

# The mole concept, chemical formula and equation

Formula penting / Important formula

$$\text{Bilangan mol} = \frac{\text{jisim}}{\text{Jisim molar}} \quad \text{Bilangan mol} = \frac{MV}{1000}$$

$$\text{Bilangan mol} = \frac{\text{isi padu gas}}{\text{isi padu molar}}$$

$$\text{Amount of moles} = \frac{MV}{1000} \quad \text{Amount of moles} = \frac{\text{Mass}}{\text{molar mass}}$$

$$\text{Amount of moles} = \frac{\text{volume}}{\text{Molar volume}}$$

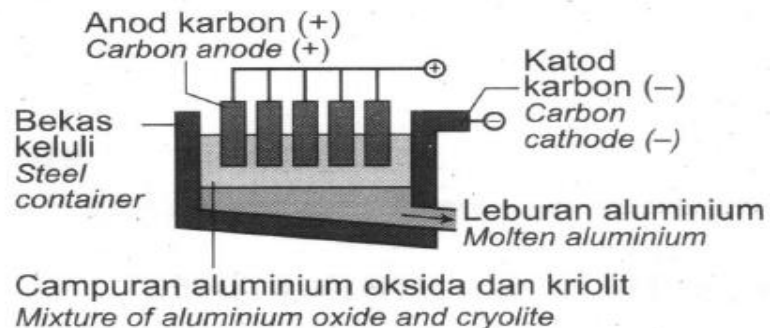
$$M_1V_1 = M_2V_2$$

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1.

Rajah 1 menunjukkan proses pengekstrakan aluminium dalam industri.

*Diagram 1 shows the process of aluminium extraction in industry.*



Rajah 1 / Diagram 1

360 cm<sup>3</sup> gas oksigen terhasil semasa elektrolisis aluminium oksida.

Berapakah bilangan atom aluminium yang terhasil?

[Isi padu molar gas = 24 dm<sup>3</sup> mol<sup>-1</sup> pada keadaan bilik; pemalar Avogadro = 6.02 × 10<sup>23</sup> mol<sup>-1</sup>]

*360 cm<sup>3</sup> of oxygen gas is produced during the electrolysis of aluminium oxide.*

*What is the number of aluminium atoms produced?*

*[Molar volume of gas = 24 dm<sup>3</sup> mol<sup>-1</sup> at room condition; Avogadro constant = 6.02 × 10<sup>23</sup> mol<sup>-1</sup>]*

**A** 9.030 × 10<sup>21</sup>

**C** 1.204 × 10<sup>21</sup>

**B** 1.806 × 10<sup>22</sup>

**D** 1.204 × 10<sup>22</sup>

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2

Semasa letupan gunung berapi, gas-gas seperti  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{SO}_2$ ,  $\text{H}_2$ , wap air,  $\text{H}_2\text{S}$  dan  $\text{HCl}$  dibebaskan. Untuk menghasilkan letupan di dalam makmal, seorang murid memasukkan 5.04 g ammonium dikromat(VI),  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  ke dalam mortar dan dinyalakan dengan serta-merta. Tindak balas penguraian ammonium dikromat(VI) menghasilkan kromium(III) oksida, gas nitrogen dan wap air.

Berapakah isi padu wap air yang terhasil pada keadaan bilik?

*During volcanic eruptions, some gases such as  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{SO}_2$ ,  $\text{H}_2$ , steam,  $\text{H}_2\text{S}$  and  $\text{HCl}$  are released. To simulate the eruption in the laboratory, a pupil added 5.04 g of ammonium dichromate(VI),  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  in a mortar and immediately ignited it. The decomposition reaction of ammonium dichromate(VI) produces chromium(III) oxide, nitrogen gas and steam.*

*What is the volume of steam produced at room condition?  
[Relative atomic mass:  $\text{H} = 1$ ,  $\text{N} = 14$ ,  $\text{O} = 16$ ,  $\text{Cr} = 52$ ;  
molar volume of gas =  $24 \text{ dm}^3 \text{ mol}^{-1}$  at room condition]*

- |                             |                             |
|-----------------------------|-----------------------------|
| <b>A</b> 0.96 $\text{dm}^3$ | <b>C</b> 0.48 $\text{dm}^3$ |
| <b>B</b> 1.92 $\text{dm}^3$ | <b>D</b> 1.44 $\text{dm}^3$ |

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3

Berapakah bilangan mol karbon yang mempunyai dua kali ganda bilangan atom dalam 77 g tetraklorometana,  $\text{CCl}_4$ ?

[Jisim atom relatif: C = 12, Cl = 35.5]

*How many moles of carbon has twice the number of atoms in 77 g of tetrachloromethane,  $\text{CCl}_4$ ?*

*[Relative atomic mass: C = 12, Cl = 35.5]*

**A** 5.0 mol

**C** 3.5 mol

**B** 4.0 mol

**D** 2.5 mol

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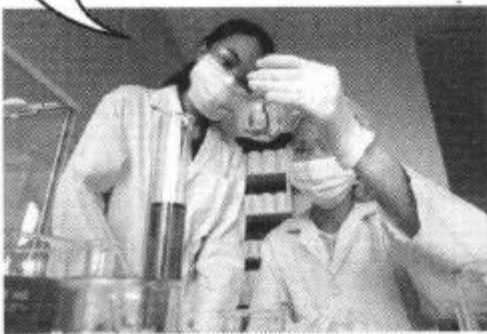
4

Rajah 5 menunjukkan perbualan antara dua orang murid semasa menjalankan satu eksperimen.

*Diagram 5 shows the conversation between two pupils while carrying out an experiment.*

Saya ingin menyediakan garam zink klorida melalui tindak balas antara pepejal zink hidroksida berlebihan dengan asid hidroklorik  $0.1 \text{ mol dm}^{-3}$ .

*I want to prepare zinc chloride salt through a reaction between excess solid zinc hydroxide with  $0.1 \text{ mol dm}^{-3}$  hydrochloric acid.*



Rajah 5 / Diagram 5

Berapakah isi padu asid yang diperlukan untuk menyediakan 1.36 g zink klorida?

[Jisim atom relatif:  $\text{Zn} = 65$ ,  $\text{Cl} = 35.5$ ]

*What is the volume of acid needed to prepare 1.36 g of zinc chloride?*

[Relative atomic mass:  $\text{Zn} = 65$ ,  $\text{Cl} = 35.5$ ]

A  $0.1 \text{ dm}^3$

C  $1.0 \text{ dm}^3$

B  $0.2 \text{ dm}^3$

D  $2.0 \text{ dm}^3$



- 5 Persamaan berikut mewakili pembakaran lengkap gas propana.

*The following equation represents the complete combustion of propane gas.*



- A. I & II
- B. I & III
- C. II & IV
- D. III & IV

Antara pernyataan berikut, yang manakah benar tentang tindak balas itu?

[Jisim atom relatif: H = 1, C = 12, O = 16; isi padu molar gas =  $22.4 \text{ dm}^3 \text{ mol}^{-1}$  pada STP]

*Which of the following about the reaction is true?*

[Relative atomic mass: H = 1, C = 12, O = 16; molar volume of gas =  $22.4 \text{ dm}^3 \text{ mol}^{-1}$  at STP]

- I Pembakaran 2.2 g propana menghasilkan  $5.6 \text{ dm}^3$  oksigen  
*Combustion of 2.2 g propane requires  $5.6 \text{ dm}^3$  oxygen*
- II Pembakaran 13.2 g propana memerlukan 14.4 g oksigen  
*Combustion of 13.2 g of propane requires 14.4 g oxygen.*
- III Pembakaran 13.2 g propana menghasilkan 21.6 g air  
*Combustion of 13.2 g of propane produces 21.6 g water*
- IV Pembakaran 0.7 mol propana menghasilkan  $50.4 \text{ dm}^3$  karbon dioksida pada STP  
*Combustion of 0.7 mole of propane produces  $50.4 \text{ dm}^3$  carbon dioxide gas at STP*

6

Antara yang berikut, yang manakah mempunyai bilangan molekul yang paling banyak?

[Jisim atom relatif:  $H = 1$ ,  $C = 12$ ,  $O = 16$ ,  $Ca = 40$ ]

*Which of the following has the greatest number of molecules?*

*[Relative atomic mass:  $H = 1$ ,  $C = 12$ ,  $O = 16$ ,  $Ca = 40$ ]*

- A** 10.8 g air,  $H_2O$   
*10.8 g of water,  $H_2O$*
- B** 18.2 g etena,  $C_2H_4$   
*18.2 g of ethene,  $C_2H_4$*
- C** 18.4 g etanol,  $C_2H_5OH$   
*18.4 g of ethanol,  $C_2H_5OH$*
- D** 30 g marmar,  $CaCO_3$   
*30 g of marble,  $CaCO_3$*

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- 7 Persamaan kimia berikut menunjukkan tindakan haba ke atas garam magnesium nitrat.

*The equation below shows the action of heat on magnesium nitrate salt.*



Berapakah bilangan mol  $\text{Mg}(\text{NO}_3)_2$  yang diperlukan untuk menghasilkan 8.0 g magnesium oksida?

[Jisim atom relatif: N = 14, O = 16 dan Mg = 24]

*How many moles of  $\text{Mg}(\text{NO}_3)_2$  are needed to produce 8.0 g of magnesium oxide?*

*[Relative atomic mass: N = 14, O = 16 and Mg = 24]*

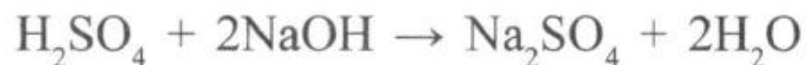
- A 0.1 mol
- B 0.2 mol
- C 0.3 mol
- D 0.4 mol

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- 8 Persamaan berikut mewakili tindak balas antara larutan natrium hidroksida dengan asid sulfurik cair.

*The following equation represents the reaction between sodium hydroxide solution and dilute sulphuric acid.*



Berapakah isi padu  $0.5 \text{ mol dm}^{-3}$  larutan natrium hidroksida yang diperlukan untuk meneutralkan  $25 \text{ cm}^3$  asid sulfurik  $0.5 \text{ mol dm}^{-3}$ ?

*What is the volume of  $0.5 \text{ mol dm}^{-3}$  sodium hydroxide solution needed to neutralise  $25 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  sulphuric acid?*

- A  $12.5 \text{ cm}^3$
- B  $25.0 \text{ cm}^3$
- C  $50.0 \text{ cm}^3$
- D  $75.0 \text{ cm}^3$

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- 9 14 g kalium hidroksida dilarutkan dalam air suling untuk membentuk  $250 \text{ cm}^3$  larutan piawai. Apakah kemolaran larutan kalium hidroksida tersebut?

*14 g of potassium hydroxide is dissolved in distilled water to form  $250 \text{ cm}^3$  standard solution. What is the molarity of the potassium hydroxide solution?*

[Jisim atom relatif/Relative atomic mass:  $\text{H} = 1$ ,  $\text{O} = 16$ ,  $\text{K} = 39$ ]

- A  $0.06 \text{ mol dm}^{-3}$
- B  $0.10 \text{ mol dm}^{-3}$
- C  $0.60 \text{ mol dm}^{-3}$
- D  $1.00 \text{ mol dm}^{-3}$

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- 10 Berapakah isi padu air suling yang perlu ditambah ke dalam  $20 \text{ cm}^3$  asid hidroklorik  $0.5 \text{ mol dm}^{-3}$  untuk memperoleh asid hidroklorik berkepekatan  $0.1 \text{ mol dm}^{-3}$ ?

