

**CHAPTER 1**  
**BAB 1****RATE OF REACTION**  
**KADAR TINDAK BALAS****OBJECTIVE QUESTIONS**  
**SOALAN OBJEKTIF**

- 1 What is the meaning of rate of reaction?  
*Apakah maksud kadar tindak balas?*
- A Decrease in the amount of product  
*Pengurangan jumlah hasil tindak balas*
- B Decrease in the amount of product against time  
*Pengurangan jumlah hasil tindak balas dengan masa*
- C Increase in the amount of product against time  
*Peningkatan jumlah hasil tindak balas dengan masa*
- D Increase in the amount of reactant against time  
*Peningkatan jumlah bahan tindak balas dengan masa*
- 2 Which reaction has the highest rate of reaction?  
*Tindak balas manakah mempunyai kadar tindak balas paling tinggi?*
- A Fermentation of glucose to produce ethanol  
*Penapaian glukosa untuk menghasilkan etanol*
- B Photosynthesis in green plants in the presence of sunlight  
*Fotosintesis dalam tumbuhan hijau dengan kehadiran cahaya matahari*
- C Formation of petroleum from decomposition of plants and animals  
*Pembentukan petroleum daripada penguraian tumbuhan dan haiwan*
- D Burning of methane in excess oxygen to boil water  
*Pembakaran metana dalam oksigen berlebihan untuk mendidihkan air*
- 3 Which of the following is the correct unit for rate of reaction?  
*Antara berikut, yang manakah unit yang betul bagi kadar tindak balas?*
- A  $\text{g mol}^{-1}$       B  $\text{g min}^{-1}$       C  $\text{mol dm}^{-3}$       D  $\text{kJ mol}^{-1}$
- 4 Diagram 1 shows the graph of volume of hydrogen gas against time when magnesium ribbon is placed into dilute sulphuric acid.  
*Rajah 1 menunjukkan graf isi padu gas hidrogen melawan masa apabila pita magnesium dimasukkan ke dalam asid sulfurik cair.*

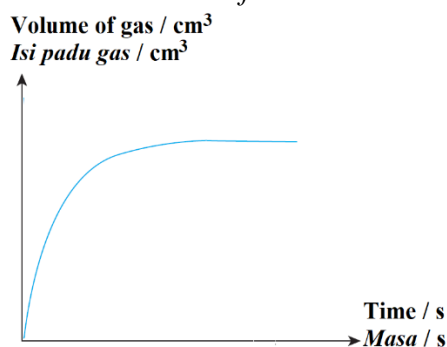


Diagram / Rajah 1

Which of the following statements explains the change in the gradient of the curve?  
*Antara pernyataan berikut, yang manakah menerangkan perubahan kecerunan lengkung?*

- A** Total surface area of magnesium ribbon increase  
*Jumlah luas permukaan pita magnesium meningkat*
- B** Temperature of reacting mixture decreases  
*Suhu campuran bahan tindak balas berkurang*
- C** Mass of magnesium sulphate decreases  
*Jisim magnesium sulfat berkurang*
- D** Concentration of sulphuric acid decreases  
*Kepekatan asid sulfurik berkurang*
- 5** One of the methods to determine the rate of reaction is by measuring the time taken for the formation of precipitate. In which reaction, can the rate of reaction be determined using this method?  
*Satu daripada kaedah untuk menentukan kadar tindak balas ialah dengan mengukur masa yang diambil untuk pembentukan mendakan. Dalam tindak balas manakah, kadar tindak balas dapat ditentukan menggunakan kaedah ini?*
- A**  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- B**  $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$
- C**  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- D**  $\text{Na}_2\text{S}_2\text{O}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{S} + \text{SO}_2 + \text{H}_2\text{O}$
- 6** Diagram 2 shows the apparatus set-up for an experiment to determine the rate of reaction.  
*Rajah 2 menunjukkan susunan radas bagi eksperimen untuk menentukan kadar tindak balas.*

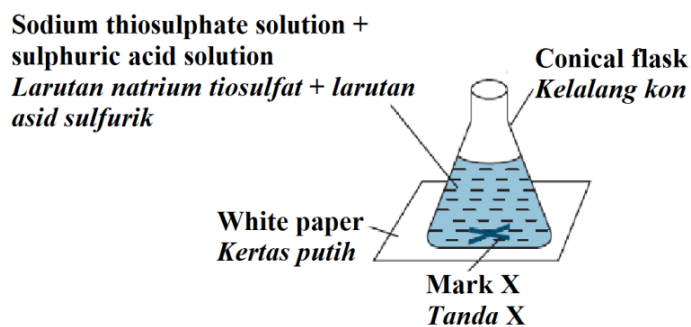


Diagram / Rajah 2

Which technique is the most suitable to determine the rate of reaction?  
*Teknik manakah yang sesuai untuk menentukan kadar tindak balas?*

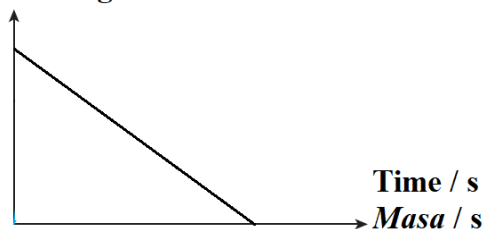
- A** Record the time as soon as the gas bubbles are released  
*Catat masa sebaik sahaja gelembung gas terbebas*
- B** Record the time as soon as the mark X is invisible from sight  
*Catat masa sebaik sahaja tanda X hilang dari penglihatan*
- C** Record the time taken to obtain the maximum mass of the mixture  
*Catat masa yang diambil untuk mendapatkan jisim maksimum campuran*

- D** Record the time taken for the change of the pH value until a fixed pH value is obtained

*Catatkan masa yang diambil bagi perubahan nilai pH sehingga nilai pH yang tetap diperolehi*

- 7** Which graph correctly shows the change of mass of reactant against time?  
*Graf yang manakah menunjukkan perubahan jisim bahan tindak balas melawan masa?*

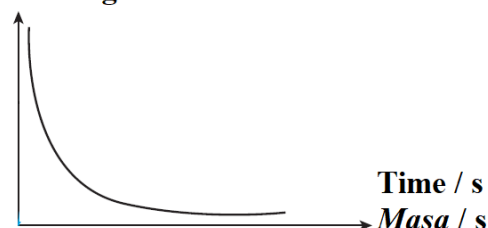
**A** Mass / g  
*Jisim / g*



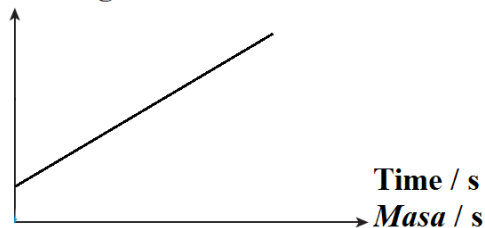
**B** Mass / g  
*Jisim / g*



**C** Mass / g  
*Jisim / g*



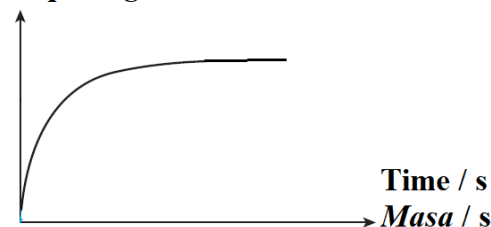
**D** Mass / g  
*Jisim / g*



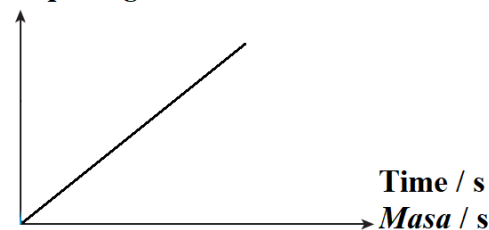
- 8** An experiment was conducted to investigate the decomposition of hydrogen peroxide. The volume of gas produced was recorded every 30 seconds. Which of the following graphs will be obtained?

*Suatu eksperimen dijalankan untuk mengkaji penguraian hidrogen peroksida. Isipadu gas yang terhasil direkodkan setiap 30 saat. Antara berikut, yang manakah graf yang akan diperolehi?*

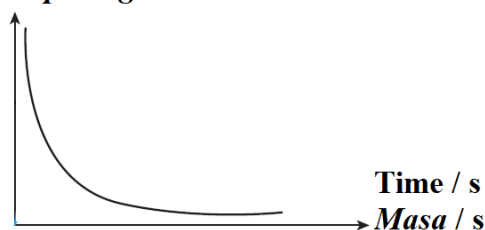
**A** Volume of gas / cm<sup>3</sup>  
*Isi padu gas / cm<sup>3</sup>*



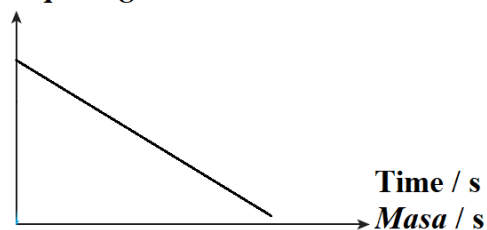
**B** Volume of gas / cm<sup>3</sup>  
*Isi padu gas / cm<sup>3</sup>*



**C** Volume of gas / cm<sup>3</sup>  
Isi padu gas / cm<sup>3</sup>



**D** Volume of gas / cm<sup>3</sup>  
Isi padu gas / cm<sup>3</sup>



- 9 Table 1 shows the volume of carbon dioxide gas released at half minutes intervals when hydrochloric acid reacts with marble chips.

Jadual 1 menunjukkan isipadu gas karbon dioksida terbebas bagi setiap setengah minit apabila asid hidroklorik bertindak balas dengan ketulan marmar.

<b>Time (min)</b> <b>Masa (min)</b>	0.0	0.5	1.0	1.5	2.0	2.5	3.0
<b>Volume of CO<sub>2</sub> (cm<sup>3</sup>)</b> <b>Isi padu CO<sub>2</sub> (cm<sup>3</sup>)</b>	0	170	260	305	340	350	350

Table / Jadual 1

What is the average rate of reaction in the second minute?

Apakah kadar tindak balas purata dalam minit kedua?

- A 80.0 cm<sup>3</sup> min<sup>-1</sup>      B 170.0 cm<sup>3</sup> min<sup>-1</sup>  
C 220.0 cm<sup>3</sup> min<sup>-1</sup>      D 340.0 cm<sup>3</sup> min<sup>-1</sup>
- 10 Table 2 shows the total volume of hydrogen gas, H<sub>2</sub> collected in the reaction between magnesium and nitric acid.

Jadual 2 menunjukkan jumlah isi padu gas hidrogen, H<sub>2</sub> yang terkumpul dalam tindak balas antara magnesium dengan asid nitrik.

