =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ , ketumpatan larutan =  $1 \text{ g cm}^{-3}$  ]  
*Calculate the heat change that occurs in this reaction.*  
[Specific heat load =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ , density of the solution =  $1 \text{ g cm}^{-3}$  ]

[1 markah]  
[1 mark]

- (e) Hitungkan haba pemendakan tindak balas ini.  
*Calculate the heat of precipitation of this reaction.*

[1 markah ]  
[1 mark]

- (f) Lukiskan gambar rajah aras tenaga bagi tindak balas pemendakan ini.  
*Draw an energy level diagram for this precipitation reaction.*

[2 markah]  
[2 marks]

- (g) Semasa perlawanan bola sepak, seorang pemain mendapati lututnya bengkak selepas berlanggar dengan pemain lawan. Ahli fisioterapi telah meletakkan ketulan ais pada lutut pemain itu untuk mengurangkan kesakitan.  
*During a soccer match, a player found his knee swollen after colliding with an opposing player. Physiotherapists have placed ice packs on the player's knee to ease the pain.*



Sebagai seorang pelajar kimia, cadangkan kaedah lain untuk membantu pemain itu meredakan kesakitan. Terangkan bagaimana?  
*As a chemistry student, suggest other methods to help the player to relieve the pain. Explain how?*

.....

.....

.....

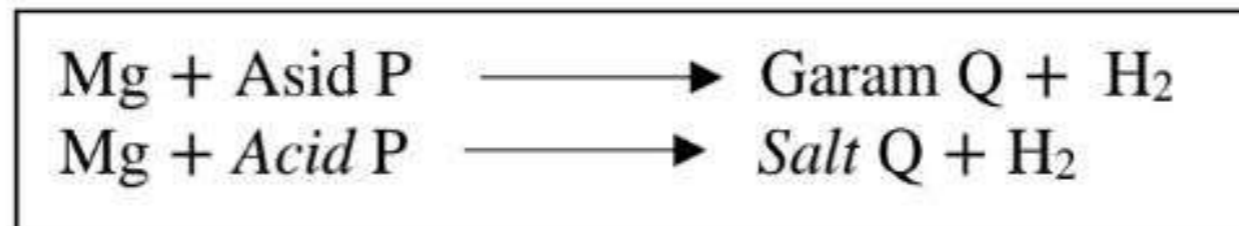
[2 markah ]  
[2 marks]

**Bahagian B**  
[20 markah]

*Jawab mana-mana satu soalan dalam bahagian ini.*

- 9 Rajah 9.1 menunjukkan persamaan tindak balas antara magnesium dan asid P. Asid P ialah asid monoprotik.

*Diagram 9.1 shows the equation reaction between magnesium and acid P. Acid P is a monoprotic acid.*



Rajah 9.1  
Diagram 9.1

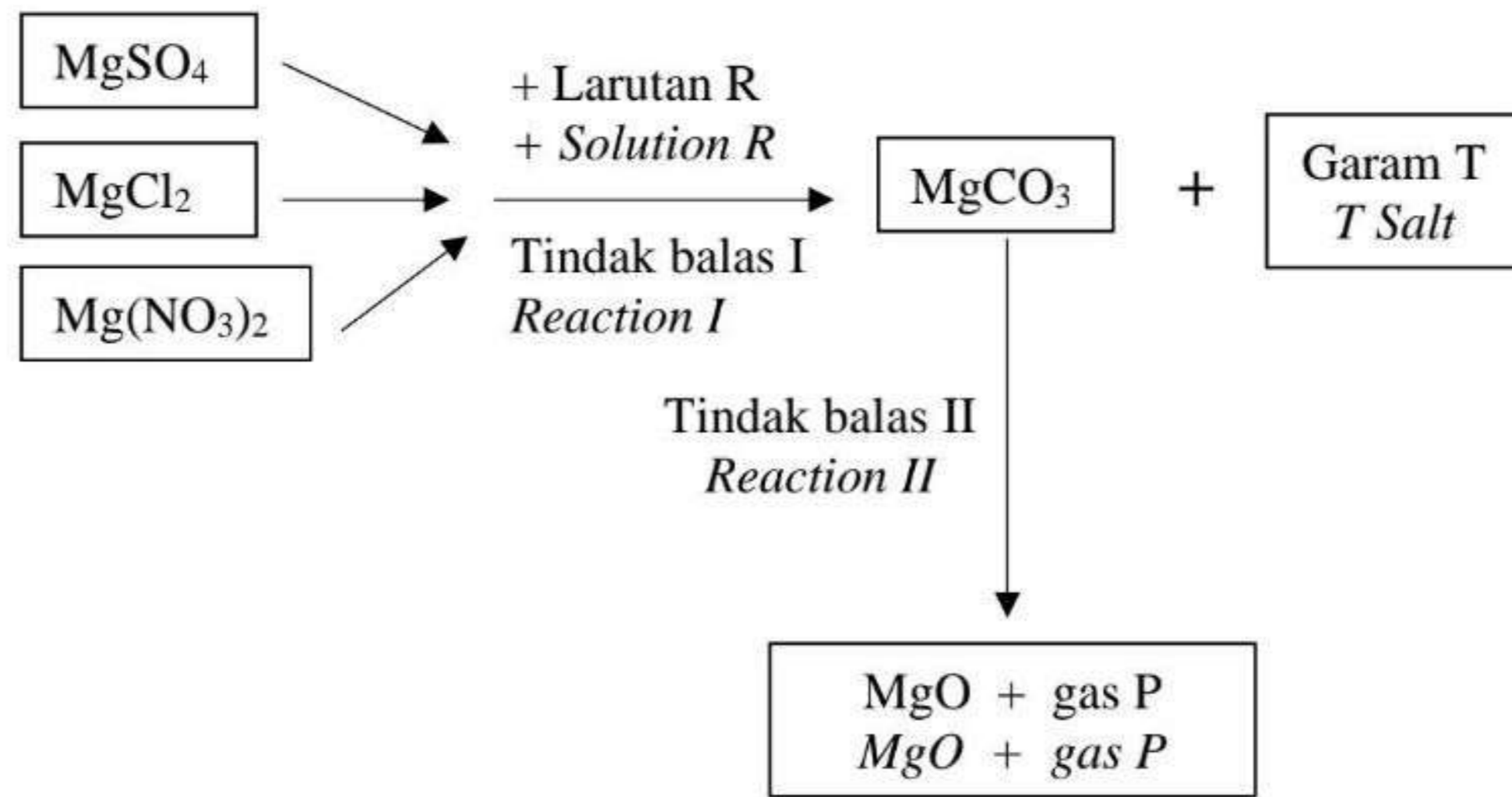
- (a) Berdasarkan Rajah 9.1,  
*Based on Diagram 9.1,*
- Nyatakan maksud asid monoprotik dan berikan satu sifat fizik bagi asid ini.
  - Cadangkan asid P dan kenal pasti garam Q
  - *State the meaning of monoprotic acid and state one physical properties for this acid.*
  - *Suggest acid P and identify salt Q..*

