



Daripada Cikgu Adura
Kertas 2

Struktur

Struktur atom (Resapan)

Formula kimia dan Persamaan – FE/FM, Eks MgO/ CuO

Elektrokimia – Gabung

(maksud elektrolit, elektrolisis, Sel kimia ke sel elektrolisis atau sebaliknya, kegunaan (aplikasi) Al_2O_3)

Asid Bes/Garam (larutan piawai/ pencairan)

Kadar tindak balas (Fokus – mungkin, lain2 juga kena tahu)

Redoks (SK/Karat/ penyesaran)

Bahan Kimia utk pengguna/ Industri – Ubat/ aloi/ bahan tambah makanan

Esei

Jadual Berkala (Kump 17- Kala)

Ikatan kimia (pembentukan ikatan dan sifat fizik) boleh gabung JBU

Sebatian karbon (pertukaran alkohol ke lain2/ kira formula empirik, lukis isomer)

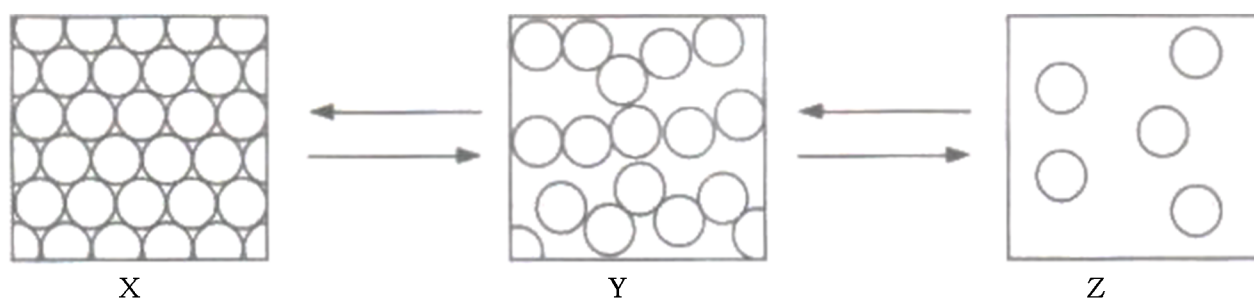
Termokimia (campur)

Garam – penyediaan/ penghabluran semula

Bab 02 – Struktur atom

[SPM10-01] Diagram 1 shows the inter-conversion of the three states of matter, X, Y and Z of water.

Rajah 1 menunjukkan perubahan keadaan tiga jirim, X, Y dan Z bagi air.



(a) What type of particle is found in water? **Molecule/ Molekul** [1M]

Apakah jenis zarah yang terdapat dalam air?

(b) Under the room temperature, at what temperature does ice change to water?

Di bawah suhu bilik, pada suhu berapakah ais berubah kepada air?

0°C

..... [1M]

(c) What is the physical state labelled Z? **Gas/ gaseous** [1M]

Apakah keadaan fizikal yang berlabel Z

(d) Name the process when water changes from state X to state Y.

Namakan proses apabila air berubah daripada keadaan X kepada keadaan Y.

Melting/ Peleburan

..... [1M]

(e) When water changes from state Y to state Z, state the changes in:

Apabila air berubah daripada keadaan Y kepada keadaan Z, nyatakan perubahan bagi:

(i) the energy of the particles. / Tenaga zarah

increases // higher.

Semakin meningkat/ semakin bertambah

..... [1M]

(ii) The forces of attraction between the particles.

Daya tarikan antara zarah-zarah itu

Weaker// decreases

Semakin lemah// semakin berkurang

..... [1M]

(f) The smell of curry cooking in the kitchen spreads to the living room. Based on the kinetic theory of matter, state the process involved. Explain your answer.

Bau masakan kari di dapur merebak hingga ke ruang tamu. Berdasarkan teori kinetik jirim, nyatakan proses yang terlibat. Terangkan jawapan anda.

1. Diffusion/ resapan

2. Particles move randomly through the air particle

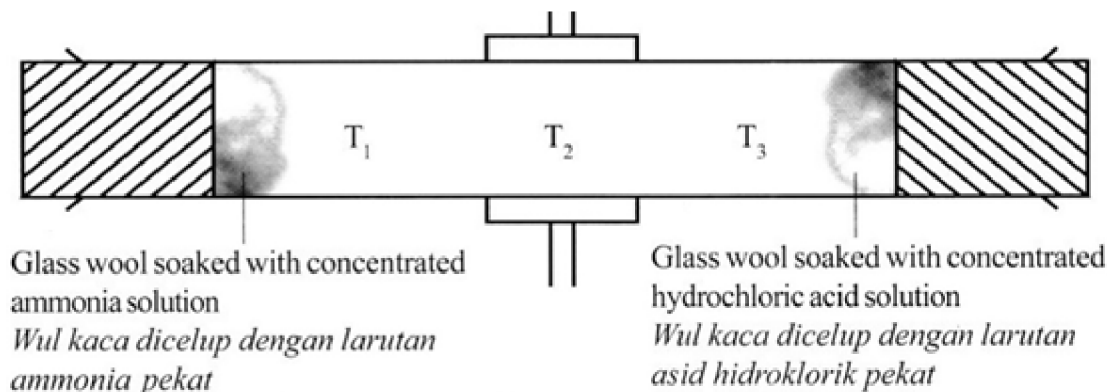
Zarah-zarah bergerak secara rawak melalui zarah-zarah udara

3. From the higher concentration region to lower concentration region

Daripada kawasan berkepekatan tinggi kepada kepekatan rendah. [3M]

[SPM15-01]. Rajah 1 menunjukkan susunan radas untuk tindak balas antara gas hidrogen klorida dan gas ammonia, T_1 , T_2 , dan T_3 adalah kedudukan yang mungkin di mana ammonium klorida, NH_4Cl terbentuk dalam eksperimen itu selepas 5 minit.

Diagram 1 shows the apparatus set-up for the reaction between hydrogen chloride gas and ammonia gas. T_1 , T_2 , and T_3 are the possible positions where ammonium chloride, NH_4Cl formed in the experiment after 5 minute.



Rajah 1 / Diagram 1

(a) Nyatakan pemerhatian dalam eksperimen ini.

State the observation in the experiment.

Wasap putih // White fume

..... [1M]

(b)(i) Apakah jenis zarah dalam gas ammonia? Molekul // molecule [1M]

What is the type of particles in ammonia gas?

(ii) Nyatakan **satu** sifat fizik bagi ammonia. [1M]

State **one** physical property of ammonia.

Larut dalam air // Soluble in water

Berbau sengit // pungent smell

gas tak berwarna // colourless gas

takat didih/lebur yang rendah // low melting point/ boiling point//

meruap // volatile

larut dalam methanol [nama larutan organik // soluble in [name organic solvent]

(iii) Nyatakan jenis ikatan dalam gas hidrogen klorida.

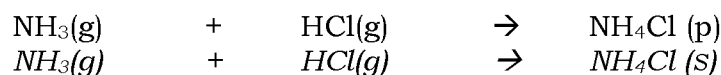
State the type of bonding in hydrogen chloride gas.

Ikatan kovalen // covalent bond

..... [1M]

(c) Persamaan untuk tindak balas adalah seperti berikut:

The equation for the reaction is as follow:



Nyatakan **dua** maklumat yang boleh disimpulkan daripada persamaan itu.

State **two** information that can be deduced from the equation.

Bahan iaitu 1 mol gas ammonia bertindak balas dengan 1 mol gas HCl menghasilkan Hasil 1 mol pepejal ammonium klorida

Reactant is 1 mol ammonia gas reacts with 1 mol HCl gas produce the product is 1 mol ammonium chloride solid

..... [2M]

(d) Berdasarkan Rajah 1, / Based on Diagram 1.

(i) Nyatakan kedudukan di mana NH_4Cl terbentuk. T3 [1M]

State the position where NH_4Cl formed.

(ii) beri **satu** sebab bagi jawapan anda dalam 1(d)(i).

give **one** reason for your answer in 1(d)(i).

Jisim NH_3 lebih ringan berbanding dengan jisim HCl //

Ammonia bergerak lebih laju // ammonia lebih ringan // hydrogen klorida bergerak lebih lambat // HCl lebih berat

Ammonia moves faster // ammonia is lighter // hydrogen chloride moves slower // HCl is heavier

..... [1M]

(e) Nyatakan **satu** kegunaan NH_4Cl dalam kehidupan seharian.

State **one** use of NH_4Cl in daily life.

Elektrolit dalam sel kering

Electrolyte in dry cell

..... [1M]

[SBP17-01] Diagram 1 shows the apparatus set-up for an experiment. The apparatus is left aside for one day.

Rajah 1 menunjukkan susunan alat radas bagi satu eksperimen. Radas dibiarkan selama satu hari.

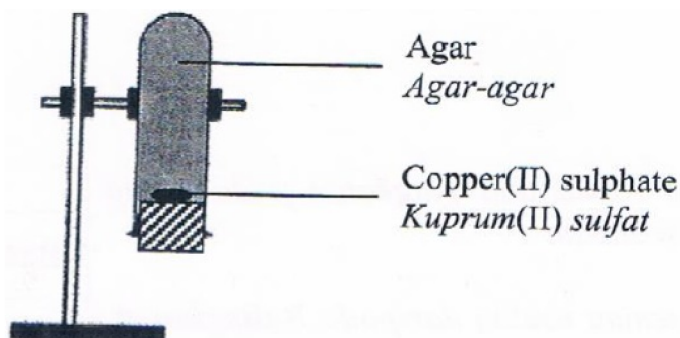


Diagram 1 / Rajah 1

(a) (i) What is the type of particle in copper(II) sulphate? Ion [1M]

Apakah jenis zarah dalam kuprum(II) sulfat?

(ii) State the observation for the experiment.

Nyatakan pemerhatian bagi eksperimen ini.

Warna biru merebak ke seluruh agar-agar selepas beberapa hari

Blue colour spread upward to the agar after one day

..... [1M]

(iii) Based on kinetic theory of matter, explain the observation in (a)(ii). Berdasarkan teori kinetik jirim, terangkan pemerhatian di (a)(ii).

1. Copper(II) sulphate consist of tiny and discrete ion

Kuprum(II) sulfat terdiri daripada ion yang kecil dan diskrit

2. which are in motion in agar particles

yang sentiasa bergerak dalam zarah-zarah agar-agar

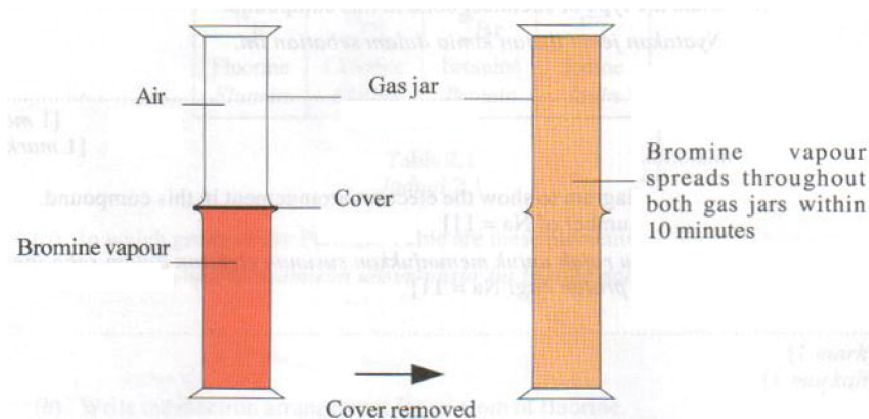
3. from higher concentration region to lower concentration region

daripada kawasan berkepekatan tinggi ke kawasan berkepekatan rendah

..... [3M]

[SPM08-03a] (a) Rajah 3.1 menunjukkan keputusan suatu eksperimen untuk mengkaji pergerakan zarah-zarah bromin di udara.

Rajah 3.1 shows the results of an experiment to investigate the movements of bromine particles in air.



Rajah 3.1 / Diagram 3.1

(i) Nyatakan nama proses yang terlibat dalam eksperimen ini. **Diffusion/ Resapan** [1M]
Nyatakan the nama of the process involved in this experiment.

(ii) Nyatakan jenis zarah dalam gas bromin, Br₂. **Molecule/ molekul** [1M]
Nyatakan the type of particles present in bromine gas, Br₂.

(iii) Terangkan pemerhatian dalam eksperimen ini berdasarkan teori kinetik jirim.
Explain the observation in this experiment based on the kinetic theory of matter.

1. Terdiri daripada zarah-zarah bromin yang sangat kecil/ diskrit
Made up of tiny/ discrete particles of bromine

2. bergerak secara rawak melalui zarah-zarah udara
Move in random motion in air particles

3. from higher concentration region to lower concentration region
daripada kawasan berkepekatan tinggi ke kawasan berkepekatan rendah

..... [3M]

(iv) Eksperimen ini diulangi pada suhu yang lebih tinggi. Ramalkan masa yang diambil untuk wap bromin merebak ke seluruh ruang dalam kedua-dua balang itu.
This experiment is repeated at a higher temperature. Predict the time taken for the bromine vapour to spread throughout the space in both gas jars. [1M]

Kurang daripada 10 minit

The time taken will be shorter (less than 10 minutes)

..... [1M]

Bab 03 – Formula dan Persamaan Kimia

[SPM06-02] (a) (i) Apakah konsep yang dikemukakan oleh Dmitri Mendeleev untuk mempermudah idea jisim atom dan isi padu gas?

What is the concept introduced by Dmitri Mendeleev to simply the idea of atomic mass and the volume of gas?

Bilangan mol/ The number of moles

..... [1M]

(ii) Berdasarkan konsep di 2(c)(1), apakah simbol kimia yang digunakan untuk mewakili satu molekul air?

Based on the concept in 2 (a)(i), what is the chemical symbol used to represent one water molecule?

H₂O

..... [1M]

(iii) Apakah nama isotop unsur yang digunakan sebagai piawai dalam penentuan jisim atom relatif?

What is the name of the isotope of an element used as a standard in determining relative atomic mass?

Karbon-12// Carbon-12

..... [1M]

(b) (i) Berdasarkan konsep di 2(a)(i), berapakah jisim bagi 6.0 dm³ gas karbon dioksida, CO₂, pada suhu dan tekanan piawai?

[1 mol gas menempati 24 dm³ pada suhu dan tekanan piawai; Jisim atom relatif bagi CO₂ = 44]

Based on the concept in (2)(a)(i), what is the mass of 6.0 dm³ of carbon dioxide gas, CO₂ at standard temperature and pressure?

[1 mol of gas occupies 24 dm³ at standard temperature and pressure;

Relative atomic mass for CO₂ = 44]

jisim = isi padu / isi padu molar X JM

Mass = volume / molar volume X MM

= 6 / 24 X 44

= 11 g

..... [2M]

(ii) Berapakah bilangan molekul yang terdapat dalam 6.0 dm³ gas karbon dioksida?

How many molecules are there in 6.0 dm³ of carbon dioxide gas?

[Nombor Avogadro = 6.02 x 10²³] [Avogadro's number = 6.02 x 10²³]

Bilangan molekul = isi padu / isi padu molar X Na

Number of molecule = volume / molar volume X Na

= 1.505 X 10²³ molekul

(iii) Perihalkan dengan ringkas hubungan antara isi padu, jisim dan bilangan molekul karbon dioksida di 2(6)(i) dan 2(6)(ii) pada suhu dan tekanan piawai.

Explain briefly the relationship between the volume, mass and the number of molecules of carbon dioxide in 2 (b)(i) and 2 (b)(ii) at standard temperature and pressure.

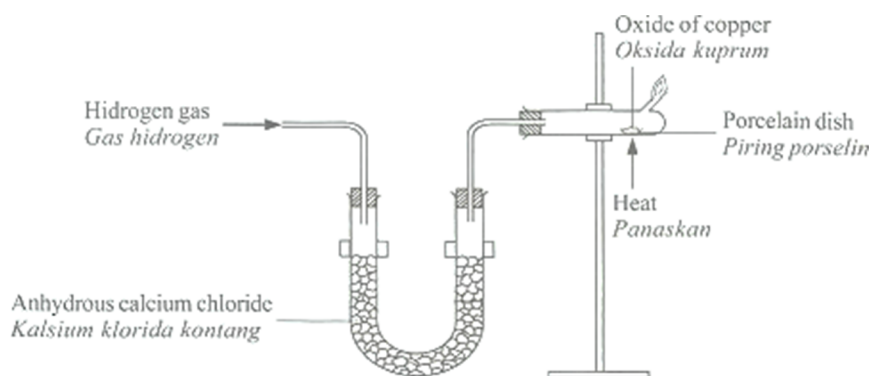
Isi padu gas CO₂ iaitu 6 dm³ [1M]/ The volume of CO₂ gas is 6 dm³

bersamaan dengan 11 g dan [1M]/ equal to 11g and

juga 1.505 X 10²³ molekul [1M]/ 1.505 X10²³ molecule

..... [3M]

[SPM14-02] Rajah 2 menunjukkan susunan radas untuk menentukan formula empirik bagi suatu oksida kuprum. Diagram 2 shows the apparatus set-up to determine the empirical formula for an oxide of copper.



Rajah 2 / Diagram 2

(a) Nyatakan nama dua bahan tindak balas bagi penyediaan gas hidrogen. State the name of two reactants for the preparation of hydrogen gas.

1. **Zink // Zinc // Zn // Magensium / Mg // Aluminium / Al // iron / Fe**
2. **Asid Hidroklorik / asid sulfurik // asid nitrit**
Hydrochloric acid // sulphuric acid // nitric acid

[2M]

(b) Apakah fungsi kalsium klorida kontang? What is the function of anhydrous calcium chloride?

- Keringkan gas hidrogen // Menyerap air**
Dry the hydrogen gas // Absorb water

[1M]

(c) Jadual 1 menunjukkan data diperolehi daripada eksperimen itu. Table 1 shows the data obtained from the experiment.

Penerangan / Description	Jisim / Mass (g)
Tiub pembakaran + piring porselin Combustion tube + porcelain dish	24.60
Tiub pembakaran + piring porselin + oksida kuprum Combustion tube + porcelain dish + oxide of copper	27.00
Tiub pembakaran + piring porselin + kuprum Combustion tube + porcelain dish + copper	26.52

Berdasarkan Jadual 1, hitung formula empirik bagi oksida kuprum. Based on Table 1, calculate the empirical formula for the oxide of copper. [Jisim atom relatif: Cu=64; O=16] [Relative atomic mass: Cu=64; O=16]

Element Unsur	Cu	O
Mass (g) Jisim	26.52 - 24.60 = 1.92	27.00 - 26.52 = 0.48
Mol Mol	1.92/64 = 0.03	0.48/16 = 0.03
Simplest Ratio Nisbah teringkas	1	1

Empirical formula / formula empirik = CuO

[3M]

(d) Bagaimanakah anda memastikan semua oksida kuprum diturunkan kepada kuprum?

How do you ensure all oxide of copper is reduced to copper?

Repeat heating, cooling and weighing until constant reading

Ulangi pemanasan, penyejukan dan penimbangan sehingga mendapat nilai bacaan yang tetap

..... [1M]

(e)(i) Bolehkah formula empirik bagi magnesium oksida ditentukan dengan menggunakan kaedah ini?

Can the empirical formula for magnesium oxide be determined by using this method?

Tidak/ s

..... [1M]

(ii) Berikan satu alasan bagi jawapan anda di 2(e)(i).

Give one reason for your answer in 2(e)(i).

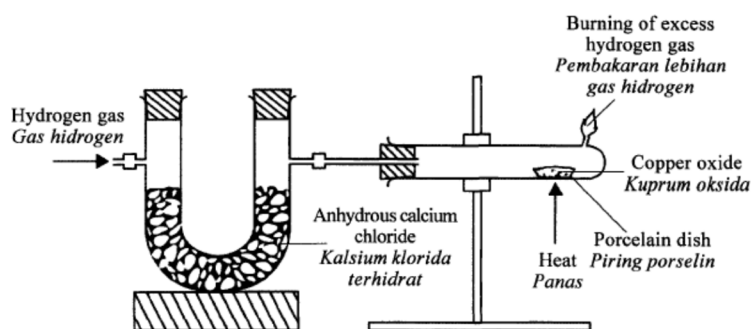
Hidrogen kurang reaktif daripada magnesium // magnesium lebih reaktif daripada hidrogen

Hydrogen less reactive than magnesium // magnesium is more reactive than hydrogen

..... [1M]

[SPM09-03] Rajah 2

menunjukkan susunan radas untuk menentukan formula empirik bagi kuprum oksida
Diagram 3 shows the apparatus set-up to determine the empirical formula of copper oxide.



Rajah 3 Diagram 3

Jadual 3 menunjukkan keputusan eksperimen ini

Table 3 shows the result of this experiment.

Penerangan/ Description	Jisim/ Mass (g)
Tiub pembakaran + piring porselin <i>Combustion tube + porcelain dish</i>	32.25
Tiub pembakaran + piring porselin + Kuprum oksida <i>Combustion tube + porcelain dish + copper oxide</i>	42.25
Tiub pembakaran + piring porselin + Kuprum <i>Combustion tube + porcelain dish + copper</i>	40.25

(a)(i) Apakah maksud formula empirik?/ *what is the meaning of empirical formula?*

Formula kimia yang menunjukkan nisbah paling ringkas bagi atom bagi setiap unsur

A Chemical formula that shows the simplest ration of atom of element in the molecule/ compound

..... [1M]

(ii) Nyatakan fungsi kalium klorida terhidrat.