<b>Time (s)</b> <b>Masa (s)</b>	0	15	30	45	60	75
<b>Volume of gas (cm<sup>3</sup>)</b> <b>Isi padu gas (cm<sup>3</sup>)</b>	0.00	22.00	38.00	45.00	48.00	48.00

Table / Jadual 2

What is the average rate of reaction?

Apakah kadar tindak balas purata?

- A 0.37 cm<sup>3</sup> s<sup>-1</sup>      B 0.64 cm<sup>3</sup> s<sup>-1</sup>      C 0.80 cm<sup>3</sup> s<sup>-1</sup>      D 1.74 cm<sup>3</sup> s<sup>-1</sup>
- 11 Table 3 shows the average rate of reaction between excess calcium carbonate and 50 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> sulphuric acid.

Jadual 3 menunjukkan kadar purata bagi tindak balas antara kalsium karbonat berlebihan dan 50 cm<sup>3</sup> asid sulfurik 0.5 mol dm<sup>-3</sup>.

<b>Time (s)</b>	60	120	180	240
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<i>Masa (s)</i>				
<b>Average rate (<math>\text{cm}^3 \text{s}^{-1}</math>)</b>				
<b>Kadar purata (<math>\text{cm}^3 \text{s}^{-1}</math>)</b>	1.28	0.60	0.23	0.12

Table / Jadual 3

Which of the following explains the changes in the average rate of reaction?

*Antara berikut, yang manakah dapat menerangkan perubahan purata kadar tindak balas itu?*

- A** Mass of calcium carbonate decreases  
*Jumlah kalsium karbonat berkurang*
  - B** Volume of gas released increases  
*Isi padu gas yang terbebas bertambah*
  - C** Concentration of hydrogen ion increases  
*Kepekatan ion hidrogen bertambah*
  - D** Volume of sulphuric acid used decreases  
*Isi padu asid sulfurik yang digunakan berkurang*
- 12** When the concentration of reactant increases, the rate of reaction increases.  
Which statement explains why the rate of reaction increases?  
*Apabila kepekatan bahan tindak balas meningkat, kadar tindak balas meningkat. Pernyataan manakah yang menerangkan mengapa kadar tindak balas meningkat?*
- A** The total surface area of the reactant particle increases  
*Jumlah luas permukaan zarah bahan tindak balas bertambah*
  - B** The total number of the reactant particles per unit volume increases  
*Jumlah bilangan zarah-zarah bahan tindak balas per unit isi padu bertambah*
  - C** The reactant particles move faster and collide more often with one another  
*Zarah-zarah bahan tindak balas bergerak lebih cepat dan berlanggar lebih kerap antara satu sama lain*
  - D** The reactant particles which collide more often are able to overcome the lower activation energy  
*Zarah-zarah bahan tindak balas yang berlanggar lebih kerap boleh mengatasi tenaga pengaktifan yang lebih rendah*
- 13** Excess calcium carbonate powder reacts with acid X to produce carbon dioxide gas.  
Which acid produces the highest rate of reaction?  
*Serbuk kalsium karbonat berlebihan bertindak balas dengan asid X untuk menghasilkan gas karbon dioksida. Asid manakah yang menghasilkan kadar tindak balas paling tinggi?*
- A**  $50 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  nitric acid  
 $50 \text{ cm}^3$  asid nitrik  $0.5 \text{ mol dm}^{-3}$
  - B**  $50 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  ethanoic acid  
 $50 \text{ cm}^3$  asid etanoik  $0.5 \text{ mol dm}^{-3}$
  - C**  $50 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  sulphuric acid  
 $50 \text{ cm}^3$  asid sulfurik  $0.5 \text{ mol dm}^{-3}$
  - D**  $50 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  hydrochloric acid  
 $50 \text{ cm}^3$  asid hidroklorik  $0.5 \text{ mol dm}^{-3}$

- 14 The following information shows the effect of a particular factor on the rate of reaction.  
*Maklumat berikut menunjukkan kesan satu faktor ke atas kadar tindak balas.*

- The kinetic energy of particles increases  
*Tenaga kinetik zarah-zarah meningkat*
- Frequency of collision between particles increases  
*Frekuensi perlanggaran antara zarah-zarah meningkat*
- Frequency of effective collision increases  
*Frekuensi perlanggaran berkesan meningkat*

Which of the following causes the above effect?

*Antara berikut, yang manakah memberikan kesan di atas?*

- A Adding a catalyst  
*Menambahkan mangkin*
- B Increasing the temperature of reactants  
*Menaikkan suhu bahan tindak balas*
- C Increasing the concentration of reactants  
*Meningkatkan kepekatan bahan tindak balas*
- D Using larger size of reactants  
*Menggunakan saiz bahan tindak balas yang lebih besar*
- 15 Calcium reacts slowly in cold water and becomes more vigorously in hot water. Which statement best explains the increasing rate of reaction?  
*Kalsium bertindak balas perlahan dalam air sejuk dan menjadi semakin cergas di dalam air panas. Pernyataan manakah yang paling baik menerangkan peningkatan kadar tindak balas?*
- A The number of particles per unit volume is higher and increases the rate of reaction  
*Bilangan zarah per unit isi padu lebih tinggi dan meningkatkan kadar tindak balas*
- B The activation energy is lower at the higher temperature and more particles have enough energy to react  
*Tenaga pengaktifan lebih rendah pada suhu yang lebih tinggi dan lebih banyak zarah-zarah mempunyai tenaga yang mencukupi untuk bertindak balas*
- C Calcium expands at higher temperature and increases its total surface area and the rate of reaction  
*Kalsium mengembang pada suhu yang lebih tinggi dan meningkatkan jumlah luas permukaan serta kadar tindak balas*
- D At higher temperature, the particles have higher kinetic energy and increases the number of collisions per second  
*Pada suhu yang lebih tinggi, zarah-zarah mempunyai tenaga kinetik yang lebih tinggi dan meningkatkan bilangan perlanggaran per saat*
- 16 Diagram 4 shows the apparatus set-up for the reaction between sodium thiosulphate solution and sulphuric acid to form yellow precipitate.  
*Rajah 4 menunjukkan susunan radas yang digunakan bagi tindak balas antara larutan natrium tiosulfat dengan asid sulfurik untuk membentuk mendakan kuning.*

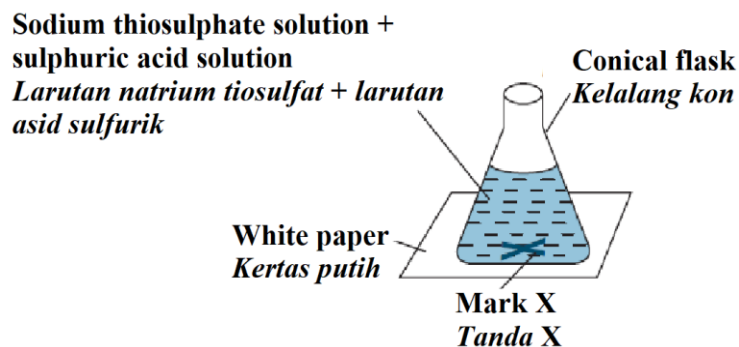
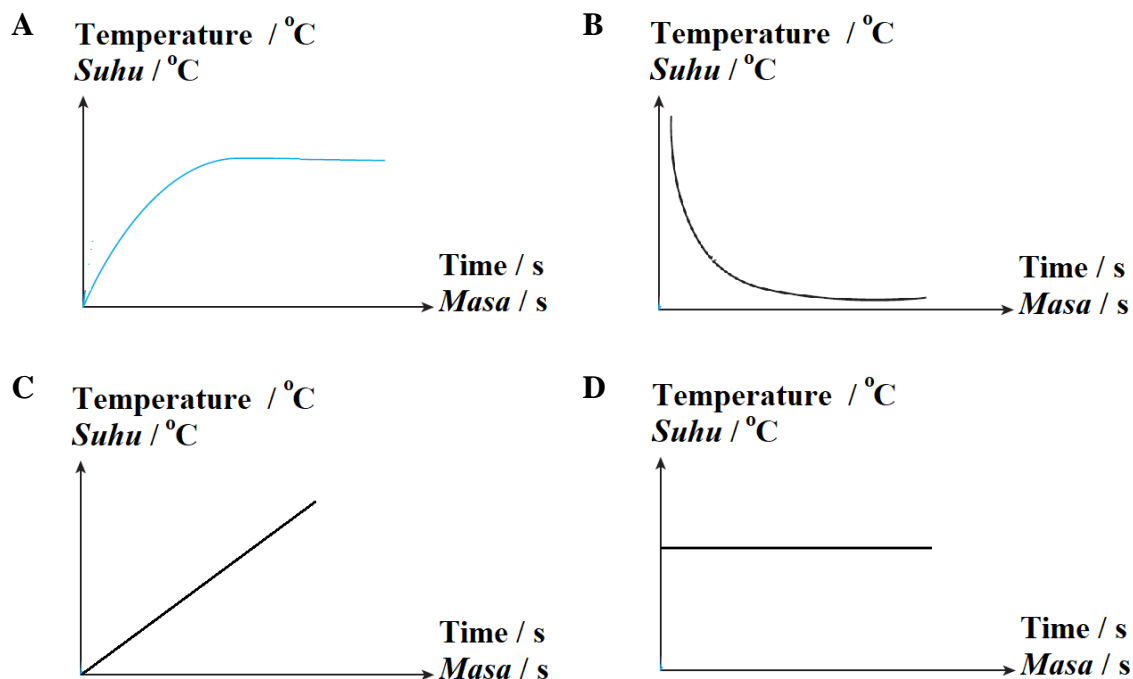


Diagram / Rajah 4

Which of the following graph shows the relationship between temperature of sodium thiosulphate solution and time taken?