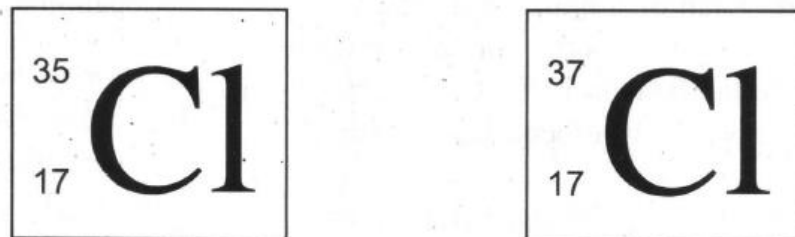
*What is the volume of distilled water needed to be added to  $20 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  hydrochloric acid to get  $0.1 \text{ mol dm}^{-3}$  hydrochloric acid?*

- |                            |                             |
|----------------------------|-----------------------------|
| <b>A</b> $16 \text{ cm}^3$ | <b>C</b> $100 \text{ cm}^3$ |
| <b>B</b> $80 \text{ cm}^3$ | <b>D</b> $120 \text{ cm}^3$ |

11.

Rajah 1 menunjukkan perwakilan piawai atom bagi dua isotop klorin.

Diagram 1 shows the standard representation of two isotopes of chlorine.



Rajah 1 / Diagram 1

- (a) (i) Berdasarkan Rajah 1, nyatakan maksud isotop.

Based on Diagram 1, state the meaning of isotope.

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[1 markah / 1 mark]

- (ii) Nyatakan **satu** kegunaan klorin dalam kehidupan harian.

Sate **one** use of chlorine in our daily lives.

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[1 markah / 1 mark]

- (iii) Kelimpahan semula jadi  $^{35}_{17}\text{Cl}$  ialah 75% dan  $^{37}_{17}\text{Cl}$  ialah 25%. Hitung jisim atom relatif klorin.

The natural abundance of  $^{35}_{17}\text{Cl}$  is 75% and  $^{37}_{17}\text{Cl}$  is 25%. Calculate the relative atomic mass of chlorine.

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- (b) Jadual 1 menunjukkan takat lebur dan takat didih bagi asid laurik.

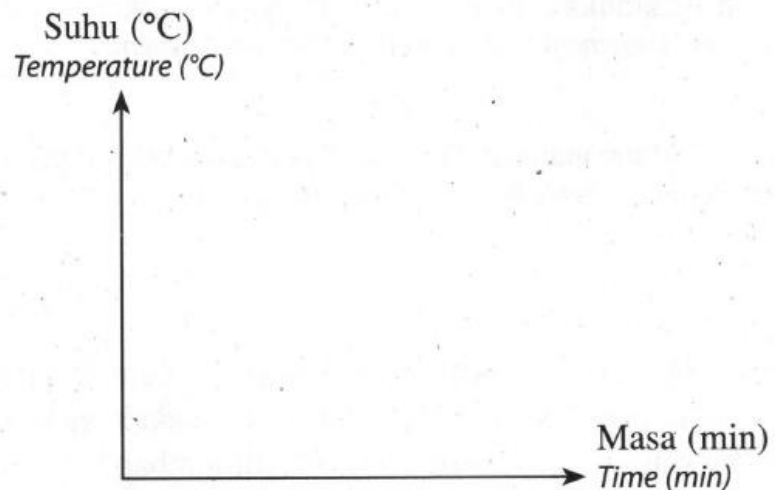
*Table 1 shows the melting point and boiling point of lauric acid.*

Takat lebur ( $^{\circ}\text{C}$ ) <i>Melting point (<math>^{\circ}\text{C}</math>)</i>	Takat didih ( $^{\circ}\text{C}$ ) <i>Boiling point (<math>^{\circ}\text{C}</math>)</i>
44.0	248.0

Jadual 1 / Table 1

- (i) Lakarkan graf suhu melawan masa apabila asid laurik dipanaskan dari  $30^{\circ}\text{C}$  hingga  $100^{\circ}\text{C}$ .

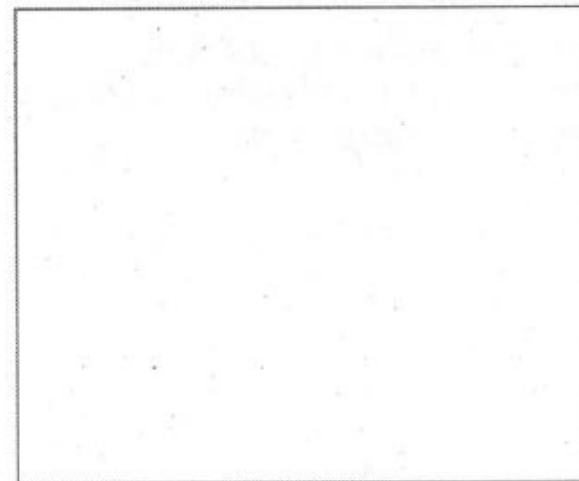
*Sketch a graph of temperature against time when lauric acid is heated from  $30^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ .*



[1 markah / 1 mark]

- (ii) Lukis susunan zarah dalam klorin pada  $60^{\circ}\text{C}$ .

*Draw the arrangement of particles in chlorine at  $60^{\circ}\text{C}$*

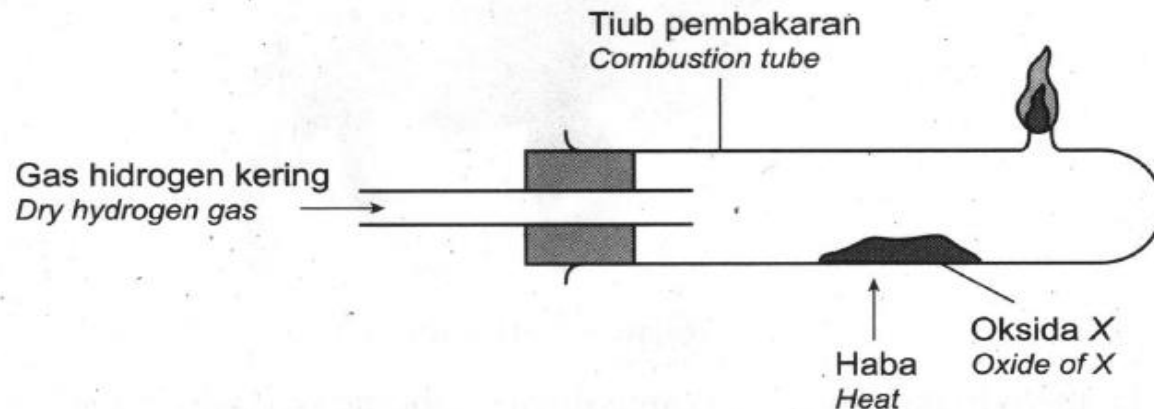


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Rajah 3.1 menunjukkan susunan radas yang digunakan untuk menentukan formula empirik oksida X.

Diagram 3.1 shows the apparatus set-up used to determine the empirical formula of X oxide.



Rajah 3.1 / Diagram 3.1

Berdasarkan Rajah 3.1, jawab soalan-soalan berikut.

Based on Diagram 3.1, answer the following questions.

- (a) Cadangkan **satu** bahan yang sesuai bagi oksida X.  
Suggest **one** suitable substance for X oxide.

[1 markah / 1 mark]

- (b) Sebelum oksida X dipanaskan, gas hidrogen kering dialirkan melalui tiub pembakaran untuk seketika. Beri **satu** sebab.  
Before X oxide is heated, the dry hydrogen gas is flowed through the combustion tube for a while.  
Give **one** reason.

[1 markah / 1 mark]

(c) Keputusan yang diperoleh daripada eksperimen tersebut ditunjukkan dalam Jadual 3:

*The result obtained from the experiment is shown in Table 3:*

<b>Jisim tiub pembakaran + kertas asbestos (g)</b> <i>Mass of combustion tube + asbestos paper (g)</i>	157.50
<b>Jisim tiub pembakaran + kertas asbestos + oksida X (g)</b> <i>Mass of combustion tube + asbestos paper + X oxide (g)</i>	173.50
<b>Jisim tiub pembakaran + kertas asbestos + X (g)</b> <i>Mass of combustion tube + asbestos paper + X (g)</i>	170.30

Jadual 3 / Table 3

Hitung formula empirik oksida X.

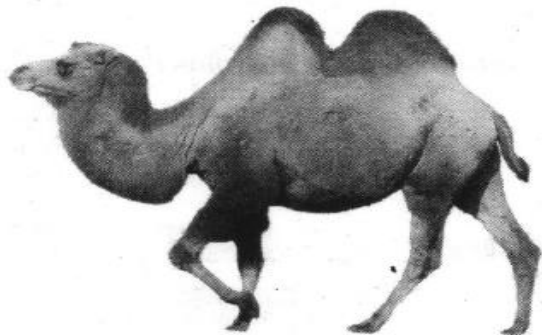
[Jisim atom relatif: O = 16, X = 64 ]

*Determine the empirical formula of X oxide.*

*[Relative atomic mass: O = 16, X = 64 ]*

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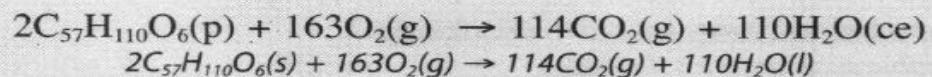
(d)



Rajah 3.2 / Diagram 3.2

Unta tidak menyimpan air pada bonggolnya tetapi menyimpan lemak yang disebut sebagai tristearin ( $C_{57}H_{110}O_6$ ). Lemak ialah sumber tenaga dan air seperti yang ditunjukkan dalam tindak balas di bawah.

*Camels do not store water in their humps but fat which is called as tristearin ( $C_{57}H_{110}O_6$ ). The fat is the source of energy and water as shown in the reaction below*



Berapakah jisim air yang dapat dihasilkan daripada 10 kg lemak seekor unta?

[Jisim atom relatif : H=1, C=12, O = 16]

*What is the mass of water that can be produced from 10 kg of fat by a camel?*

[Relative atomic mass : H=1, C=12, O = 16]

[2 markah / 2 marks]

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# Acid, Base and salt

Asid: Asid ialah bahan kimia yang mengion di dalam air untuk menghasilkan ion hidrogen

*Acid: Acid is a chemical that dissolves in water to form hydrogen ions*

Asid kuat: Aid yang mengion lengkap di dalam air

*Strong acids: Acids that ionize completely in water*

Asid lemah: Asid yang megion separa dalam air

*Weak acids: acids that ionize partially in water/*

$$\text{pH} = -\log [\text{H}^+]$$

$$\begin{aligned}\text{pH} + \text{pOH} &= 14 \\ \text{pH} &= 14 - \text{pOH}\end{aligned}$$

Indicator	Colour in medium		
	Acidic	Neutral	Alkaline
Phenolphthalein	Colourless	Colourless	Pink
Methyl orange	Red	Orange	Yellow

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## Warna garam / The colours of salts



Copper Carbonate



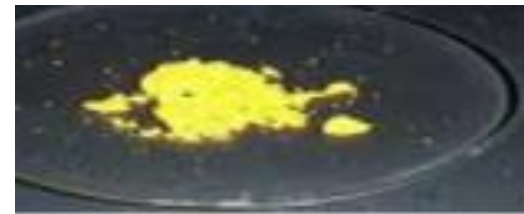
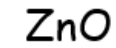
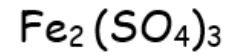
Copper Oxide CuO



Copper sulphate



Copper Cu Powder



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### ✚ Keterlarutan garam / Solubility of Salts

