2015

Seminar SKOR A+ SPM 2015

KIMIA
Bersama Cikgu Adura

Edisi Jawapan

NAMA : .....

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[MRSM14-09] (a) Diagram 9 shows the apparatus set-up of a voltaic cell using solution T and solution V. The observation is recorded in Table 9.
Rajah 9 menunjukkan susunan radas sel volta menggunakan larutan T dan larutan V. Pemerhatian direkodkan dalam Jadual 9.

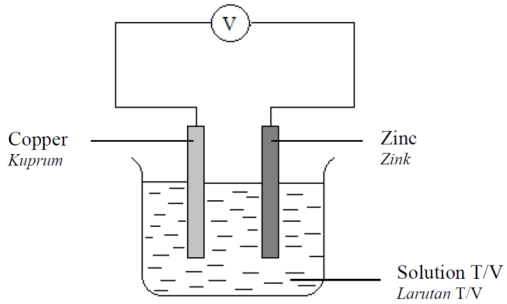


Diagram 9 /*Rajah 9*

Solution ***Larutan***	**Deflection of voltmeter's needle** ***Pesongan jarum voltmeter***
T	Yes /*Ya*
V	No /*Tidak*

Table 9 /*Jadual 9*

(i) Suggest suitable solutions for T and V. Explain the differences in observation for solutions T and V.
Cadangkan larutan T dan V yang sesuai. Terangkan perbezaan dalam pemerhatian bagi larutan T dan V. [4M]

Suggestion Answer/*Cadangan Jawapan*:

(i) T : any soluble ionic compound/ sebarang sebatian ionik yang larut
Example/contoh : Copper(II) nitrate/ *kuprum(II) nitrat*

V : any covalent compound / sebarang sebatian kovalen
Example : Benzene/*Benzena*, **methanol** /*metanol*
Reject : alcohol – this is homologous series.
Tolak : alcohol – ini adalah kumpulan homolog

Explanation /*Penerangan*:
3. T solution contains free moving ion that can conduct electricity
Larutan T mengandungi ion-ion yang bebas bergerak untuk mengkonduksi elektrik

4. V solution exist as molecule, no free moving ion present in the solution.
Larutan V mengandungi molekul, tiada ion-ion bebas di dalam larutan

(ii) Explain the process that occurs in the voltaic cell in Diagram 9 when solution T is used. Your explanation should include the half equations involved.
Terangkan tindak balas yang berlaku di dalam sel volta di Rajah 9 apabila larutan T digunakan. Penerangan anda perlu mengandungi setengah persamaan yang terlibat.
[6M]

Suggestion Answer/*Cadangan Jawapan*:

1. Zinc as negative terminal /*Zink sebagai terminal negatif.*

2. Zinc will be oxidation because zinc lost electron or oxidation number increases from 0 to +2
Zink akan mengalami pengoksidaan kerana zink kehilangan elektron atau berlaku peningkatan nombor pengoksidaan dari 0 kepada +2

3. $Zn \rightarrow Zn^{2+} + 2e$

4. Copper as positive terminal /*Kuprum sebagai terminal positif*

5. **Copper(II) ion** will be reduction because gain electron to form copper metal or decreases oxidation number from +2 to 0.
Ion kuprum(II) akan mengalami penurunan kerana ion kuprum menerima elektron atau berlaku penurunan nombor pengoksidaan dari +2 kepada 0.

6. $Cu^{2+} + 2e \rightarrow Cu$

(b) A standard solution can be prepared using dilution method. Describe how you would prepare 100 cm^3 0.5 mol dm^{-3} sodium hydroxide solution from 2.0 mol dm^{-3} sodium hydroxide solution.
Satu larutan piawai boleh disediakan melalui kaedah pencairan. Huraikan bagaimana anda boleh menyediakan 100 cm^3 larutan natrium hidroksida 0.5 mol dm^{-3} daripada larutan natrium hidroksida 2.0 mol dm^{-3}.

Your description should include the followings:
Penerangan anda perlu mengandungi perkara-perkara berikut:

- List of materials and apparatus /*Senarai bahan dan alat radas*
- Calculation involved /*Pengiraan yang terlibat*
- Procedure /*Prosedur* [10M]

Suggestion answer/ *Cadangan Jawapan:*

1. Material : 2.0 mol dm^{-3} of sodium hydroxide, distil water
Bahan *: 2.0 mol dm^{-3} Natrium hidroksida, air suling*

2. Apparatus : 100 cm^3 Volumetric flask, 25 cm^3 pipet, 250 cm^3 beaker.
Radas *: 100 cm^3 kelalang volumetrik, 25 cm^3 pipet, 250 cm^3 bikar.*

Calculation involved/ *Pengiraan yang terlibat*

$$V_1 = \frac{M_2V_2}{M_1} = \frac{0.5 \times 100}{2.0} = 25\ cm^3$$

Procedure / *Prosedur*
1. Calculate the volume of sodium hydroxide need.
Kira isipadu natrium yang diperlukan

2. Prepare 25 cm^3 of sodium hydroxide by using pipet.
Sediakan 25 cm^3 natrium hidroksida dengan menggunakan pipet.

3. Transfer the sodium hydroxide in the pipet into 100 cm^3 volumetric flask.
Pindahkan natrium hidroksida di dalam pipet ke dalam 100 cm^3 kelalang volumetrik.

4. Add the distil water into the volumetric flask that was filled half full with water.
Tambahkan air suling ke dalam kelalang volumetrik yang telah diisi dengan setengah penuh air.

5. Drop distil water wisely by using the pipet until reach graduation/calibration mark.
Titiskan air suling dengan menggunakan piet sehingga ke tanda senggatan.

6. Close the volumetric flask and shaking the volumetric flask.
Tutup kelalang volumetric dan goncangkan kelalang volumetric.

Gunakan – Teknik ABC – untuk menulis laporan eksperimen
/Used – ABC Technique – to write the laboratory report

Simbol ***/Symbol***	**Maksud** ***/Mean***	**Contoh** ***/Example***
A	Arahan	Masukkan */add/pour* Bersihkan */clean* Timbang */weights* Bakar */Burn*
B	Bahan	Kepingan Magnesium/ magnesium ribbon Larutan kuprum(II) sulfat */Copper(II) sulphate solution* # perlukan MV */need MV* M – Kepekatan */molarity* V- Isipadu */volume* Kertas litmus biru */Blue litmus paper*
C	Container	Bikar [Nyatakan saiz] */beaker [state the size]* Tabung uji */Test Tube* Kelalang kun */Conical Flask* Buret */Burrete*

Contoh menggunakan Teknik ABC
/Example using ABC Technique

	A **Arahan**	**B** **Bahan**	**C** **Container**
1.	Bersihkan *Clean*	pita magnesium *magnesium ribbon*	dengan menggunakan kertas pasir. *by using sand paper.*
2.	Masukkan *Add*	Kertas litmus biru lembab *Wet blue litmus paper*	ke dalam tabung uji. *into the test tube.*
3.	Timbang *Weights*	Pita magnesium *magnesium ribbon*	dengan menggunakan penimbang elektronik *by using weighing balance*
4.	Masukkan *Add*	50 cm^3 Larutan kuprum(II) sulfat 1.0 $moldm^{-3}$ *50 cm^3 of 1.0 $moldm^{-3}$ of copper(II) sulphate solution*	ke dalam kelalang kun *into the conical flask.*

Structure of Atom /Struktur atom

Matter / Jirim

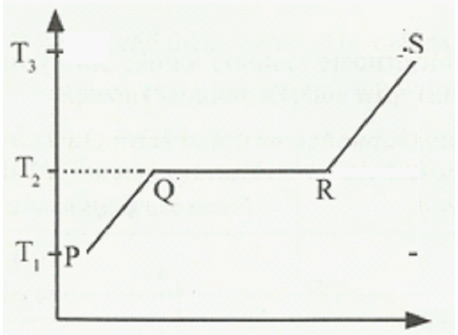
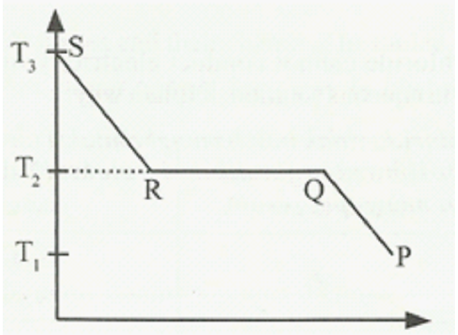
Particles /Zarah

Atom | ion | Molecule/*molekul*

Diffusion /Resapan

1. Tiny and discrete /kecil dan diskrit
2. Move through **medium** /bergerak melalui **medium**
3. From high concentration to low concentration
   /*dari kepekatan tinggi ke kepekatan rendah*

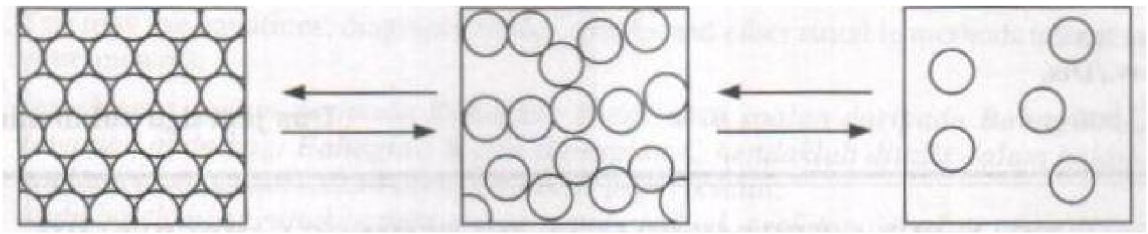
Naphthalene/Acetamide Graph /Graf naftalena/acetamida

	Heating /*Pemanasan*	Cooling /*Penyejukkan*
Graph *Graf*		
Why Constant? *Kenapa malar?*	Heat energy absorb Used to overcome the attractive force between particles (molecule) Tenaga haba diserap Digunakan untuk memutuskan ikatan di antara zarah-zarah (molekul)	Heat energy released Balance by heat released of formation of bond between particles (molecule) Tenaga haba dibebas Diseimbangkan dengan haba yang terbebas semasa pembentukan ikatan di antara zarah-zarah (molekul)
Determine melting/freezing point *Kenalpasti takat didih/ beku*	Look the constant, then point to Y-axis => T_2 Tengok pada yang malar, unjurkan kepada paksi Y => T_2	Look the constant, then point to Y-axis => T_2 Tengok pada yang malar, unjurkan kepada paksi Y => T_2
Physical state *keadaan fizikal*	PQ = Solid /Pepejal QR = Solid and liquid/ Pepejal dan cecair RS = cecair /liquid	SR = cecair /liquid RQ = Solid and liquid/ Pepejal dan cecair QP = Solid /Pepejal

Subatomic/ Zarah sub-atom

Subatomic	Symbol /*Simbol*	Charge/*cas*	Mass /*jisim*
Proton	p	**+1**	1
Electron /*Elektron*	e	**-1**	0
neutron	n	**0/neutral**	1

SPM10-01 *Rajah* 1 *menunjukkan perubahan keadaan tiga jirim,* X, Y *dan* Z *bagi air.*
Diagram 1 shows the inter-conversion of the three states of matter, X, Y and Z of water.



X Y Z

	Freezing		condesation	
Solid		liquid		gas
Pepejal		*cecair*		*gas*
	Melting		boiling	

(a) *Apakah jenis zarah yang terdapat dalam air?*
What type of particle is found is water?

Ada 3 jenis zarah

Iaitu

Atom, ion, molekul

Molekul//molecule
..... [1M]

(b) *Di bawah suhu bilik, pada suhu berapakah ais berubah kepada air?*
Under the room temperature, at what temperature does ice change to water?

Jawapan **MESTI** bersama dengan unit yang **BETUL**

0 °C
..... [1M]

(c) *Apakah keadaan fizikal yang berlabel Z*
What is the physical state labelled Z?