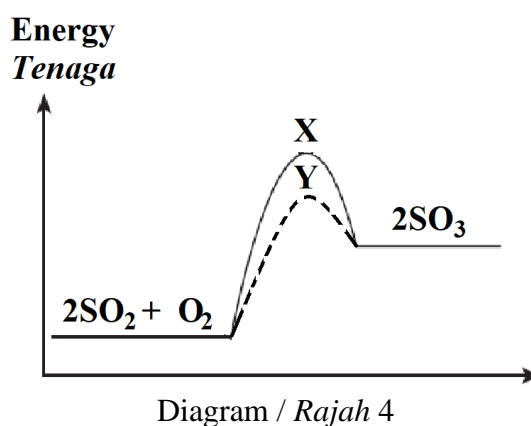
*Antara graf berikut, yang manakah menunjukkan hubungan antara suhu larutan natrium tiosulfat dengan masa yang diambil?*



- 17 Which of the following is the characteristic of catalyst?  
*Antara berikut, yang manakah merupakan sifat mangkin?*

- A** Catalyst used is only in solid form  
*Mangkin yang digunakan hanya dalam bentuk pepejal*
- B** Catalyst increase the quantity of product  
*Mangkin meningkatkan hasil tindak balas*
- C** Physical state of catalyst is unchanged during a reaction  
*Keadaan fizikal mangkin tidak berubah semasa tindak balas*
- D** The quantity of catalyst remains the same after the reaction  
*Kuantiti mangkin kekal sama selepas tindak balas*

- 18 Diagram 4 shows the energy profile diagram X for one stage of the production of sulphuric acid through Contact Process.  
*Rajah 4 menunjukkan gambar rajah profil tenaga X bagi satu peringkat dalam penghasilan asid sulfurik melalui Proses Sentuh.*



What is the change needed to be done to obtain curve Y?  
*Apakah perubahan yang perlu dilakukan untuk mendapat lengkung Y?*

- A Heat the reactants at 450°C  
*Panaskan bahan tindak balas pada suhu 450°C*
  - B Compress the reactants at 1 atm  
*Mampatkan bahan tindak balas pada tekanan 1 atm*
  - C Increase the concentration of reactants  
*Tingkatkan kepekatan bahan tindak balas*
  - D Heat the reactants with the presence of vanadium(V) oxide  
*Panaskan bahan tindak balas dengan kehadiran vanadium(V) oksida*
- 19 Diagram 5 shows the energy profile diagram for the reaction  $P + Q \rightarrow S$ .  
*Rajah 5 menunjukkan gambar rajah profil tenaga bagi tindak balas  $P + Q \rightarrow S$ .*



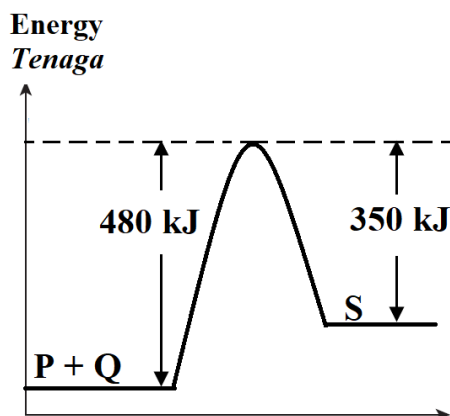


Diagram / Rajah 5

What is the activation energy for this reaction?

Apakah tenaga pengaktifan untuk tindak balas ini?

- A** 130 kJ      **B** 350 kJ      **C** 480 kJ      **D** 830 kJ
- 20** When a small amount of manganese(IV) oxide is added into hydrogen peroxide, the rate of reaction increases. Which statement explains this observation?  
 Apabila sedikit mangan(IV) oksida ditambah ke dalam hydrogen peroksida, kadar tindak balas bertambah. Pernyataan manakah menerangkan pemerhatian ini?
- A** The activation energy is lowered  
*Tenaga pengaktifan dikurangkan*
- B** The total surface area of the reactant of particles increases  
*Jumlah luas permukaan zarah-zarah bahan tindak balas bertambah*
- C** The kinetic energy of the reactant particles increases  
*Tenaga kinetik zarah-zarah bahan tindak balas bertambah*
- D** The total number of reactant particles per unit volume increases  
*Jumlah bilangan zarah-zarah bahan tindak balas per unit isipadu bertambah*
- 21** The decomposition of hydrogen peroxide produces oxygen gas and water. Which of the following changes occurred when a little manganese(IV) oxide powder is added into hydrogen peroxide?  
 Penguraian hidrogen peroksida menghasilkan oksigen dan air. Antara perubahan berikut, yang manakah berlaku apabila sedikit serbuk mangan(IV) oksida ditambah ke dalam hidrogen peroksida?
- I** More water is formed  
*Lebih banyak air terhasil*
- II** Oxygen gas is produced faster  
*Gas oksigen dihasilkan lebih cepat*
- III** Volume of oxygen gas released increases  
*Isipadu gas oksigen yang terbebas meningkat*
- IV** Rate of decomposition of hydrogen peroxide is higher  
*Kadar penguraian hidrogen peroksida lebih tinggi*
- A** I and II      **B** I and III      **C** II and IV      **D** III and IV

I dan II

I dan III

II dan IV

III dan IV

- 22 Diagram 6 shows the decomposition of hydrogen peroxide with a catalyst, manganese(IV) oxide.  
*Rajah 6 menunjukkan penguraian hidrogen peroksida dengan mangkin, mangan(IV) oksida.*

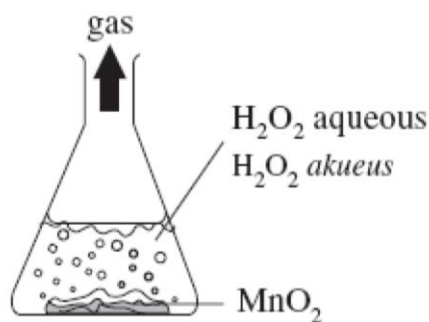


Diagram / Rajah 6

Which of the following will remain the same after the reaction?  
*Antara berikut, yang manakah kekal sama selepas tindak balas itu?*

- A Concentration of hydrogen peroxide  
*Kepekatan hidrogen peroksida*
- B Total mass of manganese(IV) oxide  
*Jumlah jisim mangan(IV) oksida*
- C Total mass of conical flask and its contents  
*Jumlah jisim kelalang kon dan kandungannya*
- D Total number of moles of water in the conical flask  
*Jumlah bilangan mol air dalam kelalang kon*
- 23 Diagram 7 shows a reaction between gas X and gas Y at room conditions.  
*Rajah 7 menunjukkan suatu tindak balas antara gas X dan gas Y pada keadaan bilik.*

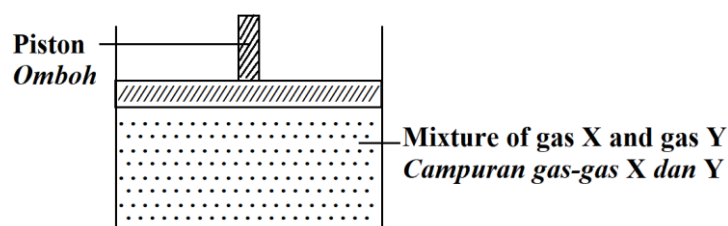
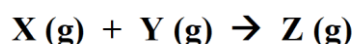


Diagram / Rajah 7

Which of the following can speed up the formation of gas Z?  
*Antara berikut, yang manakah boleh mempercepatkan pembentukan gas Z?*

- A Release some of the mixture from the container  
*Keluarkan sedikit campuran tindak balas daripada bekas itu*
- B Put the container into water at room temperature  
*Masukkan bekas itu ke dalam air pada suhu bilik*

- C Channel an inert gas into the container  
*Salurkan satu gas lengai ke dalam bekas itu*
- D Push the piston down  
*Tolak ombok ke bawah*
- 24 Chicken cooked in a pressure cooker cooks faster. Which of the following explains the situation?  
*Ayam yang dimasak dalam periuk tekanan lebih cepat masak. Antara berikut, yang manakah menerangkan situasi tersebut?*
- A The activation energy increases  
*Tenaga pengaktifan meningkat*
- B The kinetic energy decreases  
*Tenaga kinetik berkurang*
- C The total surface area exposed to reaction increases  
*Jumlah luas permukaan yang terdedah kepada tindak balas bertambah*
- D The frequency of effective collision increases  
*Frekuensi perlanggaran berkesan bertambah*
- 25 Diagram 8 shows curve I in a graph of volume of gas released against time for the reaction between excess zinc powder and 100 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> hydrochloric acid, HCl.  
*Rajah 8 menunjukkan lengkung I dalam graf isipadu gas melawan masa bagi tindak balas antara serbuk zink berlebihan dan 100 cm<sup>3</sup> asid hidroklorik, HCl 1.0 mol dm<sup>-3</sup>.*

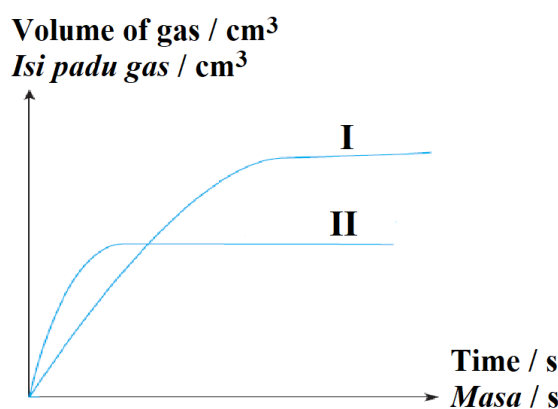


Diagram / Rajah 8

Which of the following conditions represents curve II?  
*Antara berikut, keadaan manakah mewakili lengkung II?*

	Concentration of HCl (mol dm <sup>-3</sup> ) <i>Kepekatan HCl (mol dm<sup>-3</sup>)</i>	Volume of HCl (cm <sup>3</sup> ) <i>Isipadu HCl (cm<sup>3</sup>)</i>
A	0.5	100
B	1.0	50
C	2.0	50
D	2.0	25

- 26 Diagram 9 shows a graph of two experiments conducted to investigate the rate of reaction between calcium carbonate powder and hydrochloric acid, HCl.  
*Rajah 9 menunjukkan graf bagi dua eksperimen yang dijalankan untuk mengkaji kadar tindak balas antara serbuk kalsium karbonat dan asid hidroklorik, HCl.*

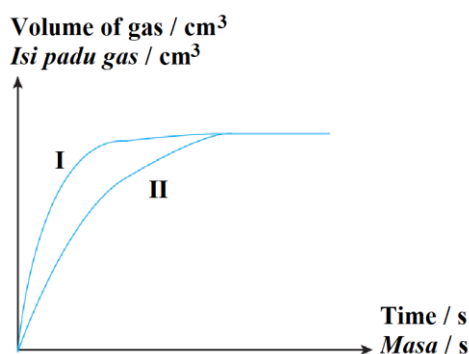


Diagram / Rajah 9

Experiment I was conducted by using 25 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> of hydrochloric acid.  
 What is the concentration and volume of hydrochloric acid used, to obtain curve II?  
*Eksperimen I dijalankan dengan menggunakan 25 cm<sup>3</sup> asid hidroklorik 1.0 mol dm<sup>-3</sup>.  
 Apakah kepekatan dan isipadu asid hidroklorik yang digunakan, untuk mendapatkan lengkung II?*