[4 markah]

[4 marks]

- (b) Rajah 9.2 menunjukkan carta alir bagi garam magnesium.  
Garam magnesium sulfat,  $\text{MgSO}_4$ , magnesium klorida,  $\text{MgCl}_2$  dan magnesium nitrat,  $\text{Mg}(\text{NO}_3)_2$  boleh ditukarkan kepada magnesium karbonat,  $\text{MgCO}_3$  melalui tindak balas I. Garam magnesium karbonat,  $\text{MgCO}_3$  terurai melalui tindak balas II menghasilkan magnesium oksida,  $\text{MgO}$  dan gas P.  
*Diagram 9.2 shows a flow chart of magnesium salt.*  
*Magnesium sulphate,  $\text{MgSO}_4$ , magnesium chloride,  $\text{MgCl}_2$  and magnesium nitrate,  $\text{Mg}(\text{NO}_3)_2$  salts can be converted to magnesium carbonate,  $\text{MgCO}_3$  through reaction I. Magnesium carbonate,  $\text{MgCO}_3$  salt decomposes through reaction II to form magnesium oxide,  $\text{MgO}$  and gas P.*





Rajah 9.2  
Diagram 9.2

Berdasarkan Rajah 9.2,  
Based on Diagram 9.2,

- (i) Pilih salah satu di antara 3 garam magnesium yang akan bertindak balas dengan larutan R melalui tindak balas I untuk menghasilkan magnesium karbonat,  $\text{MgCO}_3$  dan garam T dan
- cadangkan larutan R yang sesuai serta
  - tuliskan persamaan kimia yang terlibat

*Choose one of the 3 magnesium salts that will react with solution R through reaction I to produce magnesium carbonate,  $\text{MgCO}_3$  and salt T and*

- *suggest the appropriate solution R as well*
- *write the chemical equation involved*

[3 markah]

[3 marks]

- (ii) Namakan tindak balas II dan terangkan bagaimana untuk menguji kehadiran gas P.

*Name reaction II and explain how to test for the presence of gas P.*

[3 markah]

[3 marks]

- (c) Suatu eksperimen telah dijalankan untuk mengkaji sifat keasidan dan kekonduksian elektrik bagi larutan A dan larutan B. Larutan A dan larutan B adalah campuran asid etanoik glasial dengan dua pelarut yang berbeza, pelarut K dan pelarut L.

*An experiment is carried out to study the acidic properties and electrical conductivity of solutions A and B. Solutions A and B are the mixture of glacial ethanoic acid with two different solvents, solvents K and L.*

Larutan A : Asid etanoik glasial + Pelarut K  
*Solution A : Glacial ethanoic acid + Solvent K*

Larutan B : Asid etanoik glasial + Pelarut L  
*Solution B : Glacial ethanoic acid + Solvent L*

Rajah 9.3 menunjukkan pemerhatian bagi dua set eksperimen itu.  
*Diagram 9.3 shows the observation for two sets of the experiment.*

Set Set	Pemerhatian Observation
I	
II	

Rajah 9.3  
 Diagram 9.3

Berdasarkan Rajah 9.3, kenal pasti pelarut K dan pelarut L. Terangkan mengapa terdapat perbezaan dalam pemerhatian dalam Set I dan Set II. Tulis persamaan kimia bagi tindak balas yang berlaku di Set I.

*Based on Diagram 9.3, identify solvent K and solvent L. Explain why there are differences in the observations in Set I and Set II. Write the chemical equation for the reaction that occurs in Set I.*

[10 markah]

[10 marks]

- 10** Jadual 10 menunjukkan dua set eksperimen tindak balas antara marmar,  $\text{CaCO}_3$  dengan asid hidroklorik. Masa yang diambil untuk mengumpulkan **50 cm<sup>3</sup> gas karbon dioksida** dalam setiap set ditunjukkan di dalam jadual.