Keadaan fizikal

Adalah

Pepejal, cecair dan gas

gas
…… [1M]

(d) *Namakan proses apabila air berubah daripada keadaan* X *kepada keadaan* Y.
Name the process when water changes from state X to state Y.

X (Pepejal) kepada Y (cecair)

Takat lebur/melting point

SALAH

Sebab soalan tanya proses

Peleburan//Melting
…… [1M]

(e) Apabila air berubah daripada keadaan Y kepada keadaan Z,
nyatakan perubahan bagi:
When water changes from state Y to state Z, state the changes in:

Y (cecair) kepada Z (Gas)

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

Jawapan **MESTI** menunjukkan Perubahan

High

Reject : Strong [Salah term]
High [tidak menunjukkan perubahan

Bertambah// Increases// Higher
..... [1M]

(ii) *Daya tarikan antara zarah-zarah itu*
The forces of attraction between the particles.

Soalan menyatakan **air,**

Sebatian kovalen

Daya tarikan Van der Waals – antara molekul dengan molekul

Strong

Reject : tidak menunjukkan perubahan

Berkurang / weaker
..... [1M]

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

Soalan nak Proses yang terlibat

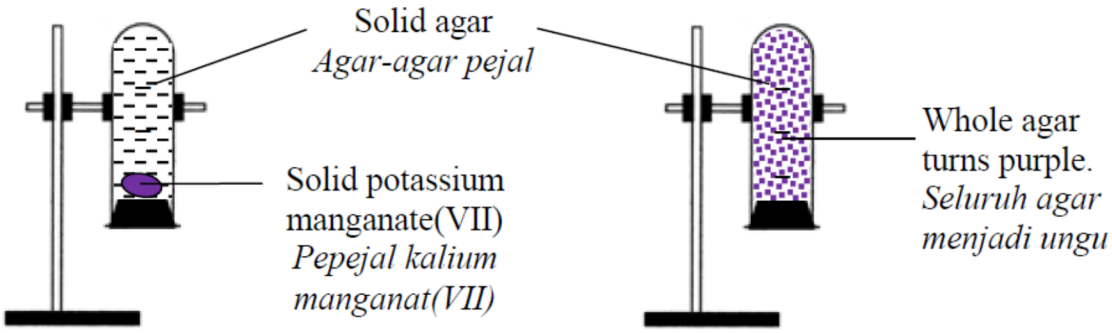
Kemudian terangkan.

Proses : Resapan//diffusion

Penerangan // explanation
1. The curry particles is tiny and discrete
Zarah kari adalah kecil dan diskrit.

2. move in between air particle from high concentration to lower concentration
bergerak di antara zarah-zarah udara dari kepekatan tinggi ke kepekatan rendah
…… [3M]

SBP13-01 (a) Diagram 1 shows the set-up of the apparatus an experiment to study Process I.
Rajah 1 menunjukkan susunan radas bagi satu eksperimen bagi mengkaji Proses I.



(i) Name the process involved in this experiment?
Namakan proses yang terlibat?

Resapan//diffusion
..... [1M]

(ii) State the type of particles present in potassium manganate(VII).
Nyatakan jenis zarah dalam kalium manganat(VII).

Potassium manganate(VII) adalah sebatian

Ionik , maka zarah yang hadir ialah

ion
..... [1M]

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

Berdasarkan teori kinetik jirim

1. The solid potassium manganate particles is tiny and discrete
Zarah pepejal kalium manganate adalah kecil dan diskrit.

2. The particles are constantly moving/vibrate and rotate
Zarah sentiasa bergerak/bergetar dan berputar

3. move in between agar particle from high concentration to lower concentration
bergerak di antara zarah-zarah agar-agar dari kepekatan tinggi ke kepekatan rendah

SPM14-03 (a) Diagram 3 shows standard representation for three isotopes of carbon which are carbon-12, carbon-13 and carbon-14.
Rajah 3 menunjukkan perwakilan piawai bagi tiga isotop karbon iaitu karbon-12, karbon-13 dan karbon-14

$$^{12}_{6}C \qquad ^{13}_{6}C \qquad ^{14}_{6}C$$

(i) What is the meaning of isotope?
Apakah yang dimaksudkan dengan isotop?

Atom of same element,
Atom unsur yang sama

Has same number of proton// proton number
Mempunyai bilangan proton yang sama// nombor proton

Different number of neutron or nucleon number
Berbeza bilangan neutron// nombor nucleon

Reject : number of nucleon// neutron number
..... [1M]

(ii) Determine the number of neutrons in carbon-13.
Tentukan bilangan neutron dalam karbon-13

Nucleon number = proton + neutron

Neutron = nucleon number – proton
= 13 - 6

7
..... [1M]

(iii) State one use of carbon-14 in daily life.
Nyatakan satu kegunaan karbon-14 dalam kehidupan harian

To estimate age of fossil
Menentukan tarikh umur fosil
..... [1M]

(iv) Draw the atomic structure of carbon-12 and label the subatomic particles.
Lukis struktur atom karbon-12 dan label zarah subatomnya.

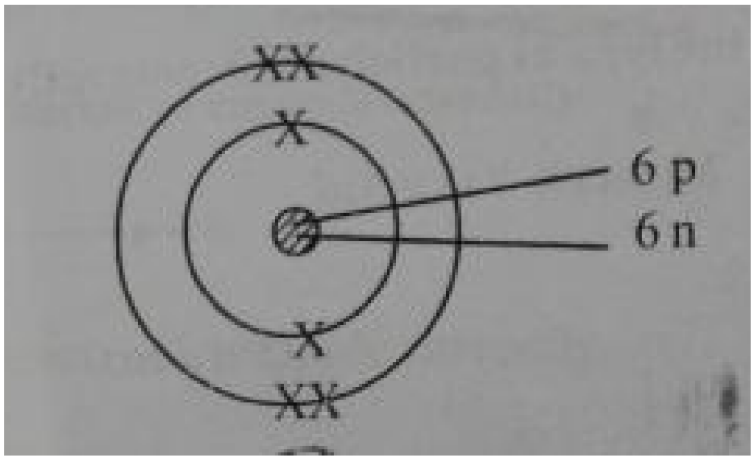
Biasa kita melukis

Susunan electron

Soalan nak sekarang adalah

Atomic structure

Mesti melukis adanya nucleus yang dikelilingi oleh elektron



[2M]

(b) Table 2 shows the physical properties of substance X and substance Y.
Jadual 2 menunjukkan sifat fizik bagi bahan X dan bahan Y.

Substance *Bahan*	Melting point (°C) *Takat lebur (°C)*	Boiling point (°C) *Takat didih (°C)*	Electrical conductivity *Kekonduksian elektrik*	
			Solid /*Pepejal*	Molten /*Leburan*
X	-23	77	Cannot *Tidak boleh*	Cannot / *Tidak boleh*
Y	801	1413	Cannot *Tidak boleh*	Can *Boleh*

Based on Table 2,
Berdasarkan Jadual 2,

	solid	Solid + liquid	liquid	Liquid + gas	gas
Substance *Bahan*		Melting point (°C) *Takat lebur (°C)*		Boiling point (°C) *Takat didih (°C)*	
X		-23	30 liquid	77	
Y	30 solid	801		1413	

(i) what are the physical states of substance X and substance Y at room temperature?
apakah keadaan fizik bagi bahan X dan bahan Y pada suhu bilik?

X: **liquid//cecair**

Y: **pepejal//solid** [2M]

(ii) Explain the difference in melting point of substance X and subtance Y.
T*erangkan perbezaan takat lebur bagi bahan X dan bahan Y*

Substance *Bahan*	Electrical conductivity *Kekonduksian elektrik*		Compound Sebatian
	Solid /*Pepejal*	Molten /*Leburan*	
X	Cannot *Tidak boleh*	Cannot / *Tidak boleh*	kovalen
Y	Cannot *Tidak boleh*	Can *Boleh*	ionik

1. Melting point Y higher than X
Takat lebur Y lebih tinggi daripada X

2. Compound Y has strong electrostatic force compare to X that has weak Van der Waals forces
Sebatian Y mempunyai daya tarikan elektrostatik yang kuat berbanding dengan X yang mempunyai daya tarikan Van der Waals yang lemah.

3. more heat energy needed by Y to overcome the attractive force between its particles
Lebih banyak tenaga haba yang diperlukan oleh Y untuk memutuskan ikatan di zarah-zarahnya
…… [2M]

(iii) state the type of particles in substance X.
Nyatakan jenis zarah dalam bahan X.

X ialah sebatian kovalen,

Maka,

molecule
…… [1M]

SPM2013-01 (a) Table 1 shows four substances and their chemical formulae.
Jadual 1 menunjukkan empat bahan dan formula kimianya.

Substance /Bahan	Chemical formula /Formula Kimia
Argon /Argon	Ar
Bromine /Bromin	Br_2
Napthalene /Naftalena	$C_{10}H_8$
Sodium chloride /Natrium klorida	NaCl

Based on table 1:
Berdasarkan jadual 1:

Substance /Bahan	Chemical formula /Formula Kimia	Zarahnya
Argon /Argon	Ar	atom
Bromine /Bromin	Br_2	Molekul
Napthalene /Naftalena	$C_{10}H_8$	Molekul
Sodium chloride /Natrium klorida	NaCl	ion

(i) State one substance which exists as atom.
Nyatakan satu bahan yang wujud sebagai atom.

Argon
..... [1M]

(ii) which substances has the highest melting point?
Bahan manakah mempunyai takat lebur yang paling tinggi?

Sebatian ion

Sodium chloride /Natrium klorida
..... [1M]

(iii) What is the physical state of bromine at room conditions?
Apakah keadaan fizik bromin pada keadaan bilik?

Sebatian kovalen

Cecair [Ikut buku teks F4 – F & Cl – gas, Br – cecair, I- solid]
..... [1M]

(iv) Sodium chloride cannot conduct electricity in solid state but can conduct electricity in aqueous solution. Explain why.
Natrium klorida tidak boleh mengkonduksi elektrik dalam keadaan pepejal tetapi boleh mengkonduksi elektrik dalam larutan akues. Terangkan mengapa.

1. Sodium chloride in solid, its ion not free to move. Hold by strong electrostatic force.
Natrium klorida di dalam pepejal, tiada ion-ion yang bebas bergerak. Di tarik oleh daya elektrostatik yang kuat

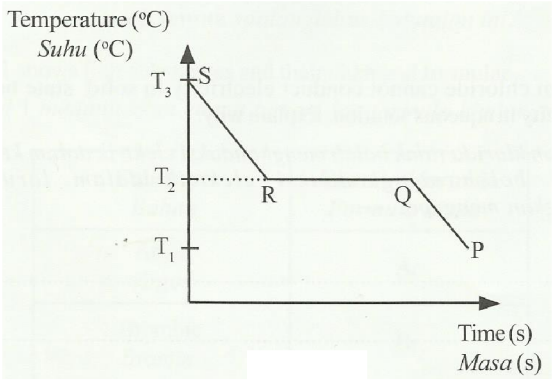
2. in liquid, its ions is free to move
Di dalam cecair, ion-ionnya bebas bergerak.
..... [2M]

(v) Why argon is an unreactive element?
Mengapakah argon adalah unsur yang tidak reaktif? [1M]

Group 18

Already achieve octet electron arrangement
Telah mencapai susunan electron oktet
..... [1M]

(b) Diagram 1 shows the graph of temperature againts time when liquid naphthalene is cooled.
Rajah 1 menunjukkan graf suhu melawan masa apabila cecair naftalene disejukkan.