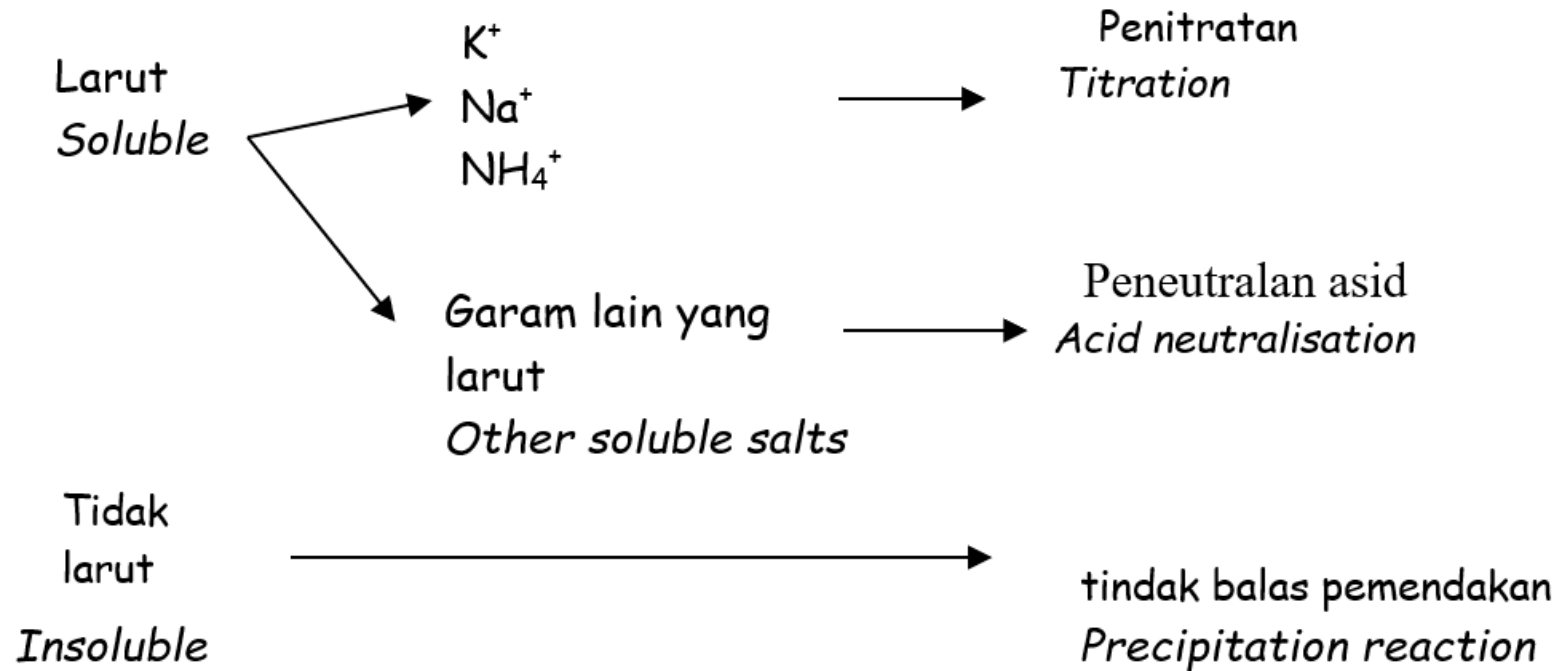
Garam nitrat <i>Nitrate salts,</i> $\text{NO}_3^-$	Garam sulfat <i>Sulphate salts,</i> $\text{SO}_4^{2-}$	Garam klorida <i>Chloride salts,</i> $\text{Cl}^-$	Garam karbonat <i>Carbonate salts,</i> $\text{CO}_3^{2-}$
Semua LARUT di dalam air/ <i>All nitrates are SOLUBLE</i>	Semua LARUT di dalam air/ <i>All sulphates are SOLUBLE</i>  Kecuali/ <i>Except:</i>  <div> <math>\text{BaSO}_4</math>  <math>\text{CaSO}_4</math>  <math>\text{PbSO}_4</math> </div> } INSOLUBLE TAK LARUT	Semua LARUT di dalam air/ <i>All chlorides are SOLUBLE</i>  Kecuali/ <i>Except:</i>  <div> <math>\text{AgCl}</math>  <math>\text{PbCl}_2</math>  <math>\text{HgCl}</math> </div> } INSOLUBLE TAK LARUT	Semua TIDAK LARUT di dalam air/ <i>All carbonates are INSOLUBLE</i>  Kecuali/ <i>Except:</i>  <div> <math>\text{Na}_2\text{CO}_3</math>  <math>\text{K}_2\text{CO}_3</math>  <math>(\text{NH}_4)_2\text{CO}_3</math> </div> } SOLUBLE LARUT

## Salt preparation

There are 2 steps in writing out the preparation of a salt.

Step 1: Check solubility of the salt to be prepared

Step 2: Check solubility of the parent acid and parent base to be used



There are 3 main methods available for salt preparation.

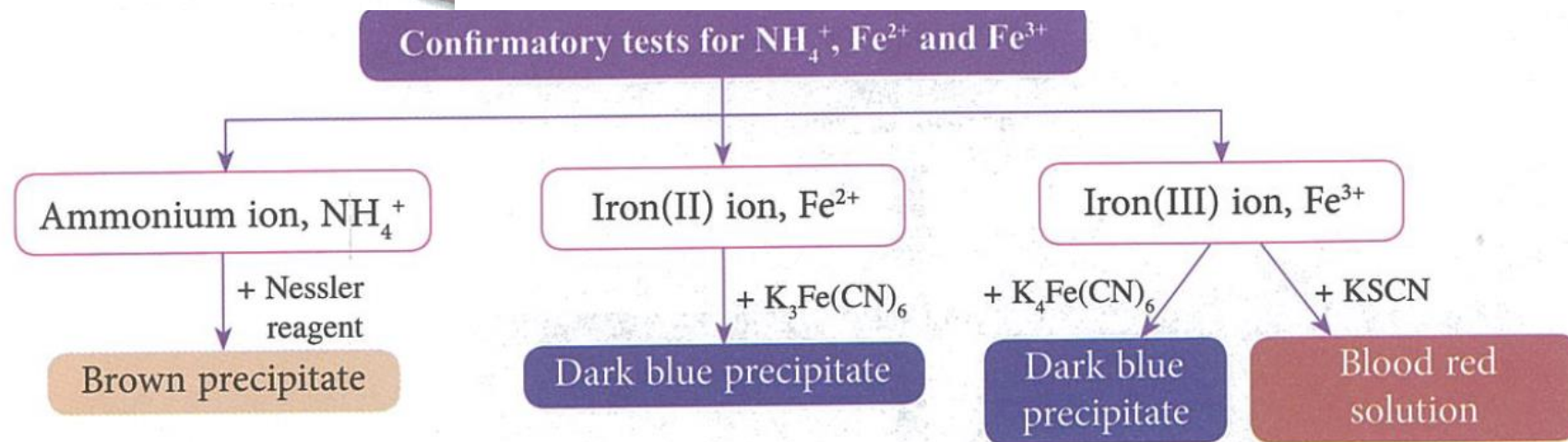
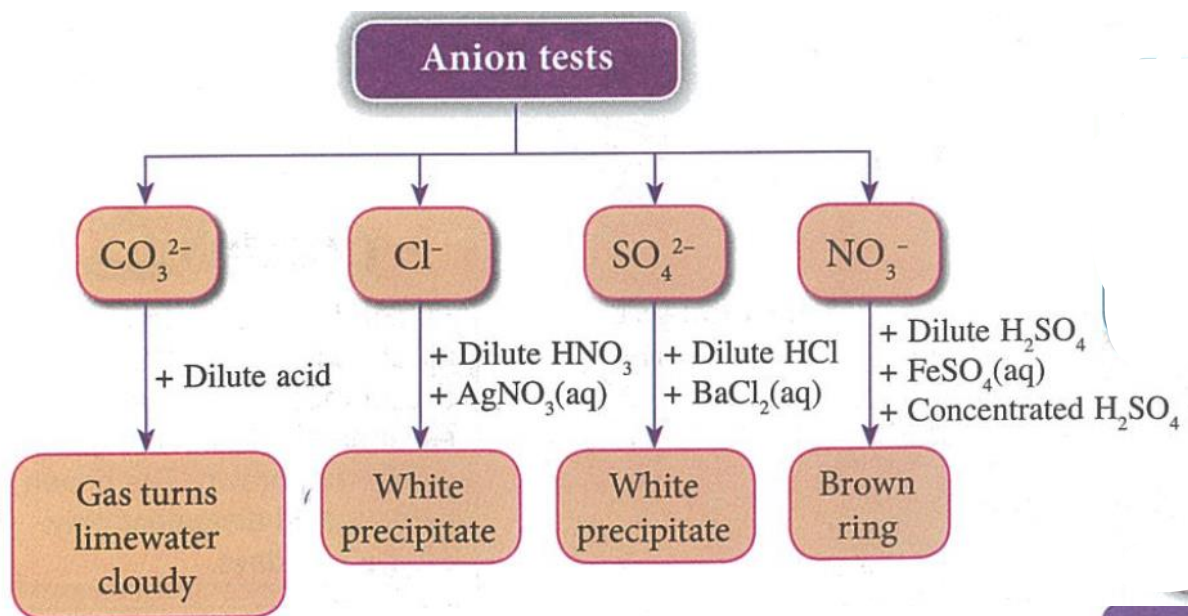
1) Penitratan asid-bes / Titration

2) Peneutralan asid (asid+logam, asid + oksida logam, asid+ karbonat)/ Acid neutralisation (acid +metal, acid + metal oxide, acid + metal carbonate)

3) tindak balas pemendakan/ Precipitation reaction

Kation/ Cation	Sedikit NaOH <i>A few drops of NaOH</i>	NaOH berlebihan <i>Excess NaOH</i>	Sedikit NH <sub>3</sub> / <i>A few drops of NH<sub>3</sub> (aq)</i>	NH <sub>3</sub> Berlebihan/ <i>Excess NH<sub>3</sub> (aq)</i>
Ca <sup>2+</sup>	Mendakan putih/ <i>White ppt</i>	MP tidak larut / <i>WP does not dissolve</i>	-----	-----
Mg <sup>2+</sup>	Mendakan putih/ <i>White ppt</i>	MP tidak larut / <i>WP does not dissolve</i>	Mendakan putih/ <i>White ppt</i>	MP tidak larut / <i>WP does not dissolve</i>
Al <sup>3+</sup>	Mendakan putih/ <i>White ppt</i>	MP Larut / <i>WP dissolves</i>	Mendakan putih/ <i>White ppt</i>	MP tidak larut / <i>WP does not dissolve</i>
Zn <sup>2+</sup>	Mendakan putih/ <i>White ppt</i>	MP Larut / <i>WP dissolves</i>	Mendakan putih/ <i>White ppt</i>	MP Larut / <i>WP dissolves</i>
Pb <sup>2+</sup>	Mendakan putih/ <i>White ppt</i>	MP Larut / <i>WP dissolves</i>	Mendakan putih/ <i>White ppt</i>	MP tidak larut / <i>WP does not dissolve</i>

iy:





13

Rajah 7 menunjukkan nilai pH bagi tanah di dua ladang jagung yang berbeza.

Diagram 7 shows the pH value of soil in two different maize plantations.



A



B

Rajah 7 / Diagram 7

Apakah bahan yang perlu Encik Ahmad tambahkan untuk meneutralkan tanah di ladang A supaya hasil yang diperoleh lebih baik seperti di ladang B?

What is the substance should Mr. Ahmad add to neutralise the soil in plantation A in order to have a better yield like plantation B?

**A** Garam dapur  
Table salt

**B** Soda kapur  
Soda lime

**C** Kompos  
Compost

**D** Cuka  
Vinegar

14

Andy merendam sekeping kertas turas ke dalam larutan P. Kemudian, dia menggunakan larutan Q untuk menulis 'CHEMISTRY IS FUN' di atas kertas turas tersebut. Tulisan pada kertas turas tersebut berubah menjadi kuning. Antara yang berikut, yang manakah pasangan larutan P dan larutan Q?