*Table 10 shows two sets of reaction experiments between marble,  $\text{CaCO}_3$  and hydrochloric acid. The time taken to collect 50 cm<sup>3</sup> of carbon dioxide gas in each set is shown in the table.*

Set Set	Bahan tindak balas <i>Reactants</i>	Masa diambil (s) <i>Time taken (s)</i>
I	5.0 g ketulan marmar, $\text{CaCO}_3$ + 50 cm <sup>3</sup> asid hidroklorik, HCl 0.5 mol dm <sup>-3</sup> pada suhu bilik <i>5.0 g marble chips, <math>\text{CaCO}_3</math> + 50 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> hydrochloric acid at room temperature</i>	50
II	5.0 g serbuk marmar, $\text{CaCO}_3$ + 50 cm <sup>3</sup> asid hidroklorik, HCl 0.5 mol dm <sup>-3</sup> pada suhu bilik <i>5.0 g marble powder, <math>\text{CaCO}_3</math> + 50 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> hydrochloric acid at room temperature</i>	20

Jadual 10  
Table 10

- (a) Berdasarkan Jadual 10,

*Based on Table 10,*

- (i) Nyatakan

- maksud kadar tindak balas dalam eksperimen ini
- faktor yang mempengaruhi kadar tindak balas

*State*

- *the meaning of rate of reaction*
- *factor that effect rate of reaction*

[2 markah]

[2 marks]

- (ii) Tuliskan persamaan kimia bagi Set 1. Hitungkan kadar tindak balas purata bagi Set 1 dan Set II. Berdasarkan jawapan anda, bandingkan kadar tindak balas kedua-dua set dan terangkan perbandingan tersebut menggunakan teori perlanggaran.

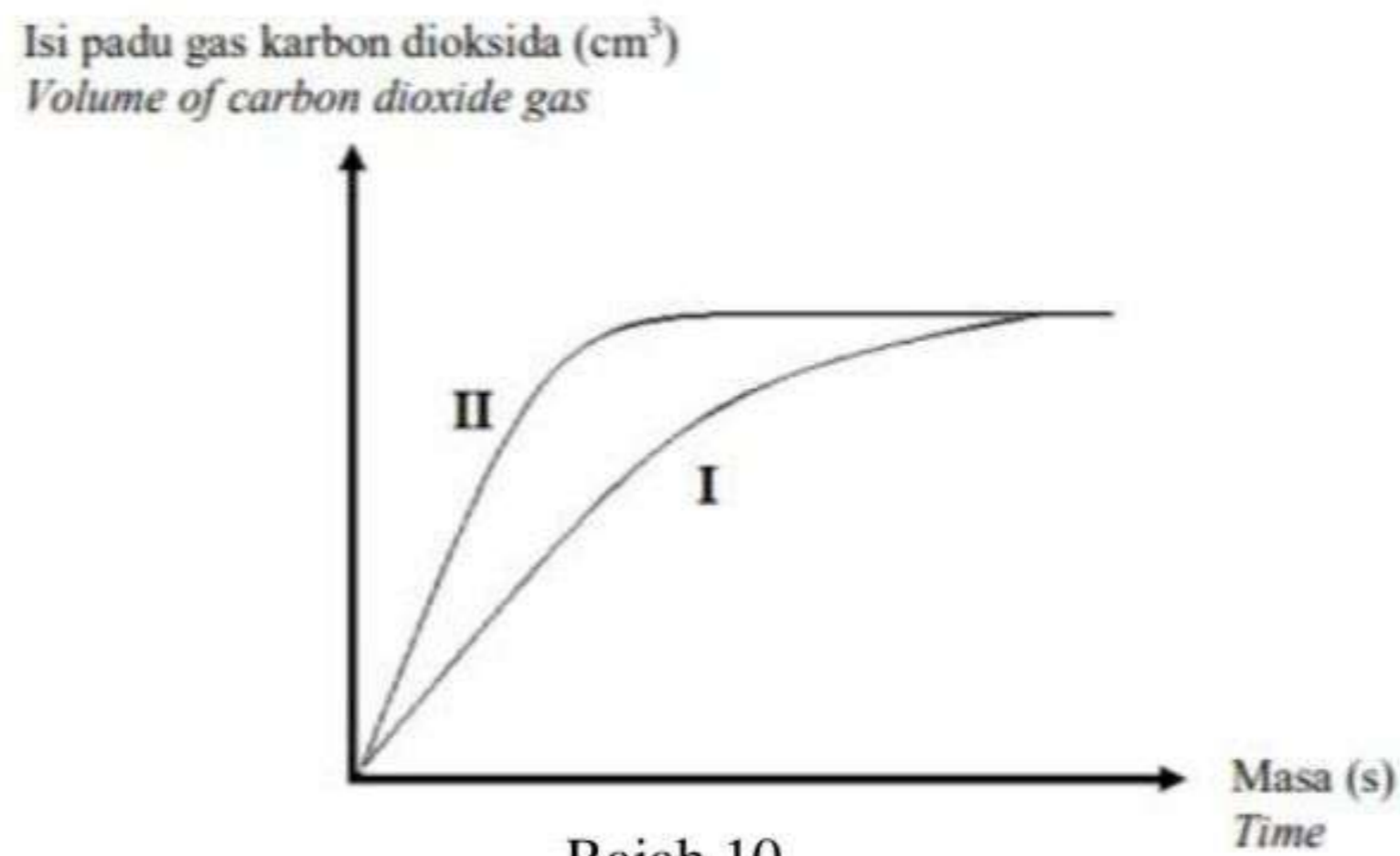
*Write the chemical equation for Set 1. Calculate the average rate of reaction for Set 1 and Set II. Based on your answer, compare the rate of reaction between two sets and explain the comparison using collision theory.*

[8 markah]

[8 marks]

- (b) Rajah 10 menunjukkan graf isipadu karbon dioksida melawan masa bagi dua set eksperimen, I dan II.