State the function of the anhydrous calcium chloride.

To dry the hydrogen gas/ to absorb water

Mengeringkan gas hidrogen/ menyerap air

..... [1M]

(b)(i) Berdasarkan Jadual 3, hitung jisim bagi:

Based on Table 3, calculate the mass of:

Kuprum/ *Copper:*

$$40.25 - 32.25 = 8.00 \text{ g}$$

Oksigen/ *Oxygen:*

$$42.25 - 40.25 = 2.00 \text{ g}$$

[2M]

(ii) Hitung nisbah mol bagi atom kuprum kepada atom oksigen.

Calculate the ratio of moles of copper to oxygen atoms.

[Jisim atom relatif: Cu=64, O=16] [*Relative atomic mass: Cu=64, O=16*]

Elements/ Unsur	Cu	O
Mass/ Jisim	8.00	2.00
Mol/ Mol	$8.00/64$ =0.125	$2.00/16$ =0.125
Simplest Ratio/ Nisbah teringkas	1	1

[1M]

(iii) Tentukan formula empirik bagi kuprum oksida. **CuO**[1M]

Determine the empirical formula copper oxide.

(c)(i) Mengapakah gas hidrogen dialirkan melalui tiub pembakaran selepas pemanasan tamat.

Why is hydrogen gas passed through the combustion tube after heating has stopped?

1. untuk mengelakkan pengoksidaan kuprum

To avoid/ prevent the oxidation of copper

2. untuk mengelakkan pembentukan kuprum(II) oksida

To avoid the formation of copper(II) oxide

[1M]

(ii) Nyatakan bagaimana untuk menentukan bahawa tindak balas yang berlaku antara kuprum oksida dengan hidrogen telah lengkap.

State how to determine that the reaction between copper oxide with hydrogen has completed.

Ulangi proses pemanasan, penyejukan dan penimbangan sehingga jisim kuprum adalah tetap

Repeated the process of heating, cooling and weighing until the mass of copper is constant

[1M]

(d)(i) Nyatakan mengapa formula empirik bagi magnesium oksida tidak dapat ditentukan dengan menggunakan teknik yang sama.

State why the empirical formula of magnesium oxide cannot be determined by using the same technique.

1 magnesium lebih reaktif berbanding hidrogen

Magnesium is more reactive than hydrogen

2. magnesium terletak di atas hidrogen dalam siri kereaktifan

Magnesium is placed above hydrogen in the reactivity series

[1M]

(ii) Nyatakan nama suatu logam oksida lain yang formula empiriknya boleh ditentukan menggunakan teknik yang sama.

State the name of another metal whose empirical formula can be determined using the same technique.

Jwpm Soalan BM

Metal: Iron//Stanum//Lead//silver | Logam: Ferum// Tin// Plumbum// Argentum

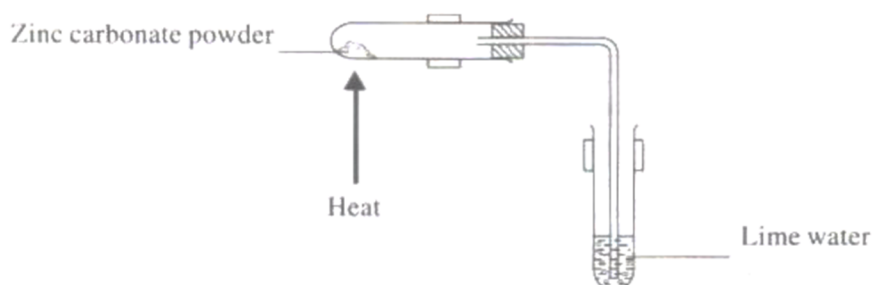
Jwpm Soalan BI

Metal Oxide: Iron(II) oxide//ferum(III) oksida// lead(II) oxide

Oksida logam: Ferum(II) oksida// Ferum(III) oksida// Plumbum(II) oksida

..... [1M]

[SPM2010-02] Diagram 2 shows the apparatus set-up for the heating of zinc carbonate, $ZnCO_3$ powder. The gas released from this experiment turned lime water chalky.
Rajah 2 menunjukkan susunan radas bagi pemanasan serbuk zink karbonat, $ZnCO_3$. Gas yang dibebaskan daripada eksperimen ini mengeruhkan air kapur.



(a) Name the gas released in this experiment. **Karbon dioksida// carbon dioxide.** 1M
Namakan gas yang dibebaskan dalam eksperimen ini

(b) In table 2, state the colour of the residue of this experiment when it is hot and when it is cold.

Pada Jadual 2, nyatakan warna baki eksperimen ini apabila panas dan apabila sejuk

Colour of residue/ Warna baki	
Hot/ Panas	Cold/ Sejuk
Kuning/ Yellow	Putih/ White

Table 2/ Jadual 2

[2M]

(c) Write a balanced chemical equation for this reaction.
Tuliskan persamaan yang seimbang bagi tindak balas ini.



..... [1M]

(d) 12.5 g of zinc carbonate, $ZnCO_3$ is heated during this experiment. Calculate the volume of gas released.

[RAM C=12, Zn=65, 1 mol of gas occupies 24 dm³ at room conditions]

12.5 g zink karbonat, $ZnCO_3$ dipanaskan semasa eksperimen ini. Hitung isi padu gas yang dibebaskan.

[Jisim atom relatif: C=12;O=16; Zn = 65; 1 mol gas menempati 24 dm³ pada keadaan bilik]

$$\text{Mol } ZnCO_3 = 12.5/125 = 0.1$$

Nisbah $ZnCO_3 : CO_2$

1 mol $ZnCO_3$ menghasilkan 1 mol CO_2

0.1 mol $ZnCO_3$ menghasilkan 0.1 mol CO_2

1 mol $ZnCO_3$ produce 1 mol CO_2

0.1 mol $ZnCO_3$ produce 0.1 mol CO_2

Isi padu/ volume $CO_2 = \text{mol} \times V \text{ molar@ SB}$

$$= 0.1 \times 24$$

$$= \mathbf{2.4 \text{ dm}^3}$$

[2M]

Bab 06 – Elektrokimia

[SPM14-04] Diagram 4.1 and Diagram 4.2 show the apparatus set-up for two electrolytic cells with different electrolytes.

Rajah 4.1 dan Rajah 4.2 menunjukkan susunan radas bagi dua sel elektrolisis dengan elektrolit yang berlainan.

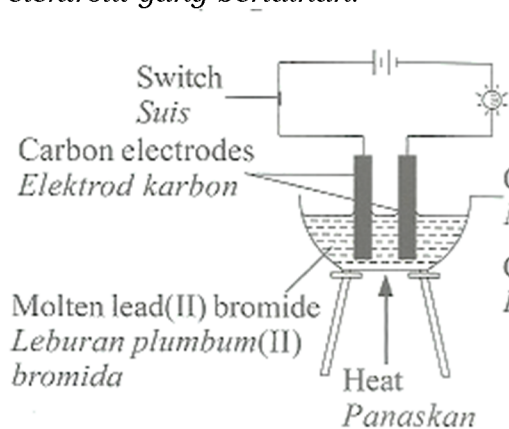


Diagram 4.1 Rajah 4.1

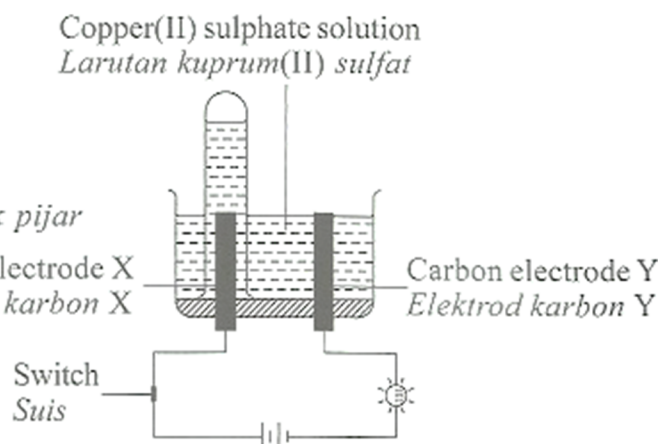


Diagram 4.2/Rajah 4.2

(a) State the meaning of electrolyte. / Nyatakan maksud elektrolit.

substance that can conducts electricity in molten or aqueous solution and undergo chemical change

Bahan yang boleh mengalirkan arus elektrik dalam keadaan leburan dan larutan akueus dan mengalami perubahan kimia

..... [1M]

(b) Based on Diagram 4.1, / Berdasarkan Rajah 4.1,

(i) Why does the bulb light up when molten lead(II) bromide is used as electrolyte?

mengapakah mentol itu menyala apabila leburan plumbum(II) bromida digunakan sebagai elektrolit?

The ion free to move // Ion bebas bergerak

..... [1M]

(ii) Write all the formulae for the ions present in lead(II) bromide.

Tulis semua formula bagi ion-ion yang hadir dalam plumbum(II) bromida.

Pb²⁺ and Br⁻

..... [1M]

(iii) state the observation at cathode. / nyatakan pemerhatian pada katod

Thicker/ Grey solid deposited // Tebal/ Enapan kelabu terbentuk

..... [1M]

(iv) write the half equation at cathode. **Pb²⁺ + 2e → Pb**[1M]

tulis setengah persamaan pada katod.

Based on Diagram 4.2, / Berdasarkan Rajah 4.2,

(i) State which electrode is anode. **Karbon elektrod X/ Carbon electrode X** [1M]

nyatakan elektrod manakah adalah anod

(ii) State the observation at the anode. / nyatakan pemerhatian pada anod.

Bubbles formed // colourless gas release // gelembong gas terbentuk

..... [1M]

(iii) Write the half equation at the anode.
 tulis setengah persamaan pada anod.



(d) In Diagram 4.2, carbon anode is replaced with copper and electrolysis is carried out for 20 minutes. State the observation at the anode. Give a reason.

Dalam Rajah 4.2, anod karbon digantikan dengan kuprum dan elektrolisis dijalankan selama 20 minit. Nyatakan pemerhatian di anod. Beri satu sebab.

1. Copper/ anode thinner

Kuprum/ anod menipis

2. copper ionizes// $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$

Kuprum mengion

3. Copper is oxidises// Copper/Cu atom changes to copper(II) ion

Copper atom release electron

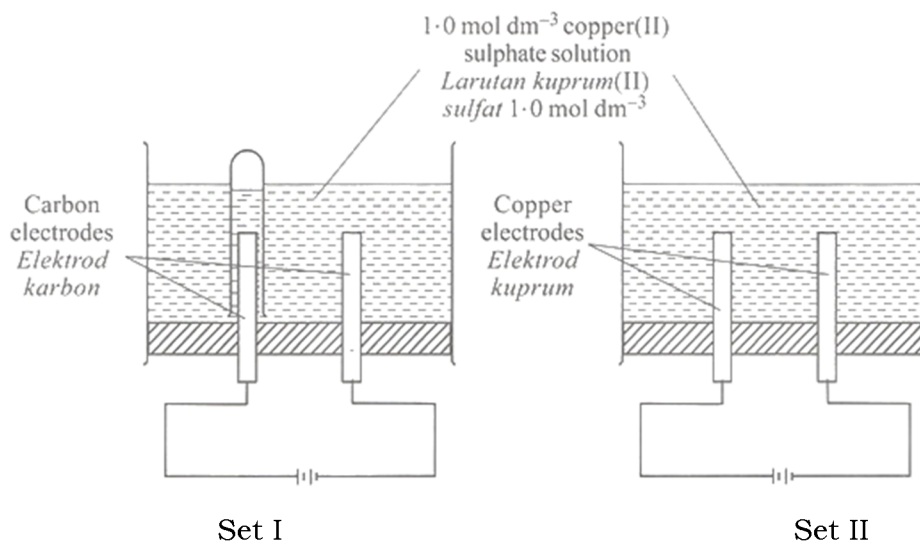
Kuprum teroksida// atom kuprum menjadi ion kuprum(II)

Atom kuprum membebaskan elektron

..... [2M]

[SPM11-05] Diagram 5 shows the apparatus set-up to study the electrolysis of 1.0 mol dm^{-3} copper(II) sulphate solution. In Set I, carbon electrodes are used. In Set II, copper electrodes are used.

Rajah 5 menunjukkan susunan radas untuk mengkaji elektrolisis larutan kuprum(II) sulfat 1.0 mol dm^{-3} . Dalam Set I, elektrod karbon digunakan. Dalam Set II, elektrod kuprum



(a) What is the meaning of an anion? / Apakah maksud anion?

Negatively -charged particles// negative charge ion

Zarah bercas negatif// ion bercas negatif

..... [1M]

(b) State all the anions and cations in copper(II) sulphate solution.

Nyatakan semua anion dan kation dalam larutan kuprum(II) sulfat.

Anions/ Anion : **SO_4^{2-} and OH^-**

sulphate ion and hydroxide ion// Ion sulfat dan ion hidroksida

Cations/ Kation : **Cu^{2+} and H^+**

Ion hydrogen dan ion kuprum(II)// Hydrogen ion and copper(II) ion

[3M]

(c) Based on Set I in Diagram 5: / Berdasarkan Set I dalam Rajah 5:

(i). Write the formula of the ion that is selectively discharged at the anode.

Tulis formula bagi ion yang dipilih untuk dinyahcaskan di anod.

OH⁻

..... [1M]

(ii). Write the half-equation for the reaction that takes place at the anode.

Tulis setengah persamaan bagi tindak balas yang berlaku di anod.

4OH⁻ → 2H₂O + O₂ + 4e⁻

..... [2M]

(iii). Describe briefly the chemical test to confirm the product at the anode.

Huraikan secara ringkas ujian kimia untuk mengesahkan hasil di anod.

1. Letakkan kayu uji berbara ke dalam tabung uji

Put a glowing splinter into the test tube

2. Kayu uji berbara menyala

The glowing splinter ignites

..... [2M]

(d). Compare the colour of the copper(II) sulphate solutions in Set I and Set II after one hour of electrolysis. Give one reason for the answer.

Bandingkan warna larutan kuprum(II) sulfat dalam Set I dan Set II selepas satu jam elektrolisis dijalankan. Beri satu alasan bagi jawapan itu. [2M]

Perbandingan/ comparison

Keamatan warna biru larutan dalam set I berkurangan dan keamatan dalam set II tidak berubah

Intensity of the blue colour solution in set I decreases and in set II the intensity remains same

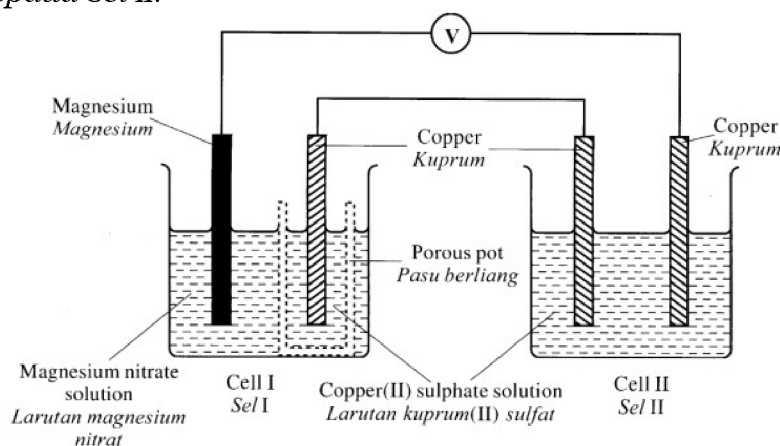
Alasan/reason

Kepekatan ion Cu²⁺ dalam set I berkurangan dan dalam set II tidak berubah

The concentration of Cu²⁺ in set I decreases and in set II remains the same

[SPM12-06] Diagram 6 shows the apparatus set-up for the combination of cell I and cell II. Cell I supplies electrical energy for cell II.

Rajah 6 menunjukkan susunan radas bagi gabungan sel I dan sel II. Sel I membekal tenaga elektrik kepada sel II.



(a) State all the ions present in the copper(II) sulphate solution.
 Nyatakan semua ion yang hadir dalam larutan kuprum(II) sulfat.

Cu²⁺, SO₄²⁻, H⁺, OH⁻

..... [1M]

(b) State the negative terminal in cell I. **Magnesium/Mg**
 Nyatakan terminal negatif bagi sel I.

[1M]

(c) After twenty minutes, / Selepas dua puluh minit,

(i) state the observation at magnesium electrode in cell I.
 nyatakan pemerhatian pada elektrod magnesium di sel I.

Magnesium became thinner/dissolve

Magnesium semakin menipis/larut

..... [1M]

(ii) write half equations for the reaction occurred at the magnesium and copper electrodes in cell I.

tulis setengah persamaan bagi tindak balas yang berlaku di elektrod magnesium dan elektrod kuprum dalam sel I.

Magnesium electrode / Elektrod magnesium : **Mg → Mg²⁺ + 2e**

Copper electrode / Elektrod kuprum : **Cu²⁺ + 2e → Cu**

[2M]

(d) State the change in colour of copper(II) sulphate solution in cell I and cell II.
 Nyatakan perubahan warna bagi larutan kuprum(II) sulfat dalam sel I dan sel II.

Cell I : keamatan warna biru larutan berkurang

Intensity of the blue colour solution decrease

Cell II : keamatan warna biru larutan tidak berubah

Intensity of the blue colour solution remain the same

[2M]

(e) A metal Z is found containing some impurities. Z is located below copper in the electrochemical series.

Suatu logam Z didapati mengandungi sedikit bendasing. Z terletak di bawah kuprum dalam siri elektrokimia.

(i) State the method used to purify the metal Z.

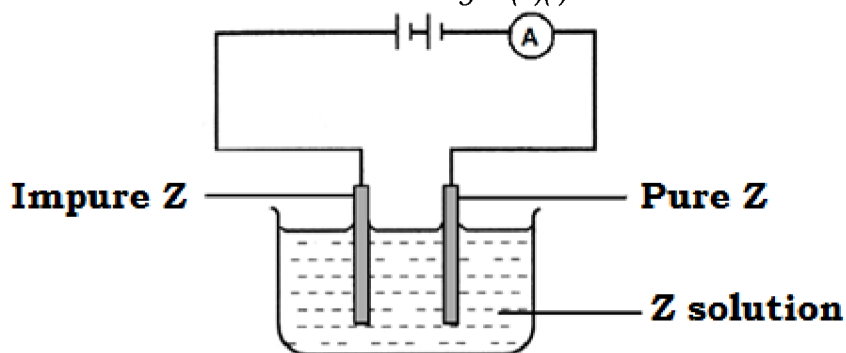
Nyatakan kaedah yang digunakan untuk menuliskan logam Z itu.

Elektrolisis // Electrolysis

..... [1M]

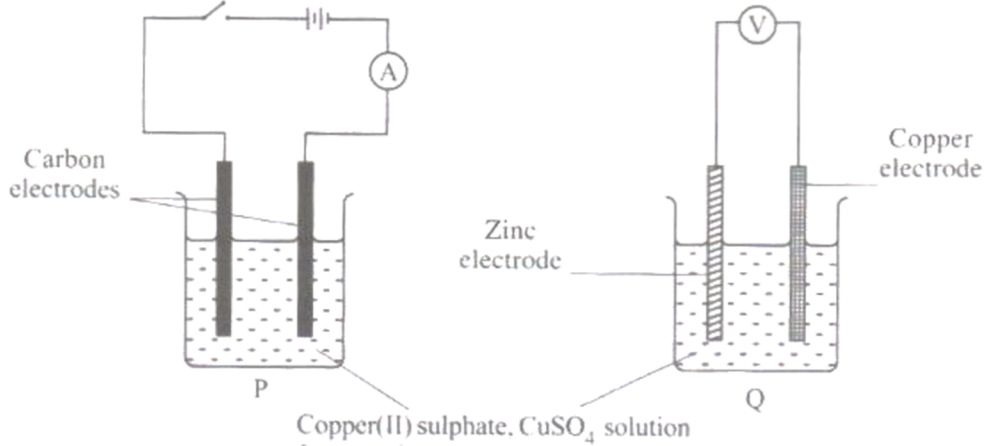
(ii) Draw a labelled diagram for the apparatus set-up for 6(e)(i).

Lukis rajah berlabel untuk susunan radas bagi 6(e)(i).



[3M]

[SPM10-05] Diagram 5.1 shows the apparatus set-up for two types so cells, P and Q.
Rajah 5.1 menunjukkan susunan radas bagi dua jenis sel, P dan Q



(a) What is the colour of copper(II) sulphate solution? **Blue/ Biru** [1M]
Apakah warna larutan kuprum(II) sulfat?

(b) State all the anions present in copper(II) sulphate solution.
Nyatakan semua anion yang hadir dalam larutan kuprum(II) sulfat.
Sulphate, SO_4^{2-} and hydroxide, OH^-
Sulphate/ Sulfat, SO_4^{2-} and hydroxide/ Hidroksida, OH^-
 [1M]

(c) Which electrode is the negative terminal in cell Q? **Zinc/ zink** [1M]
Elektrod manakah yang merupakan terminal negatif dalam sel Q?

(d) Write the half equation for the discharge of the anion in cell P.
Tulis setengah persamaan bagi anion yang dinyahcas dalam sel P.
 $4OH^- \rightarrow 2H_2O + O_2 + 4e^-$
 [2M]

(e) Cell P and Cell Q are combined as shown in Diagram 5.2
Sel P dan sel Q digabungkan seperti ditunjukkan dalam Rajah 5.2.

