CONFIDENTIAL
4541/1
Chemistry
Paper 1
September
2016
1 ¼ hours

SIJIL PENDIDIKAN
MAKTAB RENDAH SAINS MARA
2016

CHEMISTRY
KIMIA

Paper 1
Kertas 1

One hour and fifteen minutes
Satu jam dan lima belas minit

DO NOT OPEN THE QUESTION BOOKLET UNTIL BEING TOLD TO DO SO
JANGAN BUKA BUKU SOALAN SEHINGGA DIBERITAHU

1   This question booklet is bilingual.
    Kertas soalan ini adalah dalam dwibahasa.

2   Candidates are required to read the information at the last page of this question booklet.
    Calon dikehendaki membaca maklumat di halaman belakang kertas soalan.

This question booklet contains 36 printed pages.
Buku soalan ini mengandungi 36 halaman bercetak.

1   Diagram 1 shows a statement of a scientist.
Rajah 1 menunjukkan pernyataan seorang saintis.

> Nucleus contains neutron that has no charge
> *Nukleus mengandungi neutron yang tidak bercas*

Diagram 1
Rajah 1

Who is the scientist?
Siapakah saintis ini?

A   Niels Bohr

B   John Dalton

C   James Chadwick

D   Ernest Rutherford

2   Which of the following shows the correct type of particles in each substance?
Antara berikut yang manakah menunjukkan jenis zarah yang betul bagi setiap bahan?

	Atom *Atom*	Molecule *Molekul*	Ion *Ion*
A	Helium *Helium*	Carbon dioxide *Karbon dioksida*	Water *Air*
B	Potassium *Kalium*	Water *Air*	Sodium chloride *Natrium klorida*
C	Water *Air*	Iron *Besi*	Magnesium oxide *Magnesium oksida*
D	Carbon dioxide *Karbon dioksida*	Water *Air*	Potassium *Kalium*

3 The following equation represents a reaction.
Persamaan berikut mewakili satu tindak balas.

$$CuO + 2HCl \rightarrow CuCl_2 + H_2O$$
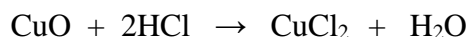
What are the products in the equation?
Apakah hasil-hasil tindak balas dalam persamaan ini?

A Copper(II) oxide and hydrochloric acid
Kuprum(II) oksida dan asid hidroklorik

B Copper(II) chloride and water
Kuprum(II) klorida dan air

C Copper(II) chloride and hydrochloric acid
Kuprum(II) klorida dan asid hidroklorik

D Copper(II) oxide and water
Kuprum(II) oksida dan air

4 Which of the following statement is true about elements in the Periodic Table of Elements?
Antara pernyataan berikut, yang manakah benar berkenaan unsur-unsur di dalam Jadual Berkala Unsur?

A The metallic properties increases from left to right across the Periodic Table of Elements
Sifat logam meningkat dari kiri ke kanan merentasi Jadual Berkala Unsur

B Elements of the same group have the same physical properties
Unsur-unsur dari kumpulan yang sama mempunyai sifat fizikal yang sama

C Group 18 elements have low melting and boiling points
Unsur-unsur Kumpulan 18 mempunyai takat lebur dan takat didih yang rendah

D Group 17 elements exist as monoatoms
Unsur-unsur Kumpulan 17 wujud sebagai monoatom

5   Diagram 2 shows the formation of aluminium ion, Al^{3+}.
       Rajah 2 menunjukkan pembentukan ion aluminium, Al^{3+}.
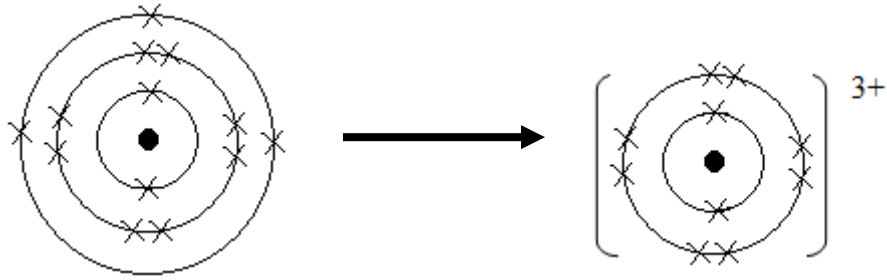

Diagram 2
Rajah 2

How aluminium ion is produced from aluminium atom?
Bagaimanakah ion aluminium terhasil daripada atom aluminium?

  A   Aluminium atom donates three valence electrons
          Atom aluminium mendermakan tiga elektron valen

  B   Aluminium atom receives three valence electrons
          Atom aluminium menerima tiga elektron valen

  C   Aluminium atom donates three protons from the nucleus
          Atom aluminium mendermakan tiga proton dari nukleus

  D   Aluminium atom receives three protons into the nucleus
          Atom aluminium menerima tiga proton ke dalam nukleus

6   Diagram 3 shows the electrolysis of copper(II) sulphate solution using platinum electrodes.
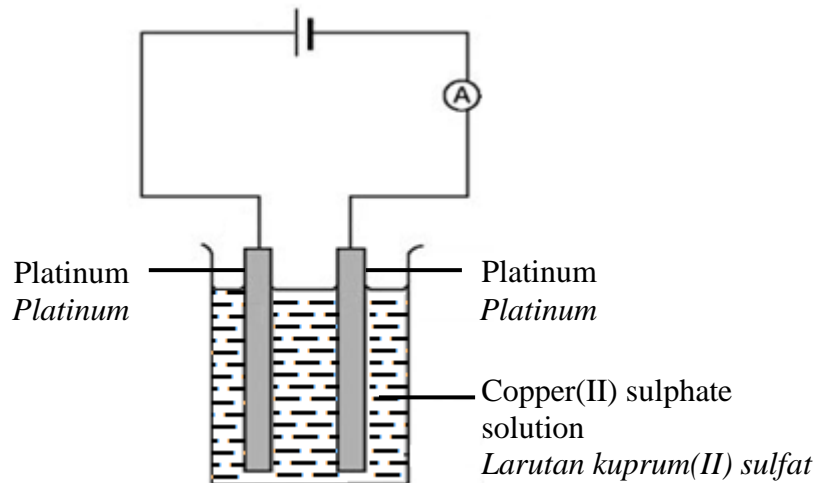*Rajah 3 menunjukkan elektrolisis larutan kuprum(II) sulfat menggunakan elektrod platinum.*

Platinum
Platinum

Platinum
Platinum

Copper(II) sulphate solution
Larutan kuprum(II) sulfat

Diagram 3
Rajah 3

Which ion is discharged at anode?
Ion manakah yang dinyahcaskan di anod?

A   Copper(II) ion
Ion kuprum(II)

B   Hydrogen ion
Ion hidrogen

C   Sulphate ion
Ion sulfat

D   Hydroxide ion
Ion hidroksida

7   Which substance ionizes partially in water?
Bahan manakah yang mengion separa di dalam air?

A   HCl

B   NaOH

C CH_3OH

D   HCOOH

8   Table 1 shows the pH values of four alkaline solutions with the same
        concentration.
        Jadual 1 menunjukkan nilai pH bagi empat larutan alkali berkepekatan sama.

Alkaline solution *Larutan alkali*	pH value *Nilai pH*
P	8.0
Q	10.0
R	12.0
S	14.0

Table 1
Jadual 1

Which solution has the highest degree of dissociation?
Larutan manakah yang mempunyai darjah penceraian tertinggi?

A   P

B   Q

C   R

D   S

9   What are the cations present in zinc sulphate solution?
        Apakah kation yang hadir di dalam larutan zink sulfat?

A Zn^{2+}

B Zn^{2+}, SO_4^{2-}

C Zn^{2+}, H^+

D OH^-, SO_4^{2-}

10 Diagram 4 shows ceramic tiles in a bathroom.
Rajah 4 menunjukkan kepingan seramik di dalam bilik mandi.

Diagram 4
Rajah 4

What is the most suitable characteristic that enable ceramic tiles to be used widely?
Apakah ciri paling sesuai yang membolehkan kepingan seramik digunakan secara meluas?

A Easy to clean
Mudah dibersihkan

B Strong and hard
Kuat dan keras

C Chemically inert
Lengai terhadap bahan kimia

D Enhance frictional force
Meningkatkan daya geseran

11 Arrange the procedures in the right sequence for the Contact Process.
Susun prosedur dalam urutan yang betul bagi Proses Sentuh.

I The oleum is mixed with water to produce sulphuric acid
Oleum dicampur dengan air bagi menghasilkan asid sulfurik

II Sulphur dioxide is further oxidized by air with vanadium(V) oxide as catalyst
Sulfur dioksida dioksidakan oleh udara dengan kehadiran mangkin vanadium(V) oksida

III Sulphur gas is heated with excess air in the chamber
Gas sulfur dipanaskan dengan udara berlebihan di dalam kebuk

IV Concentrated sulphuric acid is added to the sulphur trioxide to form oleum
Asid sulfurik pekat ditambah dengan sulfur trioksida bagi membentuk oleum

A II → IV → III → I

B III → II → IV → I

C II → III → IV → I

D III → IV → II → I

12 Which statement explains the meaning of effective collision?
Pernyataan manakah menerangkan maksud perlanggaran berkesan?

    A   The collision that can cause reaction
        Perlanggaran yang menyebabkan tindak balas

    B   The collision that has the highest energy
        Perlanggaran yang mempunyai tenaga yang tertinggi

    C   The collision which takes place before reaction
        Perlanggaran berlaku sebelum tindak balas

    D   The collision where its energy is less than the activation energy
        Tenaga perlanggaran adalah kurang dari tenaga pengaktifan

13 Which compound can undergoes addition polymerization?
Sebatian manakah yang boleh menjalani pempolimeran tambahan?

    A   Propene
        Propena

    B   Butane
        Butana

    C   Ethyl ethanoate
        Etil etanoat

    D   Butanoic acid
        Asid butanoik

14 What is the correct functional group for the following homologous series?
Apakah kumpulan berfungsi yang betul bagi siri homolog berikut?

	Homologous series *Siri homolog*	Functional group *Kumpulan berfungsi*
A	Ester *Ester*	$-\overset{\overset{\text{O}}{\|\|}}{\text{C}}-\text{O}-$
B	Alkane *Alkana*	$-\text{C}=\text{C}-$
C	Alcohol *Alkohol*	$-\overset{\overset{\text{O}}{\|\|}}{\text{C}}-\text{OH}$
D	Carboxylic acid *Asid karboksilik*	$-\text{OH}$

15 Diagram 5 shows a flower that has a pleasant fragrance.
Rajah 5 menunjukkan sejenis bunga yang berbau harum.

Diagram 5
Rajah 5

What is the name of the substance that gives the pleasant fragrance?
Apakah nama bahan yang memberikan haruman itu?

A   Geranyl ethanoate
       Geranil etanoat

B   Ethane-1,2-diol
       Etana-1,2-diol

C   Ethanoic acid
       Asid etanoik

D   Ethanol
       Etanol

16 Diagram 6 shows an apple that has been cut.
Rajah 6 menunjukkan buah epal yang telah dipotong.
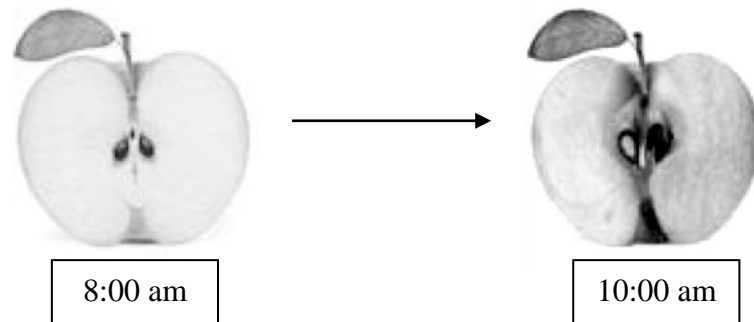

8:00 am 10:00 am

Diagram 6
Rajah 6

Which substance is most suitable to slow down the oxidation process?
Bahan manakah yang paling sesuai untuk memperlahankan proses pengoksidaan?

A Mineral water
Air mineral

B Sugar solution
Larutan gula

C Cucumber juice
Jus timun

D Lime juice
Jus limau

17 Diagram 7 shows the thermochemical equation for the formation of barium sulphate.
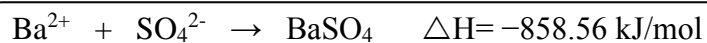*Rajah 7 menunjukkan persamaan termokimia bagi pembentukan barium sulfat.*

$$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4 \quad \triangle H = -858.56 \text{ kJ/mol}$$

Diagram 7
Rajah 7

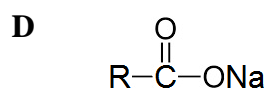Which of the following pair is true?
Antara pasangan berikut yang manakah benar?

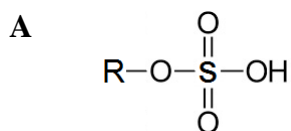|	Type of reaction *Jenis tindak balas*	Heat change *Perubahan haba*
A	Endothermic *Endotermik*	Heat is released *Haba dibebas*
B	Exothermic *Eksotermik*	Heat is absorbed *Haba diserap*
C	Endothermic *Endotermik*	Heat is absorbed *Haba diserap*
D	Exothermic *Eksotermik*	Heat is released *Haba dibebas*

18 Which pair of acid and alkali gives the highest heat of neutralization?
Pasangan asid dan alkali manakah yang memberikan haba peneutralan tertinggi?

A Ethanoic acid and potassium hydroxide
Asid etanoik dan kalium hidroksida

B Ethanoic acid and ammonia solution
Asid etanoik dan larutan ammonia

C Nitric acid and sodium hydroxide
Asid nitrik dan natrium hidroksida

D Sulphuric acid and ammonia solution
Asid sulfurik dan larutan ammonia

19 Which is the structural formula of detergent?
Formula struktur manakah adalah formula detergen?

A
$$R-O-\overset{\overset{O}{\parallel}}{\underset{\underset{O}{\parallel}}{S}}-OH$$

B
$$R-O-\overset{\overset{O}{\parallel}}{\underset{\underset{O}{\parallel}}{S}}-ONa$$

C
$$R-\overset{\overset{O}{\parallel}}{C}-OH$$

D
$$R-\overset{\overset{O}{\parallel}}{C}-ONa$$
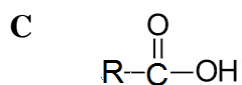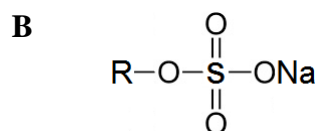
20 Diagram 8 shows the chemical formula for aspartame which was discovered by Jim Schalatter in 1965.

Rajah 8 menunjukkan formula kimia bagi aspartam yang ditemui oleh Jim Schalatter dalam tahun 1965.
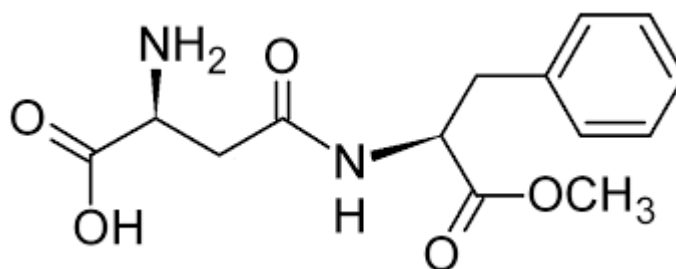

Diagram 8
Rajah 8

What is the type of food additives of aspartame?
Apakah jenis bahan tambah makanan bagi aspartam?

A Dyes
Pewarna

B Stabilizers
Penstabil

C Thickeners
Pemekat

D Flavourings
Perisa

21 Diagram 9 shows a scale of temperature.
Bromine has a melting point of -2 °C and a boiling point of 59 °C.
At which temperature bromine exists as a liquid?

Rajah 9 menunjukkan skala suhu.
Bromin mempunyai takat lebur -2 °C dan takat didih 59 °C.
Pada suhu manakah bromin wujud sebagai cecair?

```
          A         B         C         D
     |    |    |    |    |    |    |    |    |
    -50  -25   0    25   50   75  100  125  150
```
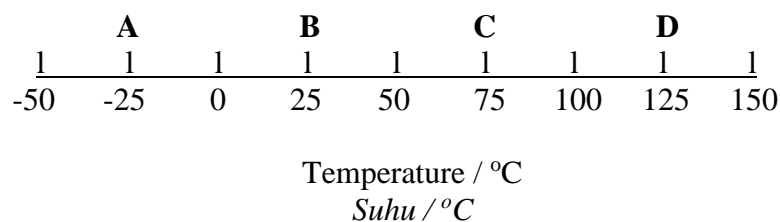
Temperature / °C
Suhu / °C

Diagram 9
Rajah 9

22 Which chemical equations is balanced?
Persamaan kimia manakah yang seimbang?

A $CaCO_{3\ (s)} \rightarrow CaO_{(s)} + 2CO_{2\ (g)}$

B $Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2\ (aq)} + H_{2\ (g)}$

C $Zn(NO_3)_{2\ (s)} \rightarrow ZnO_{(s)} + 2NO_{2\ (g)} + O_{2\ (g)}$

D $NaOH_{(aq)} + H_2SO_{4\ (aq)} \rightarrow Na_2SO_{4\ (aq)} + H_2O_{(l)}$

23 Table 2 shows the electron arrangement of the atoms of elements L, M and N. The letters used are not the actual symbol of the elements.

Jadual 2 menunjukkan susunan elektron bagi atom unsur L, M dan N.
Huruf-huruf yang digunakan bukan simbol sebenar bagi unsur-unsur itu.

Atom of the element *Atom bagi unsur*	Electron arrangement *Susunan elektron*
L	2.8.1
M	2.8.4
N	2.8.7

Table 2
Jadual 2

According to the sequence L, M and N, which statement shows the changes in the physical properties of the element?
Berdasarkan turutan L, M dan N, pernyataan manakah menunjukkan perubahan sifat fizikal unsur tersebut?

A Atomic radius decreases
Jejari atom berkurang

B Melting point increases
Takat lebur bertambah

C Metallic properties increases
Sifat kelogaman bertambah

D Electronegativity decreases
Keelektronegatifan berkurang

24 Selenium, Se and sulphur, S are in the same group in the Periodic Table of Elements.
What is the formula of sodium selenide?
[Proton number: Na = 11, S = 16]

Selenium, Se dan sulfur, S berada dalam kumpulan yang sama dalam Jadual Berkala Unsur.
Apakah formula bagi natrium selenida?
[Nombor proton: Na = 11, S = 16]

A NaSe

B $NaSe_2$

C Na_2Se

D Na_2Se_3

25 T and U are two elements with proton number 4 and 9 respectively.
Which type of bond and physical property described the compound formed
between T and U?

T dan U adalah dua unsur yang mempunyai nombor proton 4 dan 9.
Jenis ikatan dan sifat fizikal manakah yang menerangkan sebatian yang terbentuk
antara unsur T dan U?