*Diagram 10 shows the graph of volume of carbon dioxide gas against time for two sets of experiment, I and II.*



Rajah 10  
Diagram 10

Cadangkan dua kaedah lain untuk menjalankan eksperimen tersebut supaya memperoleh graf seperti Set II.

*Suggest another two methods to conduct the experiment, in order to obtain the graph as in Set II.*

[2 markah]

[2 marks]

- (c) Dengan menggunakan Set 1 dalam Jadual 10, huraikan prosedur untuk menjalankan eksperimen itu.

*Using Set 1 in Table 10, describe the procedure for conducting the experiment.*

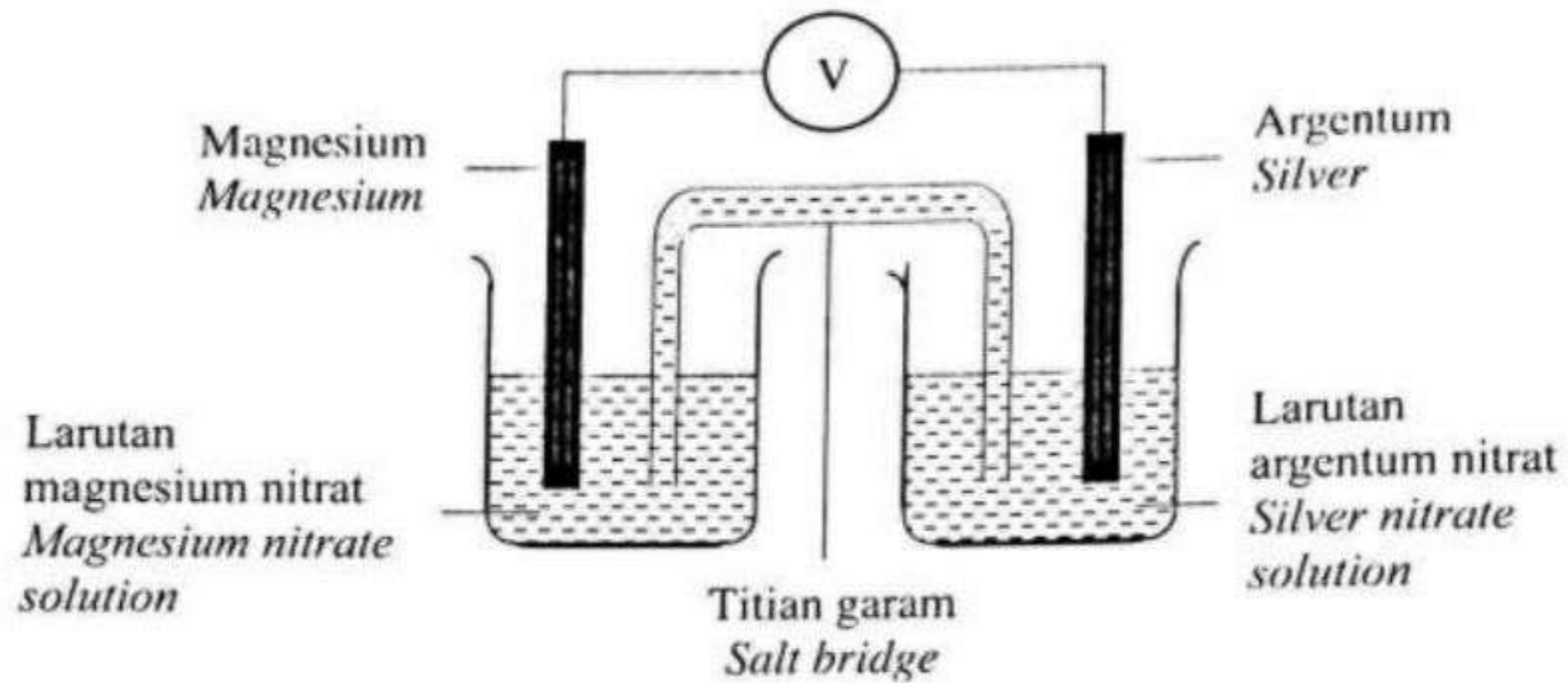
[8 markah]

[8 marks]

**Bahagian C**  
[ 20 markah ]

*Jawab soalan dalam bahagian ini.*

- 11** Rajah 11.1 menunjukkan susunan radas bagi satu sel kimia dalam satu tindak balas redoks  
*Diagram 11.1 shows the apparatus arrangement of a chemical cell in a redox reaction.*



Rajah 11.1  
Diagram 11.1

Nilai  $E^\circ$  bagi dua sel setengah tersebut adalah :