Andy immersed a piece of filter paper into a beaker containing solution P. Then, he used solution Q to write 'CHEMISTRY IS FUN' on the filter paper. The wording on the filter paper turned yellow. Which of the following pairs is solution P and solution Q?

**A** Kalium iodida dan plumbum(II) nitrat  
Potassium iodide and lead(II) nitrate

**B** Natrium klorida dan argentum nitrat  
Sodium chloride and silver nitrate

**C** Kalium sulfat dan plumbum(II) nitrat  
Potassium sulphate and lead(II) nitrate

**D** Barium klorida dan kuprum(II) sulfat  
Barium chloride and copper(II) sulphate

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15. Jadual 2 menunjukkan pemerhatian bagi suatu ujian kimia ke atas larutan *P*.

*Table 2 shows the observations of a chemical test on solution P.*

Ujian kimia <i>Chemical test</i>	Pemerhatian <i>Observation</i>
Tambah larutan natrium hidroksida sehingga berlebihan. <i>Add sodium hydroxide solution until in excess.</i>	Mendakan putih yang tidak larut dalam larutan natrium hidroksida berlebihan. <i>White precipitate which is insoluble in excess sodium hydroxide solution.</i>
Tambah larutan ammonia sehingga berlebihan. <i>Add ammonia solution until in excess.</i>	Mendakan putih yang tidak larut dalam larutan ammonia berlebihan. <i>White precipitate which is insoluble in excess ammonia solution.</i>
Tambah asid nitrik cair diikuti dengan larutan plumbum(II) nitrat. <i>Add dilute nitric acid followed by lead(II) nitrate solution.</i>	Mendakan putih terbentuk. <i>White precipitate formed.</i>

Jadual 2 / Table 2

Apakah *P*?

*What is P?*

- A Magnesium klorida  
*Magnesium chloride*
- B Aluminium sulfat  
*Aluminium sulphate*
- C Zinc sulfat  
*Zinc sulphate*
- D Kalsium klorida  
*Calcium chloride*

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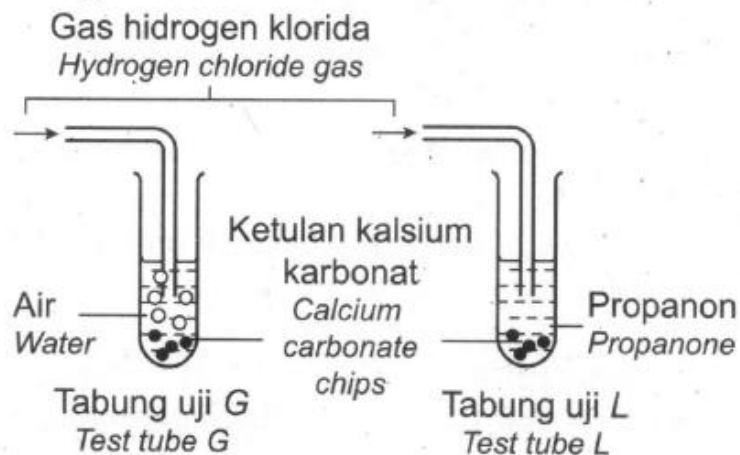
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16

Rajah 5 menunjukkan susunan radas untuk mengkaji tindak balas antara kalsium karbonat dengan gas hidrogen klorida yang melarut di dalam dua pelarut berbeza.

Diagram 5 shows the apparatus set-up to investigate the reaction between calcium carbonate and hydrogen chloride gas dissolved in two different solvents.



Rajah 5 / Diagram 5

- A** Kalsium karbonat dalam tabung uji L melarut.  
*Calcium carbonate in test tube L dissolves.*
- B** Air kekal sebagai molekul di dalam tabung uji G.  
*Water remains as molecules in test tube G.*
- C** Gas hidrogen klorida menghasilkan ion hidrogen di dalam tabung uji G.  
*Hydrogen chloride gas produces hydrogen ions in test tube G.*
- D** Gas hidrogen klorida mengion separa di dalam tabung uji L.  
*Hydrogen chloride gas ionises partially in test tube L.*

- 17 Semasa penyediaan suatu garam nitrat, Rahman memanaskan larutan garam sehingga kering secara tidak sengaja.

Apakah kesan daripada tindakannya itu?

*During the preparation of a nitrate salt, Rahman accidentally heated a salt solution until it dried up.*

*What is the consequence of his action?*

- A Garam itu terdehidrat.  
*The salt was dehydrated.*
- B Garam itu diturunkan menjadi abu.  
*The salt was reduced to ashes.*
- C Garam itu tercemar.  
*The salt was contaminated.*
- D Garam itu terurai.  
*The salt was decomposed.*

- 18 Pasangan bahan kimia manakah paling sesuai untuk menyediakan garam zink sulfat?

*Which pair of substances is the most suitable to prepare zinc sulphate salt?*

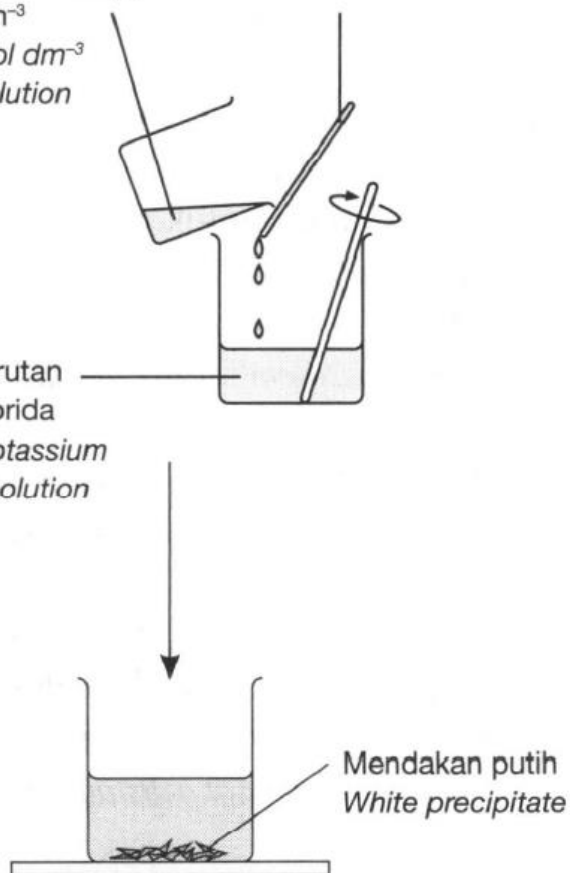
- A Zink dan larutan natrium sulfat  
*Zinc and sodium sulphate solution*
- B Zink nitrat dan larutan asid sulfurik cair  
*Zinc nitrate and dilute sulphuric acid*
- C Larutan zink klorida dan larutan natrium sulfat  
*Zinc chloride solution and sodium sulphate solution*
- D Zink karbonat dan larutan asid sulfurik cair  
*Zinc carbonate and dilute sulphuric acid*

- 19 Rajah 9 menunjukkan langkah penyediaan garam plumbum(II) klorida.

*Diagram 9 shows the steps taken to prepare of lead(II) chloride salt.*

50 cm<sup>3</sup> larutan plumbum(II)  
nitrat 1.0 mol dm<sup>-3</sup>  
50 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup>  
lead(II) nitrate solution

50 cm<sup>3</sup> larutan  
kalium klorida  
50 cm<sup>3</sup> potassium  
chloride solution



Berdasarkan Rajah 9, apakah kepekatan larutan kalium klorida yang diperlukan untuk bertindak balas lengkap dengan larutan plumbum(II) nitrat?  
*Based on Diagram 9, what is the concentration of the potassium chloride solution needed to react completely with lead(II) nitrate solution?*

- A 0.5 mol dm<sup>-3</sup>
- B 1.0 mol dm<sup>-3</sup>
- C 1.5 mol dm<sup>-3</sup>
- D 2.0 mol dm<sup>-3</sup>



20 Larutan manakah mempunyai kuantiti ion hidrogen yang paling tinggi?

*Which solution has the highest quantity of hydrogen ions?*

- A 20 cm<sup>3</sup> larutan asid hidroklorik 0.4 mol dm<sup>-3</sup>  
*20 cm<sup>3</sup> of 0.4 mol dm<sup>-3</sup> hydrochloric acid solution*
- B 20 cm<sup>3</sup> larutan asid etanoik 0.4 mol dm<sup>-3</sup>  
*20 cm<sup>3</sup> of 0.4 mol dm<sup>-3</sup> ethanoic acid solution*
- C 30 cm<sup>3</sup> larutan asid nitrik 0.2 mol dm<sup>-3</sup>  
*30 cm<sup>3</sup> of 0.2 mol dm<sup>-3</sup> nitric acid solution*
- D 25 cm<sup>3</sup> larutan asid sulfurik 0.2 mol dm<sup>-3</sup>  
*25 cm<sup>3</sup> of 0.2 mol dm<sup>-3</sup> sulphuric acid solution*

21 Nilai pH bahan Z ialah 1. Antara berikut, yang manakah **bukan** sifat kimia bahan Z?

*The pH value of substance Z is 1. Which of the following is **not** a chemical property of substance Z?*

- A Bertindak balas dengan logam karbonat untuk menghasilkan garam, air, dan karbon dioksida  
*Reacts with metal carbonates to produce salts, water, and carbon dioxide*
- B Bertindak balas dengan logam reaktif untuk menghasilkan garam dan hidrogen  
*Reacts with reactive metals to produce salts and hydrogen*
- C Bertindak balas dengan logam oksida untuk menghasilkan garam dan oksigen  
*Reacts with metal oxides to produce salts and oxygen*
- D Menukar kertas litmus biru menjadi merah  
*Turns blue litmus paper red*



- 22 Tanah di kebun Pak Samad sangat berasid. Bahan manakah paling sesuai digunakan untuk mengatasi masalah Pak Samad?

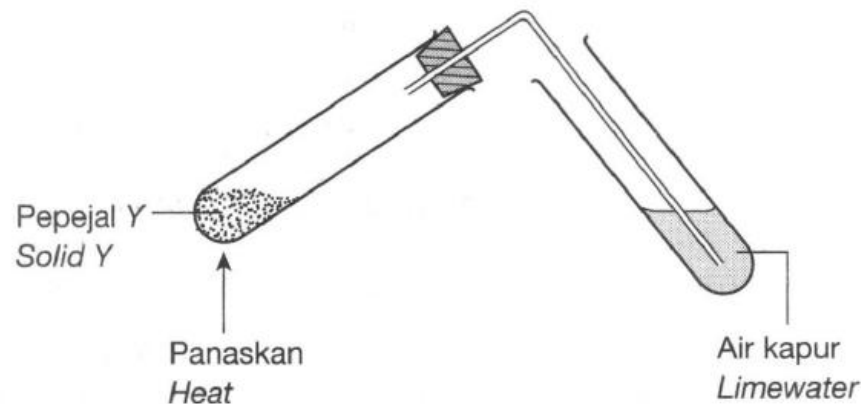
*The soil in Pak Samad's garden is highly acidic. Which material is the most suitable to be used to solve Pak Samad's problem?*

- |   |   |
|---|---|
| <b>A</b> Magnesium sulfat<br><i>Magnesium sulphate</i>  | <b>C</b> Barium klorida<br><i>Barium chloride</i> |
| <b>B</b> Kalsium hidroksida<br><i>Calcium hydroxide</i> | <b>D</b> Barium nitrat<br><i>Barium nitrate</i>   |

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Rajah 4 menunjukkan susunan radas untuk pemanasan pepejal Y.

*Diagram 4 shows the apparatus set-up for heating solid Y.*



**Rajah 4** *Diagram 4*

Air kapur menjadi keruh dan baki berwarna kuning apabila panas dan putih apabila sejuk terhasil. Apakah pepejal Y?