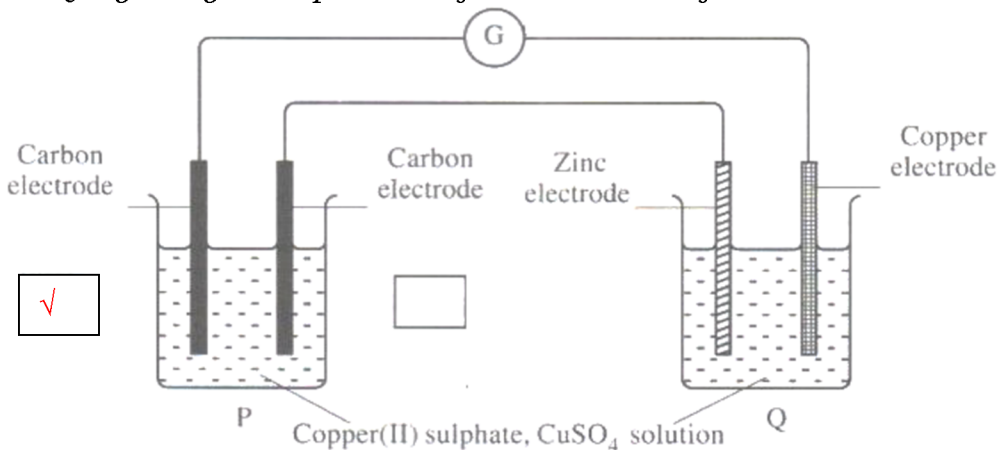


Diagram 5.2 / Rajah 5.2

(i) In Diagram 5.2, mark (✓) in the box provided to show which electrode is the anode in cell P. Explain your answer.
Dalam Rajah 5.2, tanda (✓) dalam petak yang disediakan untuk menunjukkan elektrod yang manakah adalah anod dalam sel P. Jelaskan jawapan anda. [2M]

Tindak balas pengoksidaan berlaku

Oxidation reaction occurs// lost of electron

Or/ Atau

connect to copper electrode in Cell Q, which is positive terminal*bersambung kepada elektrod kuprum in sel Q, iaitu terminal positif*

(ii) The observation for the electrolyte in cell P and cell Q is the same. State the observation and explain your answer.

Pemerhatian bagi elektrolit dalam sel P dan sel Q adalah sama. Nyatakan pemerhatian tersebut dan jelaskan jawapan anda.

1.Keamatan warna biru berkurangan

Intensity of blue colour decreases

Atau/ or

larutan biru bertukar kepada tak berwarna

Blue solution turns colourless/ decolourise

2. kepekatan ion kuprum(II)/ ion Cu^{2+} berkuranganConcentration of copper(II) ion/ Cu^{2+} ion decreases

[2M]

(iii) Copper(II) sulphate solution in cell P is replaced with dilute sulphuric acid. A colourless gas is produced at the cathode and the gas is collected. Describe one chemical test to identify the gas produced.

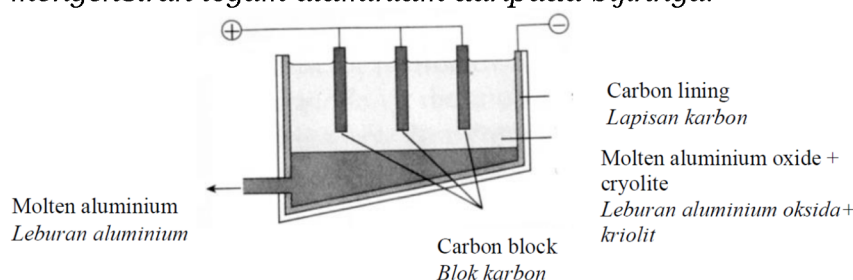
Larutan kuprum(II) sulfat dalam sel P digantikan dengan asid sulfurik cair. Gas tak berwarna dihasil pada katod dan dikumpulkan. Huraikan satu ujian kimia untuk mengenal pasti gas yang dihasilkan.

Place the burning splinter near the mouth of the test tube*Dekatkan kayu menyala di mulut tabung uji***Pop sound produce/ Bunyi ‘Pop’ terhasil**

[2M]

[TrialKedah2018-03] (d) Diagram 3.2 shows a representation of an industrial process to extract aluminium metal from its ore.

Rajah 3.2 menunjukkan perwakilan bagi suatu proses industri yang digunakan untuk mengekstrak logam aluminium daripada bijihnya.



(i) Write the chemical formula for aluminium oxide. **Al_2O_3**

Tulis formula kimia bagi aluminium oksida.

(ii) Name the product formed at the cathode. **Aluminium** [1M]

Namakan hasil terbentuk di katod.

(iii) What is the function of the cryolite?/ *Apakah fungsi kriolit?*

To low the melting point of aluminium oxide

Untuk merendahkan takat lebur aluminium oksida [1M]

Bab 07 – Asid dan Bes

[SPM11-04] Hydrochloric acid is a strong acid. Table 4 shows two solutions of hydrochloric acid, P and Q, of different concentrations.

Asid hidroklorik adalah asid kuat. Jadual 4 menunjukkan dua larutan asid hidroklorik, P dan Q pada kepekatan yang berbeza.

Hydrochloric acid solution <i>Larutan asid hidroklorik</i>	Concentration (mol dm⁻³) <i>Kepekatan (mol dm⁻³)</i>
P	0.100
Q	0.001

(a) State the meaning of an acid./ *Nyatakan maksud asid*

Bahan kimia yang terion/ bercerai di dalam air dan menghasilkan ion hydrogen.

Chemical substances that ionise/ dissociates in water and produce hydrogen ions.

(b) Why hydrochloric acid is a strong acid?

Mengapakah asid hidroklorik ialah asid kuat?

Asid hidroklorik akan terion lengkap di dalam air dan menghasilkan kepekatan ion hydrogen yang tinggi.

hydrochloric acid ionise completely in water and produce high concentration of hydrogen ion.

(c). Solutions P and Q have different pH values.

Larutan P dan Q mempunyai nilai pH yang berbeza.

(i) Which solution gives a lower pH value? **Larutan P // P // Solution P // P** [1M]

Larutan yang manakah memberi nilai pH yang lebih rendah?

(ii). Give one reason for the answer in 4(c)(i)./ *Beri satu sebab bagi jawapan di 4(c)(i).*

Larutan P mempunyai kepekatan ion hydrogen yang tinggi.

Solution P has higher concentration of hydrogen ions.

..... [1M]

(d) 25 cm³ of 0.1 mol dm⁻³ sodium hydroxide solution is put in a conical flask. Then a few drops of phenolphthalein are added. This solution is titrated with solution P.

25 cm³ larutan natrium hidroksida 0.1 mol dm⁻³ dimasukkan ke dalam kelalang kon.

Kemudian beberapa titis fenolftalein ditambah. Larutan ini dititratkan dengan larutan P.

(i). State the type of reaction between sodium hydroxide solution and solution P.

Nyatakan jenis tindak balas antara larutan natrium hidroksida dengan larutan P

Penutralan/ neutralisation

(ii) What is the colour change of the mixture at the end point?

Apakah perubahan warna campuran itu pada takat akhir?

Merah jambu kepada tidak berwarna/ Pink to colourless

(iii) Write the chemical equation for the reaction. **HCl + NaOH → NaCl + H₂O**

Tulis persamaan kimia bagi tindak balas itu.

(iv). Calculate the volume of hydrochloric acid used.

Hitung isi padu asid hidroklorik yang digunakan.

$$M_a V_a / a = M_b V_b / b$$

$$\begin{aligned} V_a &= M_b V_b / b \times a / M_a \\ &= 0.1 \times 25 / 1 \times 1 / 0.1 \dots [M1] \\ &= \underline{25 \text{ cm}^3} \dots [M2] \end{aligned}$$

[2M]

[SPM06-04] (a) 8g pepejal natrium hidroksida, NaOH, dilarutkan dalam air suling untuk menghasilkan larutan yang mempunyai isi padu 1000 cm³. Larutan NaOH yang terhasil itu mempunyai kepekatan 8 g dm⁻³ dan kemolaran 0.2 mol dm⁻³.

*8g of solid sodium hydroxide, NaOH is dissolved in distil water to produce a solution of 1000 cm³. The NaOH solution produced has the concentration of 8 g dm⁻³ and the **molarity** of 0.2 mol dm⁻³.*

(i) Nyatakan maksud kepekatan bagi larutan yang terhasil.

*State the meaning of the **concentration** for the solution produced.*

Kepekatan ialah kuantiti zat terlarut yang terlarut di dalam 1 dm³ isi padu larutan.

Concentration is the quantity of solute dissolves in a given volume of 1 dm³ of solution

..... [1M]

(ii) Nyatakan maksud kemolaran bagi larutan yang terhasil.

*State the meaning of the **molarity** for the solution produced.*

Kemolaran ialah bilangan mol zat terlarut yang hadir di dalam 1 dm³ larutan.

Molarity is the number of mole of substance that dissolved in 1 dm³ of solution.

..... [1M]

(iii) Tulis ramus yang mewakili hubungan antara bilangan mol (n), kemolaran (M) dan isipadu (V) bagi larutan itu.

Write the formula that represents the relationship between the number of mole (n), molarity (M) and volume (V) for the solution.

$n = \frac{MV}{1000} \text{ (cm}^3\text{)} // \text{ or } n = MV \text{ (dm}^3\text{)}$

..... [1M]

(iv) Gantikan nilai-nilai sebenar bagi bilangan mol, kemolaran dan isipadu larutan NaOH itu ke dalam rumus di 4(a)(iii).

Substitute the actual values of the number of mole, molarity and volume of the NaOH solution into the formula in 4 (a)(iii).

[relative molecular mass of NaOH = 40] [Jisim molekul relatif bagi NaOH = 40]

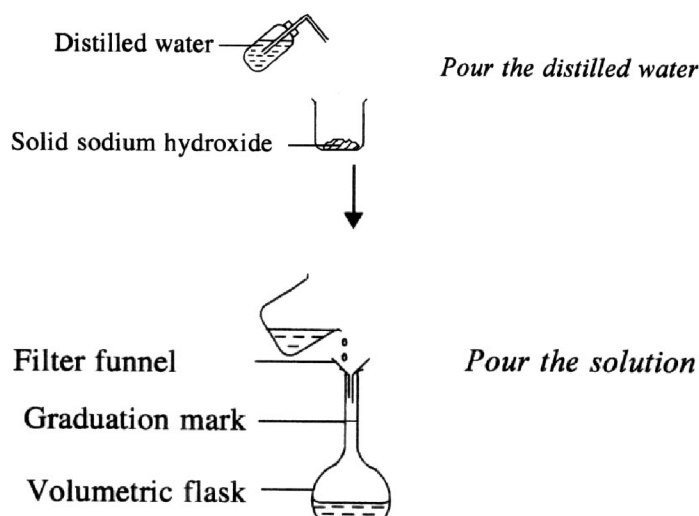
$n = 8/40 = 0.2 \text{ mol/ mole,}$

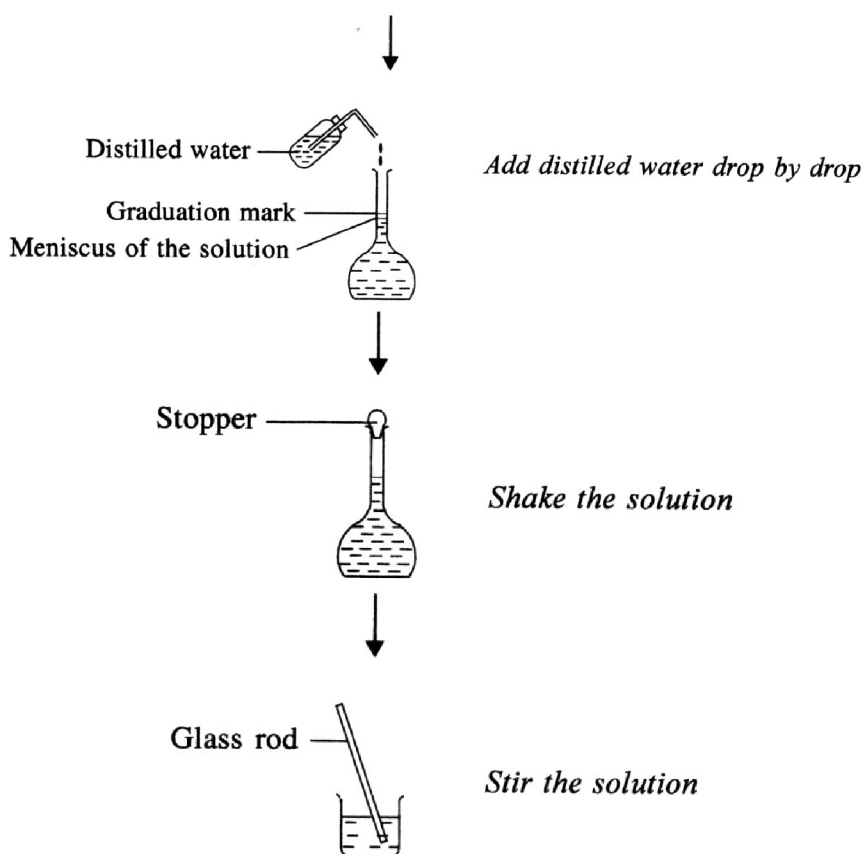
$M = 0.2 \times 1000/1000, M = 0.2 \text{ mol dm}^{-3}$

[1M]

(b) Rajah 4.1 menunjukkan penyediaan larutan piawai NaOH, 0.2mol dm⁻³.

Diagram 4.1 shows the preparation of the standard solution of NaOH, 0.2 mol dm⁻³





Rajah 4.1 / Diagram 4.1

(i) Apakah dua parameter yang perlu diukur dengan tepat untuk menyediakan larutan piawai NaOH itu?

What are the two parameters that should be measured accurately to prepare the standard solution of NaOH? [2M]

Parameter I/ *Parameter I* : **Jisim NaOH** / *mass of NaOH*

Parameter II/ *Parameter II* : **Isi padu larutan** / *volume of solution*

(ii) Setelah semua larutan NaOH dituangkan ke dalam kelalang volumetri, bikar dan corong turas perlu dibilas beberapa kali dengan air suling. Selepas setiap bilasan, semua air bilasan itu dipindahkan masuk ke dalam kelalang volumetri. Beri satu sebab mengapa ini perlu dilakukan.

After all the NaOH solution is poured into volumetric flask, the beaker and the filter funnel must be rinse several times with distilled water. After each rinse, all of this water is transferred into the volumetric flask. Give one reason for doing this.

Untuk memastikan tiada baki natrium hidrokksida yang tertinggal pada corong turas atau bikar. Dengan ini ketepatan kepekatan larutan adalah tepat.

There is no residue of sodium hydroxide left on the filter funnel/ beaker

No traces of sodium hydroxide is left on the filter funnel or beaker for accurate concentration

..... [1M]

(iii) Apakah langkah yang perlu dilakukan untuk memastikan aras meniskus larutan piawai, segaris dengan tepat dengan tanda senggatan pada kelalang volumetri

What step should be taken to ensure that the meniscus level of the standard solution is exactly in line with the graduation mark on the volumetric flask?

Tambahkan air suling titis demi titis sehingga ke tanda senggatan. // aras mata selari dengan senggatan

Add distilled water drop by drop until the meniscus is at the calibration mark. [1M]

(iv) Kelalang volumetri lebih sesuai digunakan untuk menyediakan larutan piawai berbanding dengan bikar. Mengapa?

A volumetric flask is more suitable to be used in the preparation of the standard solution rather than a beaker. Why?

Kelalang volumetri mengukur ukuran isi padu lebih tepat daripada bikar
Volumetric flask measures the volume more accurately than a beaker

..... [1M]

(v) Mengapakah kelalang volumetri ditutup setelah larutan piawai disediakan?

Why is the volumetric flask stoppered after the standard solution is prepared?

Untuk mengelakkan sejatan// sejatan air ke udara menyebabkan perubahan kepekatan larutan// memudahkan larutan digoncang

To prevent the evaporation of distilled water// the water evaporation into the air can change the concentration of the solution// easy to swirl the solution

..... [1M]

[SPM10-06] (a) Diagram 6 shows the apparatus set-up for the titration of **25.0 cm³ of 0.1 mol dm⁻³** sodium hydroxide, NaOH solution with dilute hydrochloric acid, HCl, using phenolphthalein as an indicator.
Rajah 6 menunjukkan susunan radas bagi pentitratan antara 25.0 cm³ larutan natrium hidroksida, NaOH 0.1 mol dm⁻³ dengan asid hidroklorik cair, HCl menggunakan fenolftalein sebagai penunjuk

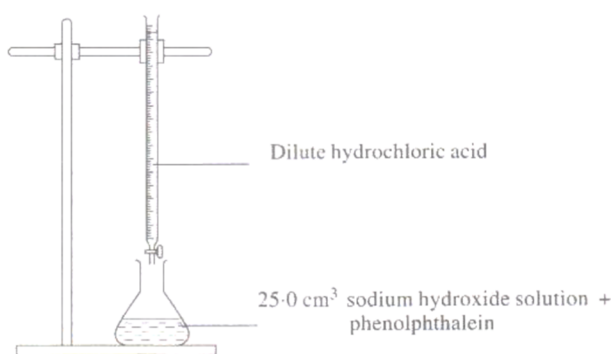


Diagram 6 / Rajah 6

(i) Name the type of reaction that occurs in the conical flask.

Namakan jenis tindak balas yang berlaku dalam kelalang kon itu.

Penutralan// Neutralisation

..... [1M]

(ii) Write a balanced chemical equation for the reaction in 6(a)(i).

Tulis persamaan kimia yang seimbang bagi tindak balas dalam 6(a)(i).

HCl + NaOH → HCl + H₂O

..... [2M]

(iii) State the colour change of the solution in the conical flask when the end point of titration is reached.

Nyatakan perubahan warna bagi larutan dalam kelalang kon itu apabila takat akhir pentitratan dicapai.

Merah jambu kepada tidak berwarna/ Pink to colourless

..... [1M]

(iv) 20.0 cm³ of hydrochloric acid is needed to neutralise completely the sodium hydroxide solution in the conical flask.

20.0 cm³ asid hidroklorik diperlukan untuk meneutralkan dengan lengkap larutan natrium hidroksida dalam kelalang kon itu. Hitung kemolaran asid hidroklorik itu.

$$M_a V_a / a = M_b V_b / b$$

$$M_a = M_b V_b / b \times a / V_a$$

$$= 0.1 \times 25 / 1 \times 1 / 20 \dots [M1]$$

$$= \underline{0.125 \text{ mol dm}^{-3}} \dots [M2]$$

[2M]

(b) Table 6 shows the concentration and volume of two different types of strong acid, X and Y, which are used to neutralise 20.0 cm³ of 0.5 mol dm⁻³ potassium hydroxide solution. *Jadual 6 menunjukkan kepekatan dan isi padu dua jenis asid kuat yang berlainan, X dan Y, yang digunakan untuk meneutralkan 20.0 cm³ larutan kalium hidroksida 0.5 mol dm⁻³*

Acid / Asid	X	Y
X	0.5 mol dm ⁻³	0.5 mol dm ⁻³
Y	V cm ³	2 V cm ³

Table 6 / *Jadual 6*

Based on the information in Table 6, identify acid X and Y.

Berdasarkan maklumat dalam Jadual 6, kenal pasti asid X dan asid Y

X: asid dwibes // Asid sulfurik // sulphuric acid // diprotic acid

Y: asid monobes // Asid hidroklorik // HCl // asid nitric / HNO₃
 monoprotic // hydrochloric acid // HCl // nitric acid / HNO₃ [2M]

(c) Sulphuric acid solution contains sulphate ion, SO₄²⁻. Describe one confirmatory test for sulphate ion, SO₄²⁻. [3M]

Larutan asid sulfurik mengandungi ion sulfat, SO₄²⁻. Huraikan satu ujian pengesahan bagi ion sulfat, SO₄²⁻.

1. tambah asid hidroklorik

Add hydrochloric acid

2. Diikuti oleh larutan barium klorida / [boleh larutan barium nitrat]

Followed by barium chloride solution

3. mendakan putih terbentuk

White precipitate is formed

..... [3M]

Bab 08 – Garam

[SPM05-04] Jadual 4 menunjukkan ion positif dan ion negatif bagi tiga larutan garam. *Table 4 shows the positive and negative ions in three salt solutions.*

Jadual 4/ Table 4

Nama Garam <i>Name of Salt</i>	Ion Positif <i>Positive ion</i>	Ion Negatif <i>Negative ion</i>
Kuprum(II) sulfat <i>Copper(II) Sulphate</i>	Cu^{2+}	SO_4^{2-}
Natrium sulfat <i>Sodium Sulphate</i>	Na^+	SO_4^{2-}
Piumbum(II) nitrat <i>Lead(II) Nitrate</i>	Pb^{2+}	NO_3^-

Gunakan maklumat dalam Jadual 4 untuk menjawab soalan-soalan berikut (a)
Use the information in Table 4 to answer the following questions.

(a) Apakah nama lain bagi ion bercas positif? **Cation/ kation** [1M]
What is another name for a positively charged ion?

(b) Namakan ion-ion yang terdapat dalam larutan kuprum(II) sulfat.
Name the ions in copper (II) sulphate solution.

Ion sulfat dan ion kuprum(II)// Sulphate ion and copper(II) ion

..... [1M]

(c) Tuliskan formula bagi natrium sulfat. **Na_2SO_4** [1M]
Write the formula for sodium sulphate.