*The  $E^\circ$  value for the two half-cells are :*

$Mg^{2+} (ak/aq) + 2e^- \rightleftharpoons Mg (p/s)$	$E^\circ = -2.38 V$
$Ag^+ (ak/aq) + e^- \rightleftharpoons Ag (p/s)$	$E^\circ = +0.80 V$

Berdasarkan Rajah 11.1,

*Based on Diagram 11.1,*

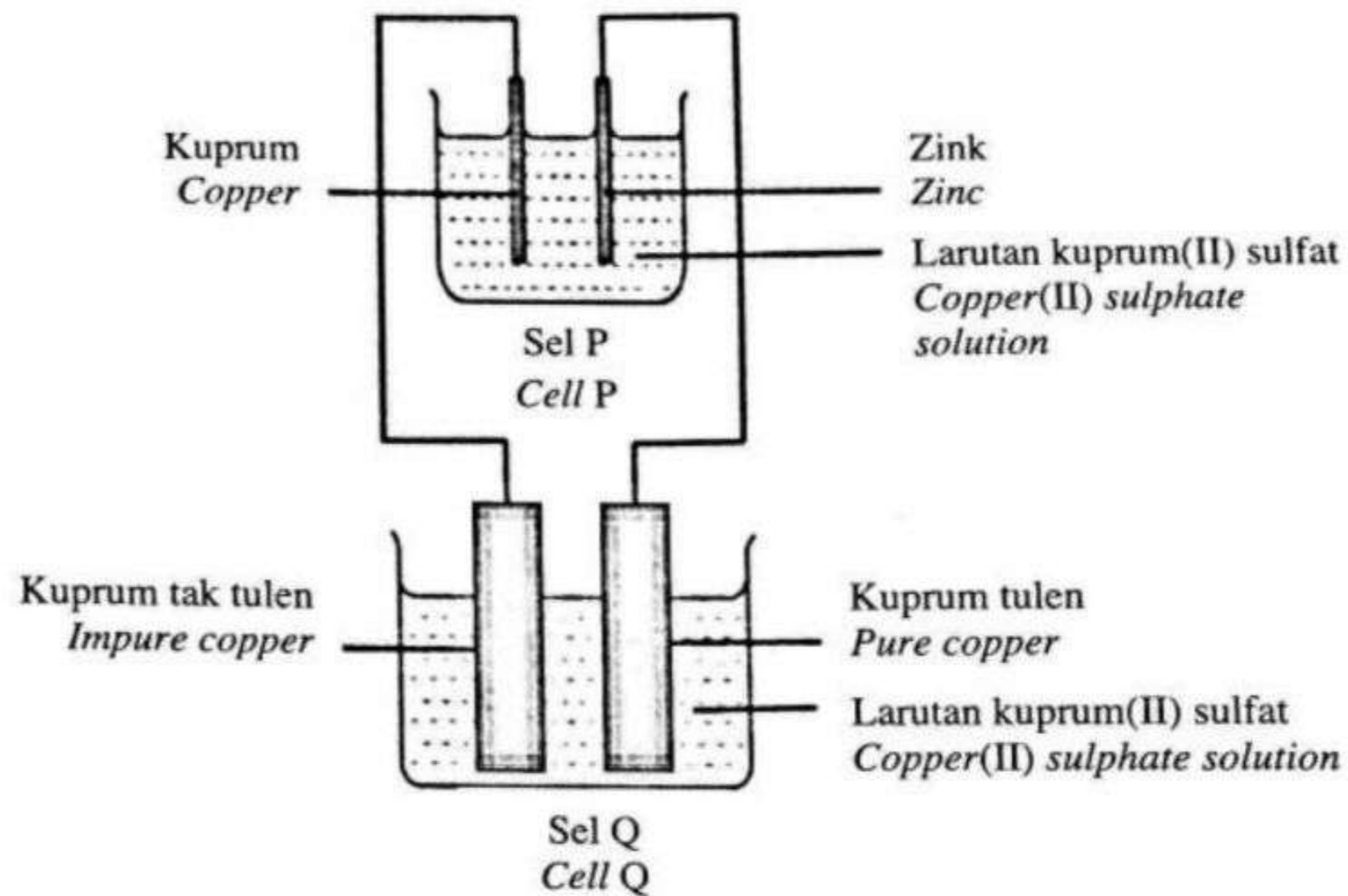
- (a) Apakah yang dimaksudkan dengan tindak balas redoks dan nyatakan terminal negatif dan terminal positif bagi sel ini. Seterusnya, tuliskan persamaan ion dan notasi sel bagi sel tersebut.

*What is meant by a redox reaction and state the negative terminal and positive terminal of this cell. Next, write the ionic equation and cell notation for the cell.*

[ 7 markah ]

[ 7 marks ]

- (b) Rajah 11.2 menunjukkan susunan radas proses penulenan logam kuprum  
*Diagram 11.2 shows the apparatus setup of purification process of copper metal.*



Rajah 11.2  
 Diagram 11.2

Nilai  $E^\circ$  bagi beberapa sel setengah adalah :  
*The  $E^\circ$  value for a few half-cells are :*

$\text{Zn}^{2+} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{Zn} (\text{p/s})$	$E^\circ = -0.76 \text{ V}$
$2\text{H}^+ (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2 (\text{g})$	$E^\circ = 0.00 \text{ V}$
$\text{Cu}^{2+} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{Cu} (\text{p/s})$	$E^\circ = +0.34 \text{ V}$
$\text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{ce/l}) + 4\text{e}^- \rightleftharpoons 4\text{OH}^- (\text{ak/aq})$	$E^\circ = +0.40 \text{ V}$
$\text{S}_2\text{O}_8^{2-} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons 2\text{SO}_4^{2-} (\text{ak/aq})$	$E^\circ = +2.01 \text{ V}$

Berdasarkan Rajah 11.2, bandingkan pemerhatian pada warna elektrolit dalam sel P dan sel Q selepas 30 minit. Terangkan jawapan anda.