*The limewater becomes cloudy and the residue formed is yellow when hot and white when cold. What is solid Y?*

- |  |  |
|--|--|
| <b>A</b> Kalsium karbonat<br><i>Calcium carbonate</i>    | <b>C</b> Magnesium sulfat<br><i>Magnesium sulphate</i> |
| <b>B</b> Ferum(III) klorida<br><i>Iron(III) chloride</i> | <b>D</b> Zink karbonat<br><i>Zinc carbonate</i>        |

Jadual 2 menunjukkan pemerhatian bagi ujian yang dijalankan ke atas larutan T.

Table 2 shows the observations of tests performed on solution T.

Ujian Test	Pemerhatian Observation
Tambahkan larutan ammonia sehingga berlebihan <i>The addition of ammonia solution until in excess</i>	Mendakan putih yang larut dalam larutan ammonia berlebihan terbentuk <i>A white precipitate that dissolves in excess ammonia solution is formed</i>
Tambahkan asid sulfurik cair diikuti dengan larutan ferum(II) sulfat dan beberapa titik asid sulfurik pekat <i>Addition of dilute sulphuric acid followed by iron(II) sulphate solution and a few drops of concentrated sulphuric acid</i>	Gelang perang terbentuk <i>A brown ring is formed</i>

Jadual 2 Table 2

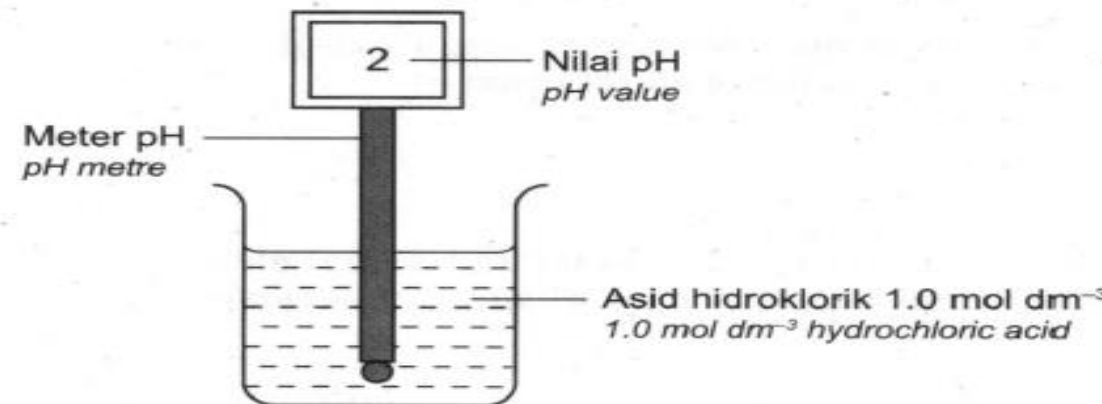
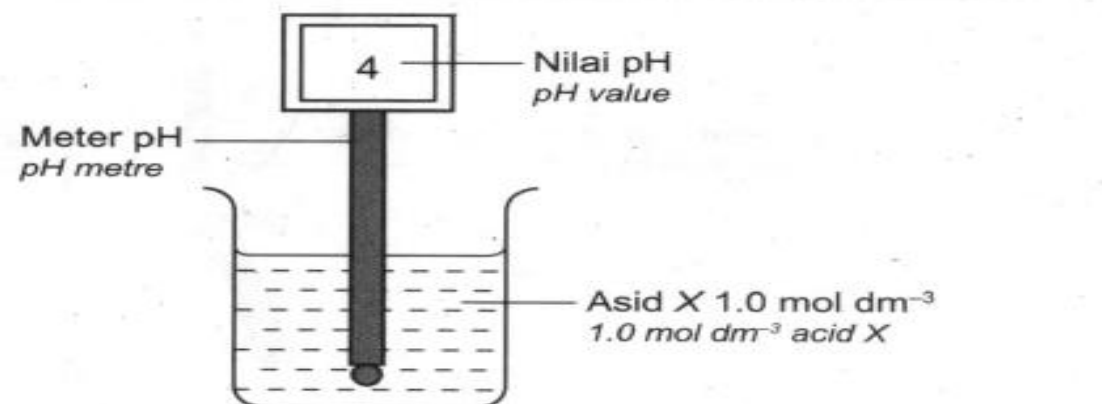
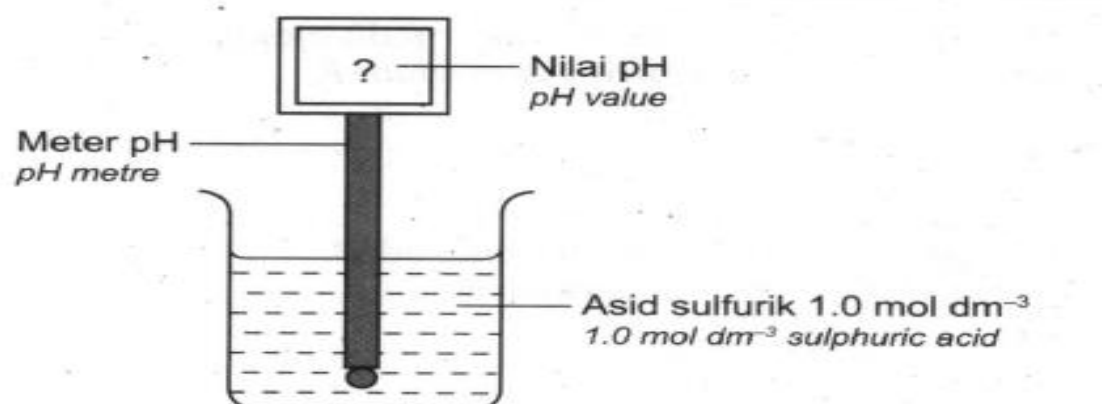
Apakah T?

What is T?

- A Plumbum(II) sulfat  
*Lead(II) sulphate*
- B Plumbum(II) klorida  
*Lead(II) chloride*
- C Plumbum(II) nitrat  
*Lead(II) nitrate*
- D Zink nitrat  
*Zinc nitrate*

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25. Table 5 shows the experiment to investigate the relationship between the concentration of hydrogen ion,  $H^+$  and the pH value.

<b>Eksperimen</b> <b>Experiment</b>	<b>Kepekatan asid hidroklorik, HCl dan nilai pH</b> <b>Concentration of hydrochloric acid, HCl and pH value</b>
I	 <p>Diagram illustrating Experiment I: A pH meter is used to measure the pH of 1.0 mol dm<sup>-3</sup> hydrochloric acid. The pH meter display shows a value of 2.</p>
II	 <p>Diagram illustrating Experiment II: A pH meter is used to measure the pH of 1.0 mol dm<sup>-3</sup> acid X. The pH meter display shows a value of 4.</p>
III	 <p>Diagram illustrating Experiment III: A pH meter is used to measure the pH of 1.0 mol dm<sup>-3</sup> sulphuric acid. The pH meter display shows a question mark.</p>

- (a) (i) Dalam Eksperimen I, kepekatan asid hidroklorik yang digunakan ialah  $1.0 \text{ mol dm}^{-3}$ .

Apakah yang dimaksudkan dengan  $1.0 \text{ mol dm}^{-3}$ ?

*In Experiment I, the concentration of hydrochloric acid used is  $1.0 \text{ mol dm}^{-3}$ .*

*What is meant by  $1.0 \text{ mol dm}^{-3}$ ?*

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[1 markah / 1 mark]

- (ii) Cadangkan nama bagi asid X dalam Eksperimen II.

*Suggest the name of acid X in Experiment II.*

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[1 markah / 1 mark]

- (iii) Banding dan jelaskan nilai pH asid dalam Eksperimen I dan Eksperimen III.

*Compare and explain the pH value of acids in Experiment I and Experiment III.*

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[3 markah / 3 marks]

ught to you by:



- (b)  $12.5 \text{ cm}^3$  asid hidroklorik dalam Eksperimen I ditambahkan dengan air suling sehingga jumlah isi padu yang diperoleh ialah  $50 \text{ cm}^3$ . Berapakah kepekatan baharu bagi larutan asid hidroklorik tersebut?

*$12.5 \text{ cm}^3$  of hydrochloric acid in Experiment I is added with distilled water until a total volume of  $50 \text{ cm}^3$  is obtained. What is the new concentration of hydrochloric acid solution?*

[2 markah / 2 marks]

- (c) Persamaan kimia tak seimbang bagi tindak balas antara asid HX dengan natrium hidroksida adalah seperti berikut.

*The imbalance chemical equation for the reaction between acid HX and sodium hydroxide solution is as follows.*



$30 \text{ cm}^3$  asid HX  $0.5 \text{ mol dm}^{-3}$  diperlukan untuk meneutralkan  $40 \text{ cm}^3$  larutan natrium hidroksida  $0.75 \text{ mol dm}^{-3}$ . Berdasarkan hasil penghitungan anda, tentukan HX.

*$30 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  acid HX is needed to neutralise  $40 \text{ cm}^3$  of  $0.75 \text{ mol dm}^{-3}$  sodium hydroxide solution. Based on your calculation, determine HX.*

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Rajah 6.1 menunjukkan penguraian baja ammonium klorida.  
Diagram 6.1 shows the decomposition of ammonium chloride fertiliser.



Rajah 6.1 / Diagram 6.1

- (a) Ammonium klorida terurai apabila dipanaskan dengan kuat untuk menghasilkan gas Y dan gas Z.

*Ammonium chloride is decomposed when it is heated strongly to produce gas Y and gas Z.*

- (i) Namakan gas Y.  
*Name gas Y.*

[1 markah / 1 mark]

- (ii) Huraikan **satu** ujian kimia untuk mengesahkan gas Y dalam 7(a)(i).  
*Describe **one** chemical test to confirm gas Y in 7(a)(i).*

[2 markah / 2 marks]

- (iii) Kertas litmus biru lembap dimasukkan ke dalam tabung uji yang berisi gas Z.

Apakah yang dapat diperhatikan pada kertas litmus itu?

*A moist blue litmus paper is placed into a test tube filled by gas Z.*

*What can be observed on the litmus paper?*

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[ 1 markah / 1 mark]

- (iv) Baja amonium klorida larut di dalam air. Jelaskan kepentingan keterlarutannya terhadap tumbuhan.

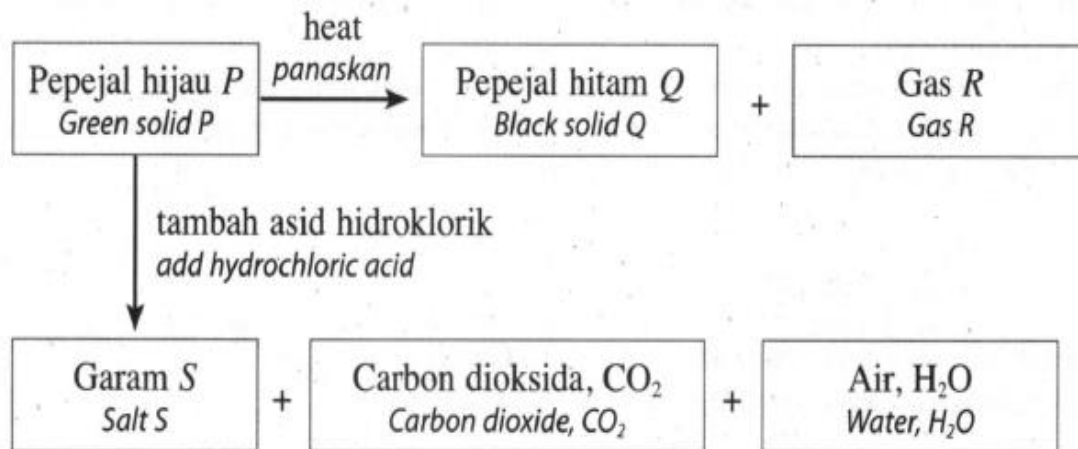
*Ammonium chloride fertiliser is soluble in water. Justify the importance of its solubility to the plant.*

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[ 1 markah / 1 mark]

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- (b) Rajah 6.2 menunjukkan siri tindak balas yang melibatkan pepejal *P*.  
Diagram 6.2 shows the series of reaction involving solid *P*.