	Chemical bond *Ikatan kimia*	**Physical property** *Sifat fizikal*
A	Ionic bond *Ikatan ion*	Can conduct electricity *Mengkonduksikan arus elektrik*
B	Ionic bond *Ikatan ion*	Dissolve in water *Larut dalam air*
C	Covalent bond *Ikatan kovalen*	Has low melting and boiling point *Mempunyai takat lebur dan takat didih yang rendah*
D	Covalent bond *Ikatan kovalen*	Dissolve in organic solvent *Larut dalam pelarut organik*

26 Diagram 10 shows the apparatus set-up of a Daniell cell.
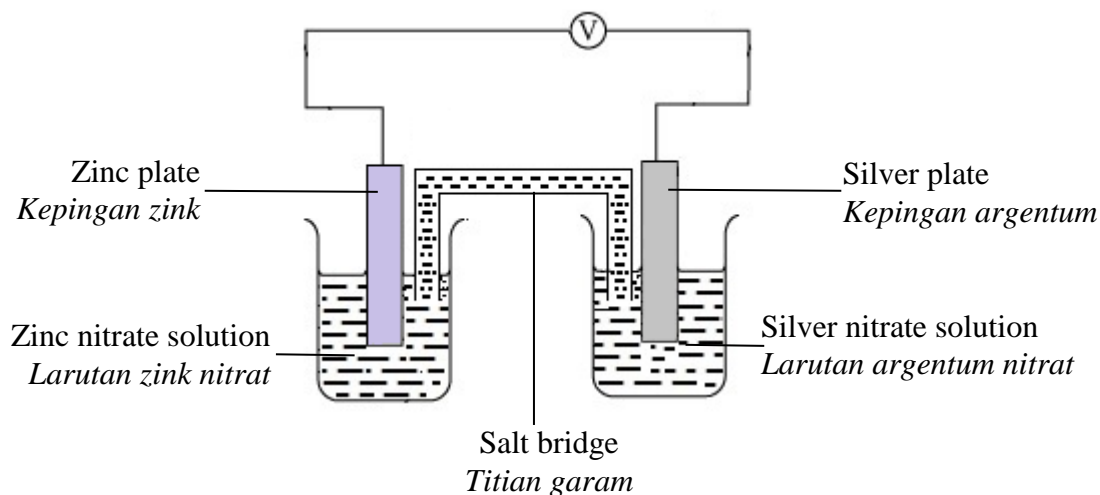*Rajah 10 menunjukkan susunan radas sel Daniell.*

Diagram 10
Rajah 10

Which statements are true about Daniell cell?
Pernyataan manakah yang benar tentang sel Daniell?

I Zinc plate becomes thinner
   Kepingan zink menjadi semakin nipis

II Silver atom releases electron to form silver ion, Ag^+
    Atom argentum membebaskan elektron membentuk ion argentum, Ag$^+$

III The silver plate acts as the negative terminal
     Kepingan argentum bertindak sebagai terminal negatif

IV Electron flows from zinc plate to silver plate through the external circuit
    Elektron mengalir dari kepingan zink ke kepingan argentum melalui litar luar

A I and II
   I dan II

B I and IV
   I dan IV

C II and III
   II dan III

D III and IV
   III dan IV

27 Diagram 11 shows the electrolysis of 0.0001 mol dm^{-3} potassium chloride solution using carbon electrodes.
Rajah 11 menunjukkan elektrolisis bagi larutan kalium klorida 0.0001 mol dm^{-3} menggunakan elektrod karbon.

0.0001 mol dm^{-3} potassium chloride solution
Larutan kalium klorida 0.0001 mol dm^{-3}

Carbon electrode
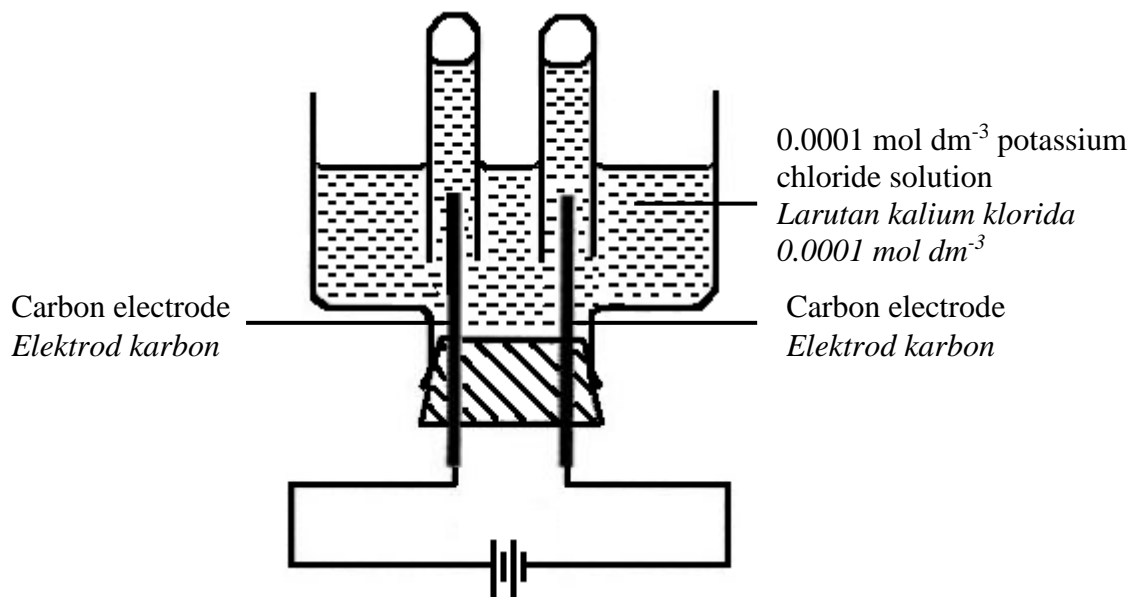*Elektrod karbon*

Carbon electrode
Elektrod karbon

Diagram 11
Rajah 11

Which half equation represents the reactions at the anode and cathode?
Setengah persamaan manakah yang mewakili tindak balas di anod dan katod?

	Anode *Anod*	**Cathode** *Katod*
A	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$	$K^+ + e^- \rightarrow K$
B	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$	$2H^+ + 2e^- \rightarrow H_2$
C	$2Cl^- \rightarrow Cl_2 + 2e^-$	$2H^+ + 2e^- \rightarrow H_2$
D	$2Cl^- \rightarrow Cl_2 + 2e^-$	$K^+ + e^- \rightarrow K$

28 Table 3 shows the information of acid X and Y.
Jadual 3 menunjukkan maklumat mengenai asid X dan Y.

Acid *Asid*	X	Y
Concentration (mol dm⁻³) *Kepekatan (mol dm⁻³)*	0.1	0.1
Ionization in water *Pengionan di dalam air*	Completely *Lengkap*	Partially *Separa*

Table 3
Jadual 3

Which statement is true about the acid?
Pernyataan manakah benar tentang asid itu?

A   pH value of X is lower than Y
Nilai pH X lebih rendah dari Y

B   X is a weak acid and Y is a strong acid
X adalah asid lemah dan Y adalah asid kuat

C   The number of mole of hydrogen ions in X is lower than Y
Bilangan mol ion hidrogen dalam X lebih rendah daripada Y

D   The number of mole of hydroxide ions of X is higher than Y
Bilangan mol ion hidroksida dalam X lebih tinggi daripada Y

29 Diagram 12 shows the reaction between egg shells and glacial ethanoic acid.
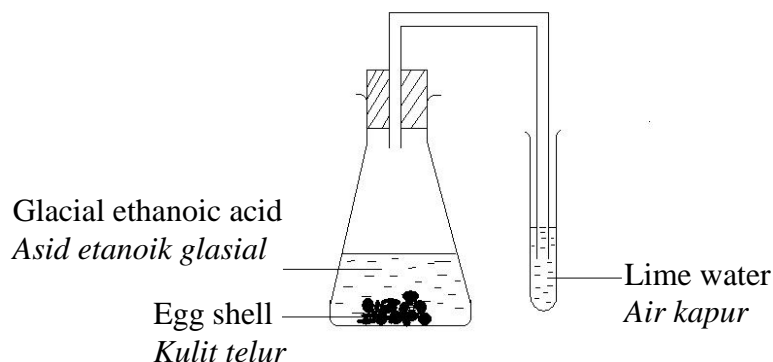*Rajah 12 menunjukkan tindak balas antara kulit telur dan asid etanoik glasial.*

Glacial ethanoic acid
Asid etanoik glasial

Egg shell
Kulit telur

Lime water
Air kapur

Diagram 12
Rajah 12

No changes are observed.
What should be done in order to turn the lime water cloudy?

Tiada perubahan yang diperhatikan.
Apakah yang perlu dilakukan untuk mengeruhkan air kapur?

A   Heat the mixture
Panaskan campuran

B   Use powdered egg shells
Gunakan serbuk kulit telur

C   Add water to the mixture
Tambahkan air kepada campuran

D   Shake vigorously the mixture
Goncangkan campuran dengan kuat

30 Diagram 13 shows the properties of a manufactured substance.
Rajah 13 menunjukkan sifat-sifat bagi bahan buatan.

> - Hard but brittle
>   *Keras tetapi rapuh*
>
> - Inert towards chemicals
>   *Lengai secara kimia*
>
> - Transparent
>   *Lutsinar*
>
> - Sensitive to light intensity
>   *Peka terhadap keamatan cahaya*

Diagram 13
Rajah 13

Which of the following suit with the above properties?
Antara berikut, yang manakah menepati ciri-ciri di atas?

A

B

C

D

31 Diagram 14 shows three different sizes of magnesium carbonate with the same mass.
Rajah 14 menunjukkan tiga saiz magnesium karbonat yang berbeza dengan jisim yang sama.
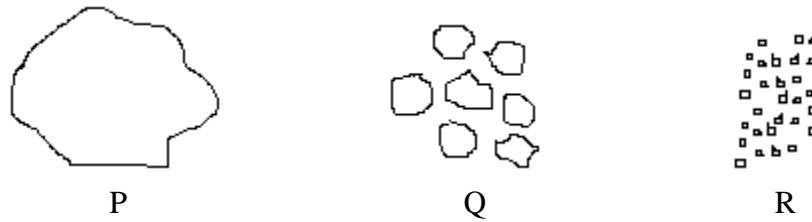

P   Q   R

Diagram 14
Rajah 14

Which graph represents the reaction between 2 g of magnesium carbonate and 50 cm^3 of 1.0 mol dm^{-3} hydrochloric acid?

Graf manakah mewakili tindak balas antara 2 g magnesium karbonat dan 50 cm^3 asid hidroklorik 1.0 mol dm^{-3}?

A Volume of gas, cm^3
Isipadu gas, cm^3
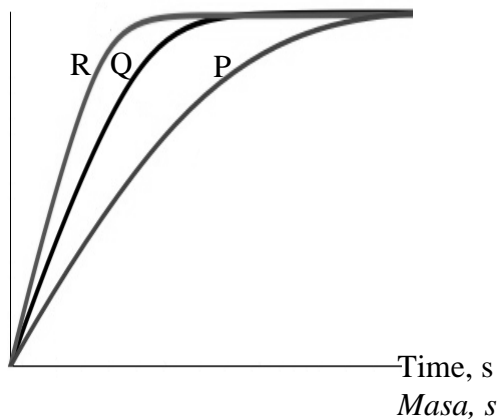
B Volume of gas, cm^3
Isipadu gas, cm^3
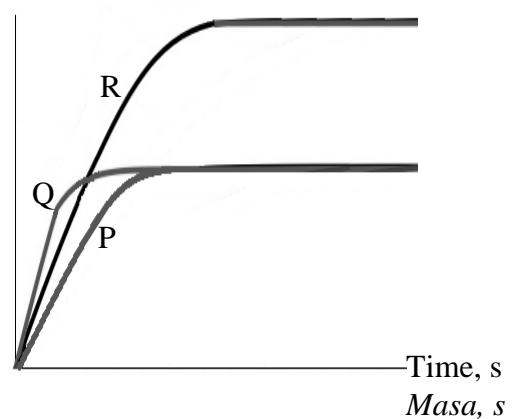
C Volume of gas, cm^3
Isipadu gas, cm^3

D Volume of gas, cm^3
Isipadu gas, cm^3

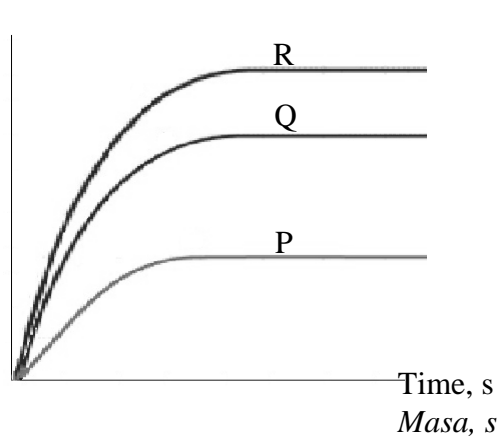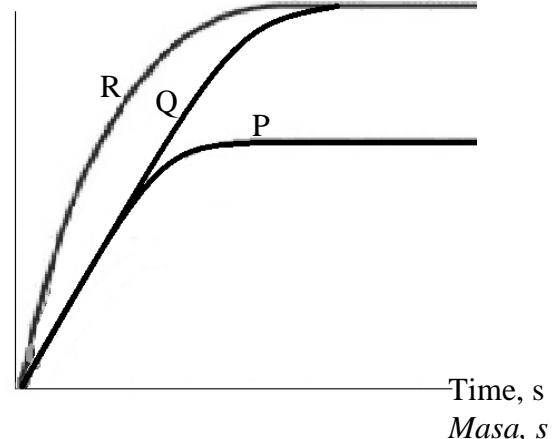**32** Diagram 15 shows the apparatus set-up for an experiment to determine the rate of reaction between sodium thiosulphate solution and nitric acid.

Rajah 15 menunjukkan susunan radas eksperimen untuk menentukan kadar tindak balas di antara larutan natrium tiosulfat dan asid nitrik.

Look vertically down
Melihat ke bawah

Swirl
Pusar

Sodium thiosulphate solution and nitric acid
Larutan natrium tiosulfat dan asid nitrik

White paper
Kertas putih

Mark 'X'
Tanda 'X'
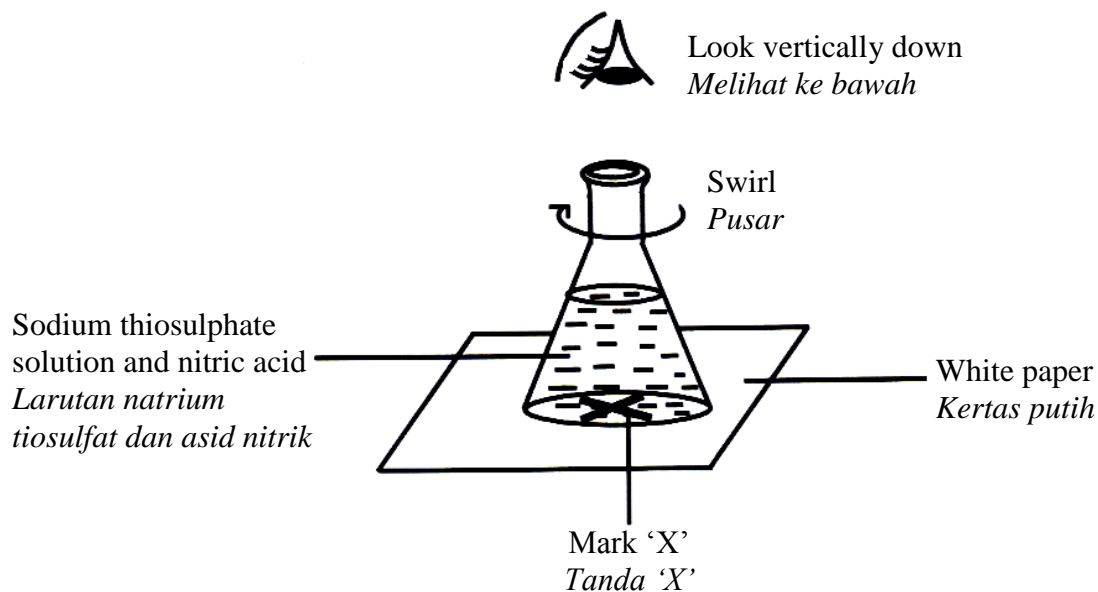
Diagram 15
Rajah 15

Which combination will take the shortest time for the 'X' mark to disappear from sight?

Kombinasi manakah mengambil masa yang paling singkat untuk tanda 'X' hilang dari pandangan?

	Nitric acid *Asid nitrik*		Sodium thiosulphate solution *Larutan natrium tiosulfat*		Temperature *Suhu* (^oC)
	Volume *Isipadu* (cm^3)	Concentration *Kepekatan* ($mol\ dm^{-3}$)	Volume *Isipadu* (cm^3)	Concentration *Kepekatan* ($mol\ dm^{-3}$)	
A	10	1.0	50	0.5	30.0
B	10	0.5	50	0.5	30.0
C	10	1.0	50	0.5	40.0
D	20	0.5	40	0.5	40.0

33 Table 4 shows physical properties of alcohol.
Jadual 4 menunjukkan ciri-ciri fizikal alkohol.

Alcohol *Alkohol*	Solubility (g per 100 cm^3 water) *Keterlarutan (g per 100 cm^3 air)*
Methanol, CH_3OH *Metanol, CH$_3$OH*	Miscible in all proportion *Terlarut campur dalam semua bahagian*
Pentanol, $C_5H_{11}OH$ *Pentanol, C$_5$H$_{11}$OH*	2.7

Table 4
Jadual 4

Which statement best explains low solubility of pentanol in water compared to methanol?

Pernyataan manakah yang terbaik menerangkan keterlarutan pentanol yang rendah di dalam air berbanding metanol?

A Pentanol has higher molar mass
Pentanol mempunyai jisim molar yang lebih tinggi

B Pentanol has higher boiling point
Pentanol mempunyai takat didih yang lebih tinggi

C Pentanol has higher intermolecular force
Pentanol mempunyai daya antara molekul yang tinggi

D Pentanol has longer hydrocarbon chain
Pentanol mempunyai rantai hidrokarbon yang lebih panjang

34   Diagram 16 shows the apparatus set-up to investigate the redox reaction involving transfer of electron at a distance.

Rajah 16 menunjukkan susunan radas untuk mengkaji tindak balas redoks yang melibatkan pemindahan elektron pada satu jarak.
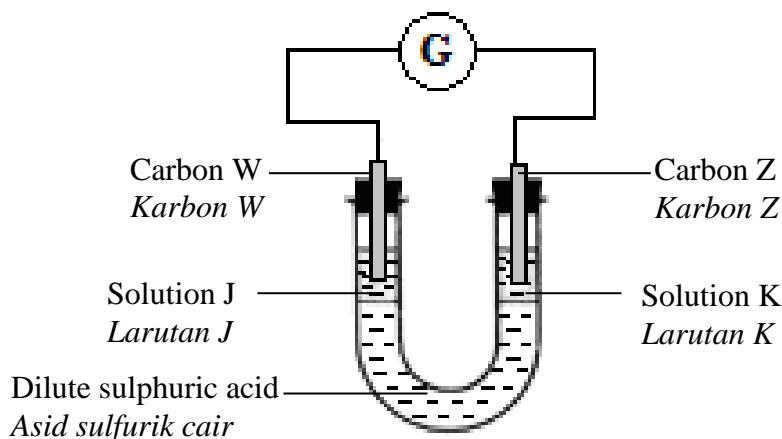

Carbon W
Karbon W

Carbon Z
Karbon Z

Solution J
Larutan J

Solution K
Larutan K

Dilute sulphuric acid
Asid sulfurik cair

Diagram 16
Rajah 16

Identify solutions J and K which will produce electron flow from Z to W through the external circuit.