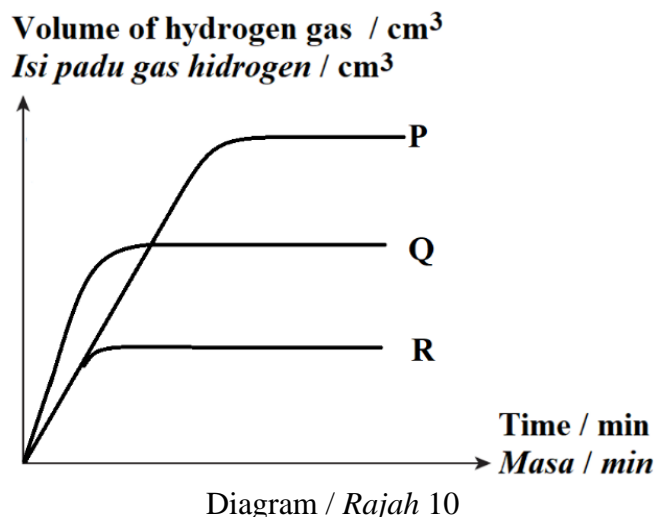
	Concentration of HCl (mol dm <sup>-3</sup> ) <i>Kepekatan HCl (mol dm<sup>-3</sup>)</i>	Volume of HCl (cm <sup>3</sup> ) <i>Isipadu HCl (cm<sup>3</sup>)</i>
A	0.5	50
B	1.0	50
C	2.0	25
D	0.5	25

- 27 Three experiments were conducted by a group of students to investigate the reaction between excess zinc and the acids as shown in Table 4.  
*Tiga eksperimen telah dijalankan oleh sekumpulan pelajar untuk menyiasat tindak balas antara zink berlebihan dan asid-asid seperti yang ditunjukkan dalam Jadual 4.*

Experiment <i>Eksperimen</i>	Acid <i>Asid</i>
I	25 cm <sup>3</sup> of 2.0 mol dm <sup>-3</sup> hydrochloric acid 25 cm <sup>3</sup> <i>asid hidroklorik</i> 2.0 mol dm <sup>-3</sup>
II	50 cm <sup>3</sup> of 1.5 mol dm <sup>-3</sup> hydrochloric acid 50 cm <sup>3</sup> <i>asid hidroklorik</i> 1.5 mol dm <sup>-3</sup>
III	15 cm <sup>3</sup> of 1.5 mol dm <sup>-3</sup> sulphuric acid 15 cm <sup>3</sup> <i>asid sulfurik</i> 1.5 mol dm <sup>-3</sup>

Table / Jadual 4

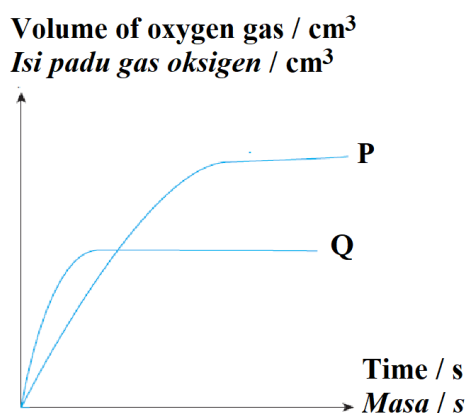
Diagram 10 shows the graph of volume of hydrogen gas against time for the above experiments.  
*Rajah 10 menunjukkan graf isi padu gas hidrogen melawan masa bagi eksperimen-eksperimen di atas.*



Which of the following represents the results for the experiments correctly?  
 Antara berikut, yang manakah mewakili keputusan-keputusan eksperimen, dengan betul?

	I	II	III
A	P	Q	R
B	Q	P	R
C	P	R	Q
D	R	Q	P

- 28 The rate of catalytic decomposition of  $20 \text{ cm}^3$  of  $1.0 \text{ mol dm}^{-3}$  hydrogen peroxide is shown as curve Q.  
 Kadar penguraian bermangkin  $20 \text{ cm}^3$  hidrogen peroksida  $1.0 \text{ mol dm}^{-3}$  ditunjukkan sebagai lengkung Q.



Which of the following changes to the experiment will produce curve P?  
 Antara perubahan berikut, yang manakah dapat menghasilkan lengkung P?

- A Cool the hydrogen peroxide solution

*Sejukkan larutan hidrogen peroksida itu*

- B** Repeat the experiment using 50 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> hydrogen peroxide  
*Ulang eksperimen menggunakan 50 cm<sup>3</sup> hidrogen peroksida 0.5 mol dm<sup>-3</sup>*
- C** Repeat the experiment using 20 cm<sup>3</sup> of 1.5 mol dm<sup>-3</sup> hydrogen peroxide  
*Ulang eksperimen menggunakan 10 cm<sup>3</sup> hidrogen peroksida 1.5 mol dm<sup>-3</sup>*
- D** Add more catalyst to the 20 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> hydrogen peroxide  
*Tambah lebih banyak mangkin kepada 20 cm<sup>3</sup> hidrogen peroksida 1.0 mol dm<sup>-3</sup>*

- 29** Diagram 11 shows an experiment using excess dilute acid and a metal. The volume of hydrogen gas released is measured and plotted on a graph as curve M. The experiment is repeated by changing one condition at a time. The volume of hydrogen gas released is measured and plotted on a graph as curve N.

*Rajah 11 menunjukkan suatu eksperimen menggunakan asid cair berlebihan dan suatu logam. Isi padu gas hidrogen yang dibebaskan diukur dan diplotkan pada graf sebagai lengkung M. Eksperimen diulangi dengan mengubah satu keadaan pada satu masa. Isi padu gas hidrogen yang dibebaskan diukur dan diplotkan pada graf sebagai lengkung N.*

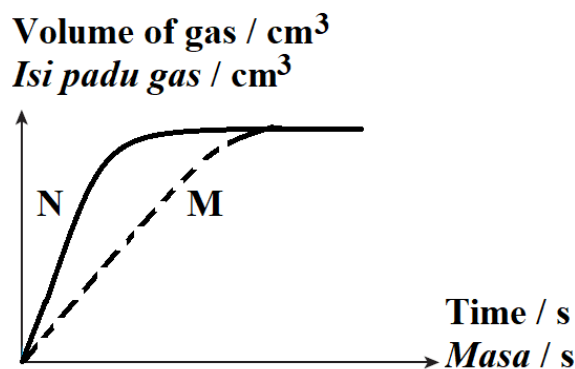


Diagram / Rajah 11

What are the possibilities of the condition changed to obtain curve N?

Apakah perubahan keadaan yang mungkin, untuk mendapatkan lengkung N?

	Increase in concentration of acid <i>Meningkatkan kepekatan asid</i>	Increase in size of metal <i>Meningkatkan saiz logam</i>	Increase in temperature <i>Meningkatkan suhu</i>
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓

D	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---	-------------------------------------	-------------------------------------	-------------------------------------

- 30 Diagram 12 shows three different sizes of magnesium carbonate with the same mass.  
*Rajah 12 menunjukkan tiga saiz berlainan magnesium karbonat dengan jisim yang sama.*

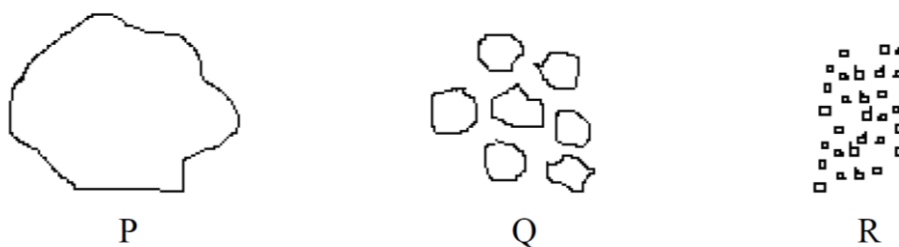
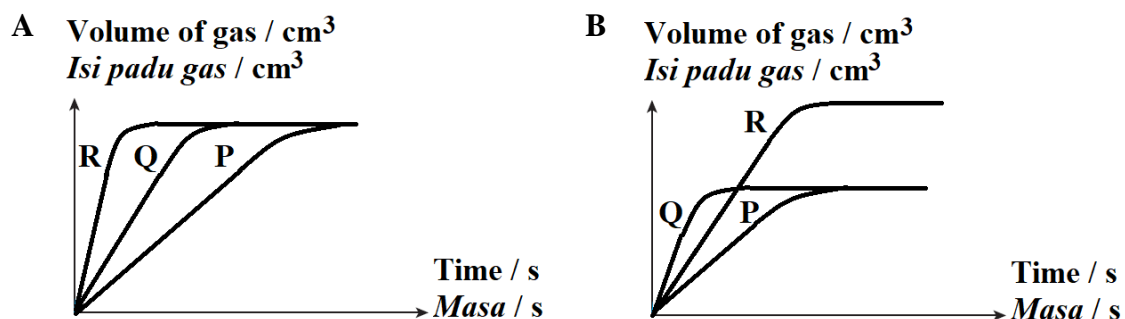
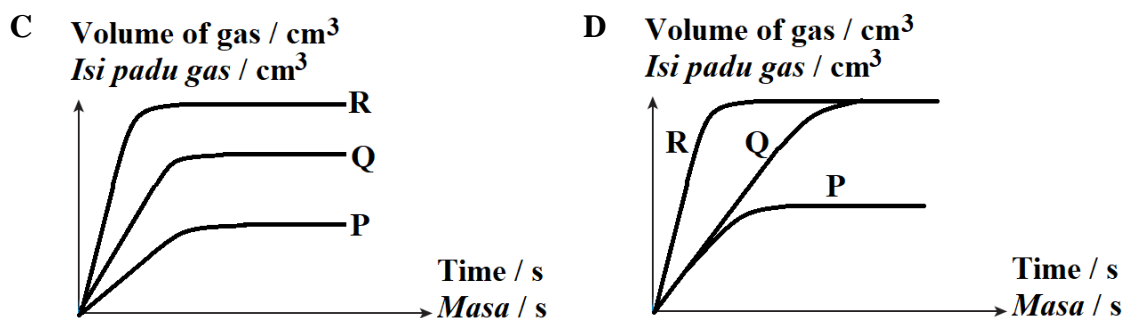


Diagram / Rajah 12

Which graph represents the reaction between 2 g magnesium carbonate and 50 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> hydrochloric acid?