Berdasarkan graf diatas, 3 soalan lazim yang akan ditanya

1. Takat lebur/ takat beku
2. keadaan fizikal pada graf yang malar
3. penerangan pada graf yang malar

Based on diagram 1
Berdasarkan Rajah 1:

(i) State the freezing point of napthalene.
Nyatakan takat beku bagi naftalena. [1M]

T_2 °C
..... [1M]

(ii) Why there is no change in temperature from R to Q?
Mengapakah tidak terdapat perubahan suhu dari R ke Q? [1M]

Heat released
Haba di bebaskan

Was balance by heat released during the formation of bond between the particles
Diseimbangkan oleh haba yang dibebaskan semasa pembentukkan ikatan di antara zarah-zarah
..... [1M]

(iii) What are the states of matter from R to Q?
Apakah keadaan jirim dari R ke Q? [1M]

Liquid and solid// liquid + solid // cecair dan pepejal

Reject : liquid, solid
..... [1M]

Mole / *Mol*

Definition /Definasi

an amount of substance that contains as many particles as number of atoms in exactly 12 g of carbon-12

sejumlah bahan yang mengandungi sejumlah zarah yang sama dengan tepat dengan 12 g karbon-12

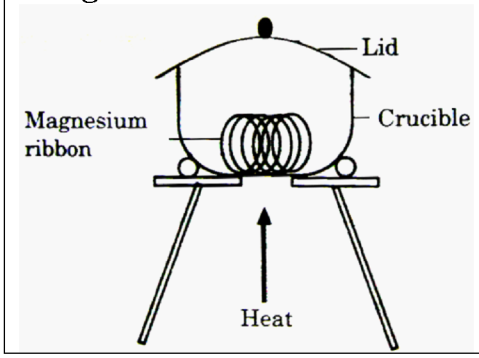
The Mole /Mol

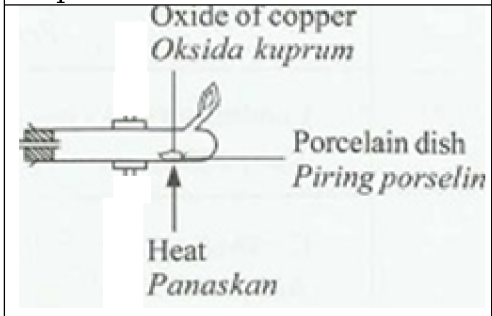
$\text{Mass} = \frac{mass}{Molar\ mass}$	$\text{Mol} = \frac{volume}{Molar\ volume}$	$\text{Mol} = \frac{Number\ of\ particles}{Avagadro\ number}$
Molar mass – has unit $gmol^{-1}$ also equal to atom = JAR molecule = JMR ionic = JFR	Molar volume at STP = 22.4 dm^3mol^{-1} Room temperature = 24 dm^3mol^{-1}	Particles is atom | ion | Molecule Avogadro constant = 6.02×10^{23}

Chemical Formula / *Formula Kimia*

Empirical formula *Formula empirik*	Chemical formula that show the simplest ratio of atom of element in compound *Formula kimia yang menunjukkan nisbah yang paling ringkas bagi atom unsur di dalam sebatian*
Molecular formula *Formula molekul*	Chemical formula that show the actual number of atom of element in molecule *Formula kimia yang menunjukkan bilangan sebenar atom unsur di dalam molekul*

Experiment / *Eksperimen*

Experiment MgO	Precaution
Diargram  	Clean the magnesium ribbon with sand paper to remove **oxide layer** Bersihkan kepingan magnesium dengan kertas pasir untuk membuang lapisan oksida
	Open and close during experiment Open – let oxygen enter to continue combustion Closed – prevent product released Buka dan tutup semasa eksperimen Buka – membenarkan oksigen masuk dan meneruskan pembakaran Tutup – mengelakkan hasil terbebas

Experiment CuO	Precaution
 	Flow hydrogen gas before experiment to remove the air and prevent explosion *Alirkan gas hydrogen sebelum experiment untuk mengeluarkan udara/ gas oksigen dan mengelakkan letupan*
	Flow hydrogen gas after experiment to prevent air /oxygen gas enter the combustion tube and oxide the product back to CuO. Aliran gas hidrogen selepas eksperimen untuk mencegah udara/ gas oksigen masukkan ke dalam tiub pembakaran dan mengoksidakan produk, Cu kembali ke CuO

[SBPTrial14-02] (a) (i) One mole of a substance is defined as the quantity of a substance that contains the same number of particles as in n g of element A.
What are n and A?
Satu mol bahan ditakrifkan sebagai kuantiti bahan yang mengandungi bilangan zarah yang sama seperti yang terdapat dalam n g unsur A.
Apakah n dan A?

n = 12 **A = carbon-12// karbon-12** **2M]**

(ii) What is the number of atoms in 0.5 mole of methane gas, CH_4? [2M]
Berapakah bilangan atom dalam 0.5 mol gas methane, CH_4?
[Avogadro constant = 6.02×10^{23} mol^{-1}] *[Pemalar Avogadro = 6.02×10^{23} mol^{-1}]*

Telah diberikan : 0.5 mol

Soalan nak atom,

Diberikan molekul CH_4

Maka

Ada 1 atom C dan 4 atom H

Maka ada 5 atom yang membentuk CH_4

= $0.5 \times 6.02 \times 10^{23} \times 5$
= 1.505×10^{24} atom

(b) Diagram 2 shows an experiment to determine the empirical formula of magnesium oxide.
Rajah 2 menunjukkan satu eksperimen untuk menentukan formula empirik magnesium oksida.

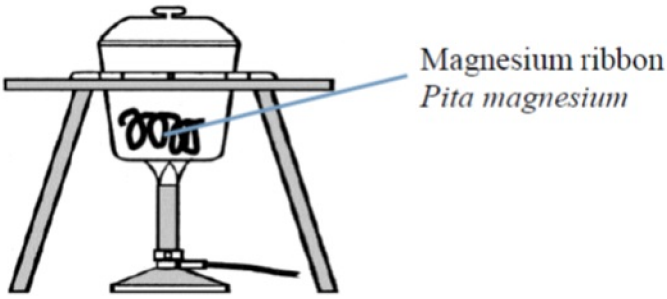


Diagram 2 /*Rajah 2*

(i) When carrying out the experiment, why does the crucible lid need to be opened once a while? [1M]
Semasa menjalankan eksperimen itu, mengapakah penutup mangkuk pijar perlu dibuka sekali sekala?

To let oxygen enter to continue the combnustion
Membenarkan oksigen masuk dan meneruskan pembakaran
.....

(ii) Why this method not suitable to determine the empirical formula of lead(II) oxide?[1M]
Mengapakah kaedah ini tidak sesuai untuk menentukan formula empirik plumbum(II) oksida?

Bila melibatkan pertukaran oksigen atau pembakaran dengan oksigen

Gunalah Siri Kereaktifan

Lead less reactive with oxygen than Magnesium
Plumbum kurang reaktif dengan oksigen berbanding dengan magnesium

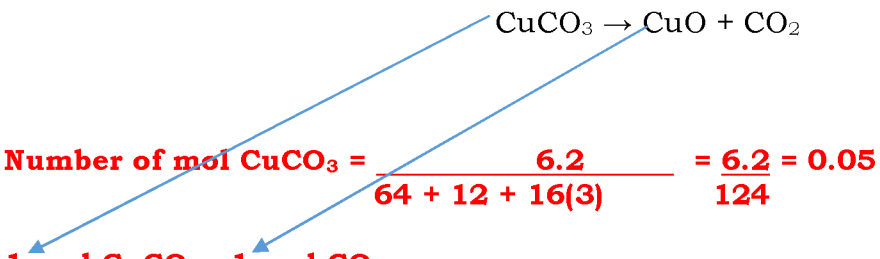
Reject : plumbum(II) oksida
.....

(c) Copper(II) carbonate, $CuCO_3$ is heated strongly to produce copper(II) oxide and carbon dioxide gas. The reaction is given by chemical equation below;
Kuprum(II) karbonat, $CuCO_3$ dipanaskan dengan kuat menghasilkan kuprum(II) oksida dan gas karbon dioksida. Tindakbalas ditunjukkan oleh persamaan kimia di bawah;

$$CuCO_3 \rightarrow CuO + CO_2$$

6.2 g copper(II) carbonate, $CuCO_3$ is heated during an experiment. Calculate the volume of gas released. [3M]
6.2 g kuprum(II) karbonat, $CuCO_3$ di panaskan dalam suatu eksperimen. Hitungkan isipadu gas yang dibebaskan.

[Relative atomic mass: Cu=64; C=12, O=16; 1 mole of gas occupies 24 dm^3 at room conditions]
[Jisim atom relatif: Cu=64; C=12, O=16; 1 mol gas menempati 24 dm^3 pada keadaan bilik]



Number of mol $CuCO_3$ = $\frac{6.2}{64 + 12 + 16(3)}$ = $\frac{6.2}{124}$ = 0.05

1 mol $CuCO_3$: 1 mol CO_2
0.05 mol $CuCO_3$: 0.05 mol CO_2

Volume of CO_2 gas = 0.05 x 24 / 1.2 dm^3

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

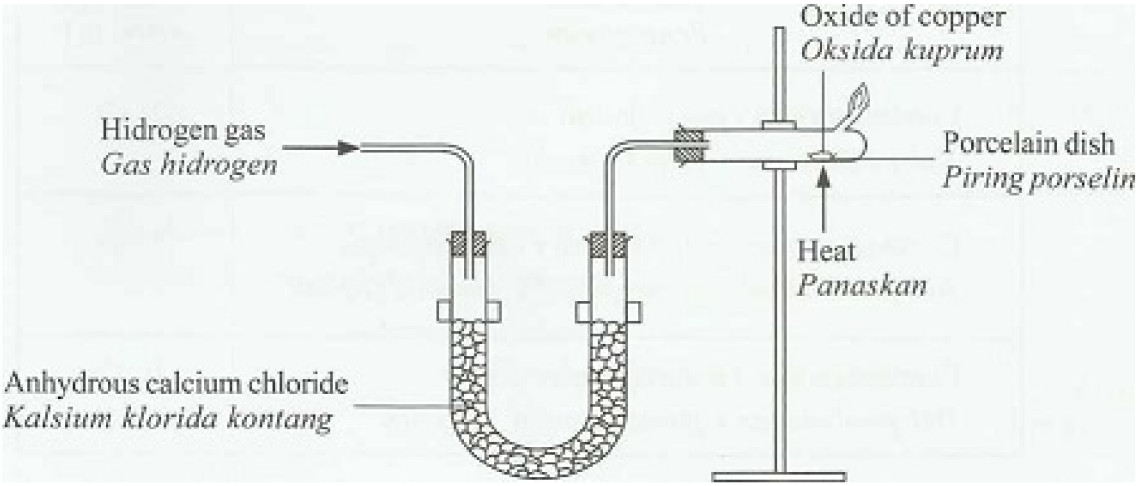


Diagram 2 /*Rajah 2*

(a) State the name of two reactants for the preparation of hydrogen gas. [2M]
Nyatakan nama dua bahan tindak balas bagi penyediaan gas hidrogen.

Tindak balas di antara logam dengan asid kuat

Zinc/magnesium/aluminium // hydrochloric acid/nitric acid/ sulphuric acid
Zink/magnesium/aluminium // asid hidroklorik/asid nitrik/ asid sulfurik
.....

(b) What is the function of anhydrous calcium chloride? [1M]
Apakah fungsi kalsium klorida kontang?

Absorb water vapour// to dry hydrogen gas
Menyerap wap air// mengeringkan gas hidrogen
.....

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

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

Table 1 /*Jadual 1*

Based on Table 1, calculate the empirical formula for the oxide of copper.
Berdasarkan Jadual 1, hitung formula empirik bagi oksida kuprum.

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

Buat jadual

Element/unsur	Cu	O
Mass/jisim (g)	26.52 – 24.60 = 1.92	27.00 – 26.52 = 0.48
Mol	$\frac{1.92}{64}$ = 0.03	$\frac{0.48}{16}$ = 0.03
Ratio	$\frac{0.03}{0.03}$= 1	$\frac{0.03}{0.03}$= 1
Simplest ratio	1	1

Empirical formula/ formula empiric = CuO

[3M]

(d) How do you ensure all oxide of copper is reduced to copper?
Bagaimanakah anda memastikan semua oksida kuprum diturunkan kepada kuprum?