Rajah 6.2 / Diagram 6.2

- (i) Namakan pepejal *P*.  
Name solid *P*.

[1 markah / 1 mark]

- (ii) Tulis persamaan kimia bagi tindak balas antara pepejal *P* dengan asid hidroklorik.  
Write the chemical equation for the reaction between solid *P* and hydrochloric acid.

[1 markah / 1 mark]

- (iii) Huraikan **satu** ujian kimia untuk mengesahkan gas *R*.  
Describe **one** chemical test to confirm gas *R*.

[2 markah / 2 marks]

- (iv) Nyatakan warna bagi garam *S*.  
State the colour of salt *S*.

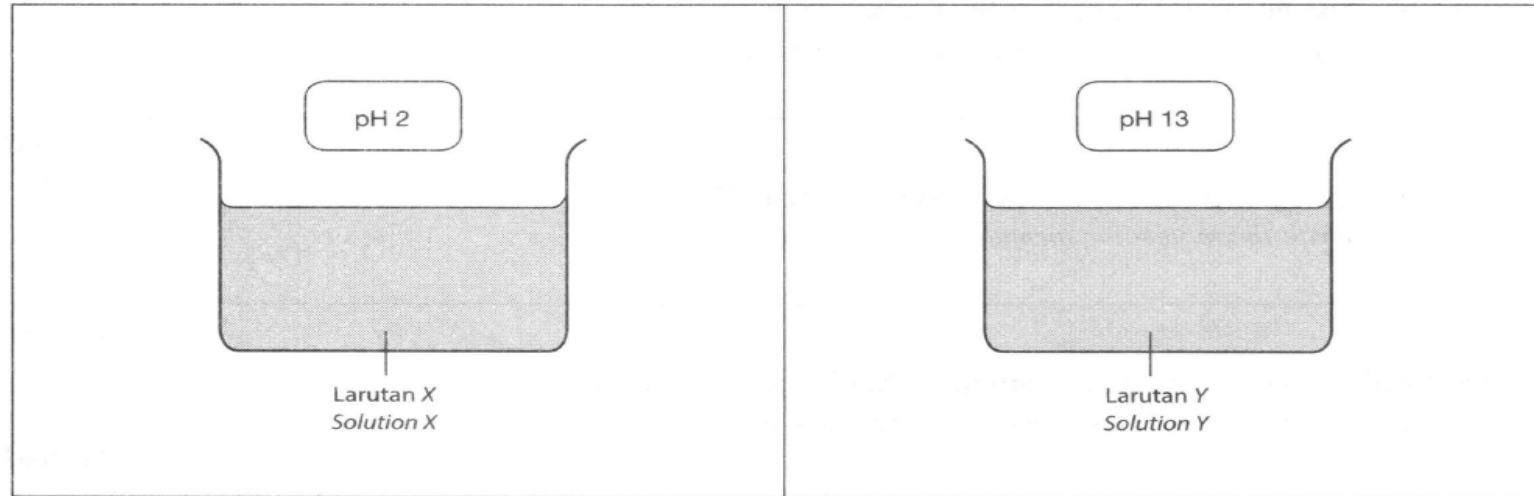
[1 markah / 1 mark]

- (a) Magnesium hidroksida adalah salah satu sebatian kimia dalam ubat gigi. Tulis formula bagi magnesium hidroksida dan terangkan fungsinya dalam ubat gigi.  
*Magnesium hydroxide is one of the chemical compounds found in toothpastes. Write the chemical formula for magnesium hydroxide and explain its function in toothpastes.*

[2 markah/marks]

- (b) Rajah 9 menunjukkan dua bikar yang mengandungi  $0.1 \text{ mol dm}^{-3}$  larutan *X* dan larutan *Y* dan nilai pH masing-masing.

*Diagram 9 shows two beakers containing  $0.1 \text{ mol dm}^{-3}$  solution *X* and solution *Y* and their respective pH readings.*



Bandingkan kedua-dua larutan dari segi sifat fizik dan sifat kimia. Berikan **satu** contoh yang sesuai bagi larutan *X* dan *Y*.

*Compare both solutions in terms of their physical and chemical properties. Give **a** suitable example for both solutions *X* and *Y*.*

[9 markah/marks]

- (c) Terangkan satu eksperimen yang boleh dijalankan di makmal untuk menyediakan garam zink karbonat tulen yang kering. Dalam jawapan anda, sertakan persamaan kimia yang terlibat.

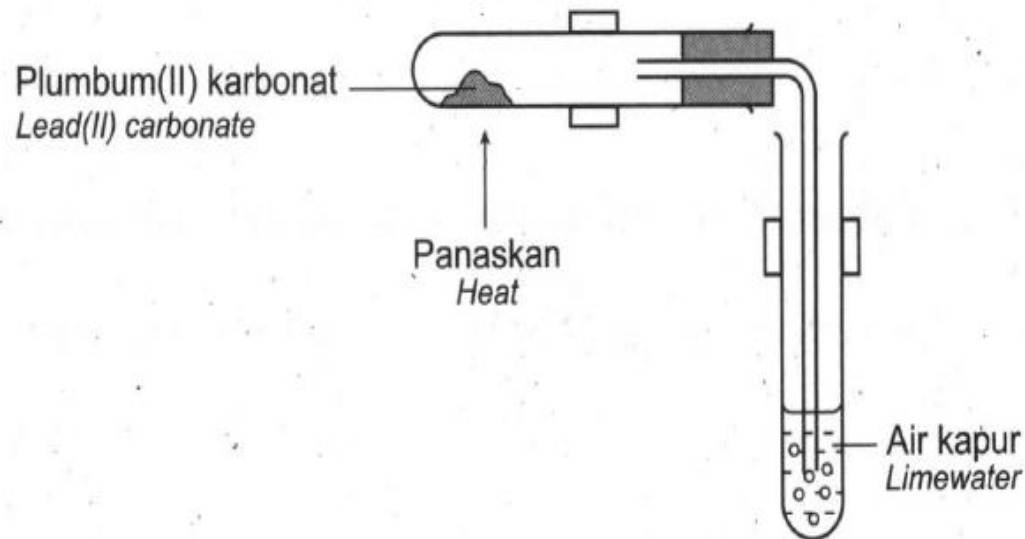
*Describe an experiment that could be carried out in a laboratory to prepare dry pure zinc carbonate salt. In your answer, include the chemical equations involved.*

[9 markah/marks]



- 28 Rajah 6 menunjukkan susunan radas bagi pemanasan serbuk plumbum(II) karbonat,  $\text{PbCO}_3$ . Gas yang dibebaskan mengeruhkan air kapur.

*Diagram 6 shows the apparatus set-up for the heating of lead(II) carbonate,  $\text{PbCO}_3$  powder. The gas released turns limewater chalky.*



Rajah 6 / Diagram 6

- (a) Namakan gas yang dibebaskan.  
*Name the gas released.*

[1 markah / 1 mark]

(b) Nyatakan warna baki apabila panas dan apabila sejuk.

*State the colour of the residue when hot and when cold.*

[2 markah / 2 marks]

(c) Tulis persamaan kimia yang seimbang bagi tindak balas ini.

*Write a balanced chemical equation for this reaction.*

[1 markah / 1 mark]

(d) 9.345 g plumbum(II) karbonat,  $\text{PbCO}_3$  dipanaskan semasa eksperimen ini.

Hitung isi padu gas yang dibebaskan.

[Jisim atom relatif: C = 12, O = 16, Pb = 207; isi padu molar gas =  $24 \text{ dm}^3 \text{ mol}^{-1}$  pada keadaan bilik]

*9.345 g of lead(II) carbonate,  $\text{PbCO}_3$  is heated during this experiment.*

*Calculate the volume of gas released.*

*[Relative atomic mass: C = 12, O = 16, Pb = 207; molar volume of gas =  $24 \text{ dm}^3 \text{ mol}^{-1}$  at room condition]*

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- (e) Baki eksperimen ini ditindak balaskan dengan bahan X untuk menghasilkan larutan plumbum(II) nitrat,  $\text{Pb}(\text{NO}_3)_2$ .

*The residue of this experiment is reacted with substance X to produce lead(II) nitrate,  $\text{Pb}(\text{NO}_3)_2$  solution.*

- (i) Apakah bahan X?

*What is substance X?*

[1 markah / 1 mark]

- (ii) Bagaimanakah anda menentusahkan kehadiran kation di dalam larutan plumbum(II) nitrat?

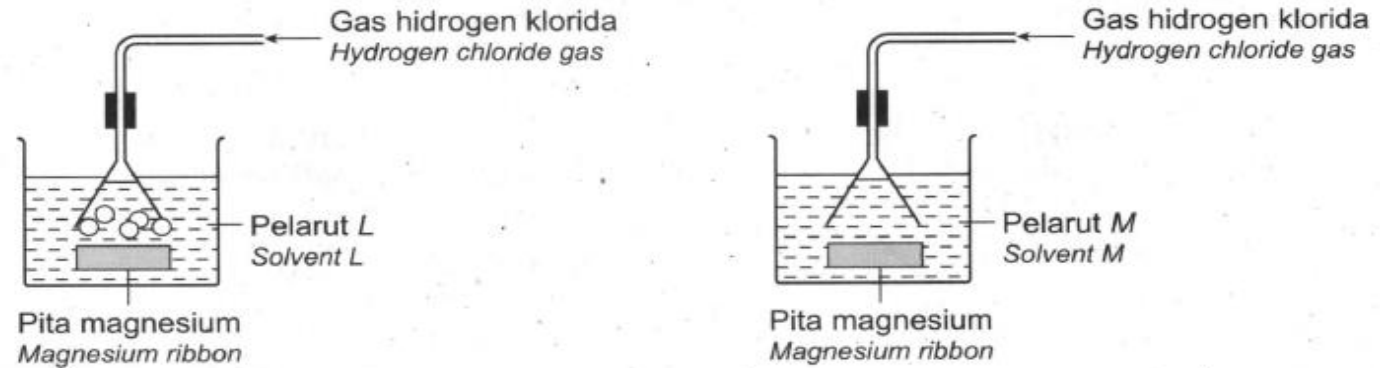
*How would you verify the presence of the cation in lead(II) nitrate solution?*

[2 markah / 2 marks]

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Rajah 5.1 menunjukkan susunan radas bagi menyediakan dua larutan dengan melarutkan hidrogen klorida di dalam pelarut *L* dan *M*. Sekeping pita magnesium dimasukkan ke dalam setiap bikar.

Diagram 5.1 shows the apparatus set-up to prepare two solutions by dissolving hydrogen chloride gas in solvent *L* and *M*. A piece of magnesium ribbon is dipped into each beaker.



Rajah 5.1 / Diagram 5.1

(a) Jadual 2 menunjukkan keputusan eksperimen di atas.

Table 2 shows the results of an experiment above.