*Graf manakah mewakili tindak balas antara 2 g magnesium karbonat dan 50 cm<sup>3</sup> asid hidroklorik 1.0 mol dm<sup>-3</sup>?*





OBJ

30

### STRUCTURE QUESTIONS SOALAN STRUKTUR

- 1** An experiment is carried out to investigate the rate of reaction between magnesium and sulphuric acid. Excess magnesium powder is added to 20 cm<sup>3</sup> of 0.1 mol dm<sup>-3</sup> sulphuric acid. Table 1 shows the volume of gas collected at intervals of 30 seconds.
- Satu eksperimen dijalankan untuk mengkaji kadar tindak balas antara magnesium dan asid sulfurik. Serbuk magnesium berlebihan ditambahkan kepada 20 cm<sup>3</sup> asid sulfurik 0.1 mol dm<sup>-3</sup>. Jadual 1 menunjukkan isi padu gas yang terkumpul pada sela masa 30 saat.*

<b>Time (min)</b> <i>Masa (min)</i>	0	30	60	90	120	150	180	210	240
<b>Volume of gas (cm<sup>3</sup>)</b> <i>Isi padu gas (cm<sup>3</sup>)</i>	0.00	12.00	22.00	31.00	38.00	42.00	44.00	45.00	45.00

Table / Jadual 1

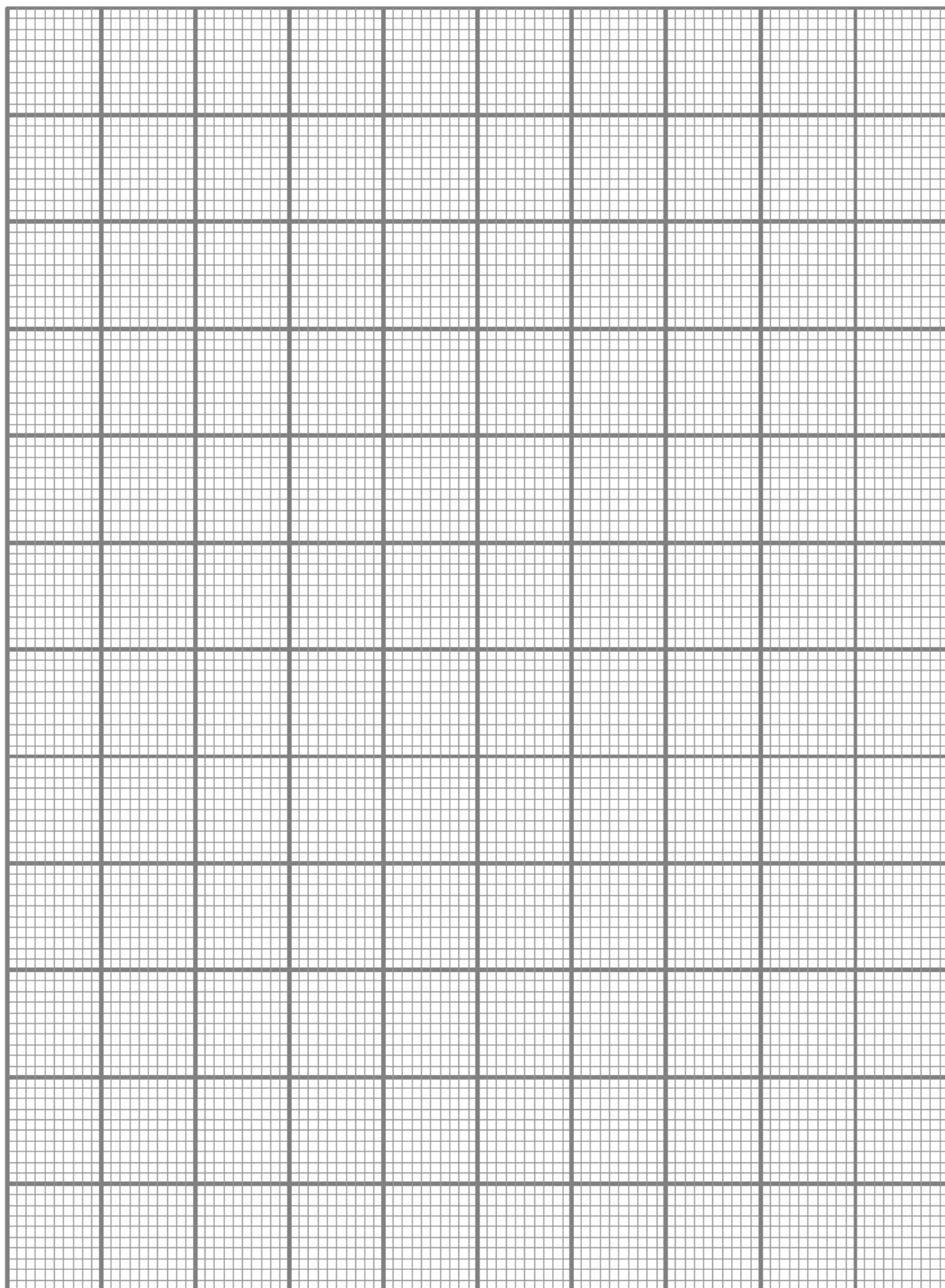
- (a) Name the gas released from the above reaction.  
*Namakan gas yang terbebas daripada tindak balas di atas.*

.....  
[1 mark / markah]

- (b) Based on Table 1, plot a graph of the volume of gas collected against time.  
*Berdasarkan Jadual 1, plot graf isi padu gas yang terkumpul melawan masa.*
- [3 marks / markah]



Graph of volume of gas collected against time  
*Graf isipadu gas terkumpul melawan masa*



- (c) Based on the graph plotted in **1(b)**, calculate:  
*Berdasarkan graf yang diplot dalam 1(b), hitung:*
- (i) the rate of reaction at 120 s.

kadar tindak balas pada 120 s.

[2 marks / markah]

- (ii) the overall rate of reaction.  
*kadar tindak balas purata keseluruhan.*

[1 mark / markah]

- (d) Another experiment is carried out to investigate the factors affecting the rate of reaction. Diagram 1 shows the results of the experiment. Curve L represents the result of the experiment using excess magnesium powder and 50 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> hydrochloric acid.

*Satu eksperimen berasingan dijalankan untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas. Rajah 1 menunjukkan keputusan eksperimen itu. Lengkung L mewakili keputusan eksperimen yang menggunakan serbuk magnesium berlebihan dan 50 cm<sup>3</sup> asid hidroklorik 1.0 mol dm<sup>-3</sup>.*

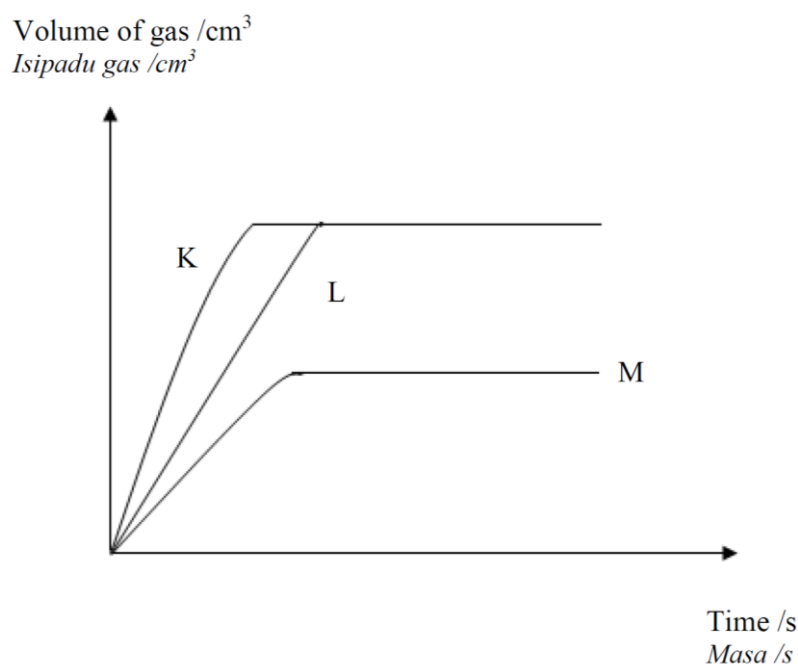


Diagram / Rajah 1

- (i) Suggest the factor that influence the rate of reaction to obtain curve K.  
*Cadangkan satu faktor yang memepengaruhi kadar tindak balas untuk memperoleh lengkung K.*

.....  
[1 mark / markah]

- (ii) The rate of reaction of curve K is higher than that of L. Explain your answer based on collision theory.

*Kadar tindak balas lengkung K lebih tinggi daripada L. Terangkan jawapan anda berdasarkan teori perlanggaran.*

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

- (iii) The final volume of gas obtained in curve M is half of the final volume of gas obtained in curve L. Give one reason for this occurrence.

*Isipadu akhir gas yang diperolehi dalam lengkung M adalah separuh daripada isipadu akhir gas yang diperolehi dalam lengkung L. Berikan satu sebab bagi keadaan ini.*

.....  
[1 mark / markah]

A1

11
----

A student carried out two experiments to investigate the factor that affects the rate of reaction. Table 2 shows the results of the experiments.

Seorang pelajar menjalankan dua eksperimen untuk mengkaji faktor yang mempengaruhi kadar tindak balas. Jadual 2 menunjukkan keputusan bagi eksperimen-eksperimen tersebut.

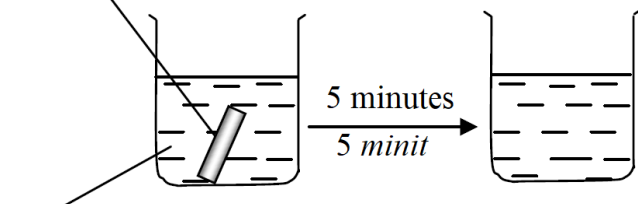
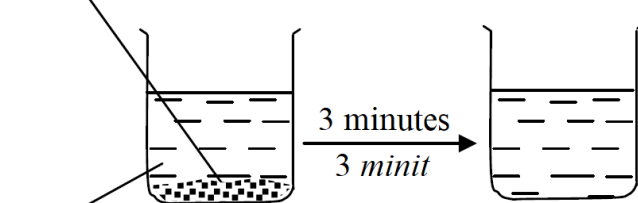
Experiment <i>Eksperimen</i>	Diagram <i>Rajah</i>	Volume of gas collected / cm <sup>3</sup> <i>Isipadu gas yang terkumpul / cm<sup>3</sup></i>
I	<p><b>m g of magnesium ribbon</b> <b>m g pita magnesium</b></p>  <p>0.5 mol dm<sup>-3</sup> hydrochloric acid in excess <i>asid hidroklorik 0.5 mol dm<sup>-3</sup> berlebihan</i></p>	50
II	<p><b>m g magnesium powder</b> <b>m g serbuk magnesium</b></p>  <p>0.5 mol dm<sup>-3</sup> hydrochloric acid in excess <i>asid hidroklorik 0.5 mol dm<sup>-3</sup> berlebihan</i></p>	50

Table / *Jadual 2*

- (a) Based on the experiment, state the meaning of rate of reaction.  
*Berdasarkan eksperimen, nyatakan maksud kadar tindak balas.*

.....