(d) Apabila 10 cm^3 larutan natrium sulfat 0.5 mol dm^{-3} dicampurkan kepada larutan plumbum(II) nitrat berlebihan, suatu mendakan putih terbentuk.
When 10 cm^3 of 0.5 mol dm^{-3} sodium sulphate solution is added to excess lead(II) nitrate solution, a white precipitate is formed.

(i) Tuliskan persamaan kimia bagi tindak balas yang berlaku.
Write the chemical equation for the reaction.



..... [2M]

(ii) Perihalkan persamaan kimia di (d)(i)./ *Describe the chemical equation in (d)(i).*

1 mol plumbum(II) nitrat bertindak balas dengan satu mol natrium sulfat menghasilkan 1 mol plumbum(II) sulfat dan 2 mol natrium nitrat

1 mol of lead(II) nitrate reacts with 1 mol of sodium nitrate produce 1 mol of lead(II) sulphate and 2 moles of sodium nitrate

..... [1M]

(iii) Namakan mendakan putih itu. **Plumbum(II) sulfat// Lead(II) sulphate** [1M]
Name the white precipitate.

(iv) Hitungkan bilangan mol natrium sulfat yang terdapat dalam larutan itu.

Gunakan rumus: Bilangan mol = Isipadu X Kepekatan

Calculate the number of mole of sodium sulphate in the solution.

Use the formula: Number of mole = Volume X concentration.

Bilangan mol natrium sulfat/ Number of mole = $10/1000 \times 0.5 = 0.005$

[1M]

(v) Hitungkan jisim mendakan yang terbentuk./ *Calculate the mass of precipitate formed.*

[Diberi jisim atom relatif bagi O=16, S=32, Pb=207.]

Gunakan rumus: Jisim = Bilangan mol X Jisim molekul relatif]

[Given that the relative atomic mass of O=16, S=32, Pb=27.

Use the formula: Mass = Number of mole X Relative molecular mass.]

Mass = $0.005 \times (207 + 32 + 16 \times 4)$

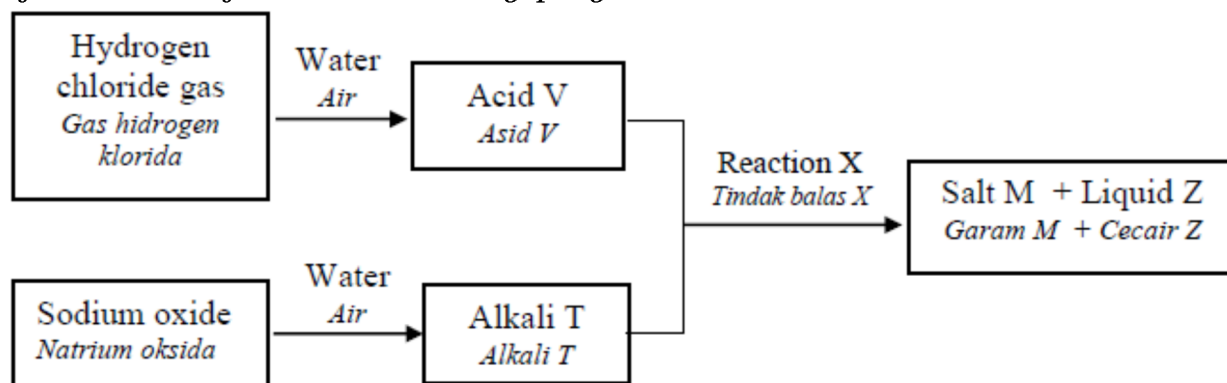
= 0.005×303

= 1.515 g

[2M]

[MRSM15-04] Diagram 4.1 shows a flowchart to form Salt M.

Rajah 4.1 menunjukkan carta alir bagi penghasilan Garam M.



Based on Diagram 4.1, answer the following questions:

Berdasarkan Rajah 4.1, jawab soalan-soalan berikut:

(a) State acid V and alkali T. / Nyatakan asid V dan alkali T.

Acid V/ Asid V: **hydrochloric acid**// Asid hidroklorik// HCl

Alkali T/Alkali T: **sodium hydroxide**// natrium hidroksida// NaOH [2M]

(b) (i) Name reaction X.// Namakan tindak balas X. **Neutralisation**// peneutralan [1M]

(ii) Write the chemical equation for reaction X. **HCl + NaOH → NaCl + H₂O**

Tuliskan persamaan kimia bagi tindak balas X.

(c) 25 cm³ of alkali T is needed to neutralize 50 cm³ of 0.1 mol dm⁻³ acid V. Calculate the concentration of alkali T.

25 cm³ alkali T diperlukan untuk meneutralkan 50 cm³ asid V 0.1 mol dm⁻³. Hitungkan kepekatan alkali T.

1. Bilangan mol// no. of mol of acid V = 0.1X 50/1000 = 0.005 mol

2. daripada persamaan: 1 mol asid V bertindak balas dengan 1 mol alkali T

Daripada pengiraan, 0.005 mol asid V bertindak balas dengan 0.005 mol alkali T

From equation, 1 mol of acid V react with 1 mol alkali T

From calculation, 0.005 mol of acid V react with 0.005 mol alkali T

3. Kepekatan alkali T/ concentration of alkali T = 0.005 X 1000/ 25 = 0.2 mol dm⁻³

[3M]

(d) Describe briefly how crystals of Salt M is obtained from its solution.

Huraikan secara ringkas bagaimana hablur Garam M diperolehi dari larutannya.

Heat the solution until saturated and cool at room temperature

Filter and dry the crystal

Panas larutan sehingga tepu dan sejukkan pada suhu bilik

Turas dan keringkan kristal

[2M]

(e) If acid V is replaced with ethanoic acid, state the salt produced from reaction X.

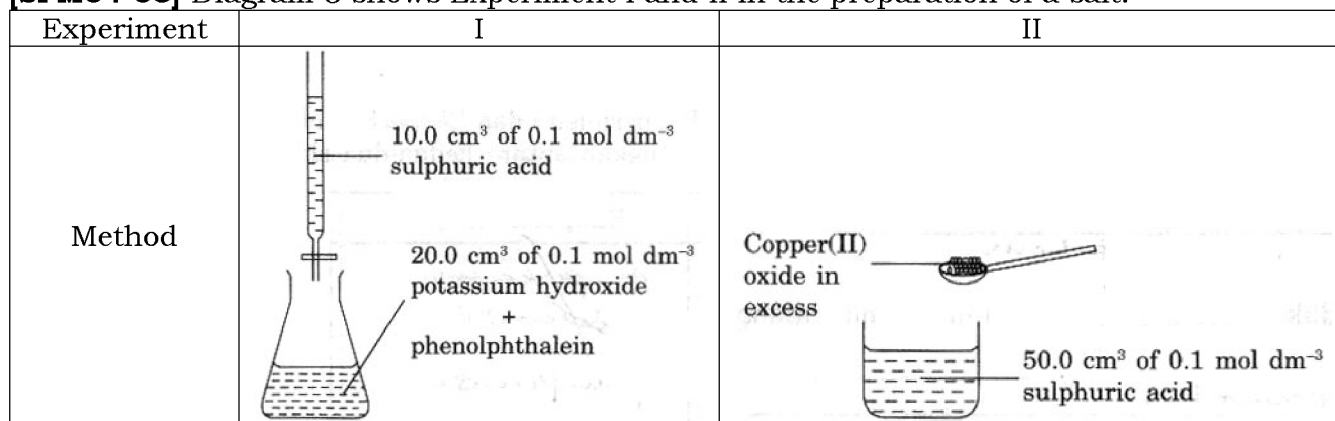
Jika asid V digantikan dengan asid etanoik, nyatakan garam yang terhasil dari tindak balas X.

Sodium ethanoate /Sodium acetate/ CH₃COONa / NaCH₃COO

Natrium etanoat/ natrium asetat

[1M]

[SPM04-05] Diagram 5 shows Experiment I and II in the preparation of a salt.



(a) State one observation in Experiment I.

Merah jambu kepada tidak berwarna / Pink to colourless

[1M]

(b) Based on Experiment II:

(i) State the reason why copper(II) oxide is added in excess.

Supaya semua asid ditindak balaskan dengan lengkap

To ensure all asid reacted completely

[1M]

(ii) State how the excess copper(II) oxide powder can be separated from the products.

Turaskan // Filter it

[1M]

(iii) State the chemical equation for the reaction that takes place in Experiment II.



[1M]

(iv) Calculate the maximum mass of the salt formed.

[Relative atomic mass of O=16, S =32 and Cu=64]

bilangan mol // Number of mole = $50 \times 0.1 / 1000 = 0.005 \text{ mol}$

Jisim garam // mass of salt = $0.005 \times 160 = 0.8 \text{ g}$

[2M]

(c) Experiment I is repeated. Sulphuric acid is replaced by hydrochloric acid of the same concentration. Predict the volume of hydrochloric required for a complete reaction.

20 cm³ // 2 kali ganda // twice

[1M]

(d) There are several steps in the preparation of the salts in each of the Experiments I and II. State one difference in the steps between the two experiments.

Experiment I	Experiment II
Tiada turasan // melibatkan proses pentitratan No filtration // involving titration process	Perlu dituras // bukan pentitratan Must filter // no involving titration

(e) (i) State the type of reaction in the preparation of salts in Experiments I and II.

Penutralan // asid dan bes // asid dan alkali // asid dan oksida logam

Neutralisation // asid and bes // asid and alkali // asid and oxide metal

[1M]

(ii) State one type of reaction in the preparation of a salt other than that in (e) (i).

Penguraian ganda dua// penyesaran// pemendakan// asid dan logam/ logam karbonat

Double decomposition reaction// displacement// precipitation// asid with metal/ metal carbonate

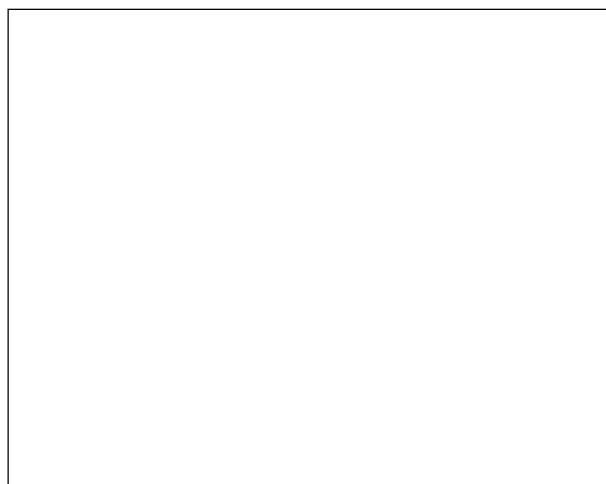
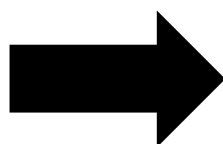
..... [1M]

[MRSM08-03] Diagram 3 shows the apparatus set-up for the preparation of zinc sulphate from zinc carbonate and an acid.

Rajah 3 menunjukkan susunan radas untuk penyediaan zink sulfat daripada zink karbonat dengan suatu asid.



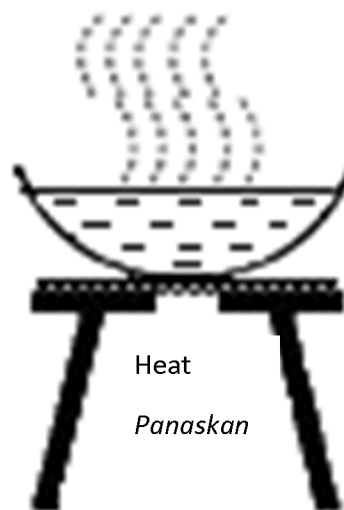
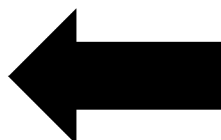
Step 1
Langkah 1



Step II
Langkah 2



Step IV
Langkah 4



Step III
Langkah III

Heat
Panaskan

Diagram 3/ Rajah 3

(a) What is meant by salt? / *Apakah yang dimaksudkan dengan garam?*

an ionic compound formed when the hydrogen ion, H⁺ from an acid is replaced by a metal ion or an ammonium ion, NH₄⁺

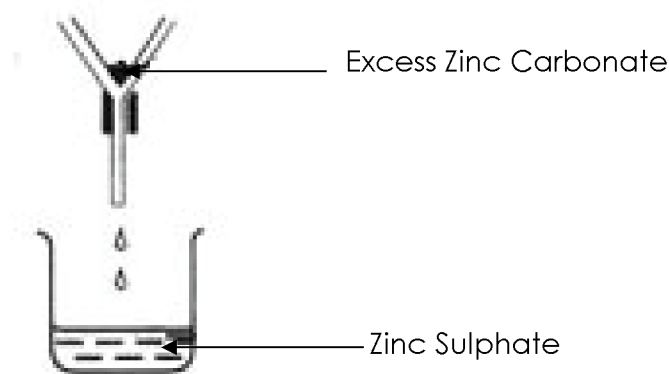
sebatian ion yang terbentuk apabila ion hidrogen, H⁺ daripada asid digantikan dengan ion logam atau ion ammonium, NH₄⁺

..... [1M]

(b) (i) Draw the diagram for step II in the box provided.

Lukis gambar rajah untuk langkah II di dalam kotak yang disediakan.

[2M]



(ii) What is the purpose of carrying out step II?

Apakah tujuan melakukan langkah II?

To remove excess zinc carbonate // to get pure of zinc sulphate

Untuk mengeluarkan lebihan zink karbonat// untuk mendapatkan zink sulfat tulen

..... [1M]

(c) (i) Name the acid used. **Sulphuric acid// asid sulfurik**

[1M]

Namakan asid yang digunakan.

(ii) Write the chemical equation for the reaction.

Tuliskan persamaan kimia untuk tindak balas tersebut.



..... [2M]

(d) The chart shows the reaction of zinc sulphate and metal X.

Carta menunjukkan tindak balas antara zink sulfat dengan logam X.



(i) Suggest a name for metal X.

Magnesium// Aluminium [1M]

Cadangkan nama untuk logam X.

(ii) What is observed when aqueous ammonia is added in excess to zinc sulphate solution?

Apakah yang diperhatikan apabila ammonia akueus ditambah kepada larutan zink sulfat sehingga berlebihan?

White precipitate formed// Mendakan putih terbentuk

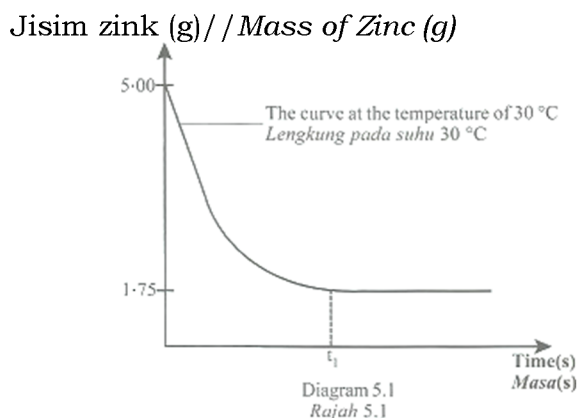
then dissolved in excess ammonia aqueous// dan kemudian larut dalam ammonia berlebihan

..... [2M]

Bab 10 – Kadar Tindak Balas

[SPM14-06] Rajah 5.1 menunjukkan graf jisim zink melawan masa bagi tindak balas antara zink dan asid hidroklorik. Dalam eksperimen ini, 5.00 g zink ditambahkan kepada 100 cm³ asid hidroklorik 1.0 mol dm⁻³ untuk mengkaji kadar tindak balas pada suhu 30 °C.

Diagram 5.1 shows the graph of the mass of zinc against time for the reaction between zinc and hydrochloric acid. In this experiment, 5.00 g of zinc is added to 100 cm³ of 1.0 mol dm⁻³ hydrochloric acid to study the rate of reaction at the temperature of 30 °C.



(a) Tulis persamaan kimia bagi tindak balas ini.
Write the chemical equation for the reaction.



(b) Berdasarkan Rajah 5.1, / Based on Diagram 5.1,

(i) mengapakah lengkung bagi graf kekal mendatar selepas t_1 saat?
Why is the curve in the graph remains constant after t_1 second?

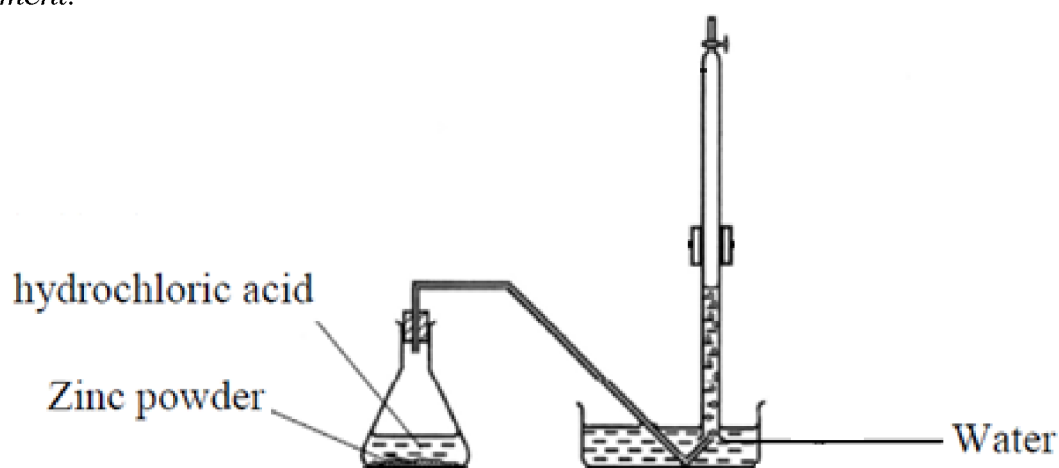
Semua asid hidroklorik telah bertindak balas lengkap dengan Zn
All hydrochloric acid was reacted completely with Zn

(ii) tentukan jisim zink yang tidak bertindak balas dalam eksperimen itu.
determine the mass of unreacted zinc in the experiment.

1.75 g (daripada graf/ from the graph)

(c) Dalam eksperimen ini, kadar tindak balas boleh ditentukan dengan mengukur isi padu gas hidrogen yang dihasilkan pada sela masa yang tetap. Lukis rajah susunan radas untuk eksperimen ini.

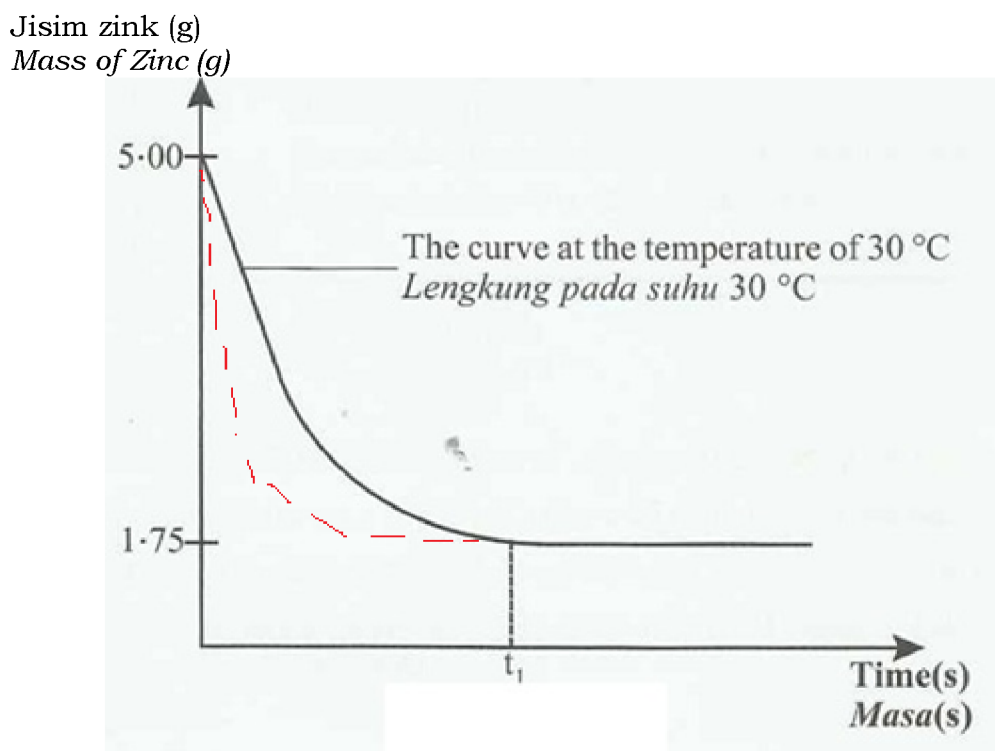
In this experiment, the rate of reaction can also be determined by measuring the volume of hydrogen gas produced at regular intervals of time. Draw the apparatus set-up for the experiment.



[2M]

(d) Eksperimen diulangi pada suhu 40 °C dengan semua faktor lain kekal tidak berubah.
The experiment is repeated at the temperature of 40 °C with other factors remain unchanged.

(i) Lakarkan lengkung yang diperoleh dalam eksperimen pada paksi yang sama dalam
Sketch the curve obtained for this experiment on the same axis in Diagram 5.2.



Rajah 5.2 / Diagram 5.2

[1M]

(ii) Berdasarkan jawapan anda di 6(d)(i), terangkan bagaimana suhu mempengaruhi kadar tindak balas dengan menggunakan teori perlanggaran.
Based on your answer in 6(d)(i), explain how temperature affects the rate of reaction by using collision theory.