Repeat heating, cooling and weighing until constant reading achieved
Ulang panas, sejuk dan timbang sehingga bacaan malar di capai
..... [1M]

(e)(i) Can the empirical formula for magnesium oxide be determined by using this method?
Bolehkah formula empirik bagi magnesium oksida ditentukan dengan menggunakan kaedah ini?

NO
..... [1M]

(ii) Give one reason for your answer in 2(e)(i).
Berikan satu alasan bagi jawapan anda di 2(e)(i).

Magnesium more reactive with oxygen than hydrogen
Magnesium lebih reaktif dengan oksigen berbanding dengan hidrogen
..... [1M]

Rate of Reaction /*Kadar Tindak balas*

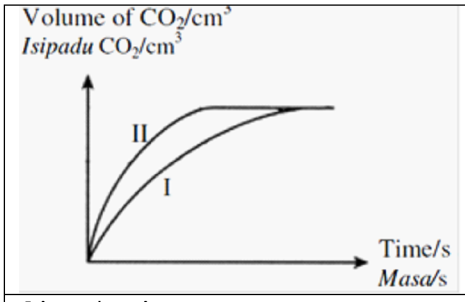
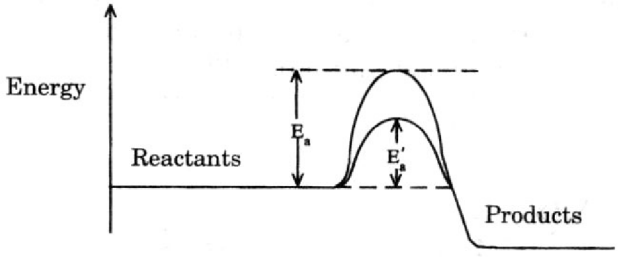
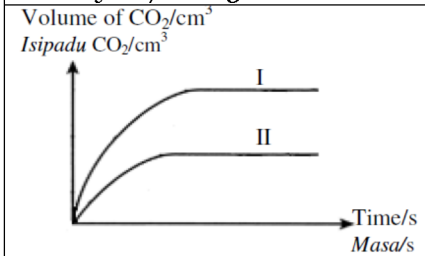
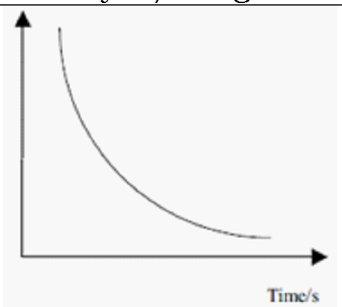
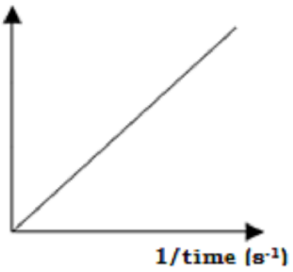
Definition /*Definasi*

- Is a measure how quickly the reaction happen [Text book]
  Mengukur berapa pantas tindak balas berlaku
- The decreases of {reactant} per time taken
  Pengurangan {bahan tindak balas} per masa yang diambil
- The increases of {product} per time taken
  Penambahan {hasil tindak balas} per masa yang diambil

Calculation /*Pengiraan*

Average /*Purata*		*Instantaneous /serta-merta*
overall average rate of reaction /*kadar keseluruhan tindak balas*	***In time*** /*dalam sela masa*	**at** /*pada*
Looked data for the first constant. Divide with the time taken for that data *Lihat pada data yang pertama tetap. Bahagikan dengan masa yang diambil untuk data tersebut.*	Looked data at the requested time, minus the data of one minute earlier/before *Lihat data pada masa yang diminta, tolakkan data seminit sebelumnya.*	Make a graph Then tangent at that time Make the triangle, Calculate the gradient *Buat graf* *kemudian lukiskan tanget pada masa yang diminta* *buatkan segitiga* *kirakan kecerunannya*

Graph /*Graf*

		
Size /*saiz* Catalyst /*mangkin*	Energy profile diagram /Rajah aras tenaga * Catalyst /Mangkin	
		
Concentration /*Kepekatan* * *Product /Hasil*	Concentration /*Kepekatan* Temperature /*Suhu* * Reactant/*Bahan*	Concentration /*Kepekatan* Temperature /*Suhu* * Reactant/*Bahan*

Collision Thoery / *Teori Perlanggaran*

Explanation how the collision theory affected the factor affecting rate of reaction

i. State the factor
ii. Explain how the factor that affect the rate of reaction affected.
iii. The frequency of collisions between particles increase.
iv. The frequency of effective collisions between particles increase.
v. The conclusion. Rate of reaction increase

a. Effect of the size of reactants
1. The size of ..... [exp: Calcium carbonate] is smaller.
2. The **smaller** the **size** of solid reactant, the **larger total surface area** exposed to collision. More particles collide with each other.
3. The frequency of collisions between particles increase.
[must give what particles react with what particles.
Example H+ ion react with CO_3^{2-} ions]
4. The frequency of effective collisions between particles also increases.
5. Rate of reaction increase / higher.

b. Effect of concentration
1. The concentration of ..... [exp: sodium thiosulphate] is higher
2. The **higher the concentration** of solution reactant, the **greater number of particles** per unit volume. More particles collide with each other.
3. The frequency of collisions between particles increase.
[must give what particles react with what particles.
Example H+ ion react with $S_2O_3^{2-}$ ions]
4. The frequency of effective collisions between particles also increases.
5. Rate of reaction increase / higher.

c. Effect of temperature
1. The temperature of ..... [exp: sodium thiosulphate] is higher
2. The **higher the temperature** of solution reaction, the **kinetic energy** of particles **increases**. The particles **move faster**. More particles collide with each other.
3. The frequency of collisions between particles increase.
[must give what particles react with what particles.
Example H+ ion react with $S_2O_3^{2-}$ ions]
4. The frequency of effective collisions between particles also increases.
5. Rate of reaction increase / higher.

d. Effect of catalyst
1. The ..... [exp: Copper(II) sulphate] present
2. The **presence of catalyst**, **alternate the rate of reaction** by **providing an alternative pathway** of reaction **which has lower activation energy**. More particles collide with each other.
3. The frequency of collisions between particles increase.
4. The frequency of effective collisions between particles also increases.
5. Rate of reaction increase / higher.

[SBPTrial14-06] Experiments I, II and III are carried out to investigate the factors affecting the rate of reaction. Table 6.1 shows the reactants and temperature used in each experiment.
Eksperimen I, II dan III dijalankan untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas. *Jadual 6.1 menunjukkan bahan tindak balas dan suhu yang digunakan dalam setiap eksperimen. Experiment*

Experiment *Eksperimen*	Reactants *Bahan tindak balas*	Temperature (°C) Suhu (°C)
I	Excess zinc powder + 25 cm^3 of 0.1 mol dm^{-3} hydrochloric acid *Serbuk zink berlebihan + 25 cm^3 asid hidroklorik 0.1 mol dm^{-3}*	30
II	Excess zinc powder + 25 cm_3 of 0.1 mol dm^{-3} hydrochloric acid *Serbuk zink berlebihan + 25 cm^3 asid hidroklorik 0.1 mol dm^{-3}*	40
III	Excess zinc powder + 25 cm^3 of 0.1 mol dm^{-3} sulphuric acid *Serbuk zink berlebihan + 25 cm^3 asid sulfurik 0.1 mol dm^{-3}*	30

Table 6.1 /*Jadual* 6.1

a) Write the ionic equation for the reaction in Experiment I. [2M]
Tuliskan persamaan ion untuk tindak balas dalam Eksperimen I.

Tulis dulu persamaan penuh

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

Kemudian, potong unsur yang tidak berubah,

$Zn + 2H^+ \rightarrow Zn^{2+} + H_2$
.....

b) Based on the experiments, state two factors that affect the rate of reaction. [2M]
Merujuk kepada eksperimen, nyatakan dua faktor yang mempengaruhi kadar tindak balas.

Exp 1 dan 3 : Kepekatan// concentration
Exp 1 dan 2 : suhu // temperature
.....

(c) Compare the rate of reaction between Experiment I and II. Explain the difference by using collision theory. [4M]
Bandingkan kadar tindak balas antara Eksperimen I dan II. Terangkan perbezaan itu dengan menggunakan teori perlanggaran.

Mesti bagi seperti ini

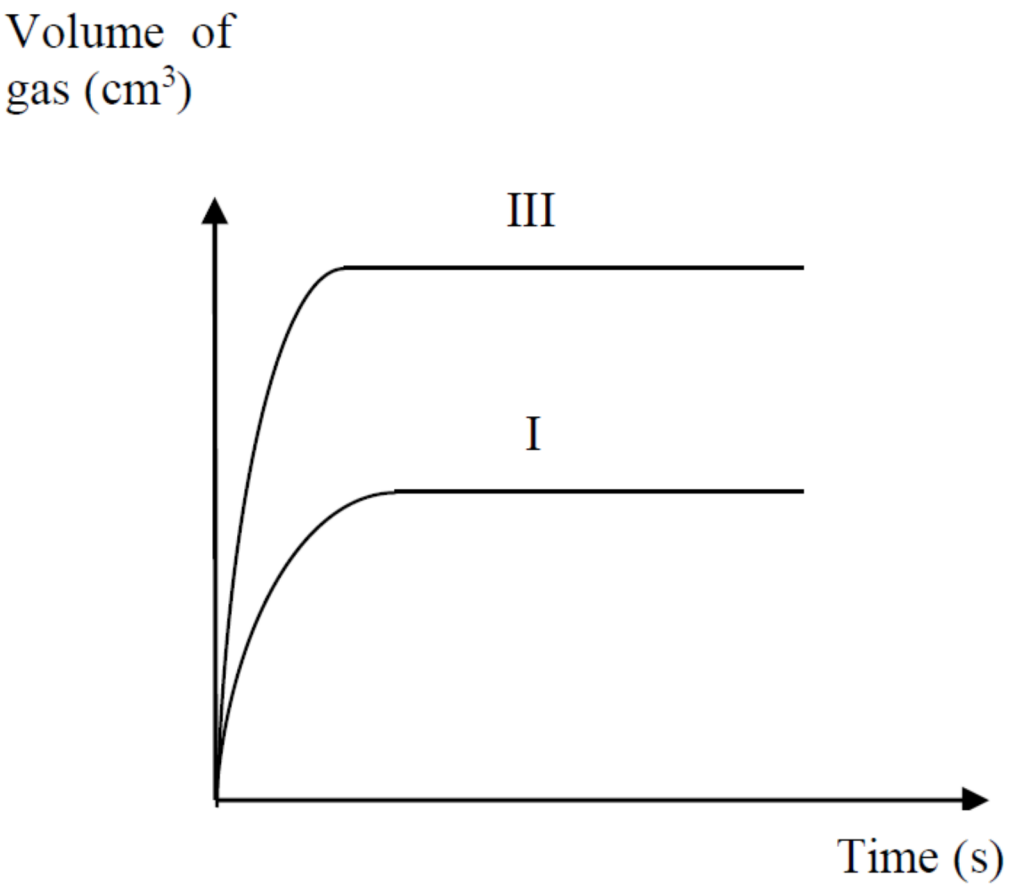
Faktor
Apa factor tu buat
FOC di antara apa dengan apa bertambah/meningkat
FOEC di antara apa dengan apa bertambah/meningkat
Kesimpulan – ROR bertambah

1. Experiment II has higher temperature than experiment 1
2. The particles in experiment II has high kinetic energy
3. Frequency of collision between Zn and H+ ion increases
4. Frequency of effective collision between Zn and H+ ion increases
5. Rate of reaction experiment II is higher than experiment I

1. Eksperimen II mempunyai suhu yang tinggi daripada eksperimen 1
2. zarah-zarah dalam eksperimen II mempunyai tenaga kinetic yang tinggi
3. Bilangan perlanggaran di antara Zn dan ion H+ bertambah
4. Bilangan perlanggaran berkesan di antara Zn dan ion H+ bertambah
5. Kadar tindak balas eksperimen II lebih tinggi daripada eksperimen I

.....