Kenalpasti larutan J dan K yang akan menghasilkan pengaliran elektron dari Z ke W melalui litar luar.

	Solution J *Larutan J*	Solution K *Larutan K*
A	Iron(II) sulphate solution *Larutan ferum(II) sulfat*	Potassium iodide solution *Larutan kalium iodida*
B	Iron(III) sulphate solution *Larutan ferum(III) sulfat*	Chlorine water *Air klorin*
C	Bromine water *Air bromin*	Potassium iodide solution *Larutan kalium iodida*
D	Potassium iodide solution *Larutan kalium iodida*	Acidified potassium dichromate(VI) solution *Larutan kalium dikromat(VI) berasid*

35 Diagram 17 shows an energy level diagram.
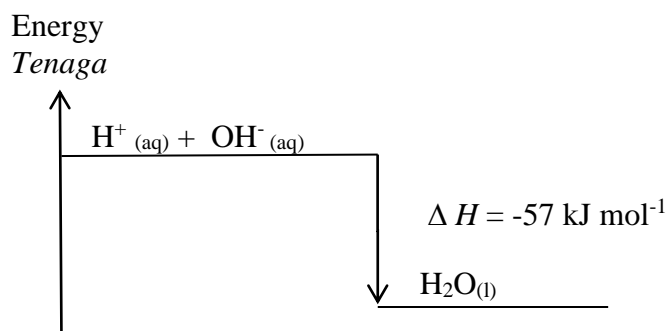*Rajah 17 menunjukkan gambarajah aras tenaga.*

Energy
Tenaga

$H^+_{(aq)} + OH^-_{(aq)}$

$\Delta H = -57 \text{ kJ mol}^{-1}$

$H_2O_{(l)}$

Diagram 17
Rajah 17

Which statement can be deduced from Diagram 17?
Pernyataan manakah yang boleh dirumuskan daripada Rajah 17?

A The surrounding temperature increases
Suhu persekitaran meningkat

B Heat is needed to initiate the reaction
Haba diperlukan untuk memulakan tindak balas

C Heat absorbed for the formation of 1 mol of water is 57 kJ
Haba diserap bagi pembentukkan 1 mol air ialah 57 kJ

D The total energy content of water is higher than total energy content of H^+ and OH^- ions
Jumlah kandungan tenaga bagi air lebih tinggi daripada jumlah kandungan tenaga bagi ion H^+ dan OH^-

36 Atom Q can form an ion with a +3 charge. The ion has 39 neutrons and 28 electrons.
Which of the symbol below represents atom Q?

Atom Q boleh membentuk ion dengan cas +3. Ion tersebut mempunyai 39 neutron dan 28 elektron.
Simbol yang manakah mewakili atom Q?

A $^{70}_{31}Q$

B $^{70}_{28}Q$

C $^{67}_{28}Q$

D $^{64}_{25}Q$

37   x g of sodium sulphate, Na_2SO_4 has 1.806×10^{23} particles.
      What is the value of x?
      [Molar mass Na_2SO_4 = 142 g mol^{-1}, Avogadro constant = 6.02×10^{23} mol^{-1}]

      x g natrium sulfat, Na₂SO₄ mempunyai 1.806 x 10²³ zarah.
      Berapakah nilai x?
      [Jisim molar Na₂SO₄= 142 g mol⁻¹, pemalar Avogadro = 6.02 x 10²³ mol⁻¹]

      A   4.26

      B   4.73

      C   42.6

      D   47.3

38   The following chemical equation represents the decomposition of 69 g silver
      carbonate, Ag_2CO_3.
      Persamaan kimia berikut mewakili penguraian 69 g argentum karbonat, Ag₂CO₃.

      $$2Ag_2CO_{3\ (s)} \rightarrow 4Ag_{(s)} + 2CO_{2\ (g)} + O_{2\ (g)}$$
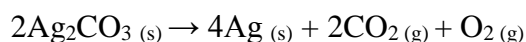
      What is the volume of oxygen gas released at standard temperature and pressure?
      [Molar mass Ag_2CO_3 = 276 g mol^{-1}; Molar volume of gas at standard temperature
      and pressure = 22.4 dm^3 mol^{-1}]

      Apakah isipadu gas oksigen yang dibebaskan pada suhu dan tekanan piawai?
      [Jisim molar Ag₂CO₃ = 276 g mol⁻¹; Isipadu molar gas pada suhu dan tekanan
      piawai = 22.4 dm³ mol⁻¹]

      A   2.8 dm^3

      B   5.6 dm^3

      C   11.2 dm^3

      D   22.4 dm^3

39 Diagram 18 shows a chemical equation of a reaction in a fire extinguisher.
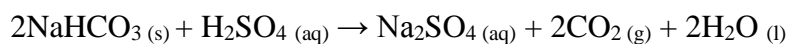*Rajah 18 menunjukkan persamaan kimia bagi tindak balas di dalam alat pemadam api.*

$$2NaHCO_{3\ (s)} + H_2SO_{4\ (aq)} \rightarrow Na_2SO_{4\ (aq)} + 2CO_{2\ (g)} + 2H_2O_{\ (l)}$$

Diagram 18
Rajah 18

Which of these statements are true?
[Molar mass: $NaHCO_3$ = 84 g mol^{-1}, Molar volume of gas = 24 dm^3 mol^{-1} at room conditions]

Pernyataan manakah yang betul?
[Jisim molar: NaHCO$_3$ = 84 g mol^{-1}, Isipadu molar gas = 24 dm^3 mol^{-1} pada keadaan bilik]

I   One mole of sodium hydrogen carbonate produces 48 dm^3 of carbon dioxide gas at room conditions
   Satu mol natrium hidrogen karbonat menghasilkan 48 dm^3 gas karbon dioksida pada keadaan bilik

II   Two moles of sodium hydrogen carbonate produces one mole of sodium sulphate
   Dua mol natrium hidrogen karbonat menghasilkan satu mol natrium sulfat

III   2 x 6.03 x 10^{23} formula unit of sodium hydrogen carbonate produces 2 x 6.03 x 10^{23} molecule of carbon dioxide
   2 x 6.03 x 10^{23} unit formula natrium hidrogen karbonat menghasilkan 2 x 6.03 x 10^{23} molekul karbon dioksida

IV   84 g of sodium hydrogen carbonate is needed to produce 0.5 mol of carbon dioxide
   84 g natrium hidrogen karbonat diperlukan untuk menghasilkan 0.5 mol karbon dioksida

A   I and II
   I dan II

B   II and III
   II dan III

C   II and IV
   II dan IV

D   III and IV
   III dan IV

40   Diagram 19(a) shows a Periodic Table of Elements version 1st June, 2012
      officially announced by the International Union of Pure and Applied Chemistry
      (IUPAC). There are four empty spaces in Period 7 of the Periodic Table of
      Elements.
      *Rajah 19(a) menunjukkan Jadual Berkala Unsur versi 1 Jun, 2012 yang secara
      rasminya diumumkan oleh Kesatuan Kimia Tulen dan Gunaan Antarabangsa.
      Terdapat empat kekosongan pada Kala 7 dalam Jadual Berkala Unsur tersebut.*

Diagram 19(a)
Rajah 19(a)

Diagram 19(b) shows four new elements in the form of their Standard
Representation of Element that were found early 2016. All elements are filled into
empty spaces in Period 7 of the new Periodic Table of Elements.
*Rajah 19(b) menunjukkan empat unsur baru dalam bentuk Perwakilan Piawaian
Unsur yang dijumpai pada awal tahun 2016. Kesemua unsur baru ini diisi dalam
ruang-ruang kosong Kala 7 bagi Jadual Berkala Unsur yang baru.*

$^{294}_{118}$Uuo Ununoctium $^{294}_{117}$Uus Ununseptium $^{289}_{115}$Uup Ununpentium $^{286}_{113}$Uut Ununtrium

Diagram 19(b)
Rajah 19(b)

As a chemistry student, which new arrangement is correct for Period 7?
Sebagai pelajar kimia, susunan baru manakah adalah betul bagi Kala 7?

A $^{294}_{118}$Uuo $^{294}_{117}$Uus $^{286}_{113}$Uut $^{289}_{115}$Uup

B $^{289}_{115}$Uup $^{286}_{113}$Uut $^{294}_{118}$Uuo $^{294}_{117}$Uus

C $^{294}_{117}$Uus $^{294}_{118}$Uuo $^{289}_{115}$Uup $^{286}_{113}$Uut

D $^{286}_{113}$Uut $^{289}_{115}$Uup $^{294}_{117}$Uus $^{294}_{118}$Uuo

41 Table 5 shows information about three voltaic cells.
Jadual 5 menunjukkan maklumat tentang tiga sel volta.

Pair of metals *Pasangan logam*	Potential difference (V) *Beza keupayaan (V)*	Positive terminal *Terminal positif*
R,S	0.6	S
S,T	2.1	S
U,T	1.3	U

Table 5
Jadual 5

What is a potential difference when metal U is paired with metal R?
Berapakah beza keupayaan bagi pasangan logam U dan logam R?

A   0.2 V   B   0.8 V

C   1.5 V   D   1.9 V

42 Diagram 20 shows a few materials in a scout's bag who is going for a camping in Hutan Belum.
Rajah 20 menunjukkan beberapa bahan di dalam beg seorang pengakap yang mengikuti perkhemahan di Hutan Belum.
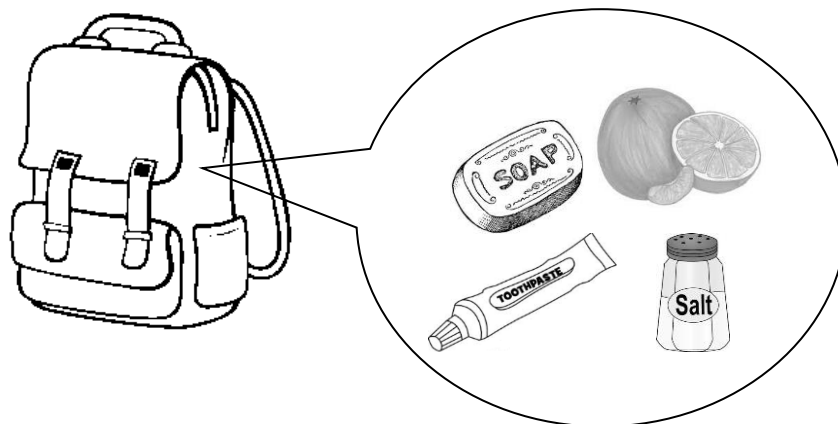
Diagram 20
Rajah 20

During the camping, the scout has been stung by a wasp.
What is the most suitable material that can be used to treat the stung?
Semasa perkhemahan tersebut, pengakap tersebut telah disengat oleh tebuan.
Apakah bahan yang paling sesuai digunakan untuk merawat sengatan itu?

A   Soap   B   Orange
     Sabun   *Buah oren*

C   Salt   D   Toothpaste
     Garam   *Ubat gigi*

43 During the preparation of a soluble salt, a student accidentally heated a salt solution until it dried up. What is the consequence of her action?

Semasa penyediaan garam terlarut, seorang pelajar secara tidak sengaja telah memanaskan larutan garam sehingga kering. Apakah kesan daripada tindakan itu?

- **A** The salt will be vapourized
  Garam akan meruap

- **B** The salt will be dehydrated
  Garam akan terhidrat

- **C** The salt will be contaminated
  Garam akan tercemar

- **D** The salt will be decomposed
  Garam akan diuraikan

44 Table 6 shows two chemical tests and its observations on solution X.
Jadual 6 menunjukkan dua ujian kimia dan pemerhatian ke atas larutan X.

Chemical test *Ujian kimia*	Observation *Pemerhatian*
Solution X is mixed with lead(II) nitrate solution *Larutan X dicampur dengan larutan plumbum(II) nitrat*	White precipitate formed *Mendakan putih terbentuk*
Ammonia gas is passed into solution X until in excess *Gas ammonia dialirkan ke dalam larutan X sehingga berlebihan*	White precipitate formed and dissolved when excess ammonia gas is passed through *Mendakan putih terbentuk dan larut apabila gas ammonia dialirkan secara berlebihan*

Table 6
Jadual 6

Based on the observation in Table 6, solution X is
Berdasarkan pemerhatian dalam Jadual 6, larutan X ialah

- **A** Zinc sulphate
  Zink sulfat

- **B** Zinc nitrate
  Zink nitrat

- **C** Magnesium chloride
  Magnesium klorida

- **D** Aluminium sulphate
  Aluminium sulfat

45   Calcium reacts slowly in cold water and becomes more vigorously in hot water. Which statement best explains the increasing in the rate of reaction?

Kalsium bertindak balas perlahan di dalam air sejuk dan menjadi semakin cergas di dalam air panas.
Pernyataan manakah yang paling baik menerangkan peningkatan kadar tindak balas?

   A   The number of particles per unit volume is higher and increase the rate of reaction
         Bilangan zarah per unit isipadu lebih tinggi dan meningkatkan kadar tindak balas

   B   The activation energy is lower at the higher temperature and more particles have enough energy to react
         Tenaga pengaktifan lebih rendah pada suhu lebih tinggi dan lebih banyak zarah-zarah mempunyai tenaga yang mencukupi untuk bertindak balas

   C   The metal expands at the higher temperature and increases its total surface area and the rate of reaction
         Logam mengembang pada suhu yang lebih tinggi dan meningkatkan jumlah luas permukaan serta kadar tindak balas

   D   At higher temperature the particles have higher kinetic energy and increases the number of collisions per second
         Pada suhu lebih tinggi zarah-zarah mempunyai tenaga kinetik yang lebih tinggi dan meningkatkan bilangan perlanggaran per saat

46 Diagram 21 shows an experiment using excess dilute acid and a metal. The volume of hydrogen gas released is measured and plotted on a graph as curve M.
The experiment is repeated by changing one condition at a time. The volume of hydrogen gas released is measured and plotted on a graph as curve N.

Rajah 21 menunjukkan eksperimen menggunakan asid cair berlebihan dan logam. Isipadu gas hidrogen yang dibebaskan diukur dan diplotkan pada graf sebagai lengkung M. Eksperimen diulang dengan mengubah satu keadaan pada satu masa. Isipadu gas hidrogen yang dibebaskan diukur dan diplotkan pada graf sebagai lengkung N.
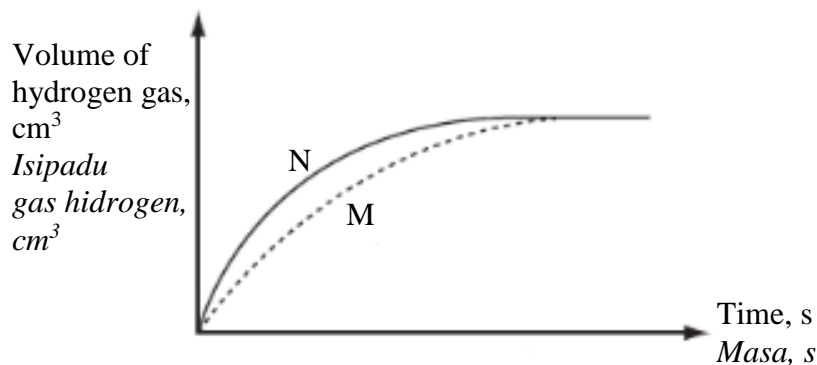
Diagram 21
Jadual 21

What are the possibilities of the condition changed to obtain curve N?
Apakah perubahan keadaan yang mungkin untuk mendapatkan lengkung N?

	Increase in concentration of acid *Meningkatkan kepekatan asid*	**Increase in size of metal** *Meningkatkan saiz logam*	**Increase in temperature** *Meningkatkan suhu*
A	√	√	√
B	√	√	X
C	√	X	√
D	X	√	√

47   Diagram 22 shows the process of producing compound G.
Rajah 22 menunjukkan proses menghasilkan sebatian G.
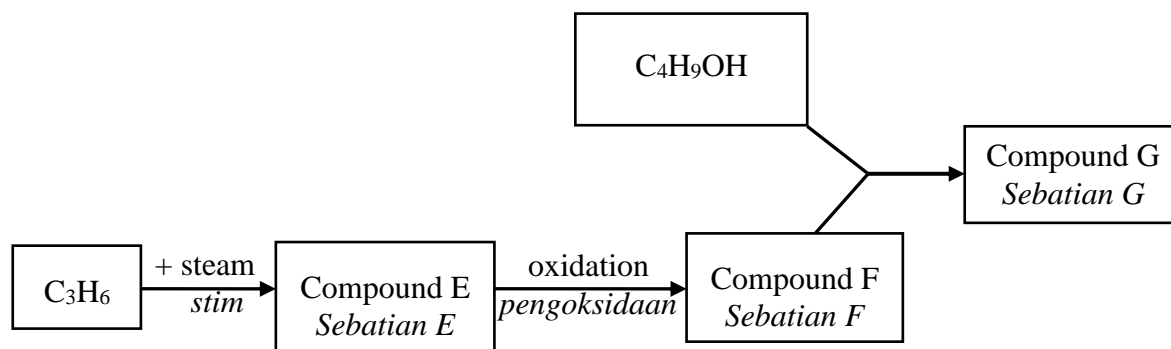
Diagram 22
Rajah 22

Which of the following is the structural formula for the compound G?
Antara formula struktur berikut yang manakah sebatian G?

A

B

C

D

48 The following ionic equation represents a redox reaction.
Persamaan ion berikut mewakili tindak balas redoks.

$$Cl_{2\ (aq)} + 2I^-_{\ (aq)} \rightarrow 2Cl^-_{\ (aq)} + I_{2\ (aq)}$$
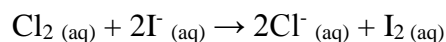
Which of the following statements describes the reaction correctly?
Pernyataan manakah yang menerangkan tindak balas itu dengan betul?