1. Suhu tinggi, menyebabkan kandungan tenaga kinetik zarah bertambah
2. Bilangan perlanggaran di antara Zn dan ion H⁺ bertambah
3. Bilangan perlanggaran berkesan di antara Zn dan ion H⁺ bertambah
4. Kadar tindak balas lebih tinggi

1. The higher temperature, the higher kinetic energy of particles
2. the frequency of collision between Zn and Hydrogen ion increases
3. The frequency of effective collision between Zn and Hydrogen ion increases
4. rate of reaction is higher

..... [3M]

(e) Selain daripada suhu, nyatakan satu faktor lain yang juga boleh mempengaruhi kadar tindak balas dalam eksperimen ini.
Apart from temperature, state one other factor that will also affect the rate of reaction in this experiment.

- Saiz zink // kepekatan HCl // penambahan mangkin**
Size of Zinc // concentration of HCl // Add catalyst (CuSO₄)

..... [1M]

[SPM08-05] Satu eksperimen dijalankan untuk mengkaji kadar tindak balas antara zink dengan asid hidroklorik. Serbuk zink berlebihan ditambah kepada 20 cm³ asid hidroklorik 0.2 mol dm⁻³. Isi padu gas yang terkumpul pada sela masa yang sama ditunjukkan dalam Rajah 5.1

An experiment is carried out to investigate the rate of reaction of zinc with hydrochloric acid. Excess zinc powder is added to 20 cm³ of 0.2 mol dm⁻³ hydrochloric acid. The volume of gas collected at regular intervals is shown in Rajah 5.1.

(a) Nyatakan maksud kadar tindak balas. / *State the meaning of the rate of reaction.*

Change of quantity of reactant/product
Time taken

Perubahan kuantiti bahan/ hasil
Masa yang diambil

..... [1M]
(b) Daripada graf dalam Rajah 5.1, tentukan/ *From the graph in Rajah 5.1, determine:*

(i) Kadar tindak balas pada 120 s. / *The rate of reaction at 120 s.*

Draw the tangent at 120 s // lukiskan tangen pada 120 s
Rate of reaction/ kadar tindak balas = (0.12- 0.18) cm³s⁻¹

[2M]

(ii) Kadar tindak balas purata antara 60 s dan 120 s

The average rate of reaction between 60 s and 120 s.
0.267 cm³s⁻¹

[1M]

(c) Terangkan mengapa kadar tindak balas berkurangan dengan masa

Explain why the rate of reaction decreases with time.

Because the concentration of hydrochloric acid decreases
Kerana kepekatan asid hidroklorik berkurangan

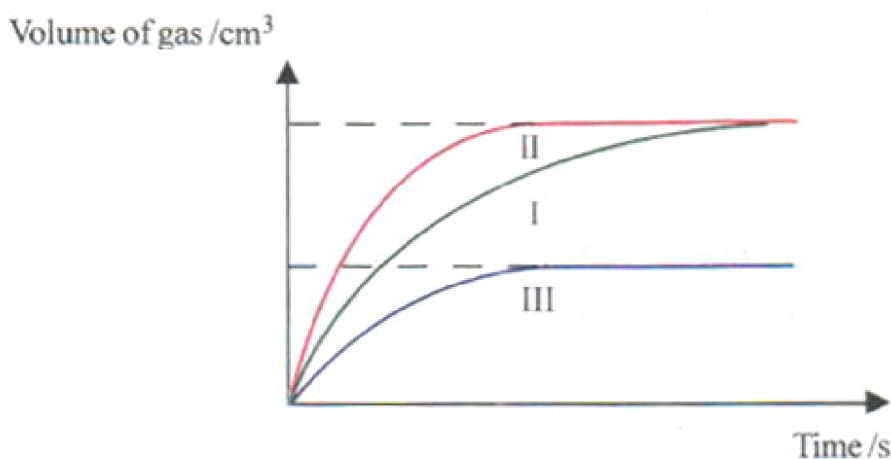
..... [1M]

(d) Satu eksperimen lain dijalankan untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas ini. Keputusan eksperimen ini ditunjukkan dalam Rajah 5.2.

Lengkung I mewakili keputusan eksperimen yang menggunakan serbuk zink berlebihan dan 50 cm³ asid hidroklorik cair 1.0 mol dm⁻³.

Another experiment is carried out to study the factors that affect the rate of this reaction.

The result of this experiment is shown in Rajah 5.2. Curve I represents the result of this experiment using excess zinc powder and 50 cm³ of 1.0 mol dm⁻³ dilute hydrochloric acid.



Rajah 5.2 / Diagram 5.2

(i) Cadangkan faktor yang mempengaruhi kadar tindak balas untuk mendapatkan lengkung-lengkung berlabel II dan III.

Suggest the factors that influence the rate of reaction to obtains the curves labelled II dan III. [2M]

Lengkung II/ Curve II : **catalyst// temperature// mungkin// suhu**

Lengkung III/ Curve III : **concentration// kepekatan**

[2M]

(ii) Huraikan dengan ringkas bagaimana eksperimen itu dijalankan untuk mendapatkan lengkung berlabel III.

Describe briefly how to carry out the experiment to obtain the curve labelled III.

Repeat the experiment as in set I

Reduce the concentration of hydrochloric acid

The volume of hydrochloric acid remains unchanged

Ulang eksperimen seperti dalam set I

Kurangkan kepekatan asid hidroklorik

Isi padu asid hidroklorik asid di kekalkan

[3M]

(iii) Beri satu sebab mengapa isi padu akhir gas yang terhasil dalam lengkung III adalah separuh daripada isi padu akhir gas dalam lengkung I.

Give one reason why the final volume of gas obtained in curve III is half the final volume of gas in curve I. [1M]

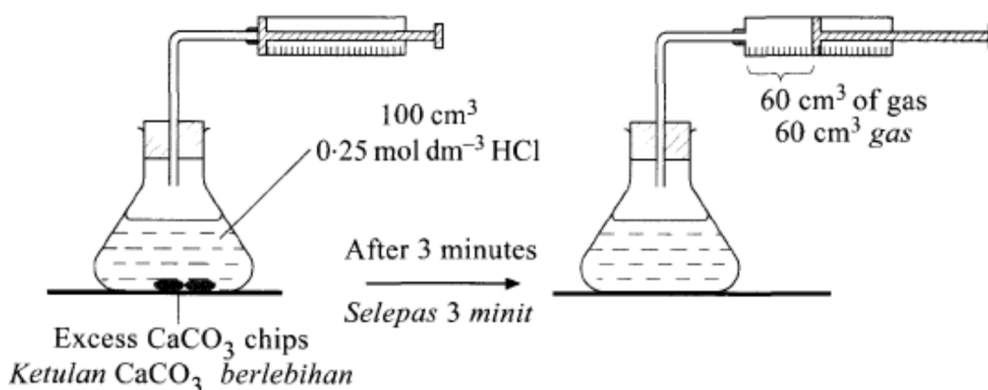
Because the number of mole of hydrochloric acid used is half of set I

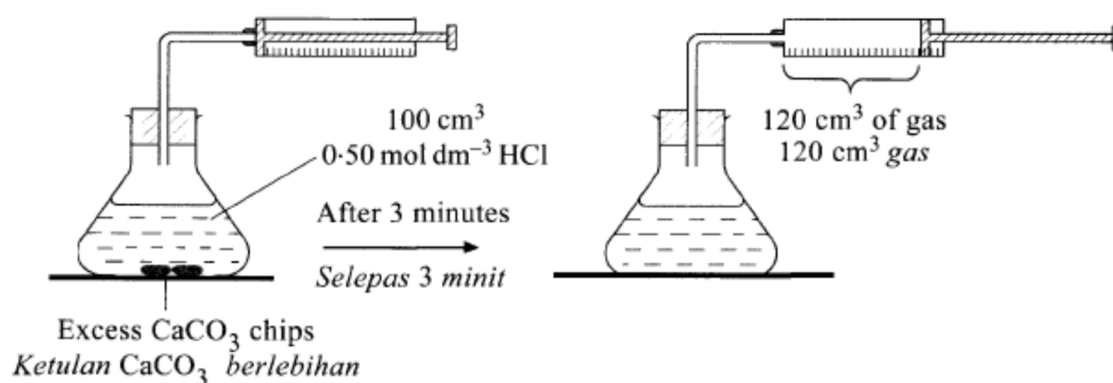
Kerana bilangan mol asid hidroklorik yang digunakan adalah separuh daripada set 1

[1M]

[SPM09-05] Rajah 5 menunjukkan dua set eksperimen mengkaji faktor yang mempengaruhi kadar tindak balas antara asid hidroklorik, HCl dengan kalium karbonat, CaCO₃.

Diagram 5 shows two sets of experiment to study the factor affecting the rate of reaction between hydrochloric acid, HCl and calcium carbonate, CaCO₃.





Rajah 5 Diagram 5

(a) Tuliskan persamaan kimia seimbang bagi tindak bala dalam eksperimen ini.

Write a balanced chemical equation for the reaction in these experiments.



..... [2M]

(b) Apakah bacaan yang perlu dicatat dalam kedua-dua eksperimen untuk menentukan kadar tindak balas dalam 3 minit.

What is the reading needed to be recorded in both experiments to determine the rate of reaction in 3 minute?

Isi padu gas CO₂ yang terbebas // Volume of CO₂ released

..... [1M]

(c) Hitung kadar tindak balas purata bagi set 1.

Calculate the average rate of reaction in set I.

$$= \frac{60}{3} = 20 \text{ cm}^3 \text{ min}^{-1}$$

$$\text{Atau } 60/180 = 0.33 \text{ cm}^3 \text{ s}^{-1}$$

[1M]

(d)(i) Bandingkan kadar tindak balas bagi set 1 dengan set 2. Jelaskan jawapan anda berdasarkan faktor yang mempengaruhi kadar tindak balas.

Compare the rate of reaction in set I and set II. Explain your answer based on the factor affecting the rate of reaction.

1. Kadar tindak balas set 2 lebih tinggi daripada set 1

2. Set 2 menggunakan kepekatan HCl dua kali ganda berbanding dengan kepekatan HCl di set 1

Set II has higher Rate of reaction than set I

Because set II has/used higher the concentration of HCl acid

..... [2M]

(ii) Jelaskan jawapan di 5(d)(i) dengan merujuk kepada teori perlanggaran.

Explain the answer in 5(d)(i) with reference to the collision theory.

1. Set 2 menggunakan kepekatan HCl 2 kali ganda berbanding kepekatan HCl set 1

2. bilangan zarah HCl di dalam set 2 adalah 2 kali ganda berbanding set 1.

3. bilangan perlanggaran di antara ion H⁺ dengan CO₃²⁻ juga bertambah

4. bilangan perlanggaran berkesan juga meningkat

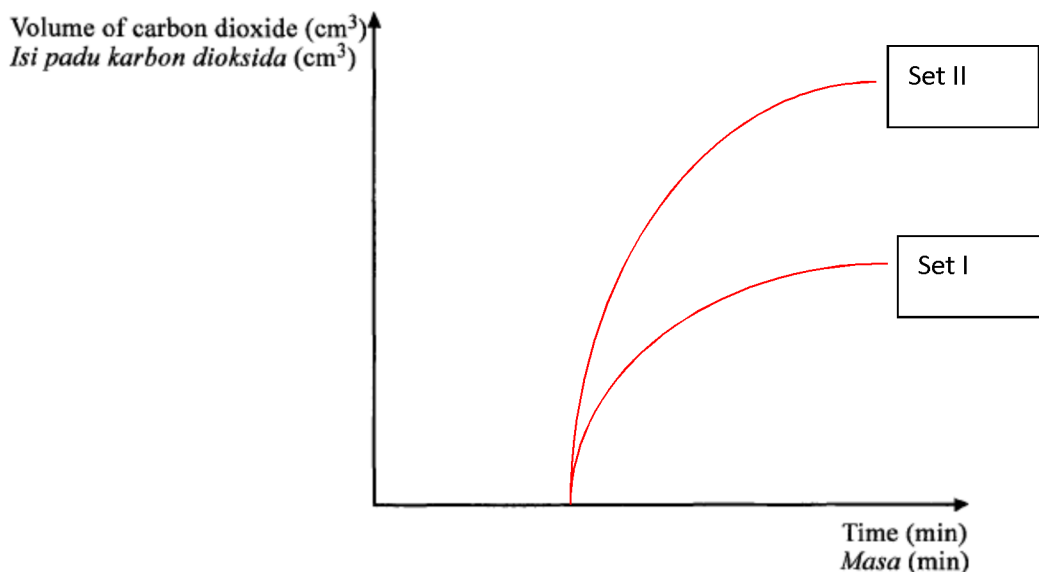
(ii) Set II has higher the concentration of HCl, Set II has higher number of particles,

The frequency of collision is increases between H⁺ ion and carbonate, CO₃²⁻ ion increases

The frequency of affective collision also increases

..... [3M]

(e) Lakar graf isi padu gas karbon dioksida yang dihasilkan melawan masa bagi kedua-dua set eksperimen dalam masa 3 minit yang pertama
 Sketch the graph of the volume of carbon dioxide gas produced against time for both sets of experiment in the first 3 minute. [2M]



[SPM15-04]. Jadual 4 menunjukkan maklumat bagi dua set eksperimen untuk menyiasat satu faktor rang mempengaruhi kadar tindak balas antara zink dengan asid sulfurik.

Table 4 shows the information for two sets of experiment to investigate one factor affecting the rate of reaction between zinc and sulphuric acid.

Set	Bahan Material	Isi padu gas terkumpul dalam 2 minit (cm ³) Volume of gas collected in 2 minutes (cm ³)
I	50 cm ³ asid sulfurik 1.0 mol dm ⁻³ + zink berlebihan 50 cm ³ of 1.0 mol dm ⁻³ sulphuric acid + excess zinc	30.00
II	50 cm ³ asid sulfurik 1.0 mol dm ⁻³ + zink berlebihan + mangkin X 50 cm ³ of 1.0 mol dm ⁻³ sulphuric acid + excess zinc + catalyst X	50.00

Berdasarkan Jadual 4 di atas, / Based on Table 4 above,

(a) Apakah yang dimaksudkan dengan mangkin? / What is the meaning of catalyst?

Suatu bahan kimia yang boleh mengubah kadar tindak balas

A chemical substances/compound to change the rate of reation

[1M]

(b) Nyatakan nama bagi mungkin X yang boleh digunakan dalam Set II.

State the name of catalyst X that can be used in Set II.

Kuprum(II) sulfat // Copper(II) sulphate

[1M]

(c) (i) hitung, kadar tindak balas purata dalam

calculate the average rate of reaction in

Set I: / Set I:

= 30/120

= 0.25 cm³ s⁻¹

Atau 30/2 = 15 cm³ min⁻¹

Set II: / Set II:

= 50/120

= 0.83 cm³ s⁻¹

Atau 50/20 = 0.42 cm³ min⁻¹

(ii) bandingkan kadar tindak balas antara Set 1 dengan Set II.

Compare the rate of reaction between Set I and Set II.

Kadar tindak balas set II lebih tinggi daripada set I

Rate of reaction of Set II is higher than Set I

[1M]

(iii) terangkan jawapan anda di 4(c)(ii) berdasarkan teori perlanggaran.

Explain your answer in 4(c)(ii) based on collision theory.

1. mungkin merendahkan tenaga pengaktifan //

Catalyst lower the activation energy

2. more colliding particles achieved the activation energy

Lebih banyak perlanggaran antara zarah-zarah yang telah mencapai tenaga pengaktifan

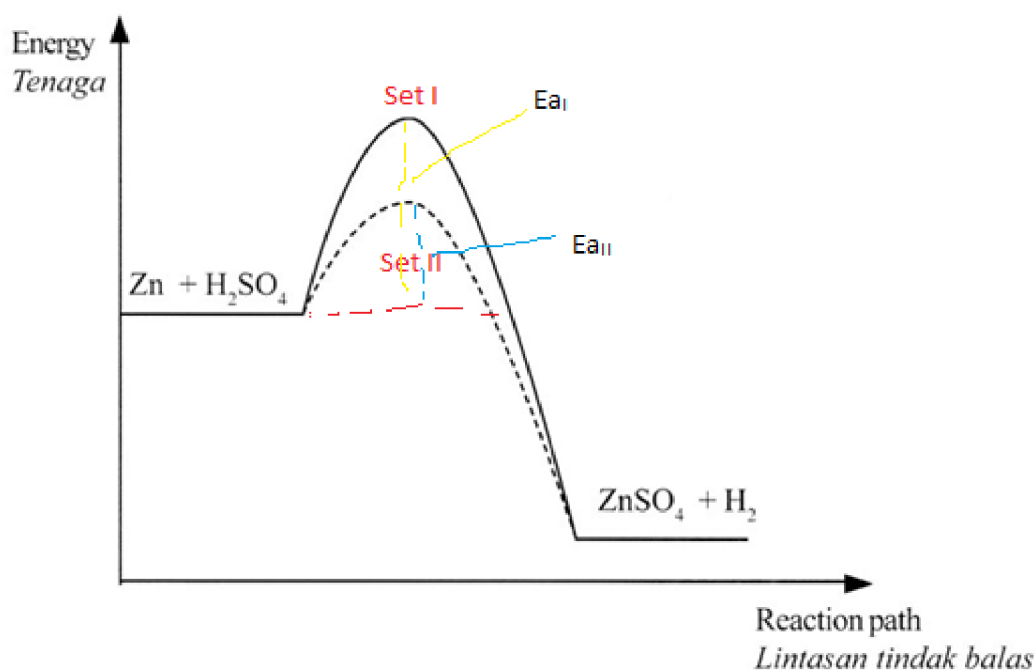
3. frekuensi perlanggaran berkesan antara zink atom dan ion H⁺ bertambah/ meningkat

Frequency of effective collision between zinc atom and H⁺ ion increases

[2M]

(d) Rajah profil tenaga bagi tindak balas antara zink dan asid sulfurik bagi kedua-dua set eksperimen itu ditunjukkan dalam Rajah 4.

The energy profile diagram for the reaction between zinc and sulphuric acid for both sets of the experiment are shown in Diagram 4.



(i) Labelkan lengkungan bagi Set I dan Set II dalam Rajah 4.

Label the curves for Set 1 and Set II in Diagram 4.

[1M]

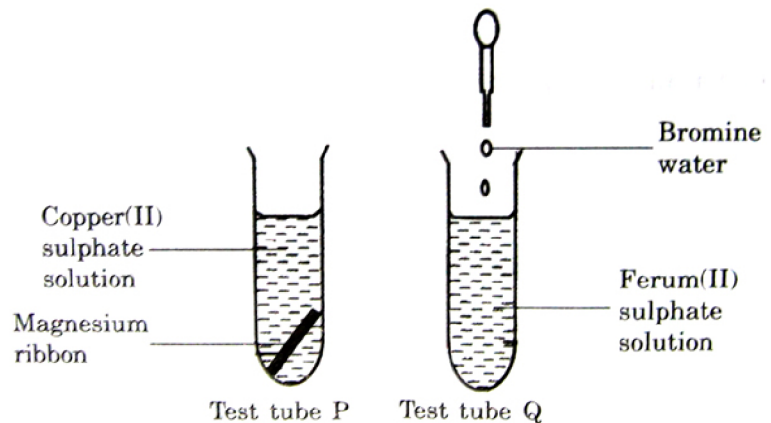
(ii) Tunjuk dan labelkan tenaga pengaktifan bagi Set I sebagai E_1 , dan Set II sebagai E_{11} dalam Rajah 4.

Show and label the activation energy for Set 1 as E_1 and Set II as E_{11} in Diagram 4. [2M]

Bab 12 – Redoks

[SPM03-05] Diagram 5 shows the setup of apparatus to investigate the reactions that take place in test tubes P and Q. *Rajah 5 menunjukkan susunan radas untuk mengkaji tindak balas yang berlaku dalam tabung uji P dan Q.*

Diagram 5/ Rajah 5



(a) State the observation for the reaction/ Nyatakan pemerhatian bagi tindak balas:

(i) is test tube P./ Pada tabung uji P.

Brown solid is formed // Mendakan Perang terhasil

..... [1M]

(ii) is test tube Q./ pada tabung uji Q.

Green solution turns brown. // Larutan hijau menjadi perang

..... [1M]

(b) Write the ionic equation for the reaction in (a)(i).

Tuliskan **persamaan ion** bagi tindak balas di (a) (i).

Mg + Cu²⁺ → Mg²⁺ + Cu

..... [1M]

(c) State what is meant by oxidizing agent in terms of electron transfer.

Nyatakan apa yang dimaksudkan dengan agen pengoksidaan dalam segi pemindahan elektron

A substance that receives electron. // Bahan yang menerima elektron

..... [1M]

(d) Referring to the reaction that takes place in test tube P.

Merujuk tindak balas yang berlaku dalam tabung uji P

(i) What is the change in the oxidation number of magnesium?

Apakah perubahan nombor pengoksidaan magnesium?

0 to/ kepada +2

..... [1M]

(ii) State the oxidation number of bromine in bromine water. **0** [1M]

Nyatakan nombor pengoksidaan bromin dalam air bromin.

(iii) What is the function of bromine water?/ *Apakah fungsi air bromin?*

oxidising agent // agen pengoksidaan

..... [1M]

(iv) Name another reagent that can replace bromine water.

Namakan satu reagen lain yang boleh menggantikan air bromin.

chlorine water // air klorin

..... [1M]

[MRSM09-06] (a) Diagram 6.1 shows the apparatus set up to investigate the transfer of electrons at a distance between potassium iodide solution and acidified potassium manganate(VII) solution. After a few minutes, colourless solution turns brown at electrode R.