(d) Diagram 6.2 shows the curve of the graph of total volume against time for Experiment I. Sketch the curve obtained for Experiment III on the same axes.
Rajah 6.2 menunjukkan garis lengkung bagi graf jumlah isi padu gas melawan masa bagi Eksperimen I. Lakarkan garis lengkung yang diperolehi bagi Eksperimen III pada paksi yang sama.



- *Correct curve which shows the volume is double*

[1M]

e) During a master chef competition, an apprentice found that a piece of meat is still not tender after cooking for one hour.
Semasa satu pertandingan 'master chef', seorang pelatih mendapati ketulan daging yang dimasak masih tidak lembut selepas satu jam.

State one method that should be taken to make the meat become tender in a shorter time. Explain you answer. [2M]
Nyatakan satu kaedah yang boleh diambil supaya daging itu menjadi lembut dalam masa lebih singkat. Terangkan jawapan anda.

1. Cut the meat into smaller size //potong daging kepada ketulan kecil
2. Larger total surface area of meat will absorb more heat

OR

1. Cook in pressure cooker
2. High pressure in pressure cooker increase the temperature
……

[SPM14-06] 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 cm^3 of 1.0 mol dm^{-3} hydrochloric acid to study the rate of reaction at the temperature of 30 °C.
Rajah 5.1 menunjukkan graf jisim zink melawan masa bagi tindak balas antara zink dan asidhidroklorik. Dalam eksperimen ini, 5.00 g zink ditambahkan kepada 100 cm^3 asid hidroklorik 1.0 mol dm^{-3} untuk mengkaji kadar tindak balas pada suhu 30 °C.

Mass of Zinc (g)/*Jisim zink (g)*

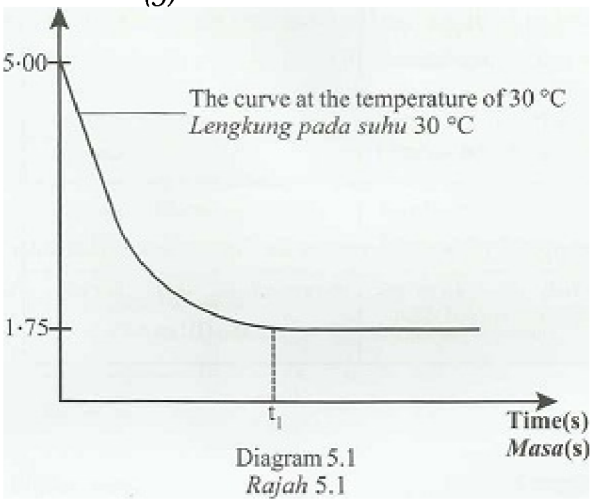


Diagram 5.1
Rajah 5.1

(a) Write the chemical equation for the reaction. [2M]
Tulis persamaan kimia bagi tindak balas ini.

Zn + HCl → $ZnCl_2$ + H_2
……

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

(i) Why is the curve in the graph remains constant after t_1 second? [1M]
mengapakah lengkung bagi graf kekal mendatar selepas t_1 saat?

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

(ii) determine the mass of unreacted zinc in the experiment. [1M]
tentukan jisim zink yang tidak bertindak balas dalam eksperimen itu.

Kira semua mol : Zn dan HCl

Mol Zn = 5/65 = 0.077

Mol HCl = MV/1000 = 1.0 X 100/1000 = 0.1

	1 mol Zn bertindak balas dengan 2 mol HCl	
Used Zn :	0.077	0.077 X 2/1 = 0.154
Used HCl	0.1 X ½ = 0.05	0.1

Mass zinc reacted = mol X mass = 0.05 X 65 = 3.25 g
Mass zinc not reacted = 5 – 3.25 = 1.75 g

Atau

Daripada graf,

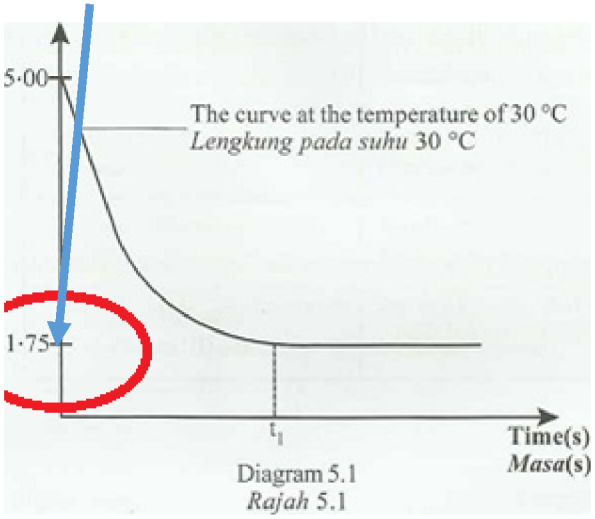
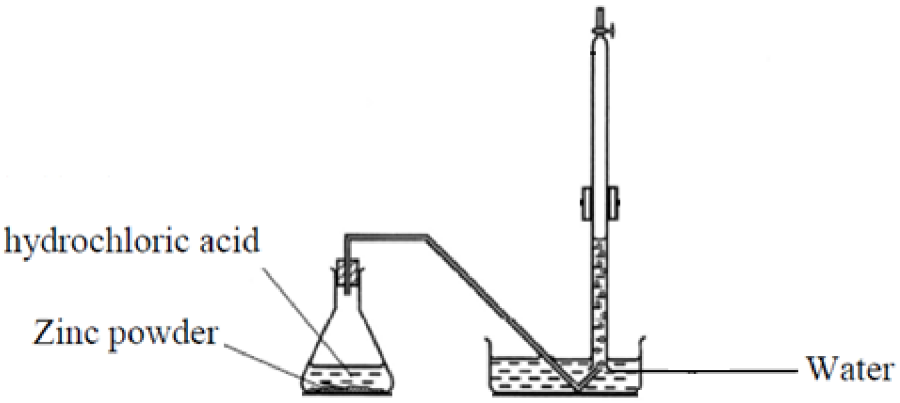


Diagram 5.1
Rajah 5.1

1.75 g

.....

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



[2M]

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

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

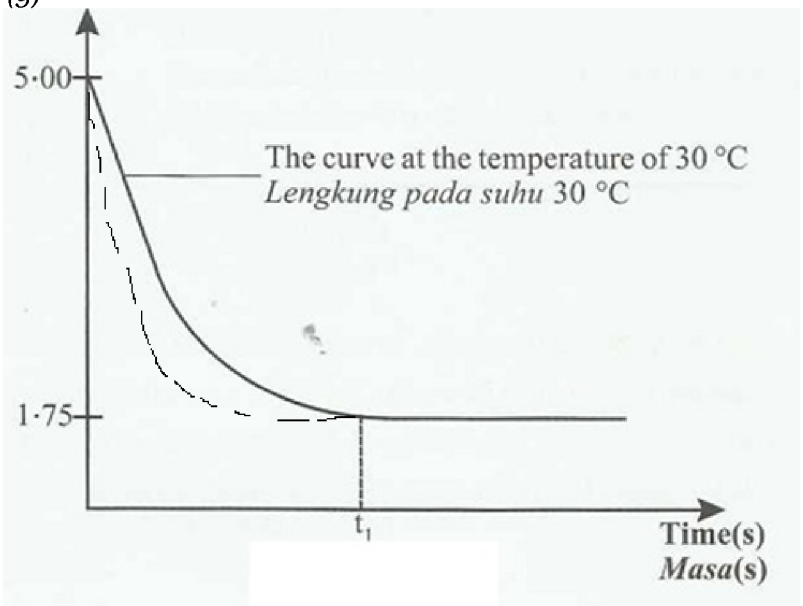


Diagram 5.2
Rajah 5.2

[1M]

(ii) Based on your answer in 6(d)(i), explain how temperature affects the rate of reaction by using collision theory. [3M]
Berdasarkan jawapan anda di 6(d)(i), terangkan bagaimana suhu mempengaruhi kadar tindak balas dengan menggunakan teori perlanggaran.

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

1. Suhu tinggi, menyebabkan kandungan tenaga kinetic 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

.....

(e) Apart from temperature, state one other factor that will also affect the rate of reaction in this experiment. [1M]
Selain daripada suhu, nyatakan satu faktor lain yang juga boleh mempengaruhi kadar tindak balas dalam eksperimen ini.

Size of Zinc// concentration of HCl // Add catalyst ($CuSO_4$)
Saiz zink// kepekatan HCl // penambahan mangkin

.....

[SBPtrial04-05] One experiment to determine heat of precipitate of lead(II) sulphate was done by mix 25 cm^3 of 0.5 mol dm^{-3} lead(II) nitrate solution and 25 cm^3 of 0.5 mol dm^{-1}
V M V M
potassium sulphate solution. The result of the experiment in the table below:

Initial of temperature of lead(II) nitrate	= 28.0 °C
Initial of temperature of potassium sulphate	= 29.0 °C
The higher temperature of mixture	= 33.0 °C

(a) What mean by the heat of precipitate of that reaction. [1M]
Heat change when 1 mol of precipitate /lead(II) sulphate formed from its ion
.....

(b) Write the ionic equation for the reaction. [1M]
Tunjuk dulu
$Pb(NO_3)_2 + K_2SO_4 \rightarrow PbSO_4 + 2KNO_3$
Solid

$Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4$
.....

(c) Calculate the number of mol of lead(II) ions and sulphate ions that exist in every solution. [2M]

(i) Lead(II) ions

Mol lead(II) ion = mol $Pb(NO_3)_2$
= MV/1000
= 0.5 X 25/1000
= 0.0125 mol

(II) Sulphate ions
Mol sulphate ion = mol K_2SO_4
= MV/1000
= 0.5 X 25/1000
= 0.0125 mol

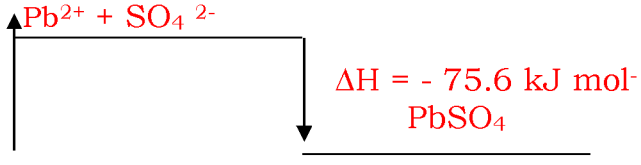
(d) Calculate the change of heat in the experiment. [2M]
[specific heat capacity of the solution=4.2 $Jg^{-1}°C^{-1}$]

Q= mcθ
= [25 + 25] x 4.2 X [33.0 – (28.0 + 29.0)/2]
= 50 X 4.2 X 4.5
= 945 J
= 0.945 kJ

(e) Calculate the heat of precipitate of this reaction. [2M]

ΔH = Q/ mole, n
= 0.945/ 0.0125
= - 75.6 kJ mol^{-1}

(f) Draw the energy level diagram for the reaction. [2M]
Energy



[SBPTrial13-04] Diagram 4 shows the apparatus set-up for an experiment to determine the heat of displacement.
Rajah 4 menunjukkan susunan radas bagi satu eksperimen untuk menentukan haba penyesaran.

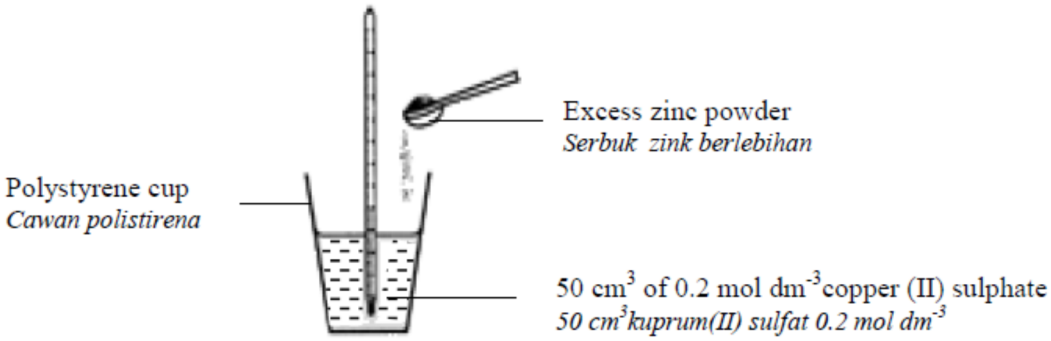


Diagram 4 *Rajah 4*

Based on the experiment,
Berdasarkan eksperimen di atas,

(a) State the meaning of heat of displacement.
Nyatakan maksud haba penyesaran.
Heat change when 1 mol of copper was displace from opper(II) sulphate by zinc that more electropositive metal
.....