Eksperimen Experiment	Hidrogen klorida di dalam Hydrogen chloride in	
	Pelarut <i>L</i> Solvent <i>L</i>	Pelarut <i>M</i> Solvent <i>M</i>
Tindak balas dengan pita magnesium Reaction with magnesium ribbon	Gelembung gas dihasilkan Bubbles gas produced	Tiada perubahan No change

Jadual 2 / Table 2

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- (i) Cadangkan bahan untuk pelarut  $L$  dan  $M$ .  
*Suggest a substance for solvents  $L$  and  $M$ .*

Pelarut  $L$  / Solvent  $L$ : \_\_\_\_\_

Pelarut  $M$  / Solvent  $M$ : \_\_\_\_\_

[2 markah / 2 marks]

- (ii) Terangkan mengapa pita magnesium tidak berubah dalam eksperimen yang menggunakan pelarut  $M$ .  
*Explain why the magnesium ribbon remains unchanged in the experiment that uses solvent  $M$ .*

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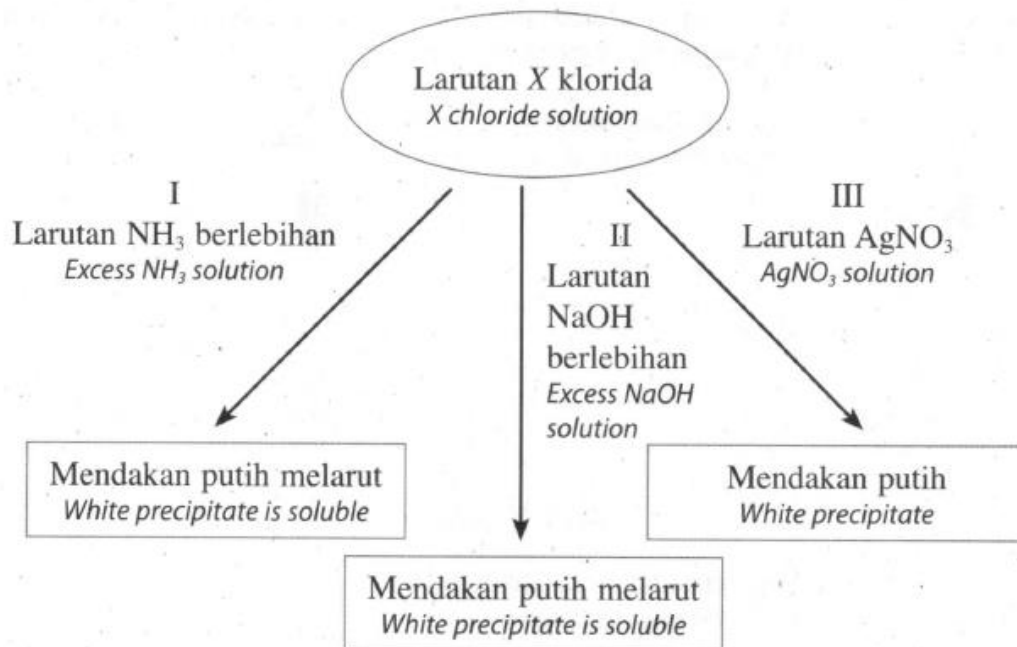
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[2 markah / 2 marks]

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- (b) Tiga siri ujian I, II dan III telah dijalankan terhadap larutan X klorida seperti yang ditunjukkan dalam Rajah 5.2.

Three sets of tests I, II and III are carried out on an X chloride solution as shown in Diagram 5.2.



Rajah 5.2 / Diagram 5.2

- (i) Namakan larutan X klorida.  
Name the X chloride solution.

[1 markah / 1 mark]

- (ii) Tulis persamaan kimia apabila X larutan klorida bertindak balas dengan NaOH berlebihan.  
Write the chemical equation when solution X chloride reacts with excess NaOH.

[1 markah / 1 mark]

- (iii) Daripada persamaan kimia dalam 5(b)(ii), hitung jisim pepejal putih yang terbentuk apabila  $5 \text{ cm}^3$  larutan X klorida  $0.5 \text{ mol dm}^{-3}$  bertindak balas dengan larutan NaOH berlebihan.

[Jisim atom relatif: Zn = 65, O = 16, H = 1]

From the chemical equation in 5(b)(ii), calculate the mass of white solid formed when  $5 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  X chloride solution reacts with excess NaOH.

[Relative atomic mass: Zn = 65, O = 16, H = 1]

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# Thermochemistry

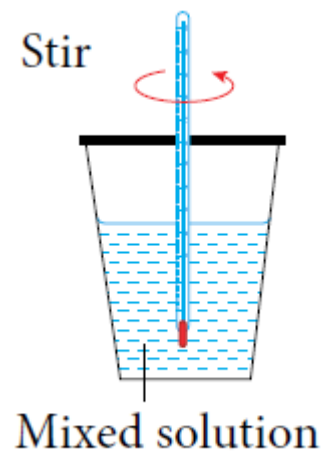
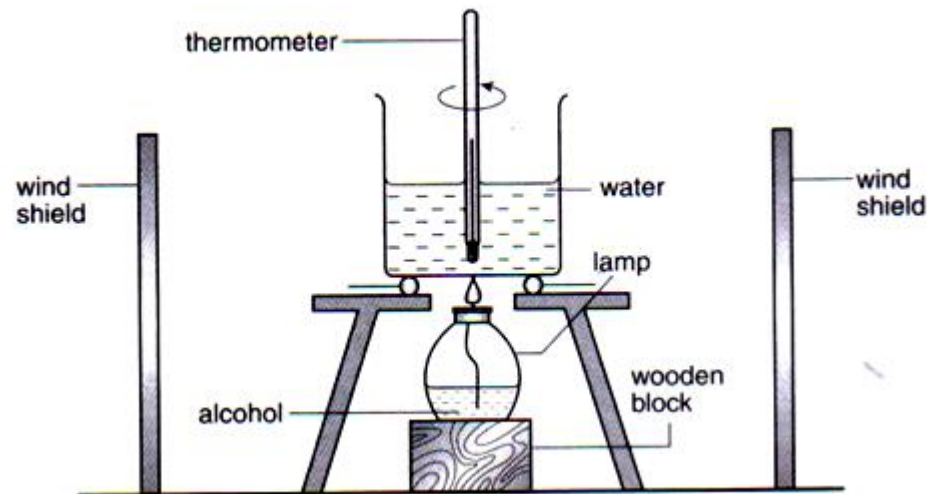
**Heat of combustion** is the heat released when **1 mol of a substance is burnt completely** in an excess of oxygen

**Heat of neutralisation** is the energy change when **1 mole of water** is formed from the neutralisation between one mole of **hydrogen ions,  $H^+$**  from an acid and one mole of **hydroxide ions,  $OH^-$**  from an alkali.

The heat of precipitation is the energy change when 1 mole of precipitate is formed from its ion

**Heat of displacement** is the energy change when **1 mole of metal** is displaced from its salt solution by a more electropositive metal.

$$\text{Fuel value (kJ g}^{-1}\text{)} = \frac{\text{heat combustion of substance (kJ mol}^{-1}\text{)}}{\text{molar mass of substance (g mol}^{-1}\text{)}}$$



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30. Apabila sedikit pepejal ammonium klorida ditambah ke dalam  $100 \text{ cm}^3$  air, suhu campuran tersebut berkurang daripada  $29^\circ\text{C}$  kepada  $22^\circ\text{C}$ . Berapakah jumlah haba yang diserap dalam tindak balas ini?

*When a small amount of solid ammonium chloride is added to  $100 \text{ cm}^3$  of water, the temperature of the mixture decreases from  $29^\circ\text{C}$  to  $22^\circ\text{C}$ . What is the total amount of heat absorbed in the reaction?*

[Muatan haba tentu/Specific heat capacity of water =  $4.2 \text{ J g}^{-1} ^\circ\text{C}^{-1}$ ]

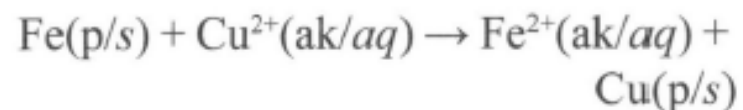
- |                 |                   |
|-----------------|-------------------|
| <b>A</b> 2940 J | <b>C</b> 9240 J   |
| <b>B</b> 5880 J | <b>D</b> 12 180 J |

Brought to you by:



31. Persamaan ionik berikut mewakili tindak balas antara ferum dengan larutan kuprum(II) nitrat.

*The following ionic equation represents the reaction between iron and copper(II) nitrate solution.*



$$\Delta H = -150 \text{ kJ mol}^{-1}$$

Berapakah kenaikan suhu maksimum campuran jika  $50 \text{ cm}^3$  larutan kuprum(II) nitrat  $0.2 \text{ mol dm}^{-3}$  digunakan?

*What is the maximum increase in temperature of the mixture if  $50 \text{ cm}^3$  of  $0.2 \text{ mol dm}^{-3}$  copper(II) nitrate solution is used?*

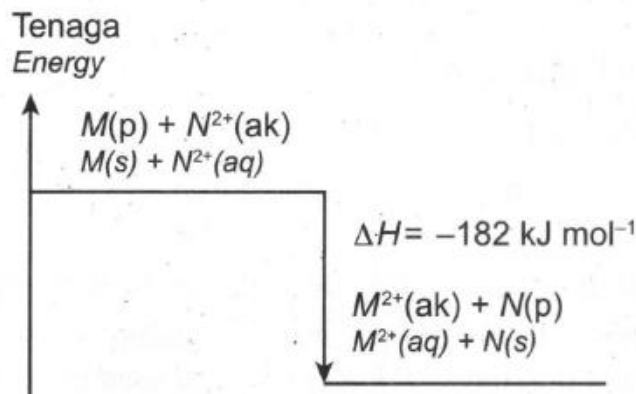
- |                              |                               |
|------------------------------|-------------------------------|
| <b>A</b> $5.0^\circ\text{C}$ | <b>C</b> $14.2^\circ\text{C}$ |
| <b>B</b> $7.1^\circ\text{C}$ | <b>D</b> $20.0^\circ\text{C}$ |

Brought to you by:

32.

Rajah 16 menunjukkan gambar rajah aras tenaga.

Diagram 16 shows the energy level diagram.



Rajah 16 / Diagram 16

Berdasarkan Rajah 16, berapakah pertambahan suhu bagi larutan jika serbuk  $M$  berlebihan ditambahkan kepada  $50 \text{ cm}^3$  larutan  $N$   $0.2 \text{ mol dm}^{-3}$ ?

[Muatan haba tentu larutan =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ]

Based on Diagram 16, what is the increase in temperature of the solution if excess  $M$  powder is added into  $50 \text{ cm}^3$  of  $0.2 \text{ mol dm}^{-3}$  solution  $N$ ?

[Specific heat capacity of solution =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ]


A  $2.2 \text{ }^{\circ}\text{C}$

C  $6.6 \text{ }^{\circ}\text{C}$

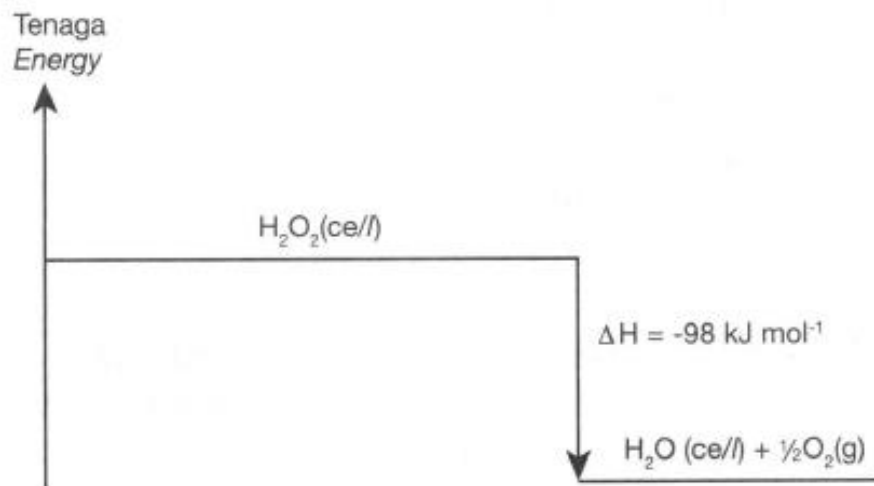
B  $4.7 \text{ }^{\circ}\text{C}$

D  $8.7 \text{ }^{\circ}\text{C}$

Brought to you by:

33.  Rajah aras tenaga bagi penguraian hidrogen peroksida ditunjukkan dalam Rajah 11.

*The energy level diagram for decomposition of hydrogen peroxide is shown in Diagram 11.*



**Rajah 11** *Diagram 11*

Apakah yang boleh dirumuskan dari rajah itu?