.....

[1 mark / *markah*]

- (b) Write the chemical equation for the reaction between magnesium and hydrochloric acid  
*Tuliskan persamaan kimia bagi tindak balas antara magnesium dan asid hidroklorik.*

.....  
[2 marks / markah]

- (c) State the factor that affects the rate of reaction in this experiment.  
*Nyatakan faktor yang mempengaruhi kadar tindak balas dalam eksperimen ini.*

.....  
[1 mark / markah]

- (d) (i) From the information in Table 2, calculate the average rate of reaction for Experiment I and Experiment II.  
*Daripada maklumat dalam Jadual 2, hitung kadar tindak balas purata bagi Eksperimen I dan Eksperimen II.*

[2 marks / markah]

- (iii) Rate of reaction in Experiment II is different from Experiment I. By referring to collision theory, explain why there are differences in the rate of reaction in both experiments.  
*Kadar tindak balas dalam Eksperimen II berbeza dengan Eksperimen I. Dengan merujuk kepada teori perlanggaran, terangkan mengapa terdapat perbezaan dalam kadar tindak balas bagi kedua-dua eksperimen.*

.....  
[3 marks / markah]

- (e) Give one reason why the final volume of gas obtained in both experiments are the same.  
*Berikan satu sebab mengapa isipadu akhir gas yang diperolehi dalam kedua-dua eksperimen adalah sama.*

.....  
[1 mark / markah]

Table 3 shows the result of two experiments to investigate the rate of reaction between zinc powder and two different acids.

*Jadual 3 menunjukkan dua eksperimen untuk mengkaji kadar tindak balas antara serbuk zink dan dua asid yang berbeza.*

A2

	10

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	Time taken for complete reaction (s) <i>Masa yang diambil untuk tindak balas lengkap (s)</i>
I	Zinc powder + 100 cm <sup>3</sup> of 0.5 mol dm <sup>-3</sup> sulphuric acid <i>Serbuk zink + 100 cm<sup>3</sup> asid sulfurik 0.5 mol dm<sup>-3</sup></i>	40
II	Zinc powder + 100 cm <sup>3</sup> of 0.5 mol dm <sup>-3</sup> hydrochloric acid <i>Serbuk zink + 100 cm<sup>3</sup> asid hidroklorik 0.5 mol dm<sup>-3</sup></i>	60

Table / Jadual 3

- (a) State a factor that can affect the rate of reaction in the experiment.  
*Nyatakan satu faktor yang memengaruhi kadar tindak balas dalam eksperimen itu.*

.....  
[1 mark / markah]

- (b) Draw the apparatus set-up to determine the rate of reaction for the experiment.  
*Lukis susunan radas untuk menentukan kadar tindak balas bagi eksperimen itu.*

[2 marks / markah]

- (c) (i) Write the ionic equation for Experiment II.  
*Tulis persamaan ion bagi Eksperimen II.*

.....  
[1 mark / markah]

- (ii) Calculate the maximum volume of gas released in Experiment II.  
[Molar volume of gas = 24 dm<sup>3</sup> mol<sup>-1</sup> at room condition]  
*Hitung isi padu maksimum gas yang terbebas dalam Eksperimen II.*

[Isi padu molar gas =  $24 \text{ dm}^3 \text{ mol}^{-1}$  pada keadaan bilik]

[3 marks / markah]

- (d) (i) Diagram 3 shows the graph of volume of gas released against time for Experiment I. Sketch the curve for Experiment II in the same axes in Diagram 3.  
*Rajah 3 menunjukkan graf isipadu gas yang terbebas melawan masa bagi Eksperimen I. Lakar lengkung bagi Eksperimen II pada paksi yang sama dalam Rajah 3.*

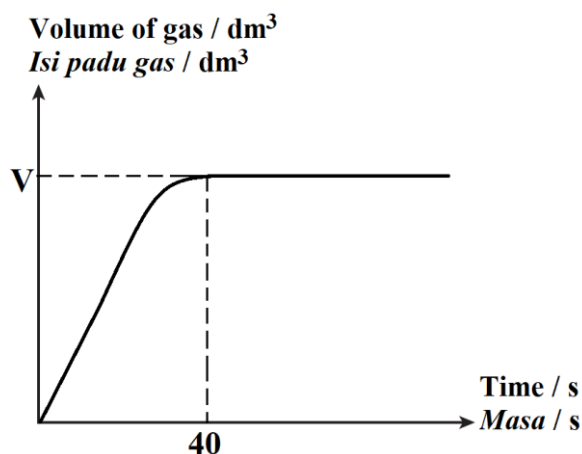


Diagram / Rajah 3

[1 mark / markah]

- (ii) Based on your answer in 3(d)(i), compare the rate of reaction between Experiment I and Experiment II by using collision theory.  
*Berdasarkan jawapan anda dalam 3(d)(i), bandingkan kadar tindak balas antara Eksperimen I dan Eksperimen II menggunakan teori perlanggaran.*

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

[3 marks / markah]

Experiment I, II and III were conducted to investigate the factors affecting the rate of reaction.

Table 4 shows the reactants involved in the experiments.

A3

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4



Ekperimen I, II dan III dijalankan untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas.

Jadual 4 menunjukkan bahan tindak balas yang terlibat dalam eksperimen tersebut.

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	
I	Excess magnesium powder <i>Serbuk magnesium berlebihan</i>	25 cm <sup>3</sup> of 0.1 mol dm <sup>-3</sup> hydrochloric acid 25 cm <sup>3</sup> asid hidroklorik 0.1 mol dm <sup>-3</sup>
II	Excess magnesium powder <i>Serbuk magnesium berlebihan</i>	25 cm <sup>3</sup> of 0.1 mol dm <sup>-3</sup> sulphuric acid 25 cm <sup>3</sup> asid sulfurik 0.1 mol dm <sup>-3</sup>
III	Excess magnesium powder <i>Serbuk magnesium berlebihan</i>	25 cm <sup>3</sup> of 0.1 mol dm <sup>-3</sup> sulphuric acid + copper(II) sulphate solution 25 cm <sup>3</sup> asid sulfurik 0.1 mol dm <sup>-3</sup> + larutan kuprum(II) sulfat

Table / *Jadual* 4

Diagram 4 shows the results of experiments I, II and III.

*Rajah 4 menunjukkan keputusan eksperimen I, II dan III.*

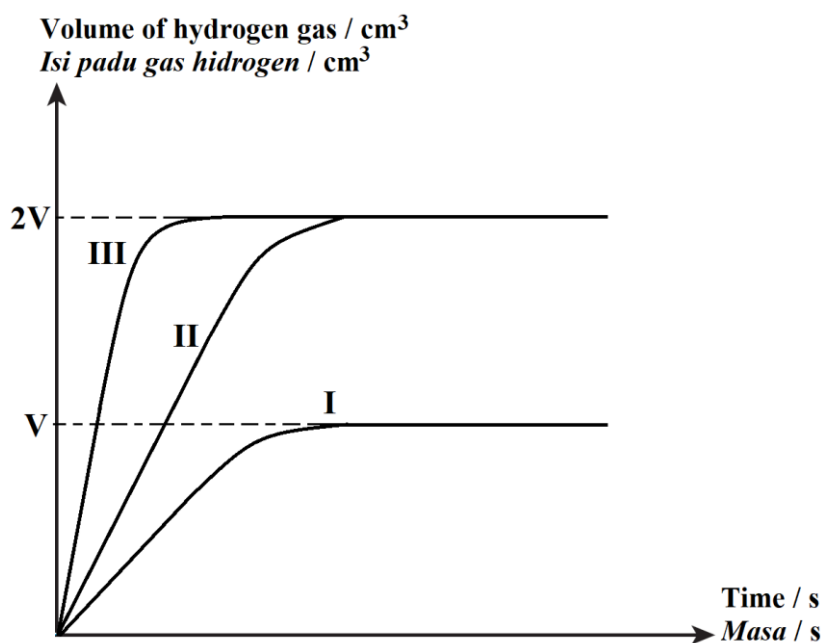


Diagram / *Rajah* 4

- (a) State one factor that affects rate of reaction.

*Nyatakan satu faktor yang mempengaruhi kadar tindak balas.*

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

- (b) (i) Give a reason why curve II is steeper than curve I.

*Beri satu sebab mengapa lengkung II lebih curam berbanding lengkung I.*

.....  
[1 mark / markah]

- (ii) Other than adding copper(II) sulphate, suggest another way to obtain curve III from curve II. The volume and concentration of sulphuric acid is unchanged.  
*Selain daripada menambahkan kuprum(II) sulfat, cadangkan satu cara lain untuk memperoleh lengkung III daripada lengkung II. Isi padu dan kepekatan asid sulfurik tidak berubah.*

.....  
[1 mark / markah]

- (c) Explain why the total volume of hydrogen gas released in Experiment II is double the total volume of hydrogen gas released in Experiment I.  
*Terangkan mengapa jumlah isipadu gas hidrogen yang dibebaskan dalam Eksperimen II adalah dua kali ganda jumlah isipadu gas hidrogen yang dibebaskan dalam Eksperimen I*

.....  
[2 marks / markah]

- (d) Based on Experiment II,  
*Berdasarkan Eksperimen II,*  
(i) Write the ionic equation for the reaction occurred.  
*Tulis persamaan ion bagi tindak balas yang berlaku.*

.....  
[1 mark / markah]

- (ii) Calculate the total volume of hydrogen gas released.  
[Molar volume of gas at room condition =  $24 \text{ dm}^3 \text{ mol}^{-1}$ ]  
*Hitung jumlah isipadu gas hidrogen yang dibebaskan.*  
[Isipadu molar gas pada keadaan bilik =  $24 \text{ dm}^3 \text{ mol}^{-1}$ ]

[3 marks / markah]

- (e) If the change in mass of magnesium during the reaction is measured, sketch the graph of mass of magnesium against time for Experiment I.

*Jika perubahan jisim magnesium semasa tindak balas diukur, lakarkan graf jisim magnesium melawan masa bagi Eksperimen I.*

[2 marks / *markah*]

**A4**

<b>11</b>

- 5** Experiments I, II and III were carried out to investigate the factors affecting the rate of reaction. Table 5 shows the reactants and temperature used in each experiment.

Eksperimen I, II dan III dijalankan untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas. Jadual 5 menunjukkan bahan tindak balas dan suhu yang digunakan dalam setiap eksperimen.