I Chlorine is the oxidising agent
Klorin adalah agen pengoksidaan

II Chlorine is less electronegative than iodine
Klorin kurang elektronegatif daripada iodin

III A brown solution is formed
Larutan perang terbentuk

IV The oxidation number of iodine decreases
Nombor pengoksidaan iodin berkurangan

A I and II
I dan II

B II and IV
II dan IV

C III and IV
III dan IV

D I and III
I dan III

49 Which chemical equation does not represent a redox reaction?
Persamaan kimia manakah yang bukan persamaan redoks?

A $2Fe_{(s)} + 3Cl_{2\ (g)} \rightarrow 2FeCl_{3\ (s)}$

B $2CuO_{(s)} + C_{(s)} \rightarrow 2Cu_{(s)} + CO_{2\ (g)}$

C $CuSO_{4\ (aq)} + Zn_{(s)} \rightarrow Cu_{(s)} + ZnSO_{4\ (aq)}$

D $ZnO_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2\ (aq)} + H_2O_{(l)}$

50   The following thermochemical equation represents a precipitation reaction.
Persamaan termokimia berikut mewakili suatu tindak balas pemendakan.

$$Na_2CO_{3\ (aq)} + Ca(NO_3)_{2\ (aq)} \rightarrow CaCO_{3\ (s)} + 2NaNO_{3\ (aq)} \quad \triangle H = +30\ kJ\ mol^{-1}$$
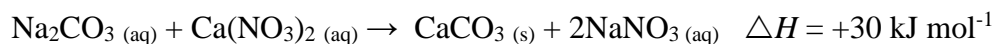
$100\ cm^3$ of $1.0\ mol\ dm^{-3}$ sodium carbonate solution is added to $100\ cm^3$ of
$1.0\ mol\ dm^{-3}$ calcium nitrate solution.
What is the temperature change of the mixture?
[Specific heat capacity of solution = $4.2\ Jg^{-1o}C^{-1}$; Density of solution = $1.0\ g\ cm^{-3}$]

$100\ cm^3$ larutan natrium karbonat $1.0\ mol\ dm^{-3}$ ditambah kepada $100\ cm^3$ larutan kalsium nitrat $1.0\ mol\ dm^{-3}$.
Apakah perubahan suhu campuran ini?
[Muatan haba tentu larutan = $4.2\ Jg^{-1o}C^{-1}$; Ketumpatan larutan = $1.0\ g\ cm^{-3}$]

A $0.4\ ^oC$

B $0.7\ ^oC$

C $3.6\ ^oC$

D $7.1\ ^oC$

END OF QUESTION PAPER
KERTAS SOALAN TAMAT

INFORMATION FOR CANDIDATES
MAKLUMAT UNTUK CALON

1.   This question paper consists of **50** questions.
      *Kertas soalan ini mengandungi **50** soalan.*

2.   Answer **all** questions.
      *Jawab **semua** soalan.*

3.   Answer each question by blackening the correct space on the answer sheet.
      Jawab setiap soalan dengan menghitamkan ruangan yang betul pada kertas jawapan.

4.   Blacken only **one** space for each question.
      *Hitamkan **satu** ruangan sahaja pada setiap soalan.*

5.   If you wish to change your answer, erase the blackened mark that you have made. Then blacken the new answer.
      Sekiranya anda hendak menukar jawapan, padamkan tanda yang telah dibuat. Kemudian hitamkan jawapan yang baru.

6.   The diagrams in the questions provided are not drawn to scale unless stated.
      Rajah yang mengiringi soalan tidak dilukiskan mengikut skala kecuali dinyatakan.

7.   You may use a scientific calculator.
      Anda dibenarkan menggunakan kalkulator saintifik.

4541/2
Chemistry
Paper 2
September
2016
2 ½ hour

Name : ……………………………………

Index Number: …......……………………

Class: …………………………………

SIJIL PENDIDIKAN MRSM 2016
https://cikguadura.wordpress.com/

CHEMISTRY

Paper 2

Two hours and thirty minutes

DO NOT OPEN THE QUESTION BOOKLET
UNTIL BEING TOLD TO DO SO

1. Write your name and index number in the
    space provided.
    Tuliskan **nama** *dan* **angka giliran** *anda pada*
    ruang yang disediakan.

2. The question booklet is bilingual
    Kertas soalan ini adalah dalam dwibahasa.

3. Candidate is required to read the information
    on the last page.
    Calon dikehendaki membaca maklumat
    di halaman belakang

Kod Pemeriksa			
Section	Question	Full mark	Marks
A	1	9	
	2	9	
	3	10	
	4	10	
	5	11	
	6	11	
B	7	20	
	8	20	
C	9	20	
	10	20	
TOTAL		100	

This question booklet contains 34 printed pages.

Section A
Bahagian A

[60 *marks*]
[60 *markah*]

Answer **all** questions in this section.
Jawab semua soalan dalam bahagian ini
https://cikguadura.wordpress.com/

1 (a) Diagram 1.1 shows the atomic structure of element T.
Rajah 1.1 menunjukkan struktur atom bagi unsur T.
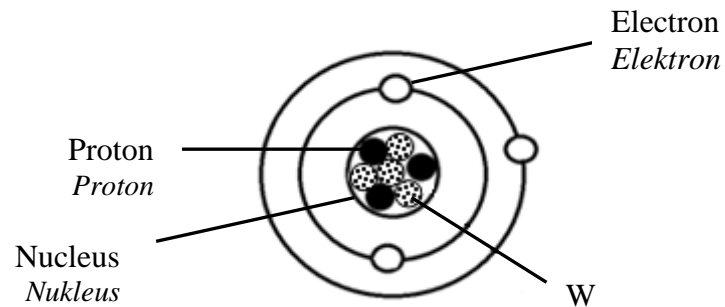
Diagram 1.1

Rajah 1.1

Based on Diagram 1.1,

Berdasarkan Rajah 1.1,

(i) identify W.

kenalpasti W.

…………………………………………………………………………………

[1 *mark*]
[1 *markah*]

(ii) state the number of proton in element T.

nyatakan bilangan proton bagi unsur T.

…………………………………………………………………………………

[1 *mark*]
[1 *markah*]

1(a)(i)

1

1(a)(ii)

1

(iii) write the electron arrangement for element T.

tulis susunan elektron bagi unsur T.

………………………………………………………………………………

[1 *mark*]
[1 *markah*]

1(a)(iii)

| | 1 |

(b) (i) Element T has a melting point of 180.5ºC.
Predict the physical state of element T at room temperature.

Unsur T mempunyai takat lebur 180.5 ºC.
Ramalkan keadaan fizikal bagi unsur T pada suhu bilik.

....…………….............................

[1 mark]
[1 *markah*]

1(b)(i)

| | 1 |

(ii) Based on the kinetic theory of matter, describe the arrangement and movement of particles of element T at room temperature.

Berdasarkan teori kinetik jirim, huraikan susunan dan pergerakan zarah bagi unsur T pada suhu bilik.

Arrangement of particles:

Susunan zarah : ....

……………………………………………………………

Movement of particles:

Pergerakan zarah: ……………………………………………………...

……………………………………………………...

[2 *marks*]
[2 *markah*]

1(b)(ii)

| | 2 |

(c) Diagram 1.2 shows the graph of temperature against time when liquid acetamide is cooled.

Rajah 1.2 menunjukkan graf suhu melawan masa apabila cecair asetamida disejukkan.

Temperature (°C)
Suhu (°C)
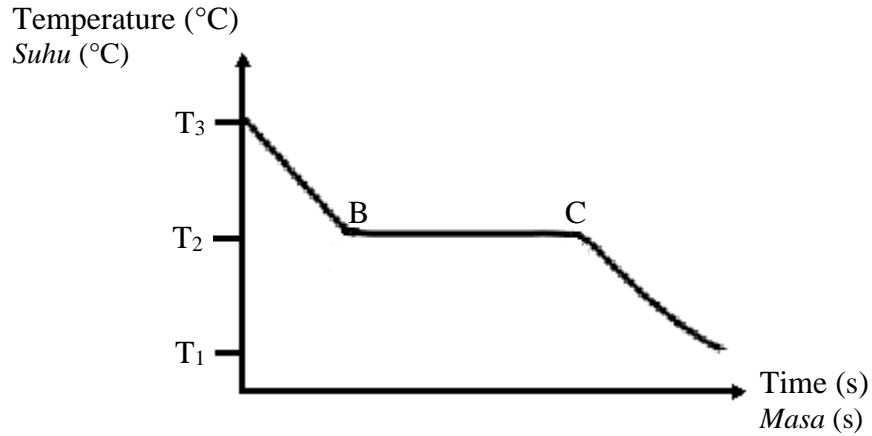
Diagram 1.2
Rajah 1.2

Based on Diagram 1.2,

Berdasarkan Rajah 1.2,

(i) determine the freezing point of acetamide.

tentukan takat beku bagi asetamida.

…………………………………………………………………………………

[1 *mark*]
[1 *markah*]

(ii) the temperature of acetamide did not change from B to C. Explain why?

suhu asetamida tidak berubah dari B ke C.
Terangkan mengapa?

…………………………………………………………………………………

…………………………………………………………………………………

[2 *marks*]
[2 *markah*]

1(c)(i)

	1

1(c)(ii)

	2

TOTAL A1

	9

2 Diagram 2.1 shows three examples of manufactured substances in industry

Rajah 2.1 menunjukkan tiga contoh bahan buatan untuk industri.

P Q R

Diagram 2.1

Rajah 2.1

(a) R is an example of alloy.

What is the meaning of alloy?

R merupakan contoh aloi.
Apakah maksud aloi?

....……………………………….............

....……………………………….............

[1 *mark*]
[1 *markah*]

2(a)

1

(b) Name the major component for the following substances:
Namakan komponen utama untuk bahan-bahan berikut:

Q : ……………………………………………………………..

R : ……………………………………………………………..

[2 *marks*]
[2 *markah*]

2(b)

2

(c)   Diagram 2.2 shows a part of the structure of P.

Rajah 2.2 menunjukkan sebahagian struktur P.
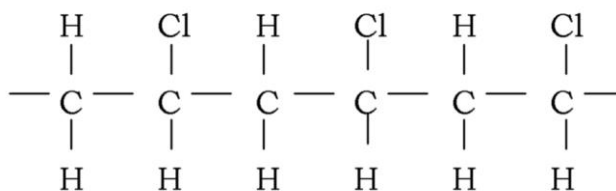
Diagram 2.2
Rajah 2.2

(i)   Draw the structural formula for monomer of P.

Lukis formula struktur monomer bagi P.

2(c)(i)

1

[1 *mark*]
[1 *markah*]

(ii)   Substance P is often used as a water pipe.
State one advantage of this type of pipe compared to iron pipe.

Bahan P selalu digunakan sebagai paip air.
Nyatakan satu kelebihan paip jenis ini berbanding dengan paip besi.

2(c)(ii)

1

…………………………………………………………………………….

[1 *mark*]
[1 *markah*]

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For Examiner's Use

(d)   Diagram 2.3 shows the conversion of glucose to another substance.

        Rajah 2.3 menunjukkan penukaran glukosa kepada bahan lain.

```
        ┌──────────────┐
        │   Glucose    │
        │   Glukosa    │
        └──────┬───────┘
               │
  Reaction I   │  + yeast
 Tindak balas I│    yis               Reaction II
               ▼                      Tindak balas II
        ┌──────────────┐                                           ┌──────────┐
        │   Liquid H   │───────────────────────────────────────►  │  Gas J   │
        │   Cecair H   │  Heated with porous pot chips             │  Gas J   │
        └──────────────┘  Dipanaskan dengan serpihan pasu berliang └──────────┘
```
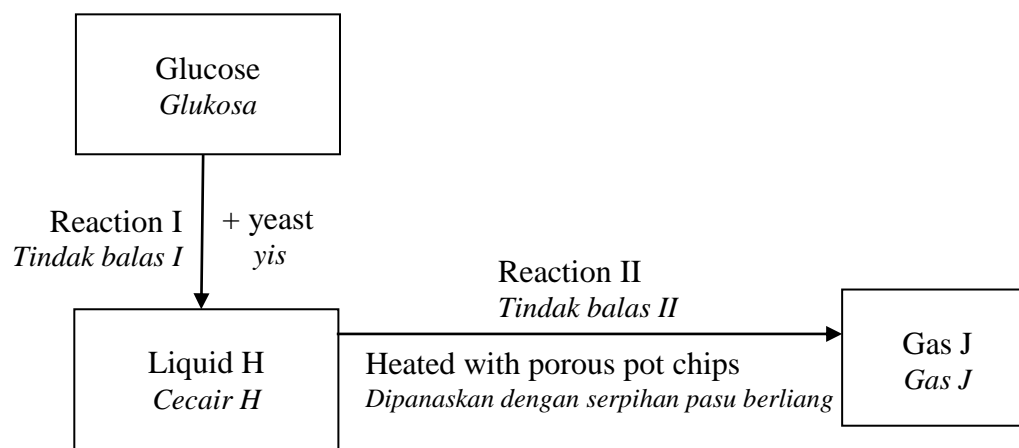
Diagram 2.3
Rajah 2.3

Based on Diagram 2.3,

Berdasarkan Rajah 2.3,

(i)   name Reaction I.

        namakan Tindak balas I.

        …………………………………………………………………………………

                             [1 *mark*]

                             [1 *markah*]

2(d)(i)	
	1

(ii)   state the homologous series for liquid H.

        nyatakan siri homolog bagi cecair H.

        …………………………………………………………………………………

                             [1 *mark*]

                             [1 *markah*]

2(d)(ii)	
	1

(iii)   write the chemical equation in Reaction II.

        tuliskan persamaan kimia dalam Tindak balas II.

        …………………………………………………………………………………

                             [1 *mark*]

                             [1 *markah*]

2(d)(iii)	
	1

2(d)(iv)	
	1

(iv)   state a substance that can be used to replace porous pot chips in Reaction II.

nyatakan satu bahan yang boleh menggantikan serpihan pasu berliang dalam Tindak balas II.

……………………………………………………………………………

[1 mark]

[1 *markah*]

	9

3 Table 3 shows the information of two substances; E and F.

Jadual 3 menunjukkan maklumat bagi dua bahan; E dan F.

Substance *Bahan*	E	F
Uses *Kegunaan*	As food flavouring and preservative. *Sebagai perisa dan pengawet makanan.* PICKLES	As electrolyte in car battery. *Sebagai elektrolit dalam bateri kereta.* Koyosonic

Table 3

Jadual 3

(a) (i) State the ion that causes the acidic properties of E and F.

Nyatakan ion yang menyebabkan sifat keasidan bagi E dan F.

....

[1 *mark*]
[1 *markah*]

(ii) State one example for substance E and F?

Nyatakan satu contoh bahan E dan F?

E : ....

F : ....

[2 *marks*]
[2 *markah*]

(iii)   At the same concentration, pH value of E is higher than F. Explain why?

Pada kepekatan yang sama, nilai pH bagi E adalah lebih tinggi daripada F.
Jelaskan mengapa?

....

....

....

[2 *marks*]
[2 *markah*]

3(a)(iii)

| | 2 |

(iv)   Describe a chemical test to verify substance F.

Huraikan satu ujian kimia bagi mengesahkan bahan F.

....

....

....

[2 *marks*]
[2 *markah*]

3(a)(iv)

| | 2 |

(b)   The chemical equation for the reaction between acid H_2X and zinc carbonate powder is as follows:

Persamaan kimia bagi tindak balas di antara asid H_2X dan serbuk zink karbonat adalah seperti berikut :

$$H_2X \ + \ ZnCO_3 \ \rightarrow \ ZnX \ + \ CO_2 \ + \ H_2O$$

Acid H_2X reacts with zinc carbonate to produce 448 cm^3 of carbon dioxide gas at standard temperature and pressure.
Calculate the mass of zinc carbonate used in this reaction.
[Relative atomic mass; Zn = 65, C = 12, O = 16,
Molar volume of gas = 22.4 dm^3 mol^{-1}]

Asid H_2X bertindak balas dengan zink karbonat untuk menghasilkan 448 cm^3 gas karbon dioksida pada suhu dan tekanan piawai.
Kira jisim zink karbonat yang digunakan dalam tindak balas ini.
[Jisim atom relatif; Zn = 65, C = 12, O = 16,
Isipadu molar gas = 22.4 dm^{3}mol^{-1}]

[3 *marks*]
[3 *markah*]

3(b)	
	3

TOTAL A3
10

4   Diagram 4.1 shows two metals inserted in a potato that contains phosphoric acid, H_3PO_4. A student found that the light emitting diode (LED) bulb is lighted.

Rajah 4.1 menunjukkan dua logam yang dimasukkan ke dalam kentang yang mengandungi asid fosforik, H_3PO_4. Seorang pelajar mendapati mentol diod pemancar cahaya (LED) tersebut menyala.
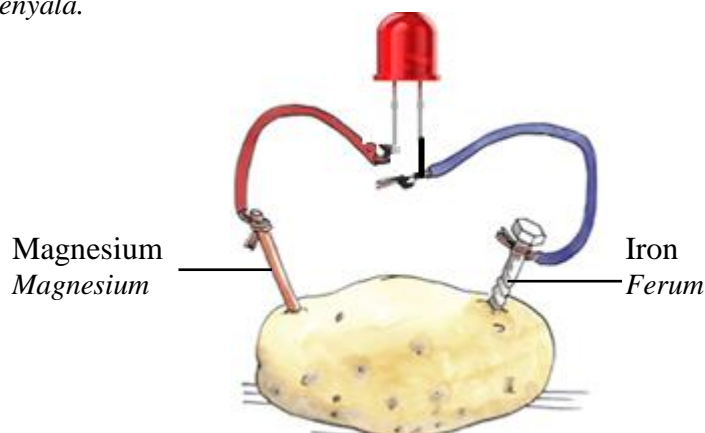

Magnesium   Iron
Magnesium   *Ferum*

Diagram 4.1
Jadual 4.1

(a)   Name the type of cell in Diagram 4.1.

Namakan jenis sel dalam Rajah 4.1.

…………………………………………………………………………………
[1 *mark*]
[1 *markah*]

4(a)

1

(b)   State the energy conversion that occur in the cell stated in (a).

Nyatakan perubahan tenaga yang berlaku dalam sel yang dinyatakan di (a).

…………………………………………………………………………………..
[1 *mark*]
[1 *markah*]

4(b)

1

(c)   Write the half equation for the reaction that occurs at positive terminal.

Tuliskan setengah persamaan bagi tindakbalas yang berlaku di terminal positif.

…………………………………………………………………………….......
[2 *marks*]
[2 *markah*]

4(c)

2

(d) If the experiment is repeated by using a series circuit containing three potatoes, suggest the suitable apparatus to replace LED to show electrical conductivity.

Sekiranya eksperimen diulang dengan litar sesiri mengandungi tiga biji kentang, cadangkan radas yang sesuai untuk menggantikan LED bagi menunjukkan kekonduksian elektrik.

…………………………………………………………………………………

[1 *mark*]
[1 *markah*]

4(d)	
	1

(e) A teacher asks the students to modify the above cell to produce brighter LED light as shown in Diagram 4.2.