*Based on Diagram 11.2, compare the observations on the colour of electrolytes in cell P and cell Q after 30 minutes. Explain your answer.*

[ 5 markah ]  
 [ 5 marks ]

- (c) Rajah 11.3 menunjukkan senarai bahan dan radas yang dibekalkan untuk membina satu sel kimia.

*Diagram 11.3 shows the list of materials and apparatus provided to construct a voltaic cell*

Tomato <i>Tomato</i>	Wayar penyambung <i>Connecting wire</i>	Mentol LED <i>LED bulb</i>
Paku besi <i>Iron nail</i>	Kepingan zink <i>Zink strip</i>	Kepingan kuprum <i>Copper strip</i>
Sudu plastik <i>Plastic spoon</i>	Kepingan magnesium <i>Magnesium strip</i>	Rod karbon <i>Carbon rod</i>
	Kertas pasir <i>Sand paper</i>	

Rajah 11.3  
*Diagram 11.3*

Jadual 11 menunjukkan sebahagian daripada nilai siri keupayaan elektrod piawai.  
*Table 11 shows part of the standard electrode potential series values.*

Tindak balas sel setengah <i>Half cell reaction</i>	$E^\circ / \text{V} (298 \text{ K})$
$\text{Mg}^{2+} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{Mg} (\text{p/s})$	$E^\circ = -2.38 \text{ V}$
$\text{Zn}^{2+} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{Zn} (\text{p/s})$	$E^\circ = -0.76 \text{ V}$
$\text{Fe}^{2+} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{Fe} (\text{p/s})$	$E^\circ = -0.44 \text{ V}$
$2\text{H}^+ (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2 (\text{g})$	$E^\circ = 0.00 \text{ V}$
$\text{Cu}^{2+} (\text{ak/aq}) + 2\text{e}^- \rightleftharpoons \text{Cu} (\text{p/s})$	$E^\circ = +0.34 \text{ V}$

Jadual 11  
*Table 11*

Dengan menggunakan pengetahuan kimia anda, lukis susunan radas sel kimia yang dapat menyalakan mentol LED. Susunan radas yang dibina perlulah menggunakan bahan dan radas yang sesuai seperti yang disenaraikan dalam Rajah 11.3.

Huraikan secara ringkas langkah pembinaan sel kimia tersebut dan terangkan tindak balas redoks yang berlaku. Kemudian, tentukan nilai bacaan voltan yang diperoleh.

*By using your chemistry knowledge, draw an apparatus setup of a voltaic cell that can light up on LED bulb. The apparatus setup constructed should use suitable materials and apparatus as listed in Diagram 11.3.*

*Describe briefly the steps of constructing the voltaic cell and explain the redox reaction that take place. Then determine the value of the voltage reading obtained.*

[ 8 markah ]

[ 8 marks ]