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	Temperature (°C) <i>Suhu (°C)</i>
I	Excess zinc powder + 25 cm <sup>3</sup> of 0.1 mol dm <sup>-3</sup> hydrochloric acid <i>Serbuk zink berlebihan + 25 cm<sup>3</sup> asid hidroklorik 0.1 mol dm<sup>-3</sup></i>	30
II	Excess zinc powder + 25 cm <sup>3</sup> of 0.1 mol dm <sup>-3</sup> hydrochloric acid <i>Serbuk zink berlebihan + 25 cm<sup>3</sup> asid hidroklorik 0.1 mol dm<sup>-3</sup></i>	40
III	Excess zinc powder + 25 cm <sup>3</sup> of 0.1 mol dm <sup>-3</sup> sulphuric acid <i>Serbuk zink berlebihan + 25 cm<sup>3</sup> asid sulfurik 0.1 mol dm<sup>-3</sup></i>	30

Table / Jadual 5

- (a) Write the ionic equation for the reaction in Experiment I.  
*Tulis persamaan ion bagi tindak balas dalam Eksperimen I.*
- .....
- [2 marks / markah]
- (b) Based on the experiments, state two factors that affect the rate of reaction.  
*Merujuk kepada eksperimen-eksperimen itu, nyatakan dua faktor yang mempengaruhi kadar tindak balas.*
- .....
- [2 marks / markah]
- (c) Compare the rate of reaction between Experiment I and II. Explain the difference using collision theory.  
*Bandingkan kadar tindak balas antara Eksperimen I dan II. Terangkan perbezaan itu menggunakan teori perlanggaran.*
- .....
- .....
- .....
- .....
- [4 marks / markah]
- (d) Diagram 5 shows the curve of the graph of the total volume of gas against time for Experiment I. Sketch the curve for Experiment III on the same axes.

Rajah 5 menunjukkan lengkung bagi graf jumlah isipadu gas melawan masa bagi Eksperimen I. Lakar lengkung bagi Eksperimen III pada paksi yang sama.

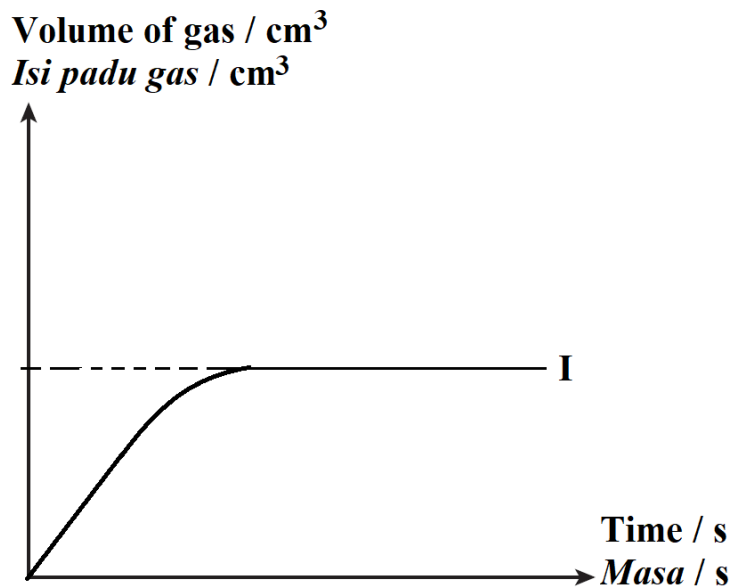


Diagram / Rajah 5

[1 mark / markah]

- (e) During a cooking competition, the participant found out that a piece of meat is still not tender even after cooking for an hour. State one method to make the meat become tender in a shorter amount of time. Explain your answer.

*Semasa satu pertandingan memasak, seorang peserta mendapati satu ketulan daging masih tidak lembut walaupun telah dimasak selama satu jam. Nyatakan satu kaedah yang boleh diambil supaya daging itu menjadi lembut dalam masa yang singkat. Terangkan jawapan anda.*

.....

.....

.....

[2 marks / markah]

A5

	11

- 6 (a) A group of students carried out experiments to investigate the factor affecting the rate of reaction between metal P and acid Q. Table 6 shows the information about

the reactants and the time taken to collect 30 cm<sup>3</sup> of hydrogen gas.

*Sekumpulan pelajar menjalankan eksperimen untuk mengkaji faktor yang mempengaruhi kadar tindak balas antara logam P dan asid Q. Jadual 6 menunjukkan maklumat berkaitan bahan tindak balas dan masa yang diambil untuk mengumpul 30 cm<sup>3</sup> gas hidrogen.*

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	Time taken / s <i>Masa yang diambil / s</i>
I	Powdered metal P + 50 cm <sup>3</sup> of 1.0 mol dm <sup>-3</sup> acid Q <i>Serbuk logam P + 50 cm<sup>3</sup> asid Q 1.0 mol dm<sup>-3</sup></i>	10
II	Powdered metal P + 100 cm <sup>3</sup> of 0.5 mol dm <sup>-3</sup> acid Q <i>Serbuk logam P + 100 cm<sup>3</sup> asid Q 0.5 mol dm<sup>-3</sup></i>	20

Table / Jadual 6

- (i) Suggest the name of metal P and acid Q. By using the named metal P and acid Q, write the chemical equation for the reaction.  
*Cadangkan nama logam P dan asid Q. Dengan menggunakan logam P dan asid Q yang dinamakan, tulis persamaan kimia bagi tindak balas itu.*  
[4 marks / markah]
- (ii) Calculate the average rate of reaction for Experiment I and II.  
*Hitung kadar tindak balas purata bagi Eksperimen I dan II.*  
[2 marks / markah]
- (iii) Explain the difference in the rate of reaction between Experiment I and II using collision theory.  
*Terangkan perbezaan kadar tindak balas antara Eksperimen I dan II menggunakan teori perlanggaran.*  
[4 marks / markah]
- (b) By using the factor temperature, describe an experiment how this factor affects the rate of reaction. Include a labelled diagram in your answer.  
*Dengan menggunakan faktor suhu, huraikan satu eksperimen bagaimana faktor ini mempengaruhi kadar tindak balas. Sertakan rajah berlabel dalam jawapan anda.*  
[10 marks / markah]

- 7 (a) Knowledge on the factors affecting rate of reaction is very useful in daily life. State one activity at home and explain how the knowledge on the factors affecting

rate of reaction is applied in the activity.

*Pengetahuan berkaitan faktor yang mempengaruhi kadar tindak balas sangat berguna dalam kehidupan seharian. Nyatakan satu aktiviti di rumah dan terangkan bagaimana faktor yang mempengaruhi kadar tindak balas diaplikasikan dalam kehidupan seharian.*

[2 marks / markah]

- (b) Diagram 7.1 shows a graph of volume of carbon dioxide gas against time for the reaction between sulphuric acid and excess marble,  $\text{CaCO}_3$ .

*Rajah 7.1 menunjukkan graf isipadu gas karbon dioksida melawan masa bagi tindak balas antara asid sulfurik dan marmar,  $\text{CaCO}_3$  berlebihan.*

Experiment I uses marble chips while Experiment II uses marble powder.

*Eksperimen I menggunakan ketulan marmar manakala Eksperimen II menggunakan serbuk marmar.*

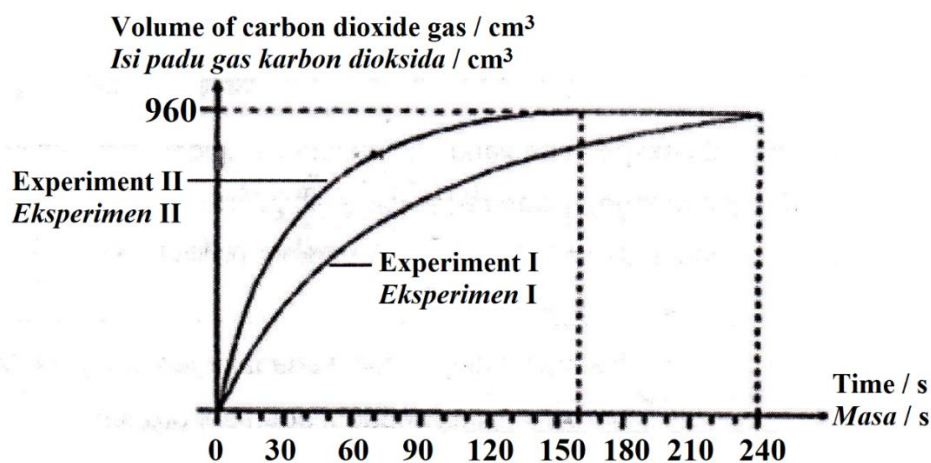


Diagram / Rajah 7.1

- (i) Write the chemical equation for the reaction between marble and sulphuric acid.

*Tulis persamaan kimia bagi tindak balas antara marmar dengan asid sulfurik.*

[2 marks / markah]

- (ii) Calculate the average rate of reaction for Experiment I and II.

*Hitung kadar tindak balas purata bagi Eksperimen I dan II.*

[2 marks / markah]

- (iii) Explain the difference in the rate of reaction between Experiment I and II. Explain your answer based on collision theory.

*Terangkan perbezaan bagi kadar tindak balas antara Eksperimen I dan II. Terangkan jawapan anda berdasarkan teori perlanggaran.*

[4 marks / markah]

- (c) Diagram 7.2 shows the decomposition of hydrogen peroxide,  $\text{H}_2\text{O}_2$  molecules to produce oxygen and water.

Rajah 7.2 menunjukkan penguraian molekul hidrogen peroksida,  $H_2O_2$  untuk menghasilkan oksigen dan air.

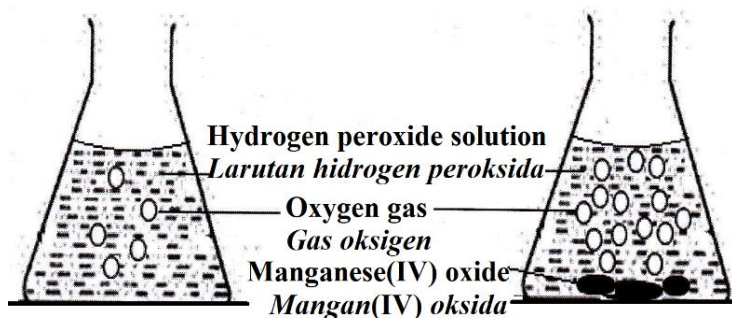


Diagram / Rajah 7.2

Based on Diagram 7.2, describe an experiment on how manganese(IV) oxide powder affects the rate of decomposition of hydrogen peroxide. Your explanation should include:

Berdasarkan Rajah 7.2, huraikan satu eksperimen bagaimana serbuk mangan(IV) oksida mempengaruhi kadar penguraian hidrogen peroksida. Penerangan anda perlu mengandungi:

- Procedure of the experiment  
*Prosedur eksperimen*
- Sketch of graph to show the effect of manganese(IV) oxide on the rate of reaction  
*Lakaran graf untuk menunjukkan kesan mangan(IV) oksida ke atas kadar tindak balas*
- Conclusion  
*Kesimpulan*

[10 marks / markah]

- 8 (a) A reaction between a metal and acid produces hydrogen gas. Addition of a catalyst can affect the rate of the production of hydrogen gas.