[1M]

(b) Give one reason why polystyrene cup is used in the experiment.
Berikan satu sebab mengapa cawan polistirena digunakan dalam eksperimen ini.
Polystyrene is a heat insulator / / to reduce heat loss to surroundings
.....

[1M]

(c) The thermochemical equation below represents the displacement reaction.
Persamaan termokimia di bawah mewakili tindak balas penyesaran itu.

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu \; ; \Delta H = -210 \text{ kJ mol}^{-1}$$

Calculate / *Hitung:*

(i) the number of moles of copper(II) ion.
bilangan mol ion kuprum.

No of moles of Copper(II) ion = $\frac{0.2 \times 50}{1000}$ // 0.01 mol

[1M]

(ii) the heat released during the reaction.
haba yang dibebaskan semasa tindak balas.

Q = 210 000 x 0.01
= 2100 J

1. 1 mol of Cu is displaced produce 210 kJ heat

2. 0.01 mol of Cu = 0.01 x 210 kJ
// 2.1 kJ / 2100 J

[2M]

(iii) the **change of temperature** in the experiment.
[Specific heat capacity of solution = 4.2 J g-1°C-1; Density of solution = 1 gcm-3]
Perubahan suhu dalam eksperimen ini.
[Muatan haba tentu larutan = 4.2 J g-1°C-1; Ketumpatan larutan =1 gcm-3]

Q = mcθ

θ = Q/mc = 2100/[50 x 4.2] = 10 C

2100 J = 50 x 4.2 x θ // θ = 10 °C

[1M]

(d) The experiment is repeated using magnesium powder to replace zinc powder. The volume and concentration of copper (II) sulphate used is remained the same.
Eksperimen diulang dengan menggunakan serbuk magnesium menggantikan serbuk zink. Isi padu dan larutan kuprum(II) sulfat yang digunakan adalah sama.

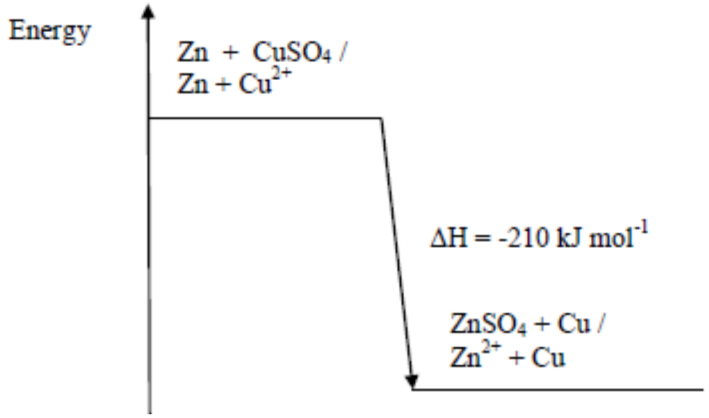
(i) Predict the heat of displacement for the reaction.
Ramalkan haba penyesaran bagi tindak balas itu.
More than -210 kJ mol-1 / Higher / Increases
……

[1M]

(ii) Give a reason for your answer in 4(d)(i).
Beri sebab bagi jawapan di 4(d(i).
Magnesium is more electropositive than zinc // magnesium is higher than zinc in electrochemical series // distance between Mg – Cu is further than Zn-Cu in electrochemical series
……

[1M]

(e) Draw the energy level diagram for the reaction.
Lukis gambar rajah aras tenaga bagi tindak balas ini.



1. Label energy and diagram has 2 different energy levels for exothermic reaction
2. Balanced chemical / ionic equation, ΔH is written

[2M]

[SBPTrial15-06] Table 6 shows the heats of combustion of some common fuels.
Jadual 6 menunjukkan haba pembakaran beberapa bahan api yang biasa digunakan.

Fuel / *Bahan api*	Heat of combustion (kJ mol^{-1}) Haba pembakaran (kJ mol^{-1})
Methane / *Metana*	-890
Propane / *Propana*	-2 230
Ethanol / *Etanol*	-1 376
Propanol / *Propanol*	-2 016

Table 6 / *Jadual 6*

(a) The combustion of the fuels is an exothermic reaction. What is meant by exothermic reaction?
Pembakaran bahan api adalah tindak balas eksotermik. Apakah yang dimaksudkan dengan tindak balas eksotermik? [1M]
Reaction that gives out / released heat to the surroundings.

(b) Diagram 6 shows the energy profile for the combustion of ethanol.
Rajah 6 menunjukkan profil tenaga bagi pembakaran etanol.

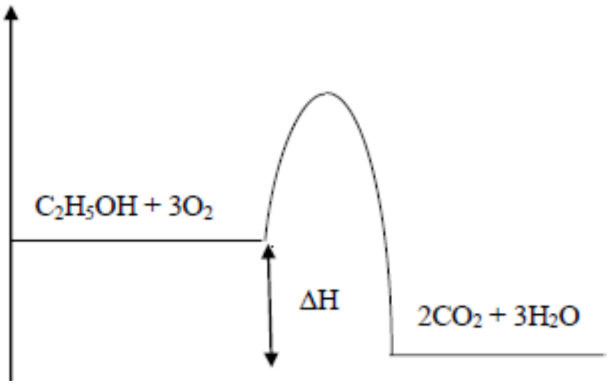


Diagram 6 / *Rajah 6*

Mark ΔH for the reaction in Diagram 6.
Tandakan ΔH bagi tindak balas itu dalam Rajah 6. [1M]

(c) (i)Compare the heat of combustion of methane and propane. [1M]
Bandingkan haba pembakaran metana dan propana.
Heat of combustion of propane is higher than methane
……

(ii) Explain your answer in (c)(i). / *Terangkan jawapan anda di (c)(i)* [3M]
1. The number of carbon atom per molecule propane is higher
2. The More carbon dioxide / water produced when propane is burnt
3. More heat energy released
……

(d) Calculate the fuel value of propanol. / *Hitungkan nilai bahan api bagi propanol.* [2M]
[Molar mass of propanol, C3H7OH = 60 g mol^{-1}]
[Jisim Molar propanol, C3H7OH = 60 g mol^{-1}]
Molar mass of propanol, C3H7OH = 60 g mol-1
60 g of C3H7OH burnt released 2016 kJ //
1 g C3H7OH burnt released 1 x 2016 kJ
60
= 33.6 kJ g-1
(correct answer with correct unit)

(e) During a football game, a player found that his knee was swollen after being hit by the opponent player.
Semasa perlawanan bola sepak, seorang pemain mendapati lututnya bengkak selepas berlanggar dengan pemain lawan.

A physiotherapy put ice cubes on his knee to relieve the pain. As a chemistry student, suggest another method to help the player. Explain how the method you choose will help the player. [3M]
Seorang ahli fisioterapi meletakkan ketulan ais pada lutut pemain itu untuk mengurangkan kesakitan. Sebagai seorang pelajar kimia, cadangkan kaedah lain untuk membantu pemain itu. Terangkan bagaimana kaedah yang dipilih dapat membantu pemain itu.

1. place the cold packs on his swollen knee
2. to absorbs heat from his swollen knee
3. constrict blood vessels and slows down blood flow / reduce the formation of fluid in the affected area.
……

02 Structure / Struktur {Paper / *Kertas* 02}

[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.

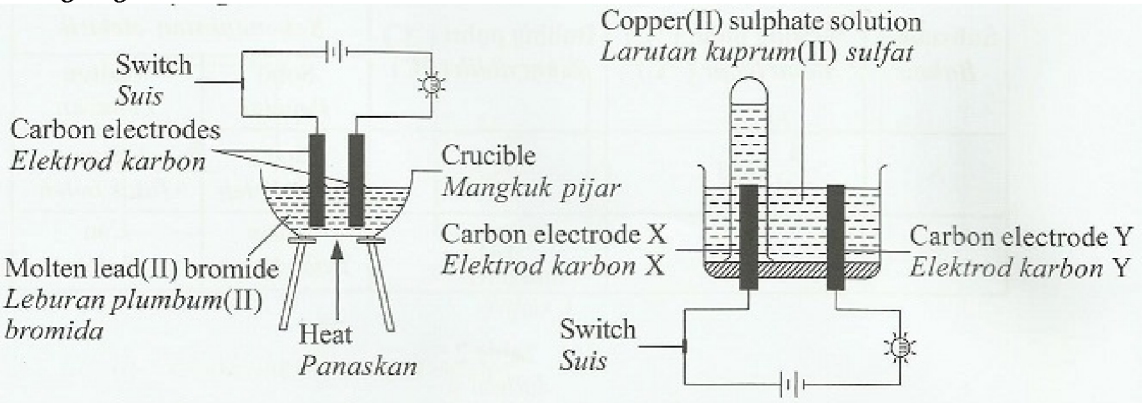


Diagram 4.1
Rajah 4.1

Diagram 4.2
Rajah 4.2

(a) State the meaning of electrolyte.
Chemical substance that can conducts electricity in molten or aqueous solution
..... [1M]

(b) Based on Diagram 4.1,
(i) Why does the bulb light up when molten lead(II) bromide is used as electrolyte?
Contains free moving ion
..... [1M]

(ii) Write all the formulae for the ions present in lead(II) bromide.
Pb^{2+} and Br^- Sebab molten
..... [1M]

(iii) State the observation at cathode.
Grey solid deposited Sebab logam Pb yang terhasil
..... [1M]

(iv) Write the half equation at cathode.
$Pb^{2+} + 2e \rightarrow Pb$
..... [1M]

Based on Diagram 4.2,
(i) State which electrode is anode?
Carbon electrode X
..... [1M]

(ii) State the observation at the anode.
Bubbles gas released Sebab factor kedudukan dan ion OH- yang terpilih
..... [1M]

(iii) Write the half equation at the anode.
$4OH^- \rightarrow 2H_2O + O_2 + 4e$
..... [1M]

(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.

Copper electrode became thinner.

Copper electrode dissolves// Copper electrode produce copper(II) ion

…… [2M]

[SPM13-04] Diagram 4 shows the apparatus set-up for the electrolysis of sodium nitrate solution using carbon electrodes.
Rajah 4 menunjukkan susunan radas untuk elektrolisis larutan natrium nitrat dengan menggunakan elektrod karbon.