Rajah 6.1 menunjukkan susunan radas untuk mengkaji pemindahan elektron pada satu jarak antara larutan kalium iodida dengan larutan kalium manganat(VII) berasid. Selepas beberapa minit, larutan tanpa warna menjadi perang di elektrod R.

(i) Name the product formed at electrode R. **Iodine // iodin** [1M]

Namakan hasil yang terbentuk di elektrod R.

(ii) Complete the half equation for the reaction at electrode S.

Lengkapkan persamaan setengah bagi tindak balas di elektrod S.



(iii) State the change in oxidation number of manganese and name the process that occurs at S.

Tentukan perubahan nombor pengoksidaan bagi mangan dan namakan proses yang berlaku di S.

Change in oxidation number/ *Perubahan nombor pengoksidaan* : **+7 to / kepada +2**

Name of process/ *Nama proses* : **reduction / penurunan**

[2M]

(iv) Suggest a substance that can replace potassium iodide solution in order to obtain the same reaction.

Cadangkan satu bahan yang boleh menggantikan larutan kalium iodida untuk menghasilkan tindak balas yang sama.

sodium iodide / natrium iodida

..... [1M]

(b) Diagram 6.2 shows the setup of the apparatus to investigate the reactivity of metals J, K and L. The different metals are heated consecutively.

Rajah 6.2 menunjukkan gambar rajah susunan radas untuk mengkaji kereaktifan logam-logam J, K dan L. Logam-logam itu dipanaskan secara bergilir-gilir.

Table 6.1 shows the observation of the experiment.

Jadual 6.1 menunjukkan pemerhatian bagi eksperimen tersebut.

Metal Logam	Observations Pemerhatian	Colour of residue Warna baki	
		Hot/ Panas	Cold/ Sejuk
J	Burns brightly <i>Menyala dengan terang</i>	Yellow <i>Kuning</i>	White <i>Putih</i>
K	Glows dimly <i>Berbara dengan malap</i>	Black <i>Hitam</i>	Black <i>Hitam</i>
L	Burns with a very bright flame <i>Menyala dengan nyalaan yang sangat terang</i>	White <i>Putih</i>	White <i>Putih</i>

Table 6.1/ *Rajah 6.1*

(i) Name metal J./ *Namakan logam J.* **Zinc / zink** [1M]

(ii) Write a chemical equation for the reaction between metal J and oxygen.

Tuliskan persamaan kimia bagi tindak balas antara logam J dengan oksigen.



(iii) Based on the observation in Table 6.1, arrange metals J, K and L in ascending order of reactivity towards oxygen.

Berdasarkan pemerhatian dalam Jadual 6.1, susun logam-logam J, K dan L dalam susunan kereaktifan menaik terhadap oksigen.

K, J, L

..... [1M]

(iv) A mixture of metal J and oxide of metal L is heated strongly. Predict an observation and explain your answer.

Campuran logam J dan oksida L dipanaskan dengan kuat. Ramalkan satu pemerhatian dan terangkan jawapan anda.

No reaction. / tiada tindak balas

Because Metal L is more reactive than metal J toward oxygen

Kerana logam L lebih reaktif daripada logam J terhadap oksigen

..... [2M]

[SPM07-06] Besi adalah sejenis logam yang mudah berkarat.

Iron is metal that rust easily.

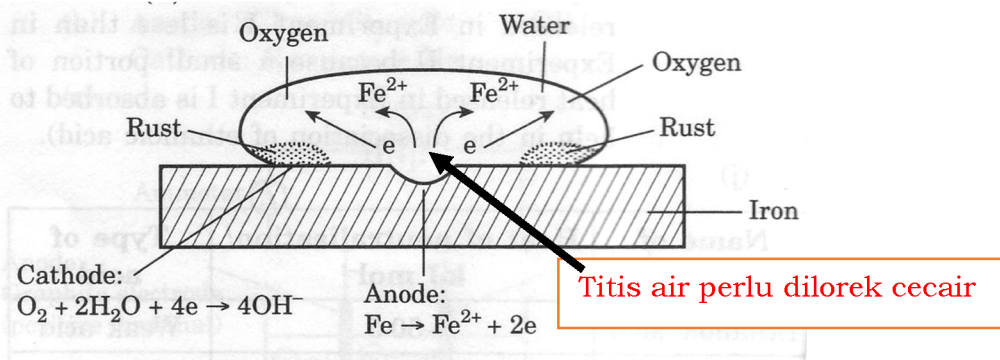
(a)(i) Nyatakan syarat untuk pengkaratan besi. / *State the condition for the rusting of iron.*

water and oxygen / air dan oksigen

..... [1M]

(ii) Lukis satu gambar rajah berlabel untuk menunjukkan bagaimana syarat untuk pengkaratan besi melibatkan pengionan besi dan pengaliran elektron.

Draw a labelled diagram to show the conditions for the rusting of iron involve the ionization of iron and the flow of electron.



[3M]

(b)(i) Huraikan tindak balas yang berlaku di pinggir titisan air (Terminal positif) semasa pengkaratan besi setelah ion Fe^{2+} dan OH^- terbentuk.

Describe the reactions that take place at the edge of water droplet (positive terminal) during the rusting of iron after the Fe^{2+} and OH^- ions are formed.

Fe^{2+} and OH^- ions combine to form iron(II) hydroxide.

Ion Fe^{2+} dan ion OH^- bergabung membentuk ferum(II) hidroksida

Iron(II) hydroxide is oxidised to iron(III) hydroxide.

Ferum(II) hidroksida dioksidakan kepada iron(III) hidroksida

Iron(III) hydroxide form hydrated iron(III) oxide / rust.

Ferum(III) hidroksida membentuk ferum(III) oksida terhidrat atau dikenali karat

..... [3M]

(ii) Nyatakan perubahan nombor pengoksidaan besi dalam 6(b)(i).

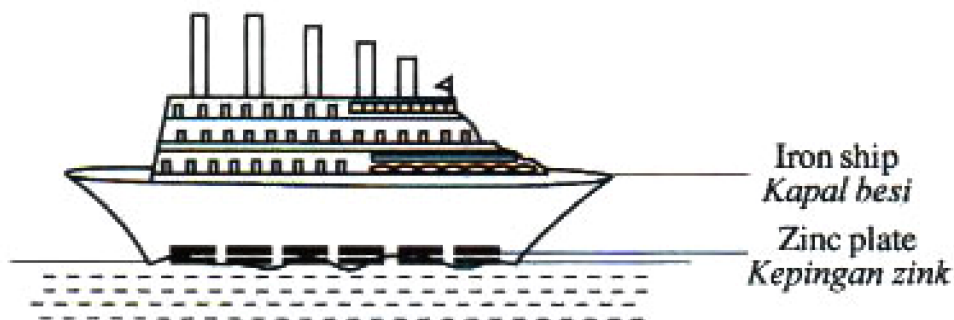
State the change in the oxidation number of iron in 6(b)(i).

+2 to/kepada +3

..... [1M]

(c) Rajah 6 menunjukkan penggunaan kepingan zink pada sebuah kapal besi untuk mengelakkan pengkaratan.

Diagram 6 shows the use of zinc plates on an iron ship to prevent rusting.



(i) Terangkan bagaimana kepingan zink itu melindungi kapal besi itu daripada berkarat.
Explain how the zinc plates protect the iron ship from rusting.

Zinc is more electropositive than iron.

Zink lebih elektropositif daripada ferum

Zinc atoms lose electrons more easily than iron.

Atom zink lebih mudah hilang electron daripada ferum

Zinc corrodes but iron does not.

Zink terkakis tetapi ferum tidak.

..... [2M]

(ii) Tulis setengah persamaan untuk tindak balas di 6(c)(i).

Write the half equation for the reaction in 6(c)(i).

Zn → Zn²⁺ + 2e

..... [1M]

Bab 9 – Bahan Kimia untuk Industri | Bab 14 – Bahan Kimia untuk pengguna

[TrialSBP018-01] (a) Diagram 1.1 shows the apparatus set-up to investigate the hardness of copper and bronze.

Rajah 1.1 menunjukkan susunan radas untuk mengkaji kekerasan untuk kuprum dan gangsa.

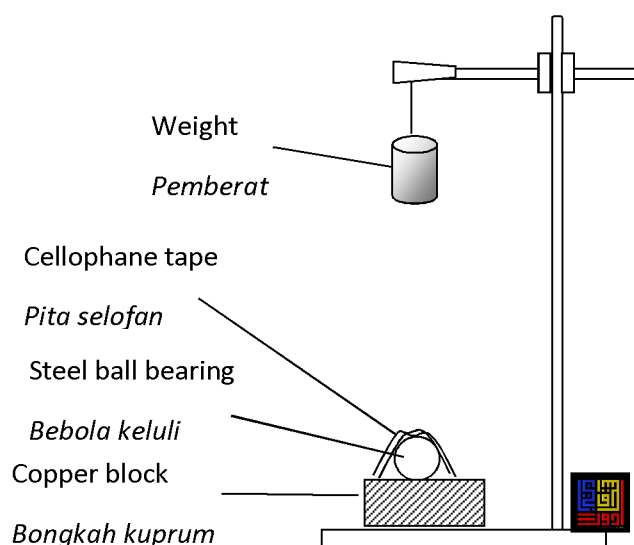


Diagram 1.1/ Rajah 1.1

A weight of 1 kilogram is dropped at a height of 50 cm to hit the ball bearing and the diameter of the dent made on the copper block is measured. The experiment is repeated by replacing copper block with bronze block. Table 1 shows the results of the experiment. Pemberat 1 kg dijatuhkan dari tinggi 50 cm ke atas bebola keluli dan diameter lekuk yang terhasil pada bongkah kuprum diukur. Eksperimen itu diulangi dengan menggantikan bongkah kuprum dengan bongkah gangsa. Jadual 1 menunjukkan keputusan eksperimen itu.

Type of block/ Jenis bongkah	Diameter of dent/ Diameter lekuk (cm)
Copper block/ Bongkah kuprum	0.5
Bronze block/ Bongkah gangsa	0.2

Table 1/ Jadual 1

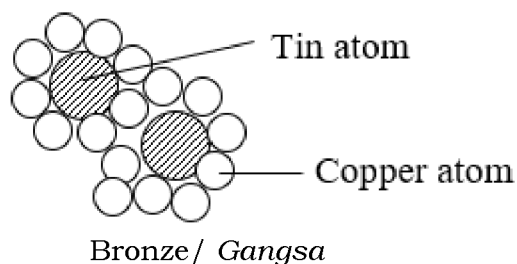
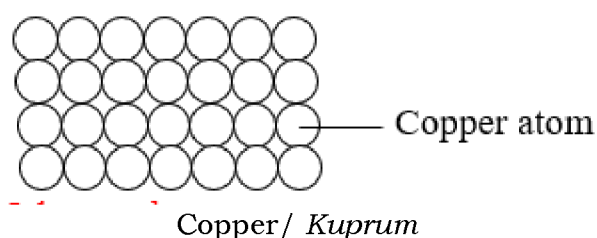
(i) Classify the copper and bronze into pure metal and alloy.
Kelaskan kuprum dan gangsa kepada logam tulen dan aloi.

Pure metal: Copper // Logam Tulen: Kuprum

Alloy: bronze // Aloi: Gangsa

[2M]

(ii) Draw a the arrangement of atoms in copper block and bronze block.
Lukiskan susunan atom dalam blok kuprum dan blok gangsa.



[2M]

(iii) Based on the results in Table 1, which block is harder?

Berdasarkan keputusan dalam Jadual 1, bongkah manakah lebih keras?

Bronze is harder than pure copper. // *Gangsa lebih keras daripada kuprum*

..... [1M]

(iv) Explain your answer in (a)(iii). / Terangkan jawapan anda di (a)(iii).

P1. The presence of tin atom of different size disrupts the orderly arrangement of copper atom.

P2. When an external force is applied, the atoms will not slide on one another easily.

P1. Kehadiran atom stanum yang berlainan saiz mengganggu susunan teratur logam kuprum

P2. Apabila daya luar dikenakan, atom-atom akan mudah menggelongsor antara satu sama lain

..... [2M]

(b) Diagram 1.2 shows a discussion in a meeting between food manufacturing workers.

Rajah 1.2 menunjukkan perbincangan dalam suatu mesyuarat antara pekerja-pekerja pengeluaran makanan

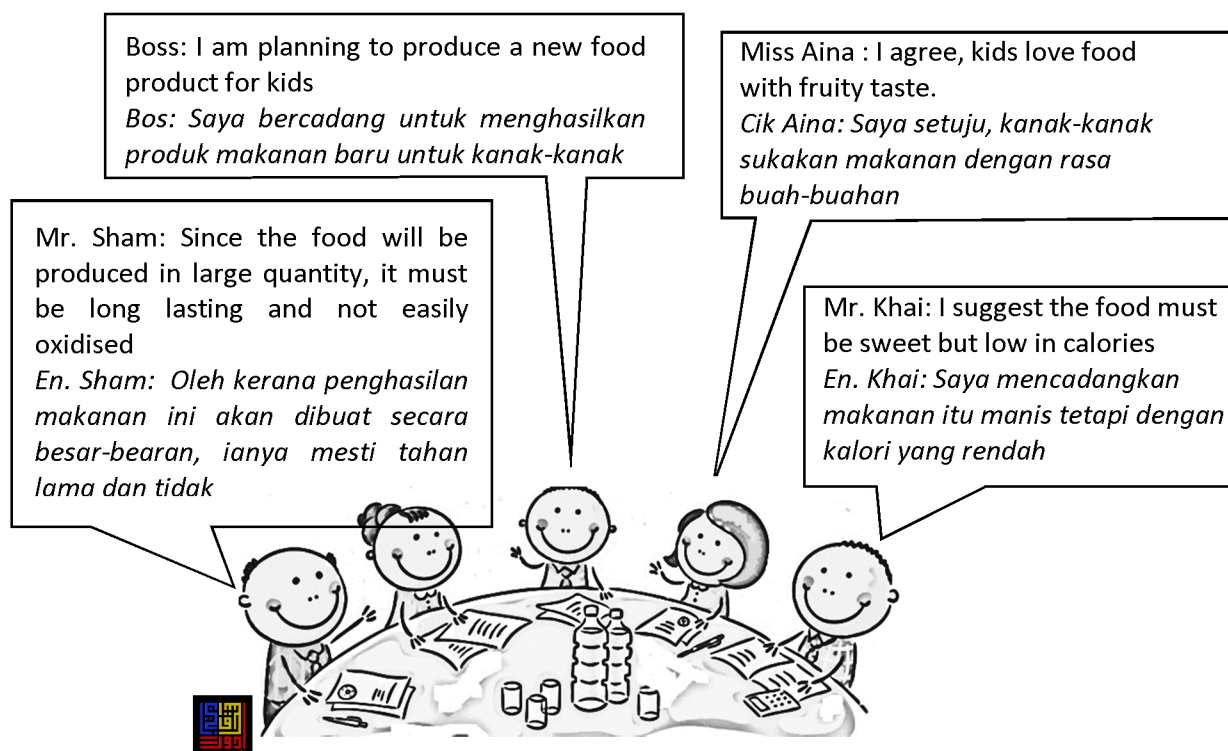


Diagram 1.2/ Rajah 1.2

(i) State the type of food additive suggested by Mr. Sham.

Nyatakan jenis bahan tambah makanan yang dicadangkan oleh En. Sham.

Antioxidant // *Antioksidan*

..... [1M]

(ii) Based on Mr Khai suggestion, give one example of food additive that can be used.

Berdasarkan cadangan En. Khai, berikan satu contoh bahan tambah makanan yang boleh digunakan

Ascorbic acid / citric acid

Asid askorbik / asid sitrik

..... [1M]

Esei**Bab 04 – Jadual Berkala Unsur**

[SPM06-08] 8. Rajah 8.1 dan Rajah 8.2 menunjukkan rajah susunan elektron bagi atom dua unsur dari Kumpulan 17 dalam Jadual Berkala Unsur.

Diagram 8.1 and diagram 8.2 show the diagrams of the electron arrangement for atoms of two elements from Group 17 in the Periodic Table of Elements.

(a) Berdasarkan Rajah 8.1: / *Based on diagram 8.1:*

(i) Tulis susunan elektron bagi atom unsur itu dan namakan unsur itu. [2M]
Write the electron arrangement for the atom of the element and name the element.

Susunan elektron: 2.8.7, unsur ialah klorin
The electron configuration is 2.8.7. The element is chlorine.

(ii) Tulis persamaan kimia bagi tindak balas antara unsur itu dengan natrium hidroksida. [3M]
Write the chemical equation for the reaction between this element and sodium hydroxide.



(b) Bandingkan daya tarikan antara nukleus dengan elektron valens dalam atom pada Rajah 8.1 dan Rajah 8.2 dan kaitkan dengan kereaktifan masing-masing. [6M]
Compare the attractive forces between the nuclei and the valence electrons in the atoms in diagram 8.1 and diagram 8.2 and relate this to their respective reactivity.

1. Daya tarikan antara nucleus dengan electron valens pada atom rajah 8.2/ bromin adalah lemah
The force of attraction between nucleus to valens electron at atom in diagram 8.2/ bromine is weaker

2. atom bromin kurang reaktif/ / *Bromine atom is less reaktif*

3. Daya tarikan antara nucleus dengan electron valens pada atom rajah 8.1/ klorin adalah kuat
The force of attraction between nucleus to valens electron at atom in diagram 8.1/ chlorine is stronger

4. Atom klorin lebih reaktif/ / *chlorine atom is more reaktif*

5. atom klorin lebih elektronegatif/ senang terima electron// atom klorin lebih senang bentuk ion// Atom broming kurang elektronegatif/ sukar terima electron// atom bromin lebih sukar bentuk ion
Chlorine atom more electronegative/ easy to receive electron// chlorine atom more easier to formed ion// bromine atom more electronegative/ hard to receive electron// bromine atom more hard to formed ion

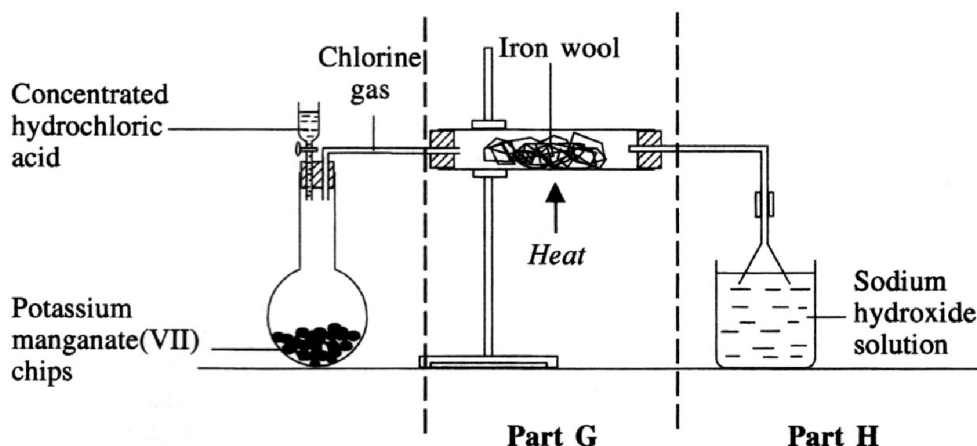
(c) Satu unsur lain dalam Kumpulan 17 adalah pepejal yang berwarna hitam. Ramalkan kereaktifan unsur itu dalam tindak balasnya dengan natrium hidroksida berbanding dengan unsur dalam Rajah 8.2.

Another element in Group 17 is a black coloured solid. Predict the reactivity of this element in its reaction with sodium hydroxide compared to that of that element in diagram 8.2. [1M]

Kurang reaktif// *Less reactive*

(d) Rajah 8.3 menunjukkan susunan radas bagi satu eksperimen untuk mengkaji tindak balas satu unsur dari Kumpulan 17 dengan logam ferum.

Diagram 8.3 shows the setup of the apparatus to investigate the reaction of an element from group 17 with iron metal.



(i) Nyatakan dua langkah keselamatan yang perlu diambil semasa menjalankan eksperimen itu

State two precautions that must be taken while carrying out the experiment. [2M]

1. pastikan sambungan semua saluran adalah ketat
2. tuangkan asid hidroklorik dengan cermat
3. guna corong turas untuk elakkan sedutan balik
4. jalankan eksperimen dalam kebuk wasap

1. make sure all the connections of the apparatus are tight to avoid the leakage of gas
2. pour the hydrochloric acid carefully to avoid it from spilling
3. use filter funnel to avoid backward sucking
4. carry out the experiment in a fume chamber

(ii) Huraikan dan tulis persamaan kimia bagi tindak balas yang berlaku di Bahagian G dan Bahagian H.

Describe and write the chemical equations for the reactions that occur in **Part G** and **Part H**. [6M]

Bahagian G/Part G

Chlorine gas will react with iron wool to produce iron (III) chloride solid.

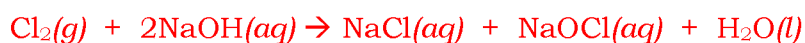
Wul ferum bertindak balas dengan gas klorin menghasilkan ferum(III) klorida



Bahagian H/ Part H

Gas klorin bertindak balas dengan natrium hidroksida menghasilkan natrium klorida, natrium hipoklorat dan air

The excess chlorine gas will flow into sodium hydroxide solution to produce sodium chloride, sodium chlorate (I) and water.



[SPM14-09] (a) Jadual 6 menunjukkan keputusan apabila tiga oksida unsur Kala 3 ditambah kepada larutan natrium hidroksida dan asid hidroklorik.