*Tindak balas antara logam dan asid menghasilkan gas hidrogen. Penambahan mangkin akan mempengaruhi kadar penghasilan gas hidrogen.*

- (i) Suggest a metal and an acid to produce hydrogen gas in the laboratory.  
*Cadangkan satu logam dan satu asid untuk menghasilkan gas hidrogen dalam makmal.*

[2 marks / markah]

- (ii) Using collision theory, explain the change in the rate of reaction that occur with the presence of a named catalyst.

*Dengan menggunakan teori perlanggaran, terangkan perubahan kadar tindak balas yang berlaku dengan kehadiran mangkin yang dinamakan.*

[4 marks / markah]

- (b) Diagram 8.1 shows the time taken to dissolve cube sugar at different temperatures when making a cup of tea.

*Rajah 8.1 menunjukkan masa yang diambil untuk melarutkan gula kiub pada suhu berbeza semasa menyediakan secawan teh.*

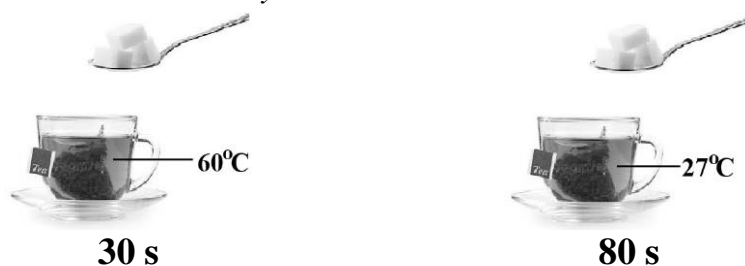


Diagram / Rajah 8.1

Explain the difference in the situation.

*Terangkan perbezaan dalam situasi itu.*

[4 marks / markah]

- (c) Diagram 8.2 shows substance M in different sizes.

*Rajah 8.2 menunjukkan bahan M dalam saiz yang berbeza.*



Diagram / Rajah 8.2

Based on Diagram 8.2, suggest substance M and describe an experiment to show how the above factor affects the rate of reaction of substance M with acid.

*Berdasarkan Rajah 8.2, cadangkan bahan M dan huraikan satu eksperimen untuk menunjukkan bagaimana faktor di atas mempengaruhi kadar tindak balas bahan M dengan asid.*

[10 marks / markah]

- 9 (a) Diagram 9.1 shows the time taken for different size of meat to cook.

*Rajah 9.1 menunjukkan masa yang diambil untuk daging berlainan saiz masak.*



120 minutes  
120 minit



20 minutes  
20 minit

Diagram / Rajah 9.1

Explain why different size of meat takes different duration of time to cook.

*Terangkan mengapa saiz daging berbeza mengambil masa berbeza untuk masak.*

[2 marks / markah]

- (b) Two experiments are carried out to investigate the factor affecting the rate of reaction between carbonate P and acid Q. Table 9.1 shows the reactants and the time taken to collect 30 cm<sup>3</sup> of carbon dioxide gas release

*Dua eksperimen dijalankan untuk mengkaji faktor yang mempengaruhi kadar tindak balas antara karbonat P dan asid Q. Jadual 9.1 menunjukkan bahan tindak balas dan masa yang diambil untuk mengumpul 30 cm<sup>3</sup> gas karbon dioksida.*

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>		Time taken / s <i>Masa diambil / s</i>
I	Excess P carbonate powder <i>Serbuk karbonat P berlebihan</i>	50 cm <sup>3</sup> of 1.0 mol dm <sup>-3</sup> acid Q 50 cm <sup>3</sup> asid Q 1.0 mol dm <sup>-3</sup>	10
II	Excess P carbonate granule <i>Ketulan karbonat P berlebihan</i>	50 cm <sup>3</sup> of 1.0 mol dm <sup>-3</sup> acid Q 50 cm <sup>3</sup> asid Q 1.0 mol dm <sup>-3</sup>	20

Table / Jadual 9.1

- (i) Name one example of carbonate P and one example of acid Q.

*Namakan satu contoh karbonat P dan satu contoh asid Q.*

[2 marks / markah]

- (ii) Compare the average rate of reaction for Experiment I and II. Explain the difference based on collision theory.

*Bandingkan kadar tindak balas purata bagi Eksperimen I dan II.*

*Terangkan perbezaan tersebut berdasarkan teori perlanggaran*

[5 marks / markah]

- (c) Diagram 9.2 shows a statement regarding a reaction.

*Rajah 9.2 menunjukkan satu pernyataan berkaitan satu tindak balas.*

When sodium thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3$  solution reacts with sulphuric acid,  $\text{H}_2\text{SO}_4$ , a precipitate is formed.

*Apabila larutan natrium tiosulfat,  $\text{Na}_2\text{S}_2\text{O}_3$  bertindak balas dengan asid sulfurik,  $\text{H}_2\text{SO}_4$ , suatu mendakan terbentuk.*

Diagram / Rajah 9.2

- (i) Based on the statement above, name the precipitate formed.  
*Berdasarkan pernyataan di atas, namakan mendakan tersebut.*  
[1 mark / markah]
- (ii) Describe a laboratory experiment to investigate the effect of temperature on the rate of reaction between sodium thiosulphate solution and acid sulphuric.  
*Huraikan satu eksperimen untuk mengkaji kesan suhu terhadap kadar tindak balas antara larutan natrium tiosulfat dan asid sulfurik.*

Your answer must include the following:

Jawapan anda perlu mengandungi perkara berikut:

- List of materials and apparatus  
*Senarai bahan dan radas*
- Procedure of the experiment and result  
*Prosedur eksperimen dan keputusannya*
- Conclusion  
*Kesimpulan*

[10 marks / markah]

- 10 (a) Diagram 10.1 shows two containers containing hydrogen and chlorine molecules at different pressures.

Rajah 10.1 menunjukkan dua bekas yang mengandungi molekul hidrogen dan klorin pada tekanan berbeza.

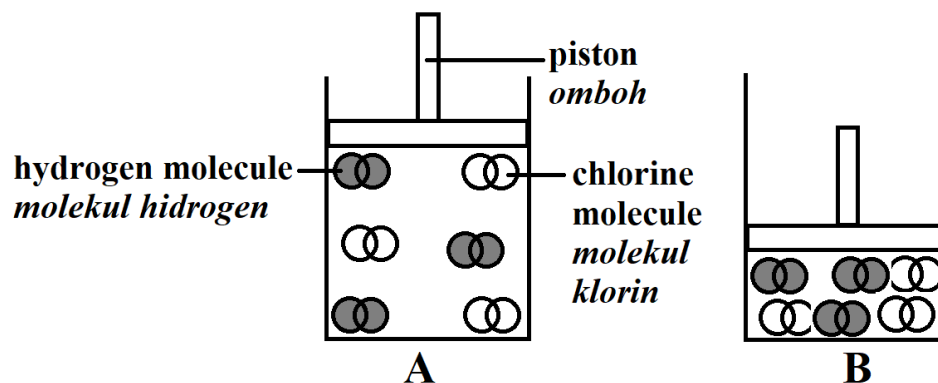


Diagram / Rajah 10.1

Explain the difference in the rate of reaction between hydrogen and chlorine gases in both containers, using collision theory.

*Terangkan perbezaan kadar tindak balas antara gas hidrogen dan gas klorin dalam kedua-dua bekas, menggunakan teori perlanggaran.*

[5 marks / markah]

- (b) Hydrogen peroxide is unstable and decomposes to form water and oxygen gas with a  $\Delta H = -98.2 \text{ kJ mol}^{-1}$ . The presence of catalyst will affect the rate of decomposition.

*Hidrogen peroksida adalah tidak stabil dan terurai membentuk air dan gas oksigen dengan  $\Delta H = -98.2 \text{ kJ mol}^{-1}$ . Kehadiran mangkin akan mempengaruhi kadar penguraian tersebut.*

- (i) State the name of the catalyst.  
*Nyatakan nama mangkin itu.*

[1 mark / markah]

- (ii) Explain how the catalyst affects the rate of decomposition, using collision theory.

*Terangkan bagaimana mangkin itu mempengaruhi kadar penguraian, menggunakan teori pelanggaran.*

[3 marks / markah]

- (iii) Draw the energy profile diagram for the decomposition of hydrogen peroxide. On the energy profile diagram, show the following:

Lukis gambar rajah profil tenaga bagi penguraian hidrogen peroksida. Pada gambar rajah profil tenaga itu, tunjukkan perkara berikut:

- Heat of decomposition,  $\Delta H$   
Haba penguraian,  $\Delta H$
- Activation energy without catalyst,  $E_a$   
Tenaga pengaktifan tanpa mangkin,  $E_a$
- Activation energy with catalyst,  $E_a'$   
Tenaga pengaktifan dengan mangkin,  $E_a'$
- Reactant and products  
Bahan dan hasil tindak balas

[5 marks / markah]

- (c) Cabbages in Kundasang, Sabah are exported to Phillipines using kargo. The journey from Sabah to Phillipines takes about 3 days. Explain how to ensure the vegetables are still in good condition when it reaches Phillipines.

*Kubis di Kundasang, Sabah dieksport ke Filipina menggunakan kargo. Perjalanan dari Sabah ke Kundasang mengambil masa 3 hari. Terangkan bagaimana memastikan sayur itu masih berada dalam keadaan baik apabila ia sampai ke Filipina.*

[3 marks / markah]

- (d) Diagram 10.2 shows Encik Ahmad is fanning satay that is being cooked while diagram 10.3 shows Encik Ramli cooking satay without fanning. They are cooking satay at the same time in a same open space.

*Rajah 10.2 menunjukkan Encik Ahmad sedang mengipas sate yang dimasak manakala Rajah 10.3 menunjukkan Encik Ramli memasak sate tanpa mengipas. Mereka memasak sate pada masa yang sama dan di kawasan lapang yang sama.*



Diagram / Rajah 10.2



Diagram / Rajah 10.3

Based on Diagram 10.2 and Diagram 10.3, explain which satay cooks faster if the size of the satay meat and the size of charcoal used are the same.

*Berdasarkan Rajah 10.2 dan Rajah 10.3, terangkan sate manakah yang akan masak lebih cepat, jika saiz daging sate dan saiz arang yang diguna adalah sama.*

[3 marks / markah]