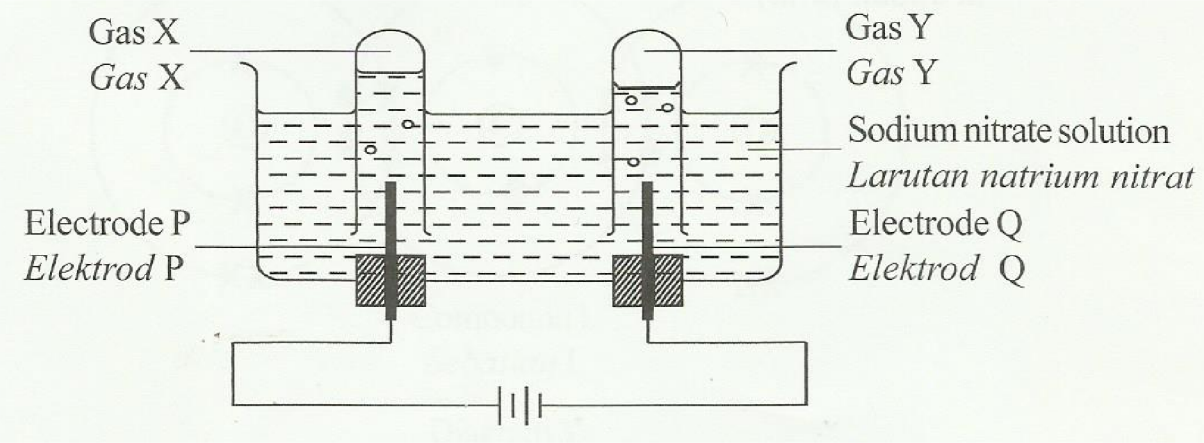


Diagram 4 /Rajah 4

Write the formulae of all the ions present in sodium nitrate solution.
Na^+, NO_3^- , H^+ , OH^-
..... [1M]

(b) Electrode Q acts as cathode.
(i) What is the meaning of cathode?
Negative Terminal
..... [1M]

(ii) What is gas Y? [1M]
Hydrogen gas
..... [1M]

Explain your answer in 4(b)(ii) in term of selective discharge of ions.
H^+ ion is less electropositive than Na^+ ion.
H+ ion receive electron to produce hydrogen atom
2 hydrogen atom combine and produce hydrogen molecules
..... [2M]

(c) Gas X is collected at the anode. Gas X can rekindle a glowing splinter.
Write the half-equation for the reaction at the anode.
$4OH^- \rightarrow 2H_2O + O_2 + 4e$
..... [1M]

(d) Rosli discovers his key which is made up of iron has rusted. By using the knowledge on electrolysis, describe briefly how he solves the problem.
By using electroplating method

Iron key will be connected to negative terminal of battery by using connecting wires
Silver electrode will be connected to positive terminal of battery by using connecting wires
Dip iron key and silver electrode into silver nitrate solution for 20 minute

Ceritakan bagaimana nak buat eksperimen
..... [3M]

[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.

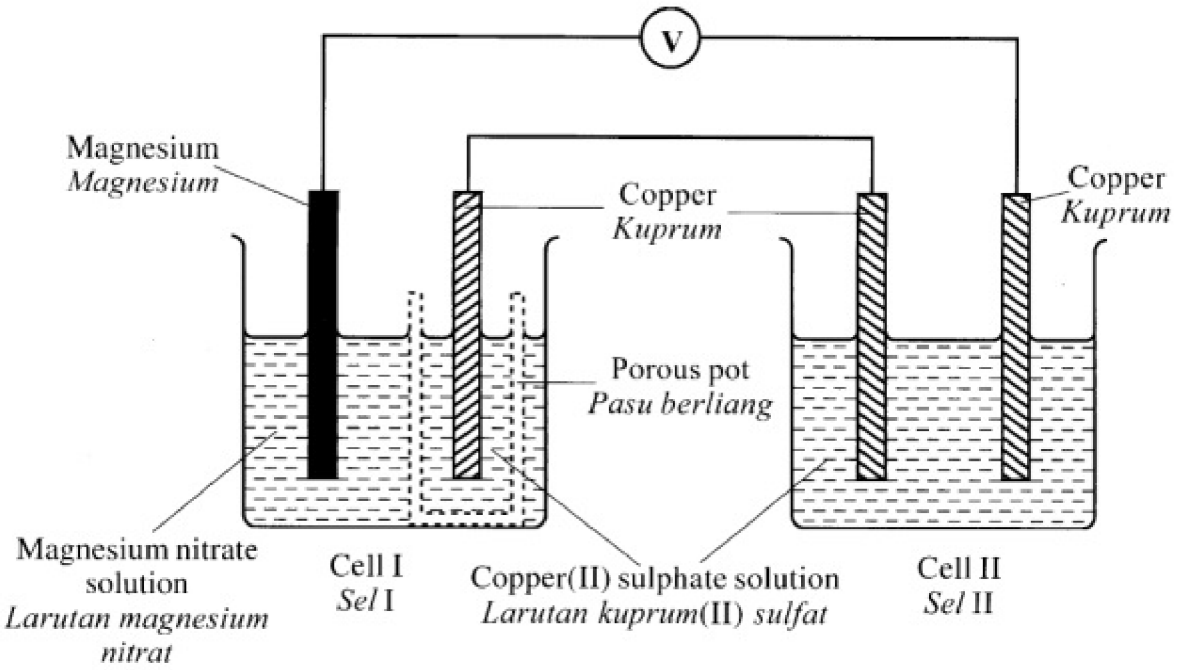


Diagram 6 / *Rajah 6*

(a) State all the ions present in the copper(II) sulphate solution.
Cu^{2+} , SO_4^{2-}, H^+ , OH^-

State - Boleh bagi nama atau formula
.....[1M]

(b) State the negative terminal in cell I.
Magnesium

Sebab – Mg higher than Cu in ECS
.....[1M]

(c) After twenty minutes,

(i) State the observation at magnesium electrode in cell I.
Magnesium became thinner
.....[1M]

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

Magnesium electrode : **$Mg \rightarrow Mg^{2+} + 2e$**

Copper electrode : **$Cu^{2+} + 2e \rightarrow Cu$** [2M]

(d) State the change in colour of copper(II) sulphate solution in cell I and cell II.

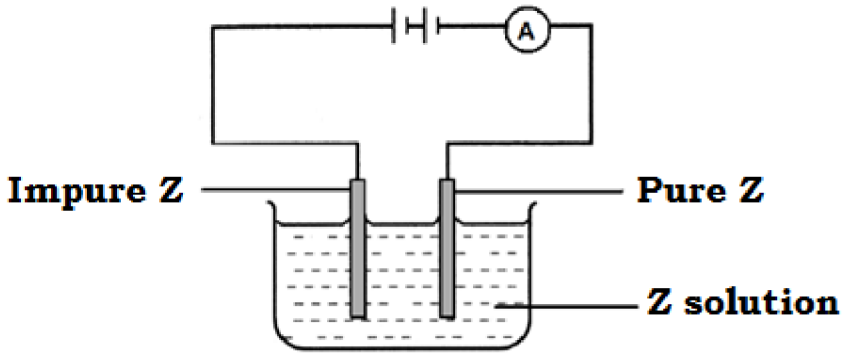
Cell I : **Blue $CuSO_4$ turn to colourless**

Cell II : **Blue $CuSO_4$ unchanged // remain blue** [2M]

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

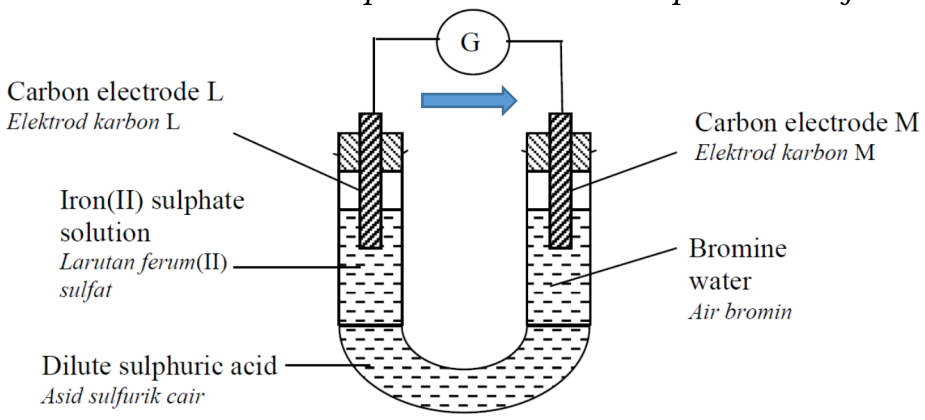
(i) State the method used to purify the metal Z.
Purification of metal
.....[1M]

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



Lukis dan berfungsi – 1 Markah
Label - 1 Markah

[MSRM14-06] Diagram 6 shows the apparatus set- up to investigate the reaction between iron(II) sulphate solution and bromine water through the transfer of electrons at a distance.
Rajah 6 menunjukkan susunan radas untuk mengkaji tindak balas antara larutan ferum(II) sulfat dan air bromin melalui pemindahan elektron pada suatu jarak.



(a) What is the function of dilute sulphuric acid?
Apakah fungsi asid sulfurik cair?
To allow the **movement of ions to complete the circuit**
..... [1M]

(b) Show the direction of electron flow in Diagram 6.
Tunjukkan arah pengaliran elektron dalam Rajah 6. [1M]
Shown in the diagram (from electrode L to electrode M through external circuit).
[r: answers in words]

(c) Referring to the reaction that take place at electrode L:
Merujuk pada tindak balas yang berlaku di elektrod L:

(i) Name the product formed.
Namakan hasil tindak balas yang terbentuk.
Iron(III) ion / Ferum(III) ion / Iron(III) sulphate
[r: formula]
..... [1M]

(ii) Describe a chemical test to determine the product formed in (c)(i).
Huraikan ujian kimia untuk mengesahkan produk yang terhasil dalam (c)(i).
Alternative 1
1. Add sodium hydroxide/ammonia solution into test tube contains solution.
2. Brown precipitate is formed.

Alternative 2
1. Add potassium hexacyanoferrate(II) solution into test tube contains solution.
2. Dark blue precipitate is formed.

Alternative 3
1. Add potassium thiocyanate solution into test tube contains solution.
2. Blood red colouration is formed.
..... [2M]

(d) Write the half equation for the reaction that takes place at electrode M.
Tuliskan setengah persamaan bagi tindak balas yang berlaku di elektrod M.
$Br_2 + 2e \rightarrow 2Br^-$
..... [1M]

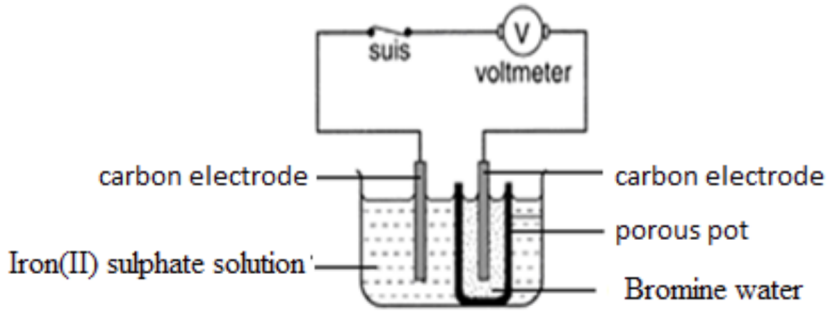
(e) The experiment is repeated by replacing bromine water with acidified potassium dichromate(VI) solution. Predict the observation at electrode M and explain your answer.
Eksperimen diulangi dengan menggantikan air bromin dengan larutan kalium dikromat(VI) berasid. Ramalkan pemerhatian pada elektrod M dan terangkan jawapan anda.

1. Orange solution turns green
2. $Cr_2O_7^{2-}$ ion undergoes reduction to form Cr^{3+} ion

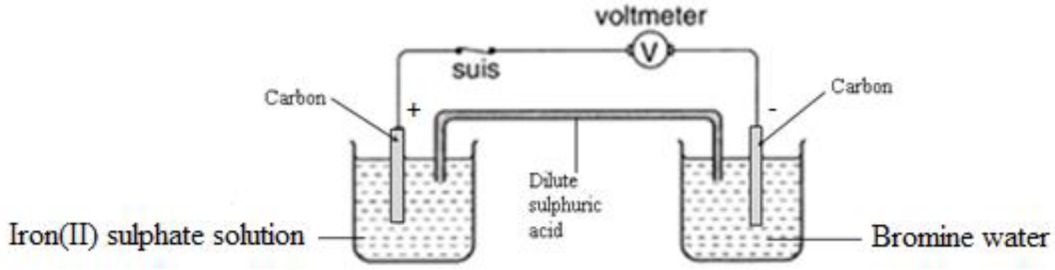
.....

[2M]

(f) Without using U Tube, draw another apparatus set up to investigate the transfer of electron at a distance, using the same materials as in Diagram 6. Mark in the diagram the positive and negative terminal of the cell.
Tanpa menggunakan Tiub U , lukiskan susunan radas lain untuk mengkaji pemindahan elektron pada satu jarak menggunakan bahan yang sama dalam Rajah 6. Tandakan terminal positif dan negatif bagi sel pada rajah itu.