Seorang guru mengarahkan pelajar-pelajarnya untuk mengubahsuai sel di atas supaya cahaya LED yang terhasil lebih terang seperti yang ditunjukkan dalam Rajah 4.2
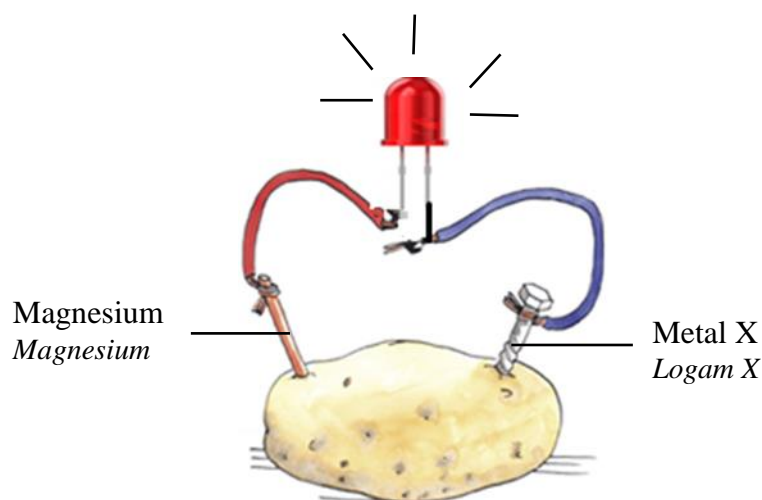

Magnesium
Magnesium

Metal X
Logam X

Diagram 4.2
Rajah 4.2

(i) State one example of metal X.

Nyatakan satu contoh logam X.

…………………………………………………………………………………

[1 *mark*]
[1 *markah*]

4(e)(i)	
	1

(ii) Explain your answer in e(i).

Terangkan jawapan anda di e(i).

…………………………………………………………………………………....

[1 *mark*]
[1 *markah*]

4(e)(ii)	
	1

4(f)(i)

	1

(f) (i) Suggest a fruit that can be used to replace potato to make the bulb lights up.

Cadangkan sejenis buah yang boleh digunakan untuk menggantikan kentang bagi menyalakan mentol.

....

[1 *mark*]
[1 *markah*]

(ii) Explain your answer in f(i).

Terangkan jawapan anda di f(i).

…………………………………………………………………………

…………………………………………………………………………

…………………………………………………………………………

[2 *marks*]
[2 *markah*]

4(f)(ii)

	2

TOTAL A4

	10

5 An experiment is carried out to investigate the rate of reaction of magnesium with sulphuric acid. Excess magnesium powder is added to 20 cm³ of 0.1 mol dm⁻³ sulphuric acid. Table 5.1 shows the volume of gas collected at intervals of 30 seconds.

Satu eksperimen dijalankan untuk mengkaji kadar tindak balas antara magnesium dengan asid sulfurik. Serbuk magnesium berlebihan ditambahkan kepada 20 cm³ asid sulfurik 0.1 mol dm⁻³.
Jadual 5.1 menunjukkan isipadu gas yang terkumpul pada setiap sela masa 30 saat.

Time /s *Masa /s*	0	30	60	90	120	150	180	210	240
Volume of gas /cm³ *Isipadu gas /cm³*	0.00	12.00	22.00	31.00	38.00	42.00	44.00	45.00	45.00

Table 5.1
Jadual 5.1

(a) Name the gas released from the above reaction.

Namakan gas yang terbebas daripada tindak balas di atas.

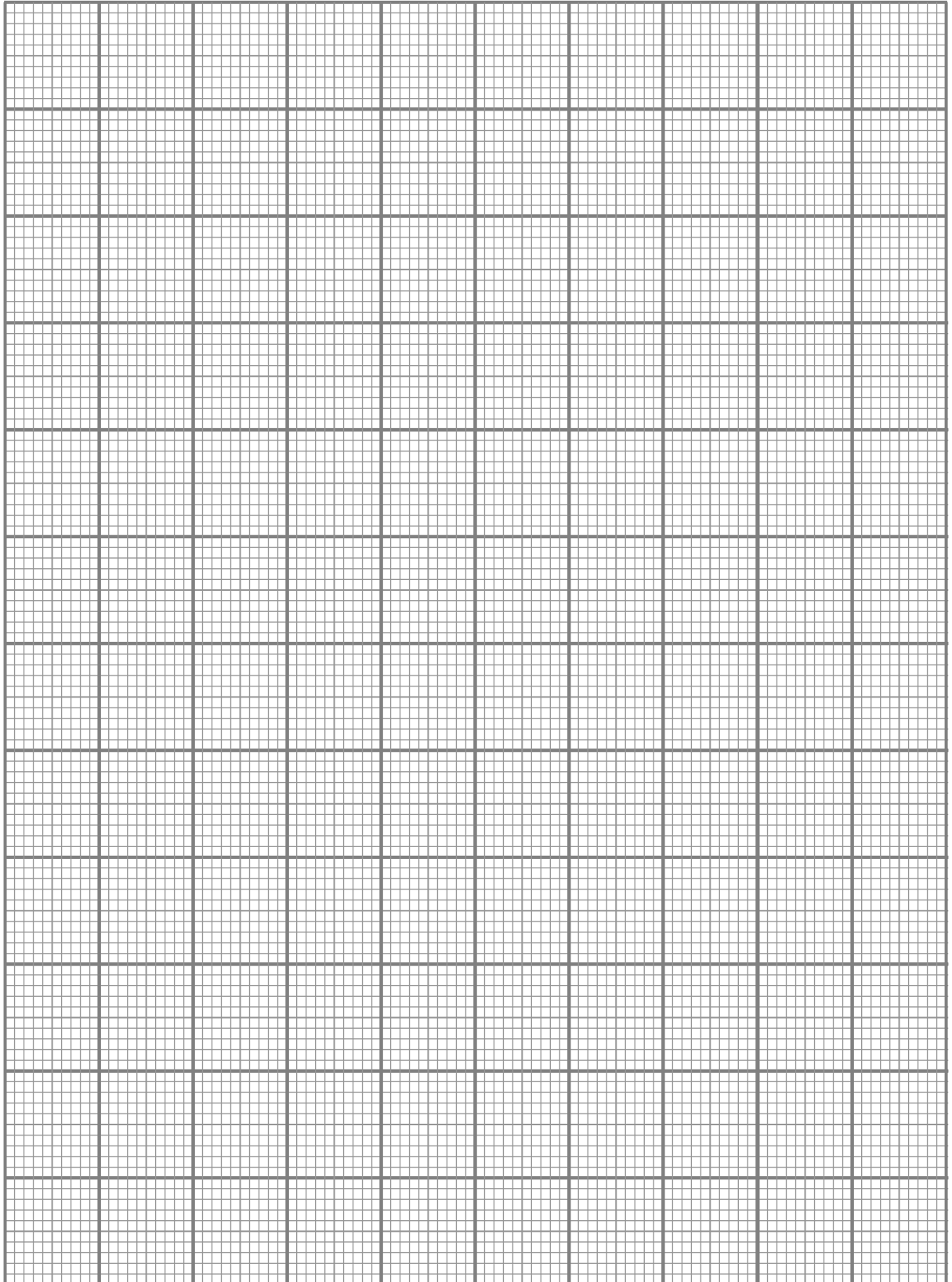………………………………………………………………………………………
[1 *mark*]
[1 *markah*]

(b) Based on Table 5.1, plot a graph of the volume of gas collected against time.

Berdasarkan Jadual 5.1, plotkan graf isipadu gas yang terkumpul melawan masa.
[3 *marks*]
[3 *markah*]

5(a)	
	1

Graph of volume of gas collected against time.

5(b)

3

For Examiner's Use

(c)   Based on graph plotted in 5(b), calculate:
         Berdasarkan pada graf yang diplotkan di 5(b), hitung :

        (i)   the rate of reaction at 120 s.

               kadar tindak balas pada masa 120 s.

[2 *marks*]
[2 *markah*]

5(c)(i)	
	2

        (ii)   the overall rate of reaction.

               kadar tindak balas purata keseluruhan.

[1 *mark*]
[1 *markah*]

5(c)(ii)	
	1

(d) Another experiment is carried out to investigate the factors affecting the rate of reaction. Diagram 5.2 shows the results of the experiment. Curve L represents the result of the experiment using excess magnesium powder and 50 cm^3 of 1.0 mol dm^{-3} hydrochloric acid.

Suatu eksperimen berasingan dijalankan untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas. Rajah 5.2 menunjukkan keputusan eksperimen. Lengkung L mewakili keputusan eksperimen yang menggunakan serbuk magnesium berlebihan dan 50 cm^3 asid hidroklorik 1.0 mol dm^{-3}.
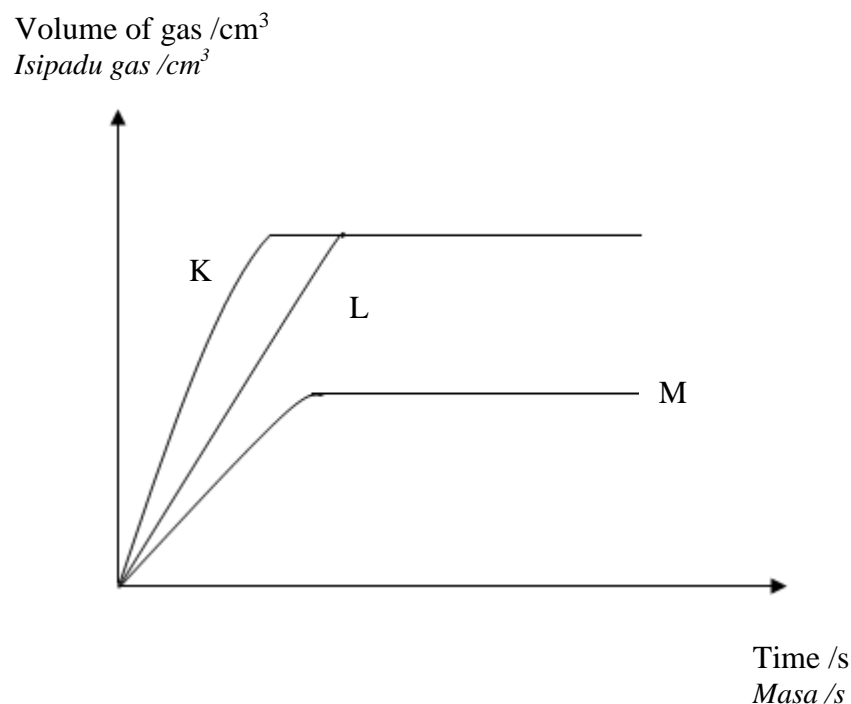
Volume of gas /cm^3
Isipadu gas /cm^3

Diagram 5.2
Rajah 5.2

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

………………………………………………………………...……

[1 *mark*]
[1 *markah*]

5(d)(i)

1

(ii) Rate of reaction of curve K is higher than L.
Explain your answer based on the Collision Theory.

Kadar tindak balas lengkung K lebih tinggi dari L.
Terangkan jawapan anda berdasarkan Teori Perlanggaran.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………
[2 *marks*]
[2 *markah*]

5(d)(ii)

2

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

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

……………………………………………………………………………………

……………………………………………………………………………………
[1 *mark*]
[1 *markah*]

5(d)(iii)

1

TOTAL A5

11

6   Diagram 6.1 shows a match head has been struck.

      Rajah 6.1 menunjukkan satu kepala mancis yang telah digeserkan.

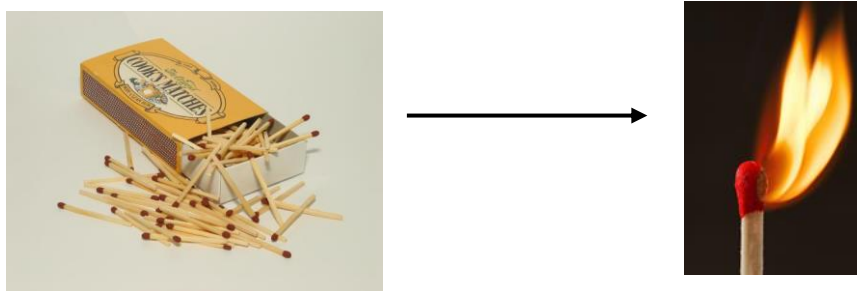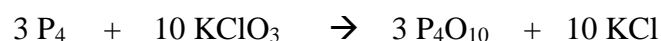Diagram 6.1
Rajah 6.1

The chemical equation for the reaction is as follow:
Persamaan kimia untuk tindak balas adalah seperti berikut:

$$3\ P_4 \quad + \quad 10\ KClO_3 \quad \rightarrow \quad 3\ P_4O_{10} \quad + \quad 10\ KCl$$

(a)   (i)   Determine the oxidation number of chlorine, Cl in $KClO_3$.

               Tentukan nombor pengoksidaan bagi klorin, Cl dalam $KClO_3$.

6(a)(i)

           1

[1 *mark*]
[1 *markah*]

        (ii)   State the substance that undergoes oxidation.

6(a)(ii)

           1

               Nyatakan bahan yang mengalami pengoksidaan.

              ………………………………………………………………………...

[1 mark]
[1 *markah*]

        (iii)   Explain the answer in (a)(ii) in terms of the change in the oxidation number.

6(a)(iii)

           1

               Terangkan jawapan di (a)(ii) dari segi perubahan nombor pengoksidaan.

              …………………………………………………………………………

[1 *mark*]
[1 *markah*]

For Examiner's Use

(b)

Copper(II) sulphate solution
Larutan kuprum(II) sulfat

Metal strip G
Kepingan logam G

Light blue solution
Larutan biru muda

Brown solid
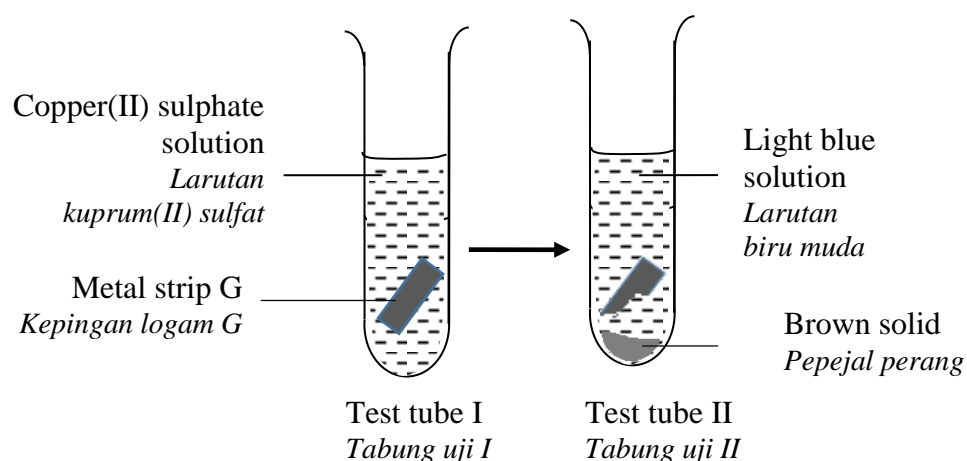*Pepejal perang*

Test tube I
Tabung uji I

Test tube II
Tabung uji II

Diagram 6.2
Rajah 6.2

(i)   State the colour of copper(II) sulphate solution in test tube I.

Nyatakan warna larutan kuprum(II) sulfat di dalam tabung uji I.

……………………………………………………………………………

[1 *mark*]
[1 *markah*]

6(b)(i)

1

(ii)   Based on Diagram 6.2, explain the change in colour of copper(II) sulphate solution.

Berdasarkan Rajah 6.2, terangkan perubahan warna larutan kuprum(II) sulfat.

……………………………………………………………………………

……………………………………………………………………………

[2 *marks*]
[2 *markah*]

6(b)(ii)

2

(iii) Suggest a suitable metal G.
Write the ionic equation for the reaction in Diagram 6.2.

Cadangkan logam G yang sesuai.
Tuliskan persamaan ion bagi tindak balas dalam Rajah 6.2.

……………………………………………………………………………

……………………………………………………………………………

[2 *marks*]
[2 *markah*]

6(b)(iii)

2

(c)   Diagram 6.3 shows zinc plate attached to the hull of the ship to prevent rusting.

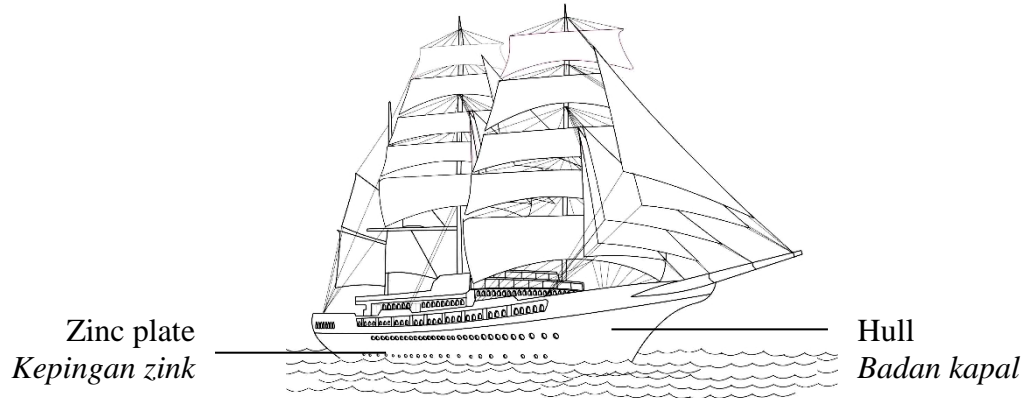*Rajah 6.3 menunjukkan kepingan zink yang dilekatkan pada badan kapal bagi mengelakkan pengaratan.*

Zinc plate   Hull
Kepingan zink   *Badan kapal*

Diagram 6.3
Rajah 6.3

(i)   Explain how zinc plate protect the ship's hull from rusting.

Terangkan bagaimana kepingan zink dapat melindungi badan kapal daripada berkarat.

……………………………………………………………………………

……………………………………………………………………………
[2 *marks*]
[2 *markah*]

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

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

……………………………………………………………………………
[1 *mark*]
[1 *markah*]

6(c)(i)

2

6(c)(ii)

1

TOTAL A6

11

Section B
Bahagian B

[20 marks]
[20 *markah*]
https://cikguadura.wordpress.com/
Answer any **one** *question from this section.*
Jawab mana-mana **satu** *soalan daripada bahagian ini.*

7   Table 7.1 shows the standard representation for sodium and chlorine atom.

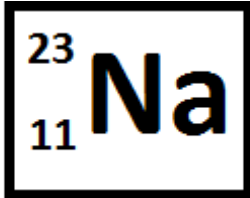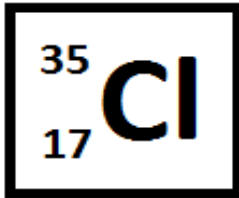*Jadual 7.1 menunjukkan perwakilan piawai bagi atom natrium dan klorin.*

Standard Representation
Perwakilan Piawai
$^{23}_{11}Na$ $^{35}_{17}Cl$

Table 7.1
Jadual 7.1

(a)   (i)   Based on the Table 7.1, explain the position of sodium and chlorine element in the Periodic Table of Elements.

Berdasarkan Jadual 7.1, terangkan kedudukan unsur natrium dan klorin dalam Jadual Berkala Unsur.