[Jisim atom relatif: H = 1, O = 16; Isi padu molar gas = 24 dm<sup>3</sup> pada keadaan bilik]

*What can be deduced from the diagram?*

[Relative atomic mass: H = 1, O = 16; Molar volume of gas = 24 dm<sup>3</sup> at room conditions]

- A** Tenaga pengaktifan bagi tindak balas ini ialah 98 kJ mol<sup>-1</sup>

*The activation energy for the reaction is 98 kJ mol<sup>-1</sup>*

- B** Penguraian 68 g hidrogen peroksida membebaskan haba sebanyak 98 kJ

*The decomposition of 68 g of hydrogen peroxide releases 98 kJ of heat*

- C** Mangan(II) oksida telah digunakan sebagai mangkin dalam tindak balas ini

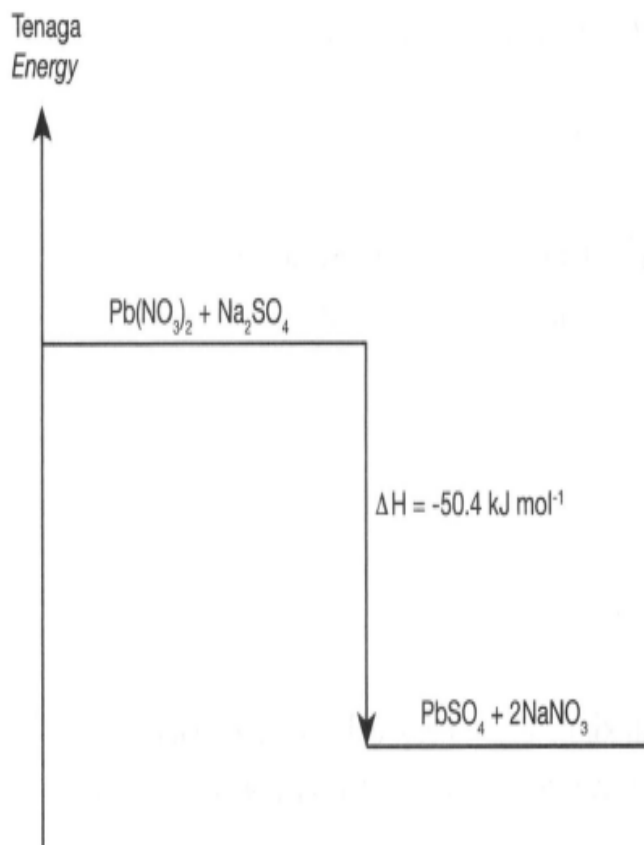
*Manganese(II) oxide was used as the catalyst for this reaction*

- D** 12 000 cm<sup>3</sup> oksigen terbentuk pada suhu bilik apabila 98 kJ haba dibebaskan

*12 000 cm<sup>3</sup> of oxygen is formed at room temperature when 98 kJ of heat is released*

34.

- (a) Rajah 6.1 menunjukkan gambarajah aras tenaga pemendakan plumbum(II) sulfat.  
 Diagram 6.1 shows the energy level diagram for the precipitation of lead(II) sulphate.



- (i) Nyatakan maksud haba pemendakan plumbum(II) sulfat.  
 State the meaning for heat of precipitation of lead(II) sulphate.

[1 markah/mark]

- (ii) Nyatakan **satu** maklumat yang boleh diperoleh daripada gambarajah aras tenaga dalam Rajah 6.1.  
 State **one** information that can be obtained from the energy level diagram in Diagram 6.1.

[1 markah/mark]

- (iii) Selain perubahan suhu, nyatakan **satu** lagi pemerhatian untuk eksperimen ini.  
 Besides temperature change, state **another** observation for this experiment.

[1 markah/mark]

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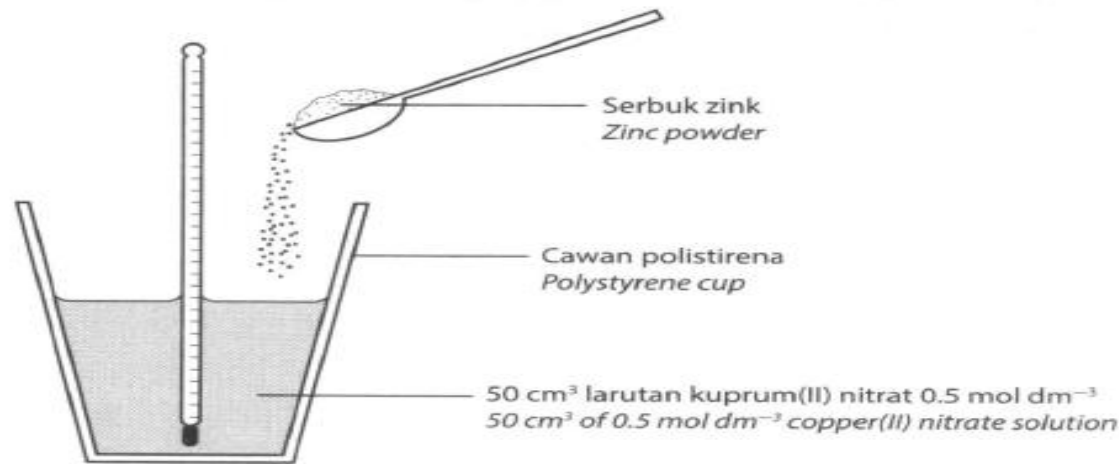


- (b) Rajah 6.2 menunjukkan satu eksperimen untuk menentukan haba penyesaran kuprum daripada larutan garamnya oleh logam zink. Kenaikan suhu adalah sebanyak  $14^{\circ}\text{C}$ .

[Muatan haba tentu larutan =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ; Ketumpatan larutan =  $1.0 \text{ g cm}^{-3}$ ]

Diagram 6.2 shows an experiment to determine the heat of displacement of copper from its salt solution by zinc. The increase in temperature is  $14^{\circ}\text{C}$ .

[Specific heat capacity of solution =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ; Density of solution =  $1.0 \text{ g cm}^{-3}$ ]



**Rajah 6.2** Diagram 6.2

- (i) Mengapakah cawan polistirena digunakan dalam eksperimen ini?  
Why is the polystyrene cup used in this experiment?

[1 markah/mark]

- (ii) Hitungkan perubahan haba dalam eksperimen ini.  
Calculate the heat change in this experiment.

[1 markah/mark]

- (iii) Tulis persamaan kimia bagi tindak balas yang berlaku.  
Write the chemical equation for the reaction that occurred.

- (iv) Hitungkan bilangan mol kuprum yang disesarkan dalam tindak balas ini.

*Calculate the number of moles of copper displaced in the reaction.*

[1 markah/mark]

- (v) Hitungkan haba penyesaran kuprum daripada larutan kuprum(II) nitrat oleh zink.

*Calculate the heat of displacement of copper from copper(II) nitrate solution by zinc.*

[1 markah/mark]

- (vi) Ramalkan berapakah perubahan suhu jika eksperimen ini diulang dengan menggunakan 50 cm<sup>3</sup> larutan kuprum(II) sulfat 1.0 mol dm<sup>-3</sup>.

**KBAT**

*Predict what will the temperature change be if the experiment is repeated using 50 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> copper(II) sulphate solution.*

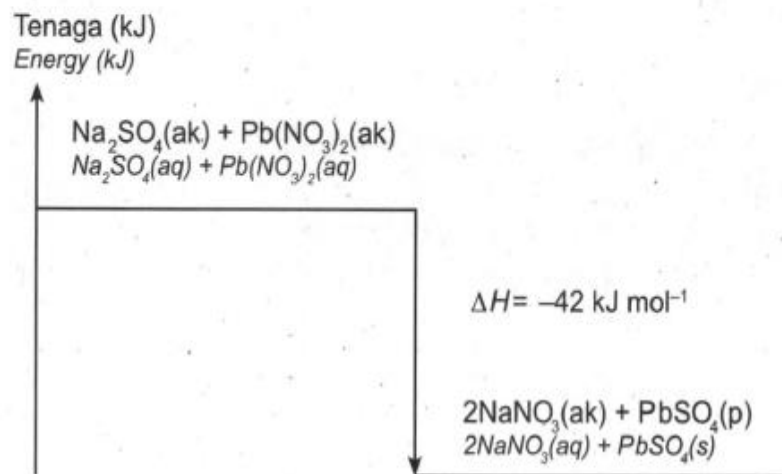
[1 markah/mark]

Brought to you by:

35.

Mariah menjalankan satu eksperimen untuk menentukan haba pemendakan plumbum(II) sulfat. 50 cm<sup>3</sup> larutan natrium sulfat 0.5 mol dm<sup>-3</sup> dicampurkan dengan 50 cm<sup>3</sup> larutan plumbum(II) nitrat 0.5 mol dm<sup>-3</sup> di dalam sebuah cawan plastik untuk membentuk mendakan putih plumbum(II) sulfat. Gambar rajah aras tenaga bagi tindak balas tersebut ditunjukkan dalam Rajah 7.

Mariah carried out an experiment to determine the heat of precipitation of lead(II) sulphate. 50 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> sodium sulphate solution is mixed with 50 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> lead(II) nitrate solution in a plastic cup to form a white precipitate of lead(II) sulphate. The energy level diagram for the reaction is shown in Diagram 7.



Rajah 7 / Diagram 7

- (a) Mengapakah cawan plastik digunakan dalam eksperimen ini?  
Why is a plastic cup used in this experiment?

[1 mark]

- (b) Berdasarkan gambar rajah aras tenaga yang ditunjukkan dalam Rajah 7,  
Based on the energy level diagram shown in Diagram 7,

- (i) terangkan maksud haba pemendakan bagi tindak balas itu.  
explain the meaning of the heat of precipitation for the reaction.

[1 mark]

- (ii) hitung bilangan mol bagi plumbum(II) sulfat yang terbentuk.  
calculate the number of moles of lead(II) sulphate formed.

[1 mark]

Brought to you by:

- (iii) hitung haba yang dibebaskan dalam tindak balas tersebut.  
*calculate the heat released in the reaction.*

[1 markah]

- (iv) hitung perubahan suhu bagi tindak balas tersebut.  
[Muatan haba tentu air =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ; ketumpatan larutan =  $1.0 \text{ g cm}^{-3}$ ]  
*calculate the temperature change of the reaction.*  
*[Specific heat capacity =  $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ; density of solution =  $1.0 \text{ g cm}^{-3}$ ]*

[1 markah]

- (c) Berikan **tiga** maklumat yang boleh diperoleh daripada gambar rajah aras tenaga dalam Rajah 7.

*Give **three** information that can be obtained from the energy level diagram in Diagram 7.*

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[3 markah / 3 marks]

- (d) Eksperimen diulang dengan menggunakan larutan kalium sulfat untuk menggantikan larutan natrium sulfat. Isi padu dan kepekatan dikekalkan. Ramalkan haba pemendakan yang terhasil. Jelaskan.

*The experiment is repeated by using potassium sulphate solution to replace sodium sulphate solution. The volume and concentration are remain unchanged. Predict the heat of precipitation obtained. Explain.*

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[2 markah / 2 marks]