Atau



Functional apparatus
Label apparatus and material
Label positive and negative terminal

[3M]

[TrialSBP13-06] (a). Diagram 6 shows the apparatus set-up to study the displacement of halogen between bromine water and potassium iodide solution.
Rajah 6 menunjukkan susunan radas untuk mengkaji tindak balas penyesaran halogen di antara air bromin dan larutan kalium iodida.

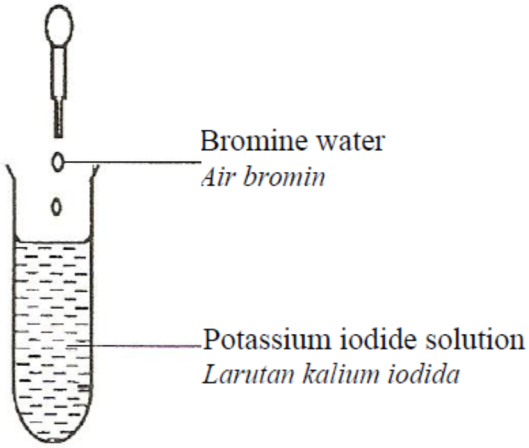


Diagram 6 / *Rajah 6*

1,1,1-trichloroethane is added into the mixture and shaken thoroughly.
1,1,1-trikloroetana ditambah ke dalam campuran itu dan digoncang lagi dengan sempurna.

(i) State the function of bromine water.
Nyatakan fungsi air bromin.
oxidizing agent / to oxidize iodide ion
..... [1M]

(ii) State one observation after 1,1,1-trichloroethane is added to the mixture.
Nyatakan satu pemerhatian setelah 1,1,1-trichloroetana ditambah kepada campuran.
Brown to Purple layer formed
..... [1M]

(iii) Write the ionic equation for the reaction.
Tuliskan persamaan ion bagi tindak balas ini.
$Br_2 + 2I^- \rightarrow 2Br^- + I_2$
1. First mark for correct formulae of reactants and products
2. Balanced the equation
..... [2M]

(iv) State the change in the oxidation number of iodine.
Nyatakan perubahan nombor pengoksidaan bagi iodin.
$-1 \rightarrow 0$
..... [1M]

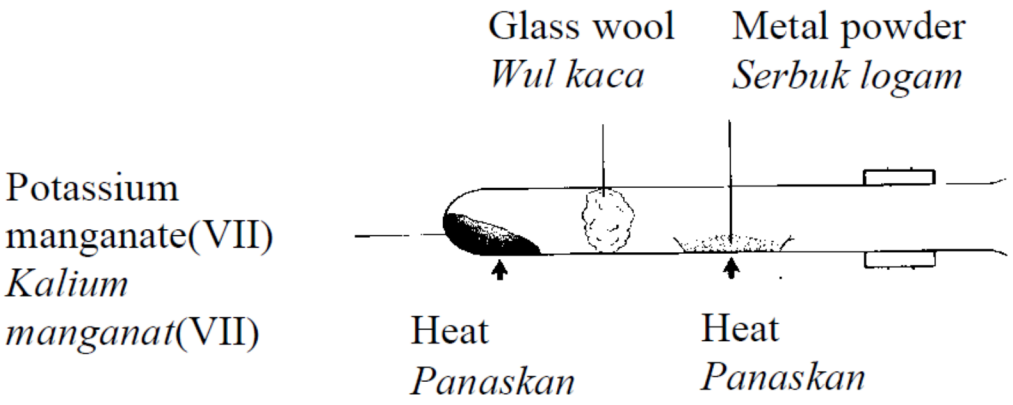
(v) Name another reagent that can replace bromine water.
Namakan reagen lain yang boleh menggantikan air bromin.
Chlorine water
r: Fluorine
..... [1M]

(b) An experiment is carried out to study the reactivity of metals with oxygen.
Satu eksperimen telah dijalankan untuk mengkaji kereaktifan logam terhadap oksigen.
Table 6 shows the observations and the colour of the residue for each metal. *Jadual 6 menunjukkan pemerhatian dan warna baki pemanasan bagi setiap logam itu.*

Metal ***Logam***	**Observation** ***Pemerhatian***	**Colour of Residue** ***Warna Baki***
W	Glow brightly Membara terang	Yellow when hot white when cold *Kuning semasa panas* *putih semasa sejuk*
X	Glow faintly *Membara malap*	Black *Hitam*
Y	Burn brightly *Menyala terang*	White *Putih*

Table 6 /*Jadual 6*

(i) Draw the diagram of the apparatus set-up for the experiment.
Lukiskan diagram bagi susunan radas bagi eksperimen ini.



[2M]

(ii) Suggest metal W.
Cadangkan logam W.
Zinc / Zn
…… [1M]

(iii) Based on your answer in 6(b)(ii),
Write the chemical equation for the reaction between metal W and oxygen.
Berdasarkan jawapan anda dalam 6(b)(ii),
Tuliskan persamaan kimia bagi tindak balas antara metal W dan oksigen.
2Zn + O2 → 2ZnO
…… [1M]

(iv) Based on the observations, arrange metals W, X and Y in descending order of the reactivity towards oxygen.
Berdasarkan kepada pemerhatian, susunkan logam-logam W, X and Y mengikut tertib menurun dalam kereaktifan terhadap oksigen.
Y, W , X
…… [1M]

[SPM14-05] Table 3 shows the information for four sets of experiment to construct the reactivity series of metals.
Jadual 3 menunjukkan maklumat bagi empat set eksperimen untuk membina siri kereaktifan I ogam.

Set	Reactants *Bahan tindak balas*	Observation *Pemerhatian*
I	Carbon + Iron(III) oxide *Karbon + Ferum(III) oksida*	Grey Fe solid is formed *Pepejal kelabu terbentuk*
II	Carbon + Oxide of X *Karbon + Oksida X*	Brown Cu solid is formed *Pepejal perang terbentuk*
III	Carbon< + Magnesium oxide *Karbon + Magnesium oksida*	No change *Tiada perubahan*
IV	X (Cu) < + Iron(III) oxide *X + Ferum(III) oksida*	No change *Tiada perubahan*

Table 3 / Jadual 3

(a) Set I is a redos reaction.
Set I adalah tindak balas redoks.

(i) What is the meaning of redox reaction?
Apakah yang dimaksudkan dengan tindak balas redoks?
Oxidation and reduction that occur at same time/simultaneously
..... [1M]

(ii) Write the chemical equation for the reaction.
Tuliskan persamaan kimia bagi tindak balas itu
$3C + 2Fe_2O_3 \rightarrow 3CO_2 + 4Fe$
..... [2M]

(iii) State the change in the oxidation number of iron.
Nyatakan perubahan nombor pengoksidaan bagi besi
+3 to 0
..... [1M]

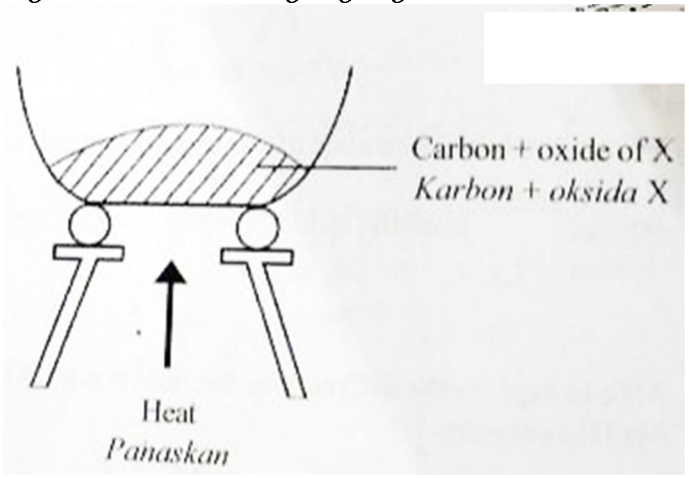
(iv) Which substance undergoes reduction?
Bahan manakah mengalami penurunan?
Iron(III) oxide // Fe2O3//Fe3+ ion
..... [1M]

(b) Based on set II and set III, explain the difference in the observations.
Berdasarkan set II dan set III, terangkan perbezaan dalam pemerhatian itu.
Reaction occur in Set II but reaction does not occur in set III
Carbon is more reactive than X but less reactive than magnesium
..... [2M]

(c) (i) Arrange X, carbon, magnesium and iron in descending order of reactivity.
Susan X, karbon, magnesium dan ferum dalam susunan menurun kereaktifan
Mg, C, Fe, X
..... [1M]

(ii) Suggest X.
Cadangkan X
Copper
..... [1M]

(d) Draw a labelled diagram for the apparatus set-up used in set II.
Lukis rajah berlabel bagi susunan radas yang digunakan dalam set II.

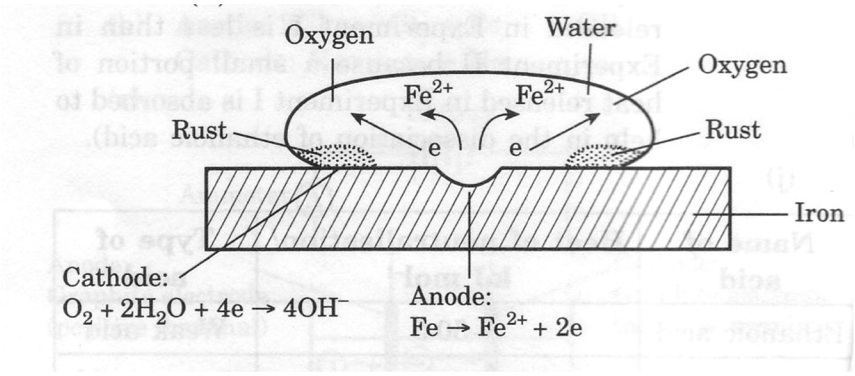


[2M]

[SPM07-06] Iron is metal that rust easily.

(a)(i) State the condition for the rusting of iron. [1M]
water and oxygen
.....

(ii)Draw a labelled diagram to show the conditions for the rusting of iron involve the ionization of iron and the flow of electron. [3 M]



(b)(i) 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. [3M]
Fe^{2+} and OH^- ions combine to form iron(II) hydroxide.
Iron(II) hydroxide is oxidised to iron(III) hydroxide.
Iron(III) hydroxide form hydrated iron(III) oxide/ rust.
.....

(ii)State the change in the oxidation number of iron in 6(b)(i). [1 M]
+2 → +3
.....

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

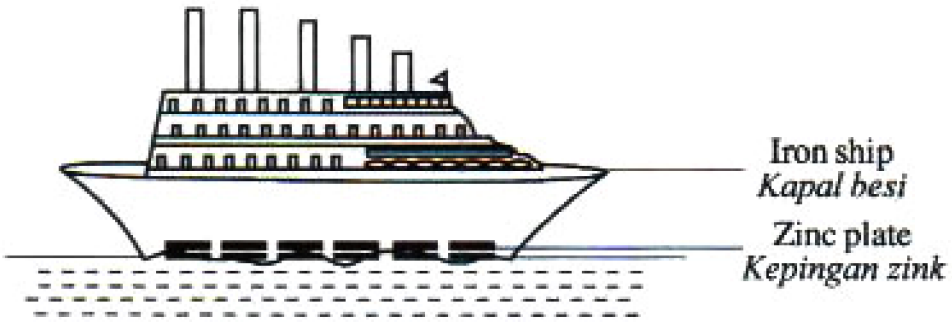


Diagram 6

(i) Explain how the zinc plates protect the iron ship from rusting. [2 M]
Zinc is more electropositive than iron.
Zinc atoms lose electrons more easily than iron.
Zinc corrodes but iron does not.
.....

(ii) Write the half equation for the reaction in 6(c)(i). [1M]
$Zn \rightarrow Zn^{2+} + 2e$
.....