[5 marks]
[*5 markah*]

(ii)

| **Apparatus set-up** |
| *Susunan radas* |

Gas jar spoon
Sudu balang gas

Gas jar
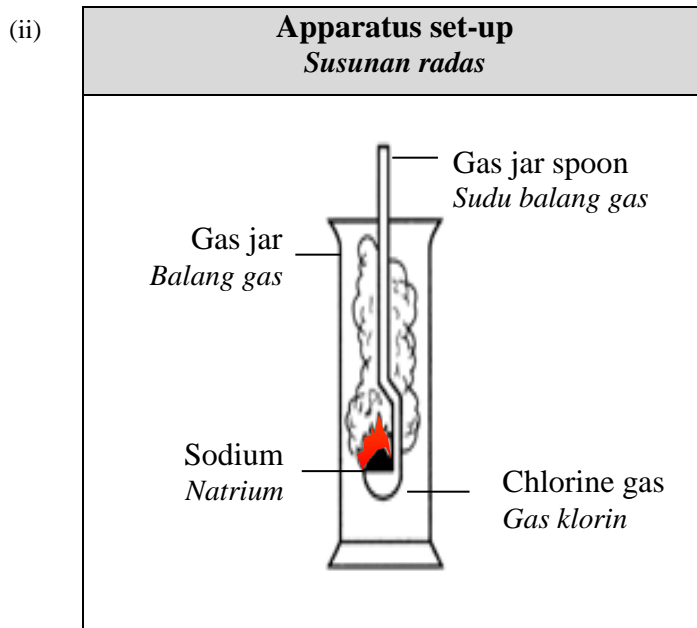*Balang gas*

Sodium
Natrium

Chlorine gas
Gas klorin

Diagram 7.2
Rajah 7.2

Diagram 7.2 shows apparatus set up for the reaction between sodium and chlorine gas.

Explain how the compound is formed and draw the electron arrangement of the compound.

Rajah 7.2 menunjukkan susunan radas bagi tindak balas antara natrium dan gas klorin.

Terangkan bagaimana sebatian itu terbentuk dan lukis susunan elektron untuk sebatian tersebut.

[7 *marks*]
[7 *markah*]

(iii) Chlorine atom can react with carbon atom to form another type of compound.

Compare the melting point of the compound formed with the melting point of the compound in a(ii).

Explain your answer.

Atom klorin boleh bertindak balas dengan atom karbon untuk menghasilkan satu sebatian lain.

Bandingkan takat lebur bagi sebatian yang terhasil dengan takat lebur sebatian di a(ii).

Terangkan jawapan anda.

[5 marks]
[5 *markah*]

(b) Diagram 7.3 shows the results when argon and oxygen gas is filled into a bulb.

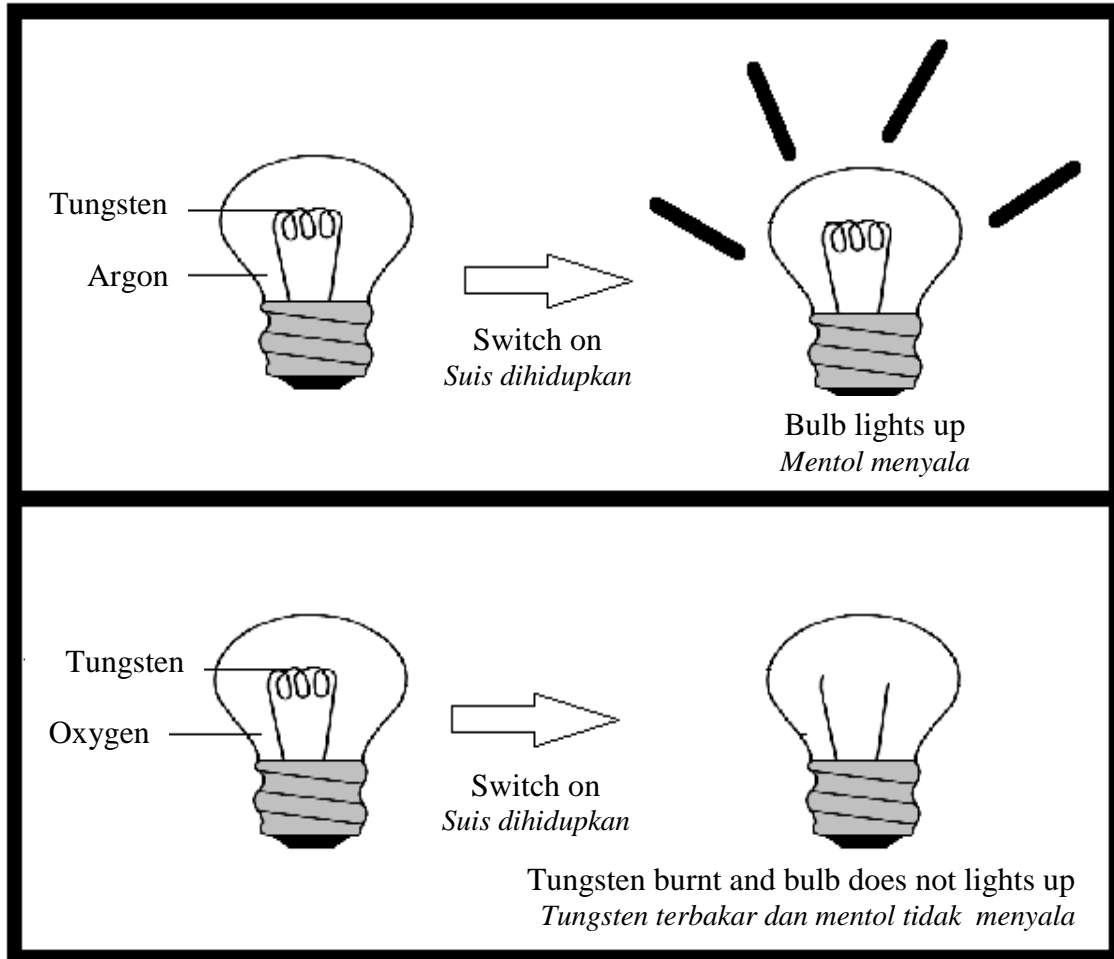*Rajah 7.3 menunjukkan pemerhatian apabila gas argon dan oksigen diisi ke dalam mentol.*

Diagram 7.3
Rajah 7.3

Based on Diagram 7.3, explain why argon is more suitable to be filled in the bulb than oxygen.

Berdasarkan Rajah 7.3, terangkan mengapa mentol lampu lebih sesuai diisi dengan gas argon berbanding gas oksigen.

[3 marks]
[3 *markah*]

8   (a)   Diagram 8.1 shows a few examples of food additive which is being permitted to be added to food.

Rajah 8.1 menunjukkan beberapa contoh bahan tambah makanan yang dibenarkan untuk di tambah kepada makanan.

Food Act 1983, allows only a certain quantity of chemicals to be added to food.
Akta makanan 1983, membenarkan hanya kuantiti tertentu bahan kimia ditambah ke dalam makanan

As example:

Benzoic acid */ Asid benzoik*	:	< 350mg/ kg
Ascorbic acid */ Asid askorbik*	:	<350 mg/kg
Pentyl Ethanoate */ Pentil etanoat*	:	< 200 mg/litre
Acacia gum / *Gam akasia*	:	< 150 mg/litre
Sulphur dioxide / *Sulfur dioksida*	:	<140 mg/kg

Diagram 8.1
Rajah 8.1

(i)   State two types of food additive permitted by Food Act and state the function for each type of food additives.

Nyatakan dua jenis bahan tambah makanan yang dibenarkan oleh Akta Makanan dan nyatakan fungsi bagi setiap bahan tambah makanan tersebut.

[4 marks]
[4 *markah*]

(ii)   State one advantage and one disadvantage about the uses of food additives in daily life.
Nyatakan satu kebaikan dan satu keburukan tentang penggunaan bahan tambah makanan dalam kehidupan.

[2 marks]
[2 *markah*]

(iii)   Mahmud and Ah Seng are close friends.
- Mahmud's right leg is swollen due to bacterial infection.
- Ah Seng is suffering from headache.

Mahmud dan Ah Seng adalah sahabat baik.
- *Kaki kanan Mahmud bengkak akibat jangkitan bakteria.*
- *Ah Seng mengalami sakit kepala*

They consult a doctor and different types of medicines are prescribed to each of them.
State the type of medicine prescribed respectively and give the correct usage.

Mereka berjumpa dengan doktor dan ubat yang berlainan jenis dipreskripsikan kepada mereka.
Nyatakan jenis ubat dan cara penggunaannya yang betul.

[4 marks]
[4 marks]

(b)   Diagram 8.2 shows a series of reaction starting from calcium carbonate, $CaCO_3$.

Rajah 8.2 menunjukkan satu siri tindak balas bermula daripada kalsium karbonat, $CaCO_3$.
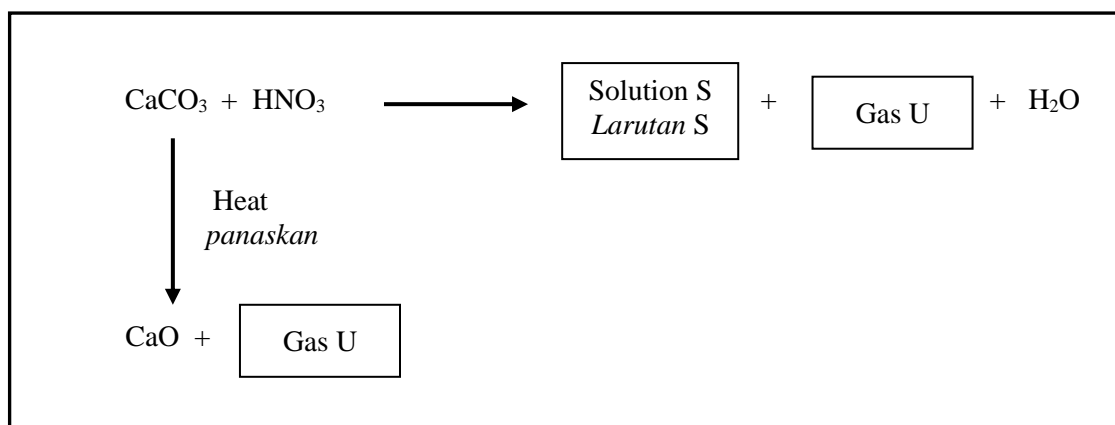
Diagram 8.2
Rajah 8.2

Based on Diagram 8.2,

Berdasarkan Rajah 8.2,

(i)   Identify gas U. Describe a chemical test to verify gas U.

Kenal pasti gas U. *Huraikan ujian kimia untuk menentusahkan gas* U.

(ii)   Describe a chemical test to determine the presence of anion in the solution S.

Huraikan ujian kimia untuk menentukan kehadiran anion dalam larutan S.

[6 marks]
[6 *markah*]

(c)   Raju wants to prepare barium sulphate during his chemistry class.
Raju ingin menyediakan barium sulfat semasa kelas kimianya.

         (i)   Suggest two aqueous solutions that he should use to prepare barium sulphate.

                Cadangkan dua larutan yang sesuai untuk dia menyediakan barium sulfat.

                                                            [2 marks]
                                                            [2 *markah*]

         (ii)   After the precipitate is formed, describe what Raju should do to get dry barium sulphate.

                Selepas mendakan terbentuk, terangkan bagaimana Raju mendapatkan barium sulfat kering.

                                                              [2 marks]
                                                            [2 *markah*]

Section C
Bahagian C

[20 marks]
[20 *markah*]

Answer any **one** *question from this section.*
Jawab mana-mana ***satu*** *soalan daripada bahagian ini.*
https://cikguadura.wordpress.com/

9   (a)   Diagram 9.1 shows the chemical bonding in a molecule of a compound present in fruits.

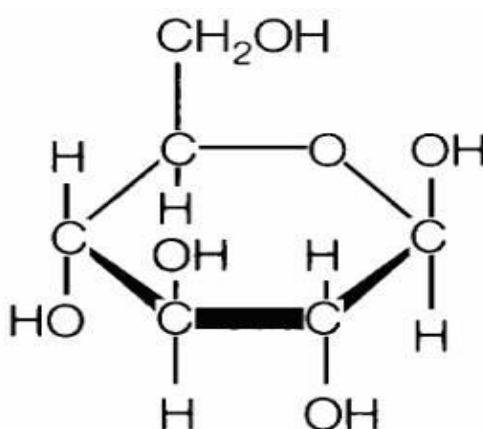*Rajah 9.1 menunjukkan ikatan kimia dalam satu molekul bagi satu sebatian yang terdapat dalam buah –buahan.*

Diagram 9.1
Rajah 9.1

     (i)   State the molecular formula and empirical formula of this compound.

Nyatakan formula molekul dan formula empirik sebatian ini.

[2 *marks*]
[2 *markah*]

     (ii)   What is the relative molecular mass of this compound?
[Relative atomic mass of H = 1, C = 12 and O = 16]

Berapakah jisim molekul relatif sebatian ini?
[Jisim atom relatif H = 1, C = 12 dan O = 16]

[1 *mark*]
[1 *markah*]

(b) Diagram 9.2 shows a gas syringe containing helium gas.

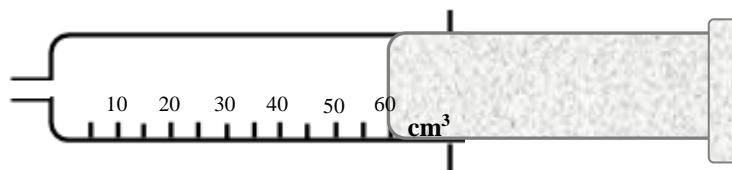*Rajah 9.2 menunjukkan picagari mengandungi gas helium.*

Diagram 9.2
Rajah 9.2

(i) Calculate the mass of helium gas in the syringe.
[Molar volume of gas = 24 dm³ mol⁻¹ at room conditions,
Relative atomic mass of He = 4]

Tentukan jisim gas helium di dalam picagari tersebut.
[Isipadu molar gas = 24 dm³ mol⁻¹ pada keadaan bilik,
Jisim atom relatif He = 4]

[3 *marks*]
[3 *markah*]

(ii) During sport day opening ceremony, balloons are filled with helium gas. The balloons deflate after a few days.
Explain the situation using Kinetic Theory of Matter.

Semasa majlis perasmian hari sukan, belon-belon diisi dengan gas helium. Belon-belon menjadi kempis selepas beberapa hari. Terangkan situasi tersebut menggunakan Teori Kinetik Zarah.

[4 *marks*]
[4 *markah*]

(c)

| Metal Y is located higher than hydrogen in the Reactivity Series. |
| *Logam Y berada di atas hidrogen di dalam Siri Kereaktifan.* |

Describe an experiment to determine the empirical formula of a Y oxide.
Your answer should include the following aspects:

Huraikan satu eksperimen untuk menentukan formula empirik oksida Y.
Jawapan anda hendaklah mengandungi aspek-aspek berikut:

- Procedure of the experiments

  Kaedah eksperimen

- Calculation of the empirical formula

  Pengiraan formula empirik

[10 *marks*]
[10 *markah*]

10   (a)   Table 10 shows the value for the heat of combustion of three types of alcohol.

Jadual 10 menunjukkan nilai haba pembakaran bagi tiga jenis alkohol.

Alcohol *Alkohol*	Heat of combustion *Haba pembakaran* $(kJ\ mol^{-1})$
Ethanol	-1376
Propanol	-2016
Butanol	-2678

Table 10
Jadual 10

(i)   3.7 g of butanol is used to heat 500 cm^3 of water.
The temperature of water rises from 28.0 ºC to 88.0 ºC.
Calculate the heat of combustion for butanol.
[Relative atomic mass ; H = 1, C = 12, O = 16,
Specific heat capacity of water 4.2 Jg^{-1} ºC^{-1}]

3.7 g butanol digunakan untuk memanaskan 500 cm^3 air.
Suhu air meningkat dari 28.0 ºC ke 88.0 ºC
Hitung haba pembakaran bagi butanol.
[*Jisim atom relatif ; H = 1, C = 12, O = 16,*
Muatan haba tentu air ialah 4.2 J g^{-1} ºC^{-1}]

[5 *marks*]
[5 *markah*]

(ii)   The value for the heat of combustion obtained in (a)(i) is less than the theoretical value given in Table 10.
Explain why the difference occurs.

Nilai haba pembakaran yang diperolehi di (a)(i) adalah lebih rendah daripada nilai teori yang diberikan di Jadual 10.
Jelaskan mengapa perbezaan itu berlaku .

[2 marks]
[2 *markah*]

(iii)   Based on Table 10, identify which alcohol has isomers.
Draw the structural formula and name one of the isomers.