### **KERTAS SOALAN TAMAT**



1A 1	2A 2							3A 13	4A 14	5A 15	6A 16	7A 17	8A 18																																																																																																																																																																																																																					
1 <b>H</b> Hydrogen 1.00794	3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.01218	11 <b>Na</b> Sodium 22.98977	12 <b>Mg</b> Magnesium 24.305	19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.9559	22 <b>Ti</b> Titanium 47.88	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.9380	26 <b>Fe</b> Iron 55.847	27 <b>Co</b> Cobalt 58.9332	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.39	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.61	33 <b>As</b> Arsenic 74.9216	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.80	37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.9059	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.9064	42 <b>Mo</b> Molybdenum 95.94	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.9055	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.82	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.757	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.9045	54 <b>Xe</b> Xenon 131.29	55 <b>Cs</b> Cesium 132.9054	56 <b>Ba</b> Barium 137.327	57 <b>*La</b> Lanthanum 138.9055	58 <b>Ce</b> Cerium 140.115	59 <b>Pr</b> Praseodymium 140.9077	60 <b>Nd</b> Neodymium 144.24	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.965	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.9254	66 <b>Dy</b> Dysprosium 162.50	67 <b>Ho</b> Holmium 164.9303	68 <b>Er</b> Erbium 167.26	69 <b>Tm</b> Thulium 168.9342	70 <b>Yb</b> Ytterbium 173.04	71 <b>Lu</b> Lutetium 174.967																																																																																																																																																																									
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium 226.0254	89 <b>†Ac</b> Actinium 227.0278	90 <b>Th</b> Thorium 232.0381	91 <b>Pa</b> Protactinium 231.0359	92 <b>U</b> Uranium 238.0289	93 <b>Np</b> Neptunium 237.048	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (260)	104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (263)	107 <b>Bh</b> Bohrium (262)	108 <b>Hs</b> Hassium (265)	109 <b>Mt</b> Meitnerium (268)	110 <b>Ds</b> Darmstadtium (269)	111 <b>Cn</b> Copernicium (285)	112 <b>Nh</b> Nihonium (286)	113 <b>Fl</b> Flerovium (289)	114 <b>Mc</b> Moscovium (288)	115 <b>Lv</b> Livermorium (293)	116 <b>Ts</b> Tennessine (294)	117 <b>Og</b> Oganesson (294)	118 <b>Uu</b> Ununseptium (295)	119 <b>Uub</b> Ununseptium (296)	120 <b>Uuq</b> Unquadium (298)	121 <b>Uuq</b> Unquadium (299)	122 <b>Uub</b> Unbinilium (301)	123 <b>Uut</b> Untrium (303)	124 <b>Uuq</b> Unquadium (304)	125 <b>Uub</b> Unbinilium (306)	126 <b>Uuq</b> Unquadium (307)	127 <b>Uub</b> Unbinilium (309)	128 <b>Uuq</b> Unquadium (310)	129 <b>Uub</b> Unbinilium (312)	130 <b>Uuq</b> Unquadium (315)	131 <b>Uub</b> Unbinilium (316)	132 <b>Uuq</b> Unquadium (318)	133 <b>Uub</b> Unbinilium (319)	134 <b>Uuq</b> Unquadium (320)	135 <b>Uub</b> Unbinilium (321)	136 <b>Uuq</b> Unquadium (323)	137 <b>Uub</b> Unbinilium (324)	138 <b>Uuq</b> Unquadium (325)	139 <b>Uub</b> Unbinilium (326)	140 <b>Uuq</b> Unquadium (327)	141 <b>Uub</b> Unbinilium (328)	142 <b>Uuq</b> Unquadium (329)	143 <b>Uub</b> Unbinilium (330)	144 <b>Uuq</b> Unquadium (331)	145 <b>Uub</b> Unbinilium (332)	146 <b>Uuq</b> Unquadium (333)	147 <b>Uub</b> Unbinilium (334)	148 <b>Uuq</b> Unquadium (335)	149 <b>Uub</b> Unbinilium (336)	150 <b>Uuq</b> Unquadium (337)	151 <b>Uub</b> Unbinilium (338)	152 <b>Uuq</b> Unquadium (339)	153 <b>Uub</b> Unbinilium (340)	154 <b>Uuq</b> Unquadium (341)	155 <b>Uub</b> Unbinilium (342)	156 <b>Uuq</b> Unquadium (343)	157 <b>Uub</b> Unbinilium (344)	158 <b>Uuq</b> Unquadium (345)	159 <b>Uub</b> Unbinilium (346)	160 <b>Uuq</b> Unquadium (347)	161 <b>Uub</b> Unbinilium (348)	162 <b>Uuq</b> Unquadium (349)	163 <b>Uub</b> Unbinilium (350)	164 <b>Uuq</b> Unquadium (351)	165 <b>Uub</b> Unbinilium (352)	166 <b>Uuq</b> Unquadium (353)	167 <b>Uub</b> Unbinilium (354)	168 <b>Uuq</b> Unquadium (355)	169 <b>Uub</b> Unbinilium (356)	170 <b>Uuq</b> Unquadium (357)	171 <b>Uub</b> Unbinilium (358)	172 <b>Uuq</b> Unquadium (359)	173 <b>Uub</b> Unbinilium (360)	174 <b>Uuq</b> Unquadium (361)	175 <b>Uub</b> Unbinilium (362)	176 <b>Uuq</b> Unquadium (363)	177 <b>Uub</b> Unbinilium (364)	178 <b>Uuq</b> Unquadium (365)	179 <b>Uub</b> Unbinilium (366)	180 <b>Uuq</b> Unquadium (367)	181 <b>Uub</b> Unbinilium (368)	182 <b>Uuq</b> Unquadium (369)	183 <b>Uub</b> Unbinilium (370)	184 <b>Uuq</b> Unquadium (371)	185 <b>Uub</b> Unbinilium (372)	186 <b>Uuq</b> Unquadium (373)	187 <b>Uub</b> Unbinilium (374)	188 <b>Uuq</b> Unquadium (375)	189 <b>Uub</b> Unbinilium (376)	190 <b>Uuq</b> Unquadium (377)	191 <b>Uub</b> Unbinilium (378)	192 <b>Uuq</b> Unquadium (379)	193 <b>Uub</b> Unbinilium (380)	194 <b>Uuq</b> Unquadium (381)	195 <b>Uub</b> Unbinilium (382)	196 <b>Uuq</b> Unquadium (383)	197 <b>Uub</b> Unbinilium (384)	198 <b>Uuq</b> Unquadium (385)	199 <b>Uub</b> Unbinilium (386)	200 <b>Uuq</b> Unquadium (387)	201 <b>Uub</b> Unbinilium (388)	202 <b>Uuq</b> Unquadium (389)	203 <b>Uub</b> Unbinilium (390)	204 <b>Uuq</b> Unquadium (391)	205 <b>Uub</b> Unbinilium (392)	206 <b>Uuq</b> Unquadium (393)	207 <b>Uub</b> Unbinilium (394)	208 <b>Uuq</b> Unquadium (395)	209 <b>Uub</b> Unbinilium (396)	210 <b>Uuq</b> Unquadium (397)	211 <b>Uub</b> Unbinilium (398)	212 <b>Uuq</b> Unquadium (399)	213 <b>Uub</b> Unbinilium (400)	214 <b>Uuq</b> Unquadium (401)	215 <b>Uub</b> Unbinilium (402)	216 <b>Uuq</b> Unquadium (403)	217 <b>Uub</b> Unbinilium (404)	218 <b>Uuq</b> Unquadium (405)	219 <b>Uub</b> Unbinilium (406)	220 <b>Uuq</b> Unquadium (407)	221 <b>Uub</b> Unbinilium (408)	222 <b>Uuq</b> Unquadium (409)	223 <b>Uub</b> Unbinilium (410)	224 <b>Uuq</b> Unquadium (411)	225 <b>Uub</b> Unbinilium (412)	226 <b>Uuq</b> Unquadium (413)	227 <b>Uub</b> Unbinilium (414)	228 <b>Uuq</b> Unquadium (415)	229 <b>Uub</b> Unbinilium (416)	230 <b>Uuq</b> Unquadium (417)	231 <b>Uub</b> Unbinilium (418)	232 <b>Uuq</b> Unquadium (419)	233 <b>Uub</b> Unbinilium (420)	234 <b>Uuq</b> Unquadium (421)	235 <b>Uub</b> Unbinilium (422)	236 <b>Uuq</b> Unquadium (423)	237 <b>Uub</b> Unbinilium (424)	238 <b>Uuq</b> Unquadium (425)	239 <b>Uub</b> Unbinilium (426)	240 <b>Uuq</b> Unquadium (427)	241 <b>Uub</b> Unbinilium (428)	242 <b>Uuq</b> Unquadium (429)	243 <b>Uub</b> Unbinilium (430)	244 <b>Uuq</b> Unquadium (431)	245 <b>Uub</b> Unbinilium (432)	246 <b>Uuq</b> Unquadium (433)	247 <b>Uub</b> Unbinilium (434)	248 <b>Uuq</b> Unquadium (435)	249 <b>Uub</b> Unbinilium (436)	250 <b>Uuq</b> Unquadium (437)	251 <b>Uub</b> Unbinilium (438)	252 <b>Uuq</b> Unquadium (439)	253 <b>Uub</b> Unbinilium (440)	254 <b>Uuq</b> Unquadium (441)	255 <b>Uub</b> Unbinilium (442)	256 <b>Uuq</b> Unquadium (443)	257 <b>Uub</b> Unbinilium (444)	258 <b>Uuq</b> Unquadium (445)	259 <b>Uub</b> Unbinilium (446)	260 <b>Uuq</b> Unquadium (447)	261 <b>Uub</b> Unbinilium (448)	262 <b>Uuq</b> Unquadium (449)	263 <b>Uub</b> Unbinilium (450)	264 <b>Uuq</b> Unquadium (451)	265 <b>Uub</b> Unbinilium (452)	266 <b>Uuq</b> Unquadium (453)	267 <b>Uub</b> Unbinilium (454)	268 <b>Uuq</b> Unquadium (455)	269 <b>Uub</b> Unbinilium (456)	270 <b>Uuq</b> Unquadium (457)	271 <b>Uub</b> Unbinilium (458)	272 <b>Uuq</b> Unquadium (459)	273 <b>Uub</b> Unbinilium (460)	274 <b>Uuq</b> Unquadium (461)	275 <b>Uub</b> Unbinilium (462)	276 <b>Uuq</b> Unquadium (463)	277 <b>Uub</b> Unbinilium (464)	278 <b>Uuq</b> Unquadium (465)	279 <b>Uub</b> Unbinilium (466)	280 <b>Uuq</b> Unquadium (467)	281 <b>Uub</b> Unbinilium (468)	282 <b>Uuq</b> Unquadium (469)	283 <b>Uub</b> Unbinilium (470)	284 <b>Uuq</b> Unquadium (471)	285 <b>Uub</b> Unbinilium (472)	286 <b>Uuq</b> Unquadium (473)	287 <b>Uub</b> Unbinilium (474)	288 <b>Uuq</b> Unquadium (475)	289 <b>Uub</b> Unbinilium (476)	290 <b>Uuq</b> Unquadium (477)	291 <b>Uub</b> Unbinilium (478)	292 <b>Uuq</b> Unquadium (479)	293 <b>Uub</b> Unbinilium (480)	294 <b>Uuq</b> Unquadium (481)	295 <b>Uub</b> Unbinilium (482)	296 <b>Uuq</b> Unquadium (483)	297 <b>Uub</b> Unbinilium (484)	298 <b>Uuq</b> Unquadium (485)	299 <b>Uub</b> Unbinilium (486)	300 <b>Uuq</b> Unquadium (487)	301 <b>Uub</b> Unbinilium (488)	302 <b>Uuq</b> Unquadium (489)	303 <b>Uub</b> Unbinilium (490)	304 <b>Uuq</b> Unquadium (491)	305 <b>Uub</b> Unbinilium (492)	306 <b>Uuq</b> Unquadium (493)	307 <b>Uub</b> Unbinilium (494)	308 <b>Uuq</b> Unquadium (495)	309 <b>Uub</b> Unbinilium (496)	310 <b>Uuq</b> Unquadium (497)	311 <b>Uub</b> Unbinilium (498)	312 <b>Uuq</b> Unquadium (499)	313 <b>Uub</b> Unbinilium (500)