Table 6 shows the results when three oxides of elements in Period 3 are added to sodium hydroxide solution and hydrochloric acid.

Oksida <i>Oxide</i>	Ditambah kepada natrium hidroksida <i>Added to sodium hydroxide</i>	Ditambah kepada asid hidroklorik <i>Added to hydrochloric acid</i>
Oksida bagi X <i>Oxide of X</i>	Tindak balas berlaku <i>Reaction occurs</i>	Tindak balas berlaku <i>Reaction occurs</i>
Oksida bagi Y <i>Oxide of Y</i>	Tiada tindak balas <i>No reaction</i>	Tindak balas berlaku <i>Reaction occurs</i>
Oksida bagi Z <i>Oxide of Z</i>	Tindak balas berlaku <i>Reaction occurs</i>	Tiada tindak balas <i>No reaction</i>

Berdasarkan Jadual 6, susun X, Y dan Z dalam tertib menaik saiz atom. Nyatakan oksida bagi X, oksida bagi Y dan oksida bagi Z. Kemudian, tulis persamaan kimia bagi tindak balas antara oksida bagi Y dan asid hidroklorik.

Based on Table 6, arrange X, Y and Z in order of their increasing atomic size.

State the oxide of X, oxide of Y and oxide of Z. Then, write a chemical equation for the reaction between oxide of Y and hydrochloric acid. [6M]

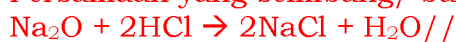
Tertib menaik/ increasing atomic size: Z, X, Y

X= aluminium oxide// aluminium oksida/ Al_2O_3

Y= sodium oxide// natrium oksida// Na_2O
magnesium oxide// magnesium oksida// MgO

Z= phosphorus pentoxide// fosforus pentoksida// P_4O_{10}
Sulphur dioxide/ sulfur dioksida/ SiO_2
Chlorine oxide/ kloridn oksida/ Cl_2O

Persamaan yang seimbang/ balanced equation



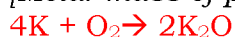
(b) Kalium bertindak balas dengan oksigen untuk menghasilkan kalium oksida. Tulis persamaan kimia dan hitung jisim bagi kalium oksida yang terbentuk apabila 0.1 mol kalium bertindak balas dengan lengkap.

[Jisim molar bagi kalium oksida= 94 g mol^{-1}]

Potassium reacts with oxygen to produce potassium oxide. Write chemical equation and calculate the mass of the product formed when 0.1 mol of potassium reacted completely.

[Molar mass of potassium oxide= 94 g mol^{-1}]

[4M]



0.1 mol kalium bertindak balas [diberikan]

4 mol K menghasilkan 2 mol K_2O // 0.1 mol K menghasilkan 0.05 mol K_2O

4 mol K produce 2 mol K_2O // 0.1 mol K produce 0.05 mol K_2O

Jisim K_2O = Jisim molar X mol

Mass molar mass mole

$$= [2(39)+16] \times 0.05$$

$$= \underline{\underline{4.7 \text{ g}}}$$

(c) Halogen yang lebih reaktif boleh menyesarkan halogen yang kurang reaktif daripada larutan garamnya. Dengan menggunakan satu contoh yang sesuai, huraikan satu eksperimen untuk menentusahkan pernyataan di atas. Sertakan dalam jawapan anda: *A more reactive halogen can displace a less reactive halogen from its salt solution. By using a suitable example, describe an experiment to verify the above statement. In your answer include:*

- Prosedur/ *Procedure*
- Pemerhatian/ *Observation*
- Persamaan kimia/ *Chemical equation*
- Ujian kimia untuk menentusahkan hasil tindak balas yang terbentuk
Chemical test to verify the product formed

[10M]

Material – potassium iodide and chlorine// potassium bromide and chlorine// potassium iodide and bromine

Bahan- kalium iodida dan klorin// kalium bromida dan klorin// kalium iodida dan bromin

Procedure/ prosedur

1. tuang larutan kalium iodida ke dalam tabung uji

Pour potassium iodide solution in test tube/ boiling tube [bekas lain tak boleh terima]

2 tambah air klorin// *Add chlorine water*

3. shake/stir// goncang/ kacau/ swirl

4. pemerhatian; - larutan tak berwarna berubah ke perang

Observation – colourless solution change to brown

Persamaan seimbang/ balanced equation



5. tambah beberapa titis larutan kanji// tambahkan 1,1,1-trikloroetana

Add a few drops of starch solution// add 1,1,1-trichloroethane

6. warna biru gelap/ mendakan terbentuk// lapisan ungu

Dark blue colour/ precipitate form// purple layer

7. klorin lebih reaktif daripada iodin

Chlorine is more reactive than iodine

Bab 05 – Ikatan Kimia

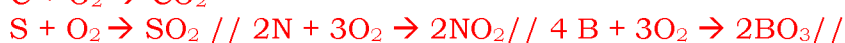
[SPM11-10] 10. (a) Element X reacts with oxygen to form a compound. The compound formed does not conduct electricity in all conditions. State the name of element X and the type of bond formed in the compound. Write a balanced chemical equation for the reaction. [4M]

Unsur X bertindak balas dengan oksigen membentuk suatu sebatian. Sebatian yang terbentuk tidak mengkonduksi arus elektrik dalam semua keadaan. Nyatakan nama unsur X dan jenis ikatan yang terbentuk dalam sebatian itu. Tulis persamaan kimia seimbang untuk tindak balas itu. [4M]

1. X ialah karbon [terima Nitrogen/ sulfur/fosforus]

name X :Carbon//Suitable element (N, S, P, Si, B)

2. ikatan kovalen// Bond :covalent



(b) Table 10 shows the proton number of elements P, Q, R and S.

Jadual 10 menunjukkan nombor proton bagi unsur P, Q, R dan S.

Element/ Unsur	P	Q	R	S
Proton number/ Nombor proton	6	8	19	20

Table 10/ *Jadual 10*

Based on Table 10, choose two elements that form a compound with a high melting point and a high boiling points. Explain how the compound is formed and draw the electron arrangement for the compound. [10M]

Berdasarkan Jadual 10, pilih dua unsur yang boleh membentuk sebatian yang mempunyai takat lebur dan takat didih yang tinggi. Terangkan bagaimana sebatian itu terbentuk dan lukis susunan elektron untuk sebatian tersebut. [10M]

1. Q, R // Q, S

Pembentukan// The formation

2. Susunan elektron atom R ialah 2.8.8.1// atom R mempunyai 1 elektron terluar
electron arrangement of atom R is 2.8.8.1// atom R has 1 valence electron

3. Susunan elektron atom Q ialah 2.6 // elektron terluar atom Q ialah 6
electron arrangement of atom Q is 2.6// atom Q has 6 valence electron

4. Atom R menderma 1 elektron, mencapai susunan elektron oktet
atom R donate 1 electron, to achieve octet electron arrangement// R achieved 2.8.8 and Q achieved 2.8

Persamaan setengah// Half equation : $R \rightarrow R^+ + e$

membentuk ion R^+ // *to form R^+ ion*

5. atom Q menerima 2 elektron dan mencapai susunan elektron oktet
atom Q receive 2 electrons, to achieve octet electron arrangement//

Persamaan setengah// Half equation : $Q_2 + 2e \rightarrow 2Q^-$

6. membentuk ion Q^{2-} // to form Q^{2-} ion

7. ion R^+ menarik ion Q^{2-} dengan daya tarikan elektrostatik yang kuat
 R^+ ions and one Q^{2-} ion attracted to each other

8. membentuk sebatian ion R_2O

to form R_2Q / $2R^+ + Q^{2-} \rightarrow R_2Q$ // $S^{2+} + Q^{2-} \rightarrow SQ$ (jika guna S, Q)

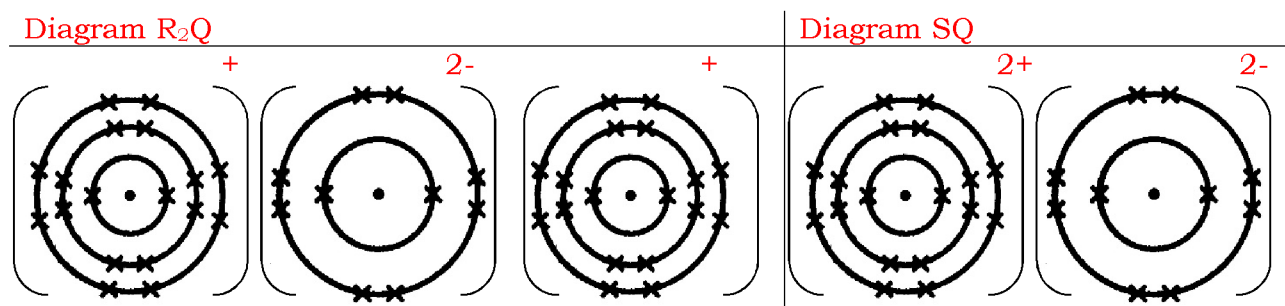
lukisan// Draw electron arrangement

9. nukleus, bilangan petala dan bilangan elektron betul

Nucleus, no of shells and number of electrons correct

10. label cas, R dan Q, dengan betul

label charge, R and Q correctly



(c) Diagram 10 shows a flow chart when substance C is dissolved in two different solvent, water and solvent D, and the properties of solutions formed.

Rajah 10 menunjukkan carta aliran apabila bahan C dilarutkan dalam dua pelarut berlainan, air dan pelarut D, dan sifat-sifat larutan yang terhasil.

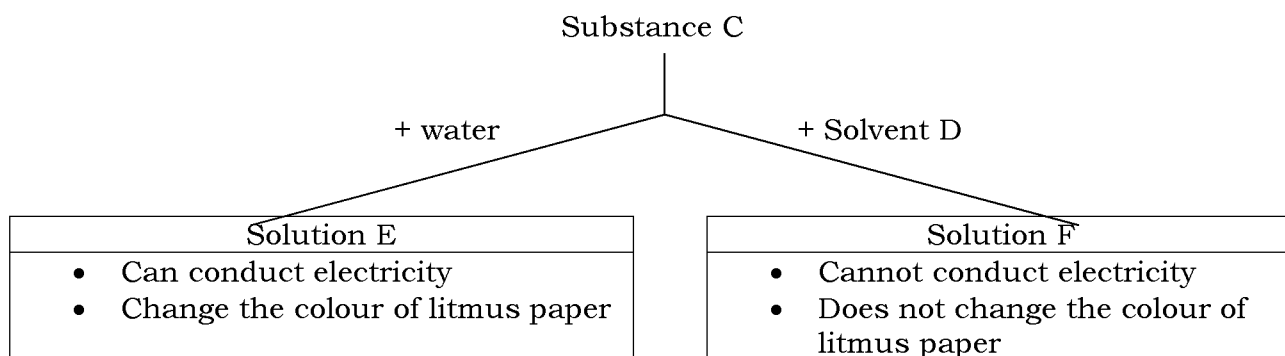


Diagram 10/ Rajah 10

(i). Suggest substance C and solvent D./ Cadangkan bahan C dan pelarut D. [2M]

Bahan C : hidrogen klorida/ asid etanoik glasial

Solution E : Hydrogen chloride, HCl// glacial ethanol acid, CH_3COOH // ammonia

Pelarut D : metil benzena/ [sebarang pelarut organik]

solvent D : methyl benzene// any organic solvent)

(ii). Explain the differences in properties between solution E and solution F. [4M]
 Terangkan perbezaan sifat di antara larutan E dengan larutan F. [4M]

Pelarut E	Pelarut F
1. HCl mengion dalam air <i>HCl ionises in water</i>	1. HCl tidak mengion dalam metil benzena <i>HCl cannot ionise in methyl benzene</i>
2. Menghasilkan ion hidrogen <i>It produce hydrogen ions</i>	2. Ia tidak menghasilkan ion hidrogen <i>It cannot produce hydrogen ion</i>
3. Ion H ⁺ bertanggung jawab menunjukkan sifat asid <i>Hydrogen ion responsible for acidic property</i>	3. Tiada ion bebas bergerak/ molekul neutral tidak boleh mengalirkan elektrik <i>No free moving ions/ neutral molecule cannot conduct electricity</i>
	4. Tiada ion hidrogen, tidak boleh menunjukkan sifat asid <i>No hydrogen ions, cannot show acidic properties</i>

Bab 11 – Sebatian Karbon

[SPM10-07] (a) A hydrocarbon X, consists of 82.75 % of carbon and 17.25 % of hydrogen by mass. The relative molecular mass of X is 58. [RAM : C = 12, H = 1]

Satu hidrokarbon X, terdiri daripada 82.75% karbon dan 17.25% hidrogen berdasarkan jisim. Jisim molekul relatif bagi X ialah 58. [Jisim atom relatif: C = 12; H = 1]

(i) Determine the empirical formula and molecular of hydrocarbon X.

Tentukan formula empirik dan formula molekul bagi hidrokarbon X.

[6M]

Unsur	C	H	
Peratus, %	82.75	17.25	
Jisim (g)	82.75	17.25	
Bilangan mol ATOM	$\frac{82.75}{12} = 6.90$	$\frac{17.25}{1} = 17.25$	<u>Markah 1</u>
Nisbah	$\frac{6.90}{6.90} = 1$	$\frac{17.25}{6.90} = 2.5$	
Nisbah teringkas	1 X 2 = 2	2.5 X 2 = 5	<u>Markah 2</u>

\therefore formula empirik = C_2H_5

Markah 3

Formula molekul [3M]

(formula empirik)ⁿ = 58

$(C_2H_5)_n = 58$

markah ke 4 {jarang diberikan}

$[2(12) + 5(1)]n = 58$

$29n = 58$

$n = 2$

markah ke 5

\therefore formula molekul = C_4H_{10}

Markah ke 6

(ii) Draw the structural formula of the two isomers of hydrocarbon X. Write the names for each isomer. [4M]

Lukis formula struktur bagi dua isomer hidrokarbon X. Tulis nama bagi setiap isomer itu.

<pre> H H H H H - C - C - C - C - H H H H H </pre>	<pre> H H-C-H H H H-C-C-C-H H H H </pre>
Butane	2-Methylpropane

[SPM14-08] (b) Table 5 shows the properties of four organic compounds. Each compound has three carbon atoms per molecule.

Jadual 5 menunjukkan sifat empat sebatian organik. Setiap sebatian mempunyai tiga atom karbon per molekul.

Organic compound <i>Sebatian organik</i>	Properties <i>Sifat</i>
W	Miscible with water in all proportions. Burns with blue flame to form carbon dioxide and water <i>Larut campur dengan air dalam semua bahagian</i> <i>Terbakar dengan nyalaan biru menghasilkan karbon dioksida dan air</i>
X	Soluble in water. Reacts with zinc to produce hydrogen gas. <i>Larut dalam air. Bertindak balas dengan zink menghasilkan gas hidrogen</i>
Y	Insoluble in water. Decolourises the purple colour of acidified potassium manganate (VII) solution. <i>Tidak larut dalam air. Menyahwarnakan warna ungu larutan kalium manganat(VU) berasid.</i>
Z	Insoluble in water. Sweet smell. <i>Tidak larut dalam air. Berbau wangi</i>

Based on Table 5, state the names for the homologous series for compounds W, X, Y and Z.

Berdasarkan Jadual 5, nyatakan nama bagi siri homolog untuk sebatian W, X, Y dan Z.

[4M]

W: alkohol // alcohol

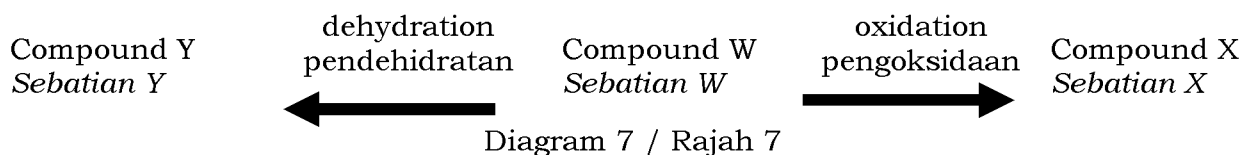
X: asid karbosilik // carbocyclic acid

Y: alkena // alkene

Z: ester // ester

(c) Diagram 7 shows the conversions of organic compound W to compound X and compound Y.

Rajah 7 menunjukkan pertukaran sebatian organik W kepada sebatian X dan sebatian Y.

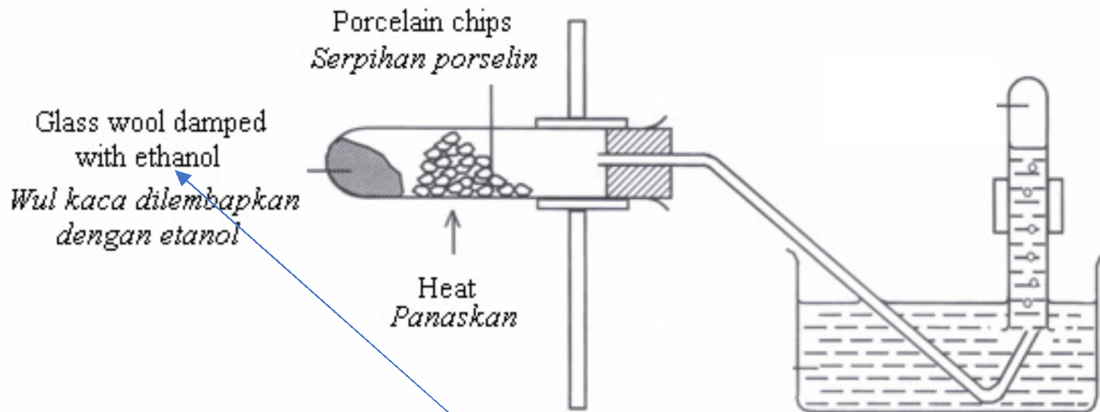


Draw a labelled diagram to show how to prepare and collect compound Y from compound W.

Lukiskan rajah berlabel menunjukkan bagaimana menyediakan dan mengumpul sebatian Y daripada sebatian W.

State the condition and reagent used for the conversion of compound W to compound X and write the chemical equation for the reaction.

Nyatakan keadaan dan reagen yang digunakan bagi penukaran sebatian W kepada sebatian X dan tulis persamaan kimia untuk tindak balas itu. [6M]



Label etanol – tukarkan kepada W

Keadaan/ Condition

Reflux/heat// refluks/ panaskan

Reagent/ reagent

Larutan kalium dikorimat(VI) berasid// larutan kalium manganat(VII) berasid

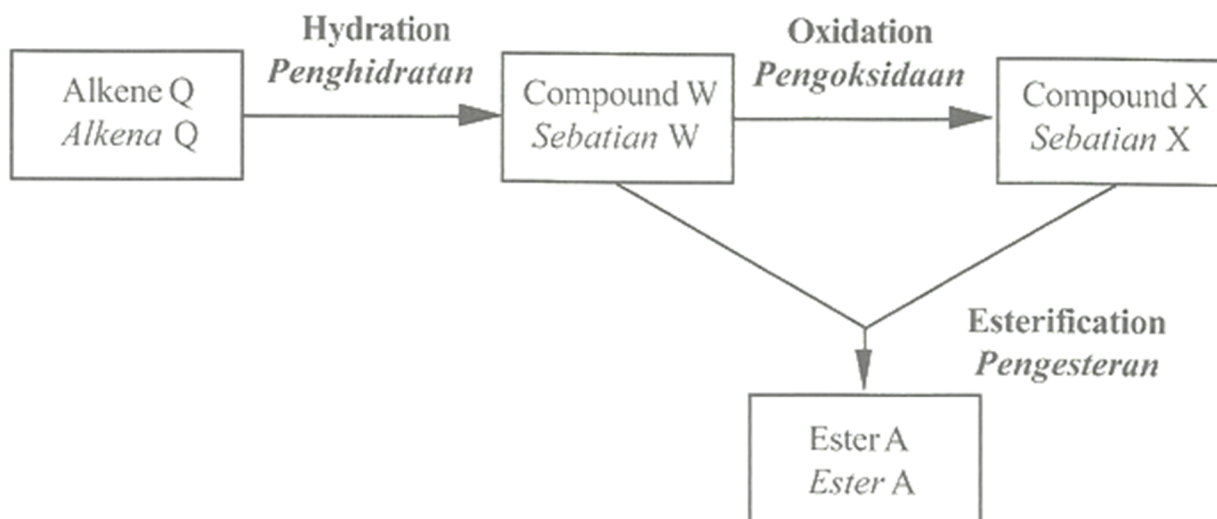
Acidified potassium dichromate(VI) solution// Acidified potassium manganate(VII) solution/

Persamaan seimbang/ balanced equation



[SPM13-09] Rajah 9 menunjukkan penukaran sebatian organik daripada satu siri homolog kepada yang lain.

Diagram 9 shows the conversion of an organic compound from one homologous series to another.



Rajah 9 / Diagram 9

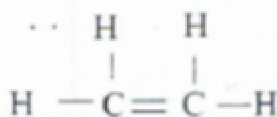
(a) Jisim molekul relatif yang mungkin bagi alkena Q adalah 28, 42 atau 56. Dengan memilih salah satu daripada jisim molekul relatif itu, tentukan formula molekul bagi alkena itu lukiskan formula struktur dan nyatakan nama bagi alkena itu. [Jisim atom relatif: H=1; C=12]

The possible relative molecular masses of alkene Q are 28, 42 or 56. By choosing any one of the relative molecular masses, determine the molecular formula for the alkene draw the structural formula and state the name of the alkene.