Berdasarkan Jadual 10, kenalpasti alkohol manakah yang mempunyai isomer.
Lukis formula struktur dan namakan salah satu isomer tersebut.
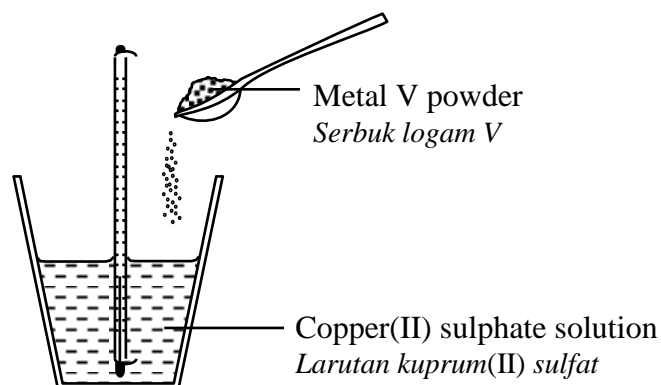
[3 marks]
[3 *markah*]

(b)

Diagram 10
Rajah 10

Danish wants to determine the heat of displacement of metal V in his chemistry class using the apparatus set up as in Diagram 10.
By using a named metal V, describe how Danish carry out the experiment.
Your description should include the following aspects:

- Procedure of experiment
- Calculation to determine the heat of displacement

Danish hendak menentukan haba penyesaran logam V dalam kelas kimianya dengan menggunakan alat radas seperti Rajah 10.
Dengan menggunakan logam V yang dinamakan, huraikan bagaimana Danish dapat menjalankan eksperimen tersebut.
Huraian anda hendaklah mengandungi aspek berikut:

- *Prosedur eksperimen*
- *Pengiraan untuk menentukan haba penyesaran*

[10 marks]
[10 *markah*]

END OF QUESTION PAPER
KERTAS SOALAN TAMAT

Periodic Table of Elements

Key:

10	→ Proton Number
Ne	→ Symbol
Neon	→ Name of element
20	→ Relative Atomic Mass

1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** Hydrogen 1																		2 **He** Helium 4
3 **Li** Lithium 7	4 **Be** Beryllium 9												5 **B** Boron 11	6 **C** Carbon 12	7 **N** Nitrogen 14	8 **O** Oxygen 16	9 **F** Fluorine 19	10 **Ne** Neon 20
11 **Na** Sodium 23	12 **Mg** Magnesium 24												13 **Al** Aluminium 27	14 **Si** Silicon 28	15 **P** Phosphorus 31	16 **S** Sulfur 32	17 **Cl** Chlorine 35·5	18 **Ar** Argon 40
19 **K** Potassium 40	20 **Ca** Calcium 40		21 **Sc** Scandium 45	22 **Ti** Titanium 48	23 **V** Vanadium 51	24 **Cr** Chromium 52	25 **Mn** Manganese 55	26 **Fe** Iron 56	27 **Co** Cobalt 59	28 **Ni** Nickel 59	29 **Cu** Copper 64	30 **Zn** Zinc 65	31 **Ga** Gallium 70	32 **Ge** Germanium 73	33 **As** Arsenic 75	34 **Se** Selenium 79	35 **Br** Bromine 80	36 **Kr** Krypton 84
37 **Rb** Rubidium 86	38 **Sr** Strontium 88		39 **Y** Yttrium 89	40 **Zr** Zirconium 91	41 **Nb** Niobium 93	42 **Mo** Molybdenum 96	43 **Tc** Technetium 98	44 **Ru** Ruthenium 101	45 **Rh** Rhodium 103	46 **Pd** Palladium 106	47 **Ag** Silver 108	48 **Cd** Cadmium 112	49 **In** Indium 115	50 **Sn** Tin 119	51 **Sb** Antimony 122	52 **Te** Tellurium 128	53 **I** Iodine 127	54 **Xe** Xenon 131
55 **Cs** Caesium 133	56 **Ba** Barium 137		57 **La** Lanthanum 139	72 **Hf** Hafnium 179	73 **Ta** Tantalum 181	74 **W** Tungsten 184	75 **Re** Rhenium 186	76 **Os** Osmium 190	77 **Ir** Iridium 192	78 **Pt** Platinum 195	79 **Au** Gold 197	80 **Hg** Mercury 201	81 **Tl** Thallium 204	82 **Pb** Lead 207	83 **Bi** Bismuth 209	84 **Po** Polonium 209	85 **At** Astatine 210	86 **Rn** Radon 222
87 **Fr** Francium 223	88 **Ra** Radium 226		89 **Ac** Actinium 227															

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INFORMATION FOR CANDIDATES
MAKLUMAT UNTUK CALON

1. This question paper consists of **three** sections: **Section A, Section B** and **Section C.**
   *Kertas soalan ini mengandungi tiga bahagian***:** *Bahagian* **A***, Bahagian* **B** *dan Bahagian* **C.**

2. Answer **all** questions in **Section A. Write your answers for Section A in the spaces provided in the** question paper.
   Jawab semua soalan dalam Bahagian **A**. *Tuliskan jawapan bagi Bahagian* **A** *dalam ruang yang disediakan dalam kertas soalan.*

3. Answer any **one** question from **Section B** and any **one** question from **Section C**. Write your answers for **Section B** and **Section C** on the 'helaian tambahan' provided by the invigilators. You may use equations, diagrams, tables, graphs and other suitable methods to explain your answer.
   Jawab mana-mana satu soalan daripada Bahagian **B** *dan mana-mana satu soalan daripada Bahagian* **C**. *Tulis jawapan anda bagi Bahagian* **B** *dan Bahagian* **C** *dalam helaian tambahan yang dibekalkan oleh pengawas peperisaan. Anda boleh menggunakan persamaan, gambar rajah, jadual, graf dan cara lain yang sesuai untuk menjelaskan jawapan anda.*

4. The diagrams in the questions are not drawn to scale unless stated.
   Rajah yang mengiringi soalan tidak dilukiskan mengikut skala kecuali dinyatakan.

5. Marks allocated for each question or part question are shown in brackets.
   Markah yang diperuntukkan bagi setiap soalan atau ceraian soalan ditunjukkan dalam kurungan.

6. Show your working, it may help you to get marks.
   Tunjukkan kerja mengira, ini membantu anda mendapatkan markah.

7. If you wish to cancel any answer, neatly cross out the answer.
   Sekiranya anda hendak membatalkan sesuatu jawapan, buat garisan di atas jawapan itu.

8. The Periodic Table of Elements is provided on page 33.
   Jadual Berkala Unsur disediakan di halaman 33.

9. You may use a non – programmable scientific calculator.
   Anda dibenarkan menggunakan kalkulator saintifik yang tidak boleh diprogramkan.

10. The time suggested to complete **Section A** is 90 minutes, **Section B** is 30 minutes and **Section C** is 30 minutes
    Masa yang dicadangkan untuk menjawab Bahagian **A** *ialah* 90 *minit, Bahagian* **B** *ialah* 30 *minit dan Bahagian* **C** *ialah* 30 *minit.*

11. Tie the 'helaian tambahan' together with the question paper and hand in to the invigilator at the end of the examination.
    Ikat helaian tambahan bersama-sama kertas soalan ini dan serahkan kepada pengawas peperiksaan pada akhir peperiksaan.

SULIT
4541/3
Kimia
Kertas 3
September
2016
1½ jam

MAKTAB RENDAH SAINS MARA
PEPERIKSAAN SIJIL PENDIDIKAN MRSM 2016

KIMIA   https://cikguadura.wordpress.com/

Kertas 3

Satu jam tiga puluh minit

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

1.   *Tuliskan **nama, kelas** dan **angka giliran** anda pada ruang yang disediakan.*

2.   *Buku soalan ini adalah dalam dwibahasa.*

3.   *Calon dikehendaki menjawab semua soalan*

Untuk Kegunaan Pemeriksa		
Soalan	Markah Penuh	Markah diperolehi
1	24	
2	9	
3	17	
Total	50	

Kertas soalan ini mengandungi 10 halaman bercetak

1 A student carried out an experiment to investigate the heat of neutralization of sodium hydroxide solution with two different acids.
Diagram 1.1 and 1.2 show the initial temperature reading of solution and highest temperature reading of the mixture.

Seorang pelajar telah menjalankan satu eksperimen untuk mengkaji haba peneutralan antara larutan natrium hidroksida dengan dua asid yang berbeza.
Rajah 1.1 dan 1.2 menunjukkan bacaan suhu awal larutan dan bacaan suhu tertinggi bagi campuran.

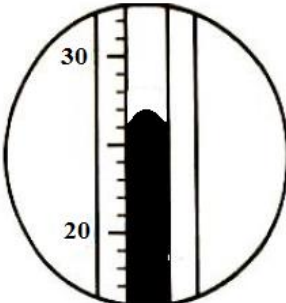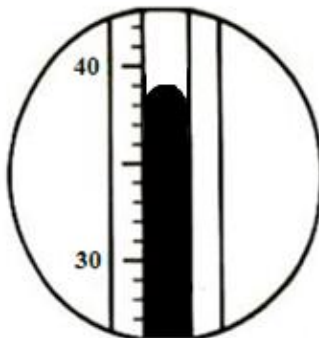| **Reactants** *Bahan tindak balas*	**Initial temperature of solution (ºC)** *Suhu awal larutan (•C)*	**Highest temperature of mixture (°C)** *Suhu tertinggi campuran (•C)*
Set I *Set I* 50 cm³ of 2.0 mol dm⁻³ hydrochloric acid *50 cm³ asid hidroklorik 2.0 mol dm⁻³* **+** 50 cm³ of 2.0 mol dm⁻³ sodium hydroxide solution *50 cm³ larutan natrium hidroksida 2.0 mol dm⁻³*	....	....

Diagram 1.1
Rajah 1.1
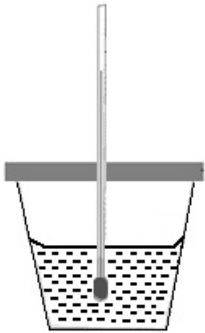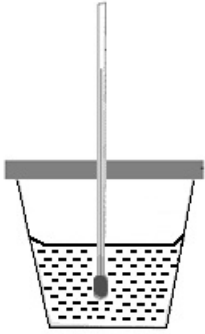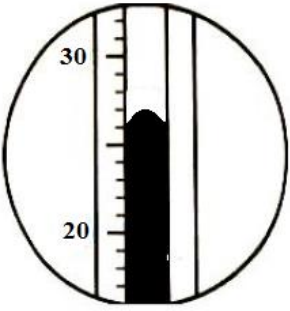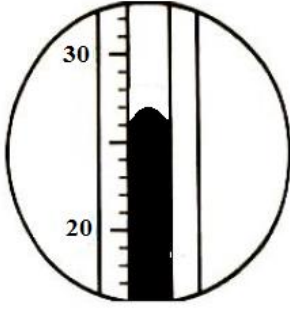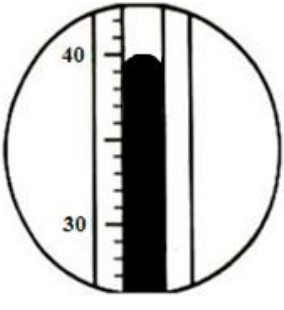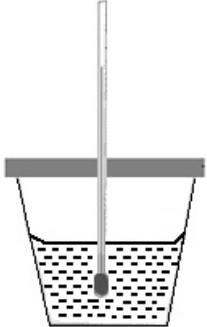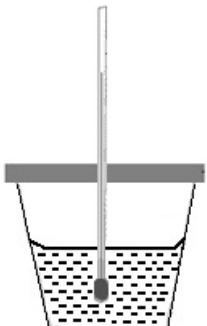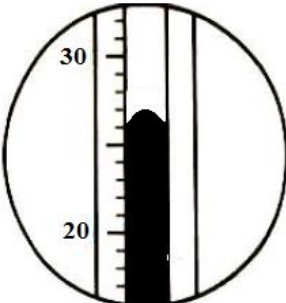
Reactants *Bahan tindak balas*	Initial temperature of solution (°C) *Suhu awal larutan (°C)*	Highest temperature of mixture (°C) *Suhu tertinggi campuran (°C)*
Set II *Set II* 50 cm³ of 2.0 mol dm⁻³ ethanoic acid *50 cm³ asid etanoik 2.0 mol dm⁻³* **+** 50 cm³ of 2.0 mol dm⁻³ sodium hydroxide solution *50 cm³ larutan natrium hidroksida 2.0 mol dm⁻³*	....	....

Diagram 1.2
Rajah 1.2

For Examiner's Use

1(*a*)

3

(a)   Record the reading of the initial temperature of solution and highest temperature of mixture in the spaces provided in Diagram 1.1 and Diagram 1.2.

Catatkan bacaan suhu awal larutan dan suhu tertinggi campuran dalam ruang yang disediakan dalam Rajah 1.1 dan Rajah 1.2.

[3 *marks*]
[3 *markah*]

(b)   Calculate and complete the table below.

Hitung dan lengkapkan jadual di bawah.

	Set I	Set II
Volume of mixture / cm^3 *Isipadu campuran / cm^3*	100	100
Number of mole = molarity x volume *Bilangan mol* *= kemolaran x isipadu*	0.1	0.1
Heat release = mcƟ [Specific heat capacity of solution = 4.2 J g^{-1} ^{o}C^{-1}] *Haba dibebas = mcƟ* *[Muatan haba tentu bagi larutan = 4.2 J g^{-1} ^{o}C^{-1}]*		
Heat of neutralization / kJ mol^{-1} *Haba peneutralan /* *kJ mol^{-1}*		

1(*b*)

3

[3 *marks*]
[3 *markah*]

(c) For both experiments, state:
Bagi kedua-dua eksperimen, nyatakan:

(i) The manipulated variable:
Pembolehubah dimanipulasikan:

....

(ii) The responding variable:
Pembolehubah bergerak balas:

....

(iii) The fixed variable:
Pembolehubah dimalarkan:

....
[3 *marks*]
[3 *markah*]

1(*c*)

3

(d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

....

....

....

....
[3 *marks*]
[3 *markah*]

1(*d*)

3

(e) State the operational definition of heat of neutralization for the experiment.
Nyatakan definisi secara operasi bagi haba peneutralan bagi eksperimen ini.

....

....

....

....
[3 *marks*]
[3 *markah*]

1(*e*)

3

(f) State the relationship between the strength of the acid and heat of neutralization.

Nyatakan hubungan antara kekuatan asid dan haba peneutralan.

....

....

....

[3 *marks*]
[3 *markah*]

1(*f*)

3

(g) Classify the following acids to strong acids and weak acids.

Kelaskan asid berikut kepada asid kuat dan asid lemah.

Sulphuric acid *Asid sulfurik*	Carbonic acid *Asid karbonik*
Methanoic acid *Asid metanoik*	Phosphoric acid *Asid fosforik*
Hydrochloric acid *Asid hidroklorik*	

Strong acids *Asid kuat*	**Weak acids** *Asid lemah*

[3 *marks*]
[3 *markah*]

1(*g*)

3

(h) Draw energy level diagram for Set I.

Lukiskan gambar rajah aras tenaga untuk Set I.

[3 *marks*]
[3 *markah*]

1(*h*)

3

Total 1

24

2   Diagram 2 shows the set-up of apparatus used to investigate the cleansing action of soap and detergent on a pair of socks with oily stain.
Rajah 2 menunjukkan susunan radas yang digunakan untuk mengkaji tindakan pencucian sabun dan detergen ke atas sepasang stokin dengan kotoran berminyak.
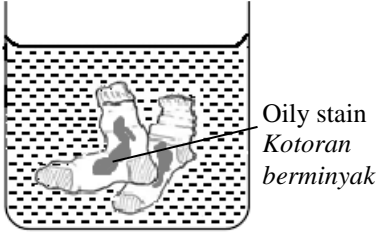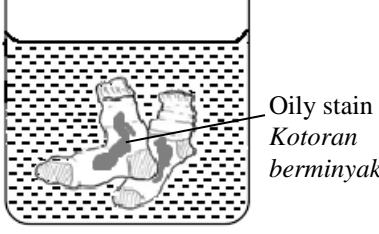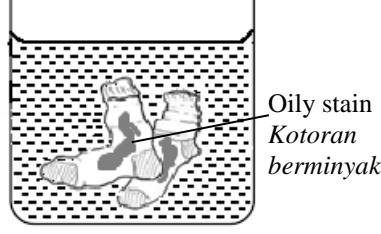
Experiment *Eksperimen*	Apparatus *Radas*	Observation *Pemerhatian*
I	Detergent + hard water *Detergen + air liat* Oily stain *Kotoran berminyak*	Detergent + hard water *Detergen + air liat*
II	Soap + hard water *Sabun + air liat* Oily stain *Kotoran berminyak*	Soap + hard water *Sabun + air liat* Oily stain *Kotoran berminyak*

Diagram 2
Rajah 2

(a)   (i)   State one observation based on the Diagram 2.
Nyatakan satu pemerhatian berdasarkan pada Rajah 2.

……………………………………………………………………………………………

……………………………………………………………………………………………
[3 *marks*]
[3 *markah*]

2 (*a*) (*i*)

3

(ii)   Based on the observation in 2(a)(i), state your inference.
Berdasarkan pemerhatian pada 2(a)(i), nyatakan inferens anda.

……………………………………………………………………………………………

……………………………………………………………………………………………
[3 *marks*]
[3 *markah*]

2 (*a*) (*ii*)

3

2(*b*)

☐ 3

(*b*)   Experiment II is repeated by using soft water to replace hard water.
         Predict your observation.
         Eksperimen II diulang menggunakan air lembut menggantikan air liat.
         Ramalkan pemerhatian anda.

         ....

         ....

                                                                                    [3 *marks*]
                                                                                    [3 *markah*]

Total 2

☐ 9

3   Diagram 3 shows a conversation between two students about product formed at anode after electrolysis of sodium chloride solution.

Rajah 3 menunjukkan perbualan antara dua orang pelajar mengenai hasil yang terbentuk di anod selepas menjalankan elektrolisis larutan natrium klorida.

I electrolysed dilute sodium chloride solution and found that the gas released at anode ignites the glowing wooden splinter.
Saya telah menjalankan elektrolisis larutan natrium klorida cair dan mendapati gas yang dibebaskan di anod menyalakan kayu uji berbara.

When I use concentrated sodium chloride solution, the gas released at anode turns moist blue litmus paper to red and then bleached.
Apabila saya menggunakan larutan natrium klorida pekat, gas yang dibebaskan di anod menukarkan kertas litmus biru lembap kepada merah dan kemudiannya dilunturkan.

Diagram 3
Rajah 3

Based on the above situation, plan a laboratory experiment to investigate the effect of the concentration of sodium chloride solution on the product formed at anode in the electrolysis.

Berdasarkan situasi di atas, rancang satu eksperimen makmal untuk menyiasat kesan kepekatan larutan natrium klorida terhadap hasil yang terbentuk di anod dalam elektrolisis.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(*a*)   Problem statement
          Pernyataan masalah

(*b*)   All the variables
          Semua pembolehubah

(*c*)   Statement of the hypothesis
          Pernyataan hipotesis

(*d*)   List of materials and apparatus
          Senarai bahan dan radas

(*e*)   Procedure for the experiment
          Prosedur eksperimen

(*f*)   Tabulation of data   [17 *marks*]
          Penjadualan data   [17 *markah*]

END OF QUESTION PAPER
KERTAS SOALAN TAMAT
https://cikguadura.wordpress.com/

INFORMATION FOR CANDIDATES
MAKLUMAT UNTUK CALON

1. This question paper consists of three questions; **Question 1**, **Question 2** and **Question 3.**
   *Kertas soalan ini mengandungi tiga soalan; **Soalan 1**, **Soalan 2** dan **Soalan 3**.*

2. Answer all the questions. Write your answers for **Question 1** and **Question 2** in the spaces provided in this question paper.
   *Jawab semua soalan. Jawapan anda bagi **Soalan 1** dan **Soalan 2** hendaklah ditulis dalam ruang yang disediakan dalam kertas soalan*

3. Write your answers for **Question 3** on the *'helaian tambahan'* provided by the invigilators. You may use equations, diagrams, tables, graphs and other suitable methods to explain your answer.
   *Tuliskan jawapan anda bagi **Soalan 3** dalam helaian tambahan yang dibekalkan oleh pengawas peperiksaan. Anda boleh menggunakan persamaan, gambar rajah, jadual, graf dan cara lain yang sesuai untuk menjelaskan jawapan anda.*

4. Show your working, it may help you to get marks.
   Tunjukkan kerja mengira. Ini akan membantu anda mendapatkan markah.

5. The diagrams in the questions are not drawn to scale unless stated.
   Rajah yang mengiringi soalan tidak dilukis mengikut skala kecuali dinyatakan.

6. Marks allocated for each question or part of a question are shown in brackets.
   Markah yang diperuntukkan bagi setiap soalan atau ceraian soalan ditunjukkan dalam kurungan.

7. If you wish to change your answer, cross out the answer that you have done. Then write down the new answer.
   Jika anda hendak menukar jawapan, batalkan jawapan yang telah dibuat. Kemudian tulis jawapan yang baru.

8. You may use a non-programmable scientific calculator.
   *Anda dibenarkan menggunakan kalkulator saintifik yang **tidak** boleh diprogramkan.*

9. You are advised to spend 60 minutes to answer **Question 1** and **Question 2** and 30 minutes for **Question 3**.
   *Anda dinasihati supaya mengambil masa 60 minit untuk menjawab **Soalan 1** dan **Soalan 2** dan 30 minit untuk menjawab **Soalan 3**.*

10. Tie the *'helaian tambahan'* together with this question paper and hand in to the invigilator at the end of the examination.
    Ikat helaian tambahan bersama-sama kertas soalan ini dan serahkan kepada pengawas peperiksaan pada akhir peperiksaan.