[Relative atomic mass: H=1; C=12]

[4M]

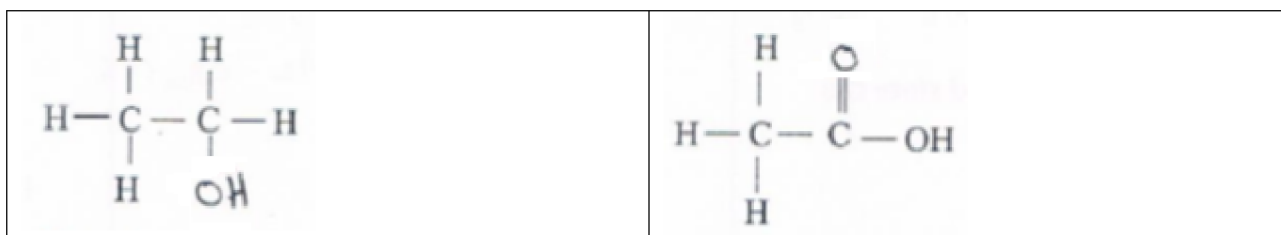
Pengiraan/ calculation $C_nH_{2n} = 28$ $2(12)+2n(1) = 28$ $12n+2n= 28$ $n= 28/14$ $n=2$ Molecular formula// formula molekul = C_2H_4	$C_nH_{2n} = 42$ $n=3$ C_3H_6 $C_nH_{2n} = 56$ $n=4$ C_4H_8
--	--



Etena// ethene

(b) Berdasarkan Rajah 9 dan jawapan yang diperolehi dari 9(a), lukiskan formula struktur dan nyatakan nama sebatian W dan sebatian X. Tuliskan persamaan kimia untuk menunjukkan penukaran sebatian W kepada sebatian X.

Based on Diagram 9 and answer that obtained from 9(a), draw the structural formulae and state the names of compound W and compound X. write the chemical equation to show the conversion of compound W to compound X. [6M]



W: Etanol/ ethanol

X: Asid etanoik/ ethanoic acid

Persamaan/ equation



(c) Dengan menggunakan sebatian W dan sebatian X yang diperoleh di 9(b), huraikan bagaimana ester A boleh disediakan di makmal. Dalam huraian anda, sertakan:
By using compound W and compound X that obtained in 9(b), describe how ester A can be prepared in the laboratory. In your description, include:

- Senarai bahan dan radas/ *List of materials and apparatus/*
- Prosedur/ *Procedure*
- Pemerhatian/ *Observations*
- Persamaan kimia/ *Chemical equation*
- Nama bagi ester A / *Name of ester A*

[10M]

Senarai bahan dan radas/ *List of materials and apparatus/*

etanol, asid etanoik, asid sulfurik, air, tabung didih, kelalang dasar bulat, bikar [bekas yang sesuai]

Ethanol, ethanoic acid, sulphuric acid, water, boiling tube, round bottom flask, beaker [suitable container]

Prosedur/ *Procedure*

1. sukut [2- 50] cm³ etanol tulen // *Measure [2 – 50] cm³ absolute/ pure ethanol*

2. tuang etanol ke dalam tabung didih/kelalang dasar bulat

Pour ethanol into a boiling tube/ round bottom flask

3. sukut [2-50]cm³ asid etanoik glasial // *Measure [2-50] cm³ glacial ethanoic acid*

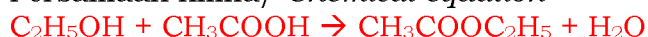
4. tambah asid etanoik kepada etanol // *Add ethanoic acid to ethanol*

5. tambah asid sulfurik pekat // *Add concentrated sulphuric acid*

6. panaskan perlahan-lahan/ refluks campuran // *Heat slowly/ reflux the mixture*

7. tuang campuran ke dalam bikar berisi air, bau harum terhasil

Pour the mixture into a beaker of water, sweet smell produce

Persamaan kimia/ *Chemical equation*Nama bagi ester A / *Name of ester A*

Etil etanoik // *Ethyl ethanoate*

Bab 13 – Termokimia

[SPM12-08] (a) Diagram 8.1 shows the energy level for the reaction between silver nitrate and sodium chloride.

Rajah 8.1 menunjukkan aras tenaga bagi tindak balas antara argentum nitrat dan natrium klorida.

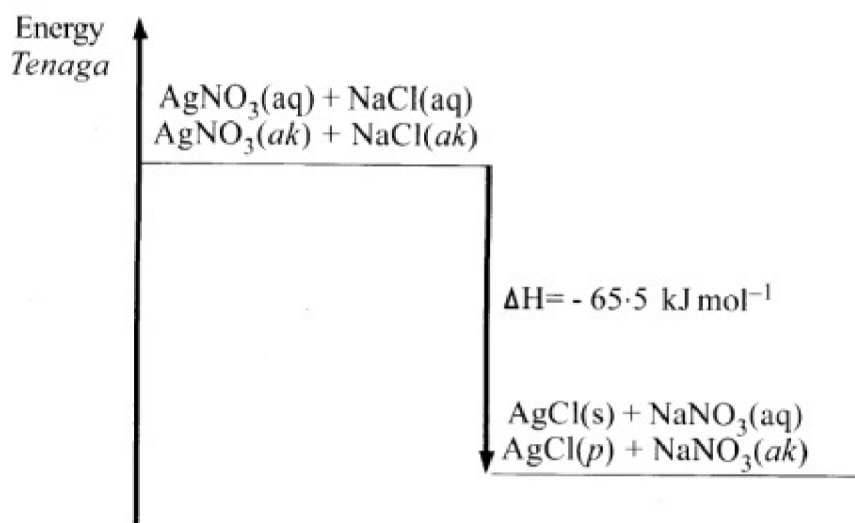


Diagram 8.1 / Rajah 8.1

(i) Write two statements that can be concluded from Diagram 8.1.

Tulis dua pernyataan yang boleh dirumus daripada Rajah 8.1. [2M]

1 tindak balas adalah eksotermik // haba dibebaskan

The reaction is exothermic // heat release // heat releases is small than heat absord

2. 1 mol AgNO_3 bertindak balas dengan 1 mol NaCl untuk membentuk 1 mol AgCl dan 1 mol NaNO_3 , haba dibebaskan ialah 65.5 kJ

1 mol AgNO_3 react with 1 mol NaCl to form 1 mol AgCl and 1 mol NaNO_3 , heat of precipitation 65.5 kJ

3. Kandungan tenaga bagi AgNO_3 dan NaCl / bahan tindak balas lebih tinggi dari kandungan tenaga AgCl dan NaNO_3 / hasil tindak balas

The energy content of AgNO_3 and NaCl / reactant higher than energy content of AgCl and NaNO_3 / products

(ii) If the sodium chloride solution is replaced with potassium chloride solution of the same concentration, predict the heat of precipitation for the reaction. Give one reason for your answer.

Jika larutan natrium klorida digantikan dengan larutan kalium klorida yang sama kepekatan, ramal haba pemendakan bagi tindak balas itu. Beri satu sebab bagi jawapan anda. [2M]

- 65.5 kJ mol⁻¹ // same // same

Ion natrium dan kalium tidak terlibat dalam pemendakan // ion pemerhati

Sodium and potassium ions are not involved in the precipitation // spectator ions

The reaction involve Ag^+ and Cl^- only

Tindak balas hanya melibatkan ion Ag^+ dan Cl^- sahaja

(b) Diagram 8.2 shows the results of three different experiments for the reaction between copper(II) sulphate solution when reacted with excess zinc in experiments I, II and with excess silver in experiment III.

Rajah 8.2 menunjukkan keputusan bagi tiga eksperimen yang berlainan antara larutan kuprum(II) sulfat yang bertindak balas dengan zink berlebihan dalam eksperimen I, II dan dengan argentum berlebihan dalam eksperimen III.

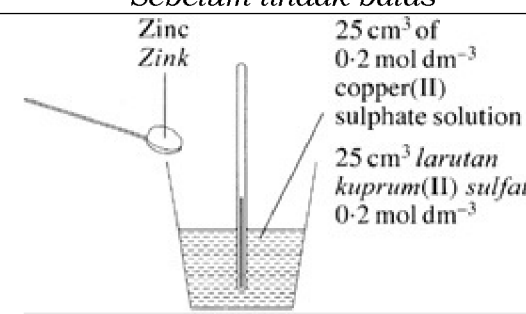
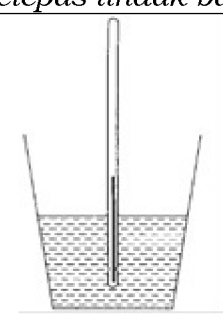
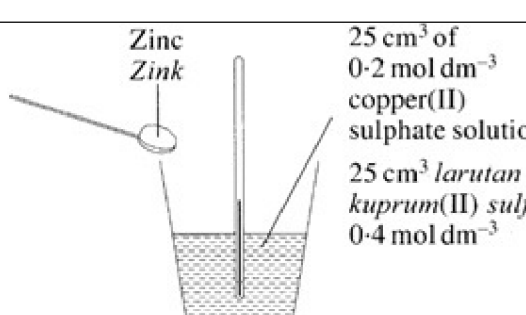
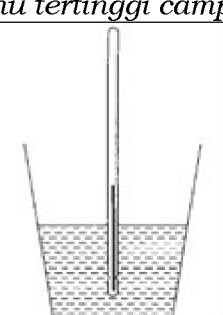
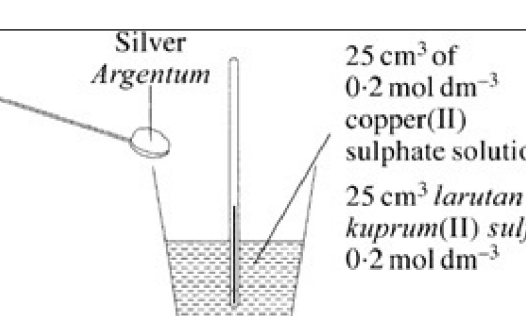
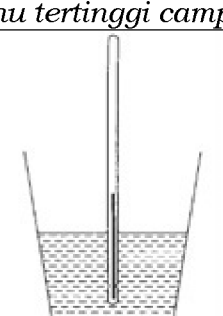
Experiment Eksperimen	Before reaction Sebelum tindak balas	After reaction Selepas tindak balas
I	 <p>25 cm³ of 0.2 mol dm⁻³ copper(II) sulphate solution 25 cm³ larutan kuprum(II) sulfat 0.2 mol dm⁻³</p> <p>Initial temperature = 28.0 °C Suhu awal</p>	 <p>Highest temperature of mixture = 33.0 °C Suhu tertinggi campuran</p>
II	 <p>25 cm³ of 0.4 mol dm⁻³ copper(II) sulphate solution 25 cm³ larutan kuprum(II) sulfat 0.4 mol dm⁻³</p> <p>Initial temperature = 28.0 °C Suhu awal</p>	 <p>Highest temperature of mixture = T₁ °C Suhu tertinggi campuran</p>
III	 <p>25 cm³ of 0.2 mol dm⁻³ copper(II) sulphate solution 25 cm³ larutan kuprum(II) sulfat 0.2 mol dm⁻³</p> <p>Initial temperature : 28.0 °C Suhu awal</p>	 <p>Highest temperature of mixture = T₂ °C Suhu tertinggi campuran</p>

Diagram 8.2 / Rajah 8.2

By comparing, experiments I and II, predict the value of T₁. Explain your answer. experiments I and III, predict the value of T₂. Explain your answer.

Dengan membandingkan, eksperimen I dan II, ramalkan nilai T₁. Terangkan jawapan anda. eksperimen I dan III, ramalkan nilai T₂. Terangkan jawapan anda.

[6M]

Experiment I and Experiment II

1. T1 lebih tinggi// *T1 is higher*

2. kepekatan larutan kuprum(II) sulfat dua kali ganda

The concentration of copper(II) sulphate solution is double/ higher

3 bilangan mol larutan kuprum(II) sulfat yang digunakan dua kali ganda

Number of mole copper(II) sulphate solution used is double

Experiment I and Experiment III

1. 28° C// tidak berubah// sama

No changes// same

2. tindak balas tidak berlaku// argentum tidak dapat menggantikan ion Cu^{2+} dari larutan garamnya// haba tidak dibebaskan

Reaction does not occur// silver cannot displace Cu^{2+} ion from its salt solution// no heat released

3. argentum kurang elektropositif berbanding kuprum

Silver is less electropositive than copper

Suggest another metal that can displace copper ions, Cu^{2+} , in experiment I.

State two observations in the reaction that occurs.

Cadangkan satu logam lain yang dapat menyasarkan ion kuprum, Cu^{2+} dalam eksperimen I. Nyatakan dua pemerhatian dalam tindak balas yang berlaku.

[3M]

Magensium

Pemerhatian// Observation

1. Warna biru larutan kuprum(II) sulfat bertukar kepada tanpa warna

Blue colour copper(II) sulphate solution change to colourless/ green if copper is used

2. pepejal perang terbentuk// *Brown solid is formed*

Calculate the heat of displacement of copper by zinc in experiment I. Write the chemical equation involved.

Hitung haba penyesaran kuprum oleh zink dalam eksperimen I. Tulis persamaan kimia yang terlibat.

[Specific heat capacity of solution is $4.2 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$ and the density of the solution is 1.0 g cm^{-3}]

[Muatan haba tentu larutan ialah $4.2 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$ dan ketumpatan larutan ialah 1.0 g cm^{-3}]

[7M]

1. Perubahan suhu/ *Temperature change = $33 - 28 = 5^\circ\text{C}$*

2. Perubahan haba/ *Heat change = $25 \times 4.2 \times 5\text{J} = 525 \text{ J}$*

3. bilangan mol/ *Number of mole ion $\text{Cu}^{2+} = 0.2 \times 25/1000 = 0.005 \text{ mol}$*

4. $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

5. 0.005 mol ion Cu^{2+} membebaskan 525 J haba

0.005 mol ion Cu^{2+} release 525 J haba

6. Haba penyesaran bagi kuprum// *Heat of displacement of copper*

= $525/ 0.005 \text{ J} = - 105\ 000 \text{ J mol}^{-1} = - 105 \text{ kJ mol}^{-1}$

[SPM10-10] Table 10 shows the heat of neutralisation of two different monoprotic acids, P and Q, with sodium hydroxide solution.

Jadual 10 menunjukkan haba peneutralan bagi dua asid monoprotik yang berlainan, **P** dan **Q**, dengan larutan natrium hidroksida.

Experiment <i>Eksperimen</i>	Reactants <i>Bahan tindak balas</i>	Heat of neutralisation <i>Haba peneutralan</i> (kJ mol ⁻¹)
I	100 cm ³ 1.0 mol dm ⁻³ sodium hydroxide solution + 100 cm ³ 1.0 mol dm ⁻³ of monoprotic acid P <i>100 cm³ larutan natrium hidroksida 1.0 mol dm⁻³ + 100 cm³ asid monoprotik P 1.0 mol dm⁻³</i>	- 55.0
II	100 cm ³ 1.0 mol dm ⁻³ sodium hydroxide solution + 100 cm ³ 1.0 mol dm ⁻³ of monoprotic acid Q <i>100 cm³ larutan natrium hidroksida 1.0 mol dm⁻³ + 100 cm³ asid monoprotik Q 1.0 mol dm⁻³</i>	- 57.0

Table 10 / *Jadual 10*

(a)(i) Based on the information in Table 10, state one example which could be acid P and one which could be acid Q.

Berdasarkan maklumat dalam **Jadual 10**, nyatakan **satu** contoh yang mungkin bagi asid **P** dan **satu** contoh yang mungkin bagi asid **Q**. [2M]

P : methanoic acid / etahonoic acid / propanoic acid
Asid metanoik / asid etanoik / asid propanoik
formula HCOOH, CH₃COOH, CH₃CH₂COOH

Q: hydrochloric acid / nitric acid
Asid hidroklorik / asid nitrik
HCl / HNO₃

(ii) Explain why there is a difference in the values of the heat of neutralisation.

Jelaskan mengapa terdapat perbezaan nilai haba peneutralan itu. [4M]

1. Q is strong acid / **Q adalah asid kuat**

2. P is weak acid / **P adalah asid lemah**

3. Q dissociate completely in water // p dissociate partially in water

Molekul asid Q tercerai dengan lengkap untuk membentuk ion hidrogen dalam air // P tercerai separa lengkap di dalam air

4. some of the heat given out during neutralisation is used by acid P molecules to dissociate completely to form hydrogen ion

Sebahagian daripada haba yang terbebas semasa peneutralan digunakan semula oleh molekul asid P untuk penceraian lengkap bagi membentuk ion hidrogen

(b) Calculate the change in the temperature of the mixture in experiment I.

Hitung perubahan suhu bagi campuran dalam eksperimen I.

[4M]

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

1. Mol asid P/ *mol Acid P* = $MV = (1.0 \times 100)/1000 // 0.1$ [1]

2. Jisim/ *mass* = $100 + 100 // 200$ [2]

3. haba dibebaskan/ *heat released*, $H = 0.1 \times 55000 // 5500$

4. Perubahan suhu/ *temperature change* = $5500/(200 \times 4.2) = 6.5 \text{ }^\circ\text{C} // 6.55^\circ\text{C}$

(c) By using one of the acid in 9(a)(i), describe one experiment to determine the heat of neutralisation. Your answer should consist of the following:

*Dengan menggunakan satu daripada asid dalam 9(a)(i), huraikan **satu** eksperimen untuk menentukan haba peneutralan. Jawapan anda perlu mengandungi perkara berikut:*

- Procedure of the experiment/ Prosedur eksperimen.
- The method to calculate the heat of neutralisation
Kaedah untuk menghitung haba peneutralan.

[10M]

1. Sukat 100 cm^3 1.0 mol dm^{-3} larutan natrium hidroksida/ KOH
Measure 100 cm^3 of sodium hydroxide/ KOH 1.0 mol dm^{-3}

2. Masukkan larutan itu ke dalam cawan plastik/ polistirena
pour the solution into a plastic/ polystyrene cup

3. Catat suhu awal larutan // *record initial temperature of the solution*

4. Sukat 100 cm^3 1.0 mol dm^{-3} asid P // Measure 100 cm^3 of P acid 1.0 mol dm^{-3}

5. Tuangkan larutan itu ke dalam cawan plastik/ polistirena
pour the solution into another plastic/ polystyrene cup

6. Catat suhu awal larutan // *record initial temperature of the solution*

7. Tuangkan asid P dengan cepat ke dalam larutan natrium hidroksida
*pour acid P **quickly** into the sodium hydroxide solution*

8. Kacau campuran // *stir the mixture*

9. Catat suhu tertinggi yang dicapai. // *record the **highest** temperature reached*

Data

10. Initial temperature of acid P/ suhu awal asid P = T1

Initial temperature of NaOH/ suhu awal NaOH = T2

Average Initial temperature/ purata suhu awal = $(T1 + T2)/2 = T_a$

Highest temperature/ Suhu tertinggi = T_b

11. heat given out/ haba di bebaskan = $mc\theta = 200 \times 4.2 \times (T_b - T_a) = XJ$

12. Heat of neutralisation/ haba peneutralan = $- X/0.1 = - \mathbf{G \text{ kJmol}^{-1}}$

Bab 08 – Garam – Penyediaan dan Penghabluran semula

[SPM13-10] (c) Jadual 10.2 menunjukkan tiga bahan yang digunakan untuk menyediakan magnesium sulfat.

Table 10.2 shows three substances used to prepare magnesium sulphate.

Asid sulfurik, H_2SO_4 , Magnesium nitrat, $Mg(NO_3)_2$, Garam karbonat
Sulphuric acid, H_2SO_4 , Magnesium nitrate, $Mg(NO_3)_2$, Carbonate salt

Dengan menggunakan bahan dalam Jadual 10.2, huraikan bagaimana anda menyediakan garam magnesium sulfat dalam makmal. Sertakan persamaan kimia yang terlibat dalam huraian anda.

By using the substances in Table 10.2, describe how to prepare magnesium sulphate salt in the laboratory. Include the chemical equations involved in your description. [10M]

1. Potassium/ sodium/ ammonium carbonate

Kalium/ natrium karbonat/ ammonium karbonat

2. Pour [20-100] cm^3 of [0.1 - 2.0] $mol\ dm^{-3}$ Potassium/ sodium/ ammonium carbonate solution into a 250 cm^3 of beaker.

Campur [20-100] cm^3 larutan kalium karbonat [0.1 - 2.0] $mol\ dm^{-3}$ dan larutan magnesium nitrat dalam bikar

3. Add 100 cm^3 of 1.0 $mol\ dm^{-3}$ magnesium nitrate solution.

Tambah [20-100] cm^3 larutan magnesium nitrat [0.1 - 2.0] $mol\ dm^{-3}$.

4. Filter and rinse // *Turas dan bilas*

5. Add magnesium carbonate until excess into [20 – 100] cm^3 of [0.1-2.0] $mol\ dm^{-3}$ dilute sulphuric acid in a 250 cm^3 beaker.

Tambah magnesium karbonat sehingga berlebihan ke dalam asid sulfurik dalam bikar

6. Filter // *Turas*

7. Heat the solution until saturated // *Panaskan sehingga tepu*

8. cool the solution at the room temperature

Sejuk pada suhu bilik dan turaskan

9 n 10 Equation 1 : $K_2CO_3 + Mg(NO_3)_2 \rightarrow MgCO_3 + 2KNO_3$

11 n 12 : $MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + CO_2 + H_2O$

GOOD LUCK kepada anda semua