TABLE OF SPECIFICATION CHEMISTRY PAPER 1 2016

QUESTION	KEY	DIAGRAM / TABLE NUMBER
1	C	DIAGRAM 1
2	B	
3	B	
4	C	
5	A	DIAGRAM 2
6	D	DIAGRAM 3
7	D	
8	D	TABLE 1
9	C	
10	C	DIAGRAM 4
11	B	
12	A	
13	A	
14	A	
15	A	DIAGRAM 5
16	D/B	DIAGRAM 6
17	D	DIAGRAM 7
18	C	
19	B	
20	D	DIAGRAM 8
21	B	DIAGRAM 9
22	B	
23	A	TABLE 2
24	C	
25	B	
26	B	DIAGRAM 10
27	B	DIAGRAM 11
28	A	TABLE 3
29	C	DIAGRAM 12
30	B	DIAGRAM 13
31	A	DIAGRAM 14
32	C	DIAGRAM 15
33	D	TABLE 4
34	C	DIAGRAM 16
35	A	DIAGRAM 17
36	A	
37	C	
38	A	
39	B	DIAGRAM 18
40	D	DIAGRAM 19
41	A	TABLE 5
42	B	DIAGRAM 20
43	D	
44	A	TABLE 6
45	D	
46	C	DIAGRAM 21
47	C	DIAGRAM 22
48	D	
49	D	
50	C	

SIJIL PENDIDIKAN MRSM

2016

CHEMISTRY

Paper 2

MARKING SCHEME

FOR EXAMINER'S USE ONLY

The marking scheme consists of 12 printed pages

MARKING GUIDELINES

SIJIL PENDIDIKAN MRSM EXAMINATION 2016

PAPER 2

Symbol		Meaning
//	-	replace the whole sentence
( )	-	replace the previous word
[ ]	-	can be summarized from explanation
___ or bold	-	key word
a.d.p	-	avoid double penalty
wcr	-	wrong cancel right
a.	-	accept
r.	-	reject
e.c.f	-	error carry forward
/	-	or

No	Mark Scheme	Mark	
		Sub	Total
1 (a) (i)	Neutron *r: symbol*	1	3
(ii)	3	1	
(iii)	2.1 // 2,1	1	
(b) (i)	Solid	1	3
(ii)	Arrangement of particles: Closely packed in orderly manner Movement of particles: Vibrate and rotate in fixed position	1 1	
(c) (i)	T_2°C *r: if no unit*	1	3
(ii)	P1: Heat loss to the surrounding is exactly balanced P2: by the heat energy liberated by the particles //Heat release to form a bond // heat release to form an attraction force between particles	1 1	
	Total		9

No	Mark Scheme	Mark	
		Sub	Total
2 (a)	Mixture of two or more elements with a certain fixed composition in which the major component is a metal.	1	1
(b)	Q : Silicon dioxide // Silica // Silicon(IV) oxide // Quartz R : Copper *r: formula*	1 1	2
(c) (i)	$$\begin{array}{ccc} H & & Cl \\ | & & | \\ C & = & C \\ | & & | \\ H & & H \end{array}$$	1	2
(ii)	Not easily rust // Chemical resistant // Lighter // Easily bend // Low cost	1	
(d) (i)	Fermentation	1	4
(ii)	Alcohol	1	
(iii)	$C_2H_5OH \longrightarrow C_2H_4 + H_2O$	1	
(iv)	Porcelain chips// pumice stone// aluminium oxide/ concentrated sulphuric acid *a:formula*	1	
	Total		9

3

No	Mark Scheme	Mark	
		Sub	Total
3 (a)(i)	Hydrogen ions // H^+// Hydroxonium ion // H_3O^+	1	1
(ii)	E: Ethanoic acid // Acetic acid // Vinegar // CH_3COOH F: Sulphuric acid // H_2SO_4	1 1	2
(iii)	P1: E is a weak acid//ionise partially in water and F is a strong acid // ionise completely in water P2: Concentration of hydrogen ions in E is lower than F *a: vice versa*	1 1	2
(iv)	P1. Add magnesium powder [any metals more electropositive than hydrogen]/ calcium carbonate powder[any metal carbonate] to a test tube containing substance F P2. Efferverscence // Gas bubbles produced // Colourless gas bubbles	1 1	2

(b)	Number of mole of CO_2 = $\dfrac{448/1000}{22.4}$
	                      = 0.02 mol
	
	From equation;
	1 mol of CO_2 produced by 1 mol $ZnCO_3$
	0.02 mol CO_2 produced by 0.02 mol $ZnCO_3$
	
	Mass of $ZnCO_3$ = 0.02 x [65 + 12 + 3(16)]
	                  = 2.50 g
		1
		
		1
		
		1
			3

	Total		10

No	Mark Scheme	Mark	
		Sub	Total
4(a)	Chemical cell// voltaic cell	1	1
(b)	Chemical energy to electrical energy	1	1
(c)	$2H^+ + 2e \longrightarrow H_2$	1+1	2
(d)	Galvanometer // Voltmeter // Miliammeter// Ammeter //Bulb // EC meter (Electrical conductivity meter)	1	1
(e)(i)	Copper/Cu// Silver/ Ag // Lead/Pb // Tin / Sn	1	
(ii)	The distance between magnesium and metal X [metal in e(i)] is further in the Electrochemical Series // Metal X is less electropositive than iron	1	2
(f)(i)	Orange// Lemon// Lime// Pineapple// Tomatoes *a: any suitable fruits*	1	
(ii)	P1. Contains electrolyte / acid / H^+ ion / ions P2. Have <u>freely moving ions</u> *#If only P2 stated , awarded 2 marks*	1 1	3
	Total		10

No	Mark Scheme	Mark	
		Sub	Total
5(a)	Hydrogen	1	1
(b)	P1. Axis with label and unit	1	
	P2. Uniform scale ,smooth curve and size $\geq$ ½ of graph paper	1	
	P3. All points transferred corrctly	1	3
(c) (i)	P1. Show tangent on the graph	1	
	P2. Rate of reaction = 0.183 cm^3s^{-1} $\pm$ 0.05 with correct unit	1	
(ii)	$\underline{45.00\ cm^3}$ // 0.214 cm^3s^{-1} 210 s	1	3
(d)(i)	Temperature// Catalyst // Use [correct volume] of [correct molarity **higher** than 0.1 mol dm^{-3}] of hydrochloric acid [to obtain the same number of mole] (e.g. 25 cm^3 of 2.0 mol dm^{-3} of HCl)	1	1
(ii)	*[Factor : Temperature]* P1. Kinetic energy of particles is higher in K	1	
	P2. Frequency of collision between hydrogen ion and magnesium atom is higher in K	1	
	P3. Frequency of effective collision between hydrogen ion and magnesium atom is higher in K	1	Max 2
	Or [Factor : Catalyst] P1. Catalyst/copper(II) sulphate provide alternative path with <u>lower activation energy</u> P2. More colliding particles achieve the lower activation energy P3. Frequency of effective collision between hydrogen ion and magnesium atom is higher in K		
	Or [Factor : concentration] P1. The number of particles per unit volume is higher in K P2. Frequency of collision between hydrogen ion and magnesium atom is higher in K P3. Frequency of effective collision between hydrogen ion and magnesium atom is higher in K		
(iii)	The number of mole of hydrochloric acid/ Hydrogen ion/H^+ in M is **half** than in L **/ [0.025 mol]**	1	1
	Total		11

5

No	Mark Scheme	Mark	
		Sub	Total
6 (a) (i)	+5	1	
(ii)	P_4 / Phosphorus	1	
(iii)	Oxidation number of phosphorus increases from 0 to +5	1	3
(b) (i)	Blue	1	
(ii)	P1. Copper(II) ion is reduced // gain / receive electron to form copper atom	1	
	P2. The concentration of copper(II) ion decreases	1	
(iii)	P1. Mg/ Al/ Zn / [any metal more electropositive than copper]	1	
	P2. $Mg + Cu^{2+} \rightarrow Mg^{2+} + Cu$ *(based on the named metal G)*	1	5
(c) (i)	P1. Zn is (more electropositive) / above iron in Electrochemical Series/ the anode // Zn has higher tendency to release electron	1	
	P2. Zn is corroded// sacrificed/ ionised/ oxidised// loss electron	1	
(ii)	$Zn \longrightarrow Zn^{2+} + 2e$	1	3
	Total	11	

No	Mark Scheme	Mark	
		Sub	Total
7(a)(i)	P1. The electron arrangement of Na = 2.8.1, Cl = 2.8.7.	1	
	P2. Both atoms have 3 shells occupied with electrons.	1	
	P3. Na and Cl belongs to Period 3.	1	
	P4. The number of valence electrons of Na is 1 so it belongs to Group 1.	1	
	P5. The number of valence electrons of Cl is 7 so it belongs to Group 17.	1	5
(ii)	P1. To achieve the stable octet electron arrangement	1	
	P2. Sodium / Na **atom** donate/release /lose 1 electron to form Na^+ ions	1	
	P3. Chlorine / Cl atom accept / gain / receive 1 electron to form Cl^- ions	1	
	P4. Na^+ ion and Cl^- ion attract each other with strong electrostatic force	1	
	P5. forms ionic bond with the formula NaCl	1	7
	[Diagram]	1	
	P6. Correct number of electrons	1	
	P7. Label nucleus shown and correct charge		
	   # if P2 and P3 is not complete, infer from the half equation		
(iii)	P1. Melting point for the compound formed / tetrachloromethane/CCl_4 is lower than compound in (a)(ii) /NaCl	1	
	P2. Weak intermoleculer force // Van der Waals force between molecules // Weak attraction force between molecules in the compound formed/ tetrachloromethane / CCl_4	1	
	P3. Less heat energy needed to overcome the forces	1	
	P4. The ions of compound in (a)(ii) are held together by strong electrostatic force	1	
	P5. More heat energy is needed to overcome the force.	1	5

7

No	Mark Scheme	Mark	
		Sub	Total
(b)	P1. Argon <u>atom</u> has achieved stable <u>octet electron arrangement</u>.	1	
	P2. Argon <u>atom</u> does not react with tungsten/ atom does not donate, receive or sharing electron / inert	1	
	P3. Oxygen atom can accept electron from tungsten atom / reacts with tungsten	1	3
	# adp atom for P2		
	Total		20

No	Mark Scheme	Mark	
		Sub	Total
8 (a) (i)			

Type of food additive	Function
Thickener	To thicken food
Preservative	To make food last longer // To slow down / prevent the growth of microorganism
Antioxidant	To prevent oxidation of food
Flavouring Agent	To improve the taste of food // To restore taste loss

	Any two correct type of food additive and its function	1 + 1 1 + 1	4
(ii)	P1. <u>Advantage</u> Make food stay fresh longer Make food look nicer Make food taste better Any one answer	1	
	P2. <u>Disadvantage</u> Able to cause serious diseases like cancer and asthma// Able to cause allergy Any one answer	1	2
(iii)	<u>Type of medicine</u> P1. Antibiotic P2. Analgesic	1 1	
	<u>Correct usage :</u> P1. Take full course / finish all the antibiotic P2. Analgesic (aspirin/paracetamol) has to be taken after food	1 1	4

No	Mark Scheme	Mark	
		Sub	Total
(b)(i)	P1. Carbon dioxide / CO_2	1	
	P2. Bubble / flow / channel / pass the gas through lime water	1	
	P3. Lime water turns milky / chalky / cloudy	1	3
(ii)	P1. Add 2 cm^3 dilute sulphuric acid followed by 2 cm^3 iron(II) sulphate solution into test tube containing solution S and shake.	1	
	P2. Add concentrated sulphuric acid slowly/carefully.	1	
	P3. A brown ring is formed.	1	3
(c)(i)	P1. Barium chloride / Barium nitrate	1	
	P2. Sodium sulphate / Potassium sulphate / Ammonium sulphate	1	2
(ii)	P1. Filter the mixture and rinse	1	
	P2. Dry between two filter papers / using oven	1	2
	Total		20

No	Mark Scheme	Mark	
		Sub	Total
9 (a) (i)	P1. Molecular formula : $C_6H_{12}0_6$	1	
	P2. Empirical formula : CH_20	1	2
(ii)	Relative molecular mass = 12(6) + 1(12) + 16(6) = 180	1	1
(b) (i)	P1. Volume of gas = 60 cm^3	1	
	P2. Number of mol of gas = 60 /24000 = 0.0025 mol	1	
	P3. Mass of gas = 0.0025 x 4 = 0.01g	1	3
(ii)	P1. Helium gas consists of tiny and discrete particles	1	
	P2. The particles// helium atoms move freely and randomly	1	
	P3. The atoms/particles diffuse / move in between the air / move through the air / through the empty space of the balloon's wall	1	
	P4. From the higher concentration area to a lower concentration area	1	4

9

No	Mark Scheme	Mark	
		Sub	Total
(c)	**Procedure :**		
	P1. A crucible and its lid is weighed and its mass is recorded.	1	
	P2. Clean [5-10]cm of metal Y by using sand paper. Coiled and placed in the crucible.	1	
	P3. The crucible with its lid and content is weighed again and the mass is recorded.	1	
	P4. The crucible is heated strongly without its lid.	1	
	P5. When metal Y starts to burn, close immediately with its lid	1	
	P6. Using a pair of tongs, the lid is lifted at intervals.	1	
	P6. When the burning has completed, the lid is removed and the crucible is heated strongly for 2 minutes.	1	
	P7. The crucible is allowed to cool to room temperature, weighed again and its mass is recorded	1	
	P8. The heating, cooling and weighing process are repeated until a constant mass is obtained	1	
	Result :		

Description	Mass(g)
Crucible + lid	a
Crucible + lid + Metal Y	b
Crucible + lid + Y oxide	c

(mark: 1)

[Calculation]

Element	Y	O
Mass (g)	b-a	c-b
Number of moles (mol)	$\dfrac{b-a}{24} = m$	$\dfrac{c-b}{16} = n$
Simplest ratio of moles	**p**	**q**

(mark: 1)

Empirical formula is Y_pO_q

(mark: 1) Total: 12

a: reasonable value

Max 10

Total	20

No	Mark Scheme	Mark	
		Sub	Total
10 (a)(i)	P1. Number of mole of butanol $= \dfrac{3.7}{4(12) + 9(1) + 16+1}$ // 0.05 mol	1	
	P2. Heat released = mcθ = 500 x 4.2 x 60 // 126000 J // 126 kJ	1	
	P3. 0.05 mol of butanol burnt completely to release 126000 J ∴ 1 mol of butanol released $\dfrac{126000 \text{ J}}{0.05}$	1	
	P4. *[value is correct]* 2520 kJ	1	
	P5. *[Negative sign with correct unit]* ΔH = - 2520 kJ mol^{-1} *ecf: P3 & P5*	1	5
(ii)	P1. Some heat is lost to the surrounding//heat is absorbed by the apparatus/ tripod stand/ windshield/copper can	1	
	P2. Butanol undergoes incomplete combustion // does not undergo complete combustion	1	2
(iii)	P1. Butanol//Propanol	1	
	P2. Correct structural formula of any isomers	1	
	P3. Name based on isomer in P2	1	3
	Sample answer :		

Structural formula	Name
	Propan-1-ol
	Propan-2-ol
	Butan-1-ol
	Butan-2-ol
	2-methylpropan-1-ol
	2-methylpropan-2-ol

11

No	Mark Scheme	Mark	
		Sub	Total
(b)	P1. Named metal V	1	
	P2. Measure [25.0 – 50.0] cm^3 of [0.1-1.0]mol dm^{-3} copper(II) sulphate solution	1	
	P3. Pour the solution into a plastic/ polystyrene cup	1	
	P4. Record the initial temperature of the solution	1	
	P5. Add quickly excess/ 1 spatula of metal V powder into copper(II) sulphate solution	1	
	P6. Stir the mixture	1	
	P7. Record the highest/maximum temperature reached	1	

	P8. Data
	  Initial temperature of copper (II) sulphate solution = T_1 ^{0}C
	  Highest temperature = T_2 ^{0}C
		1	

	P9. Heat given out = 25 x 4.2 (T_2 – T_1) = X J	1	
	P10. Number of mole of copper(II) sulphate $= \frac{MV}{1000} = Y\ mol$	1	
	P11. $\Delta H = -X/Y$ $= -Z$ kJmol^{-1}	1	11 Max 10
	Total		20

END OF MARKING SCHEME

MAKTAB RENDAH SAINS MARA

SIJIL PENDIDIKAN MRSM
2016

CHEMISTRY

PAPER 3

MARKING SCHEME

FOR EXAMINER'S USE ONLY

The marking scheme consists of 10 printed pages

Questions	Mark Scheme	Mark
1(a)	**Able to record all the temperature readings accurately with one decimal place** Answer: 	Set	Initial temperature/ °C		Highest Temperature/ °C
	Acid	Alkali	
I	27.0	27.0	40.0
II	27.0	27.0	39.0		**3**
	Able to record any <u>4 temperature reading accurately</u> // **All readings correctly but with two decimal places/without decimal place**	**2**
	Able to record any 2 temperature reading correctly.	**1**
	No response or wrong response	**0**
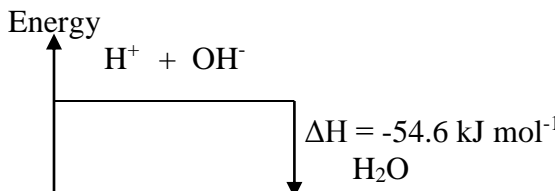
Questions	Mark Scheme	Mark
1(b)	**Able to calculate the heat release and heat of neutralization for Set I and Set II correctly and completely** 		Set I	Set II
Heat release = mcϴ	(100) x 4.2 x 13 = 5460 J	(100) x 4.2 x 12 = 5040 J
Heat of neutralization/ kJmol^{-1}	5460 / 0.1 = 54.6	5040 / 0.1 = 50.4		**3**
	Able to calculate the heat release <u>AND</u> heat of neutralization for set I <u>OR</u> set II correctly	**2**
	Able to calculate the heat release <u>OR</u> heat of neutralization for set I <u>OR</u> set II correctly	**1**
	No response or wrong response	**0**

https://cikguadura.wordpress.com/

2

Questions	Mark Scheme	Mark
1(c)	**Able to state all the variables correctly** Sample answer: Manipulated variable : hydrochloric acid and ethanoic acid // strength of acids//strong and weak acid Responding variable : heat of neutralization // temperature increase Constant variable : volume and concentration of acid // volume and concentration of sodium hydroxide solution // polystyrene cup	**3**
	Able to state any two variables correctly	**2**
	Able to state any one variable correctly	**1**
	No response given / wrong response	**0**

Questions	Mark Scheme	Mark
1(d)	**Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly** Sample answer: Reaction of hydrochloric acid and sodium hydroxide solution produce higher heat of neutralization than reaction of ethanoic acid and sodium hydroxide solution // Reaction of hydrochloric acid and sodium hydroxide solution produce higher heat of neutralization while reaction of ethanoic acid and sodium hydroxide solution produce lower heat of neutralization *a: RV :Temperature increase*	**3**
	Able to state the relationship between the manipulated variable and the responding variable less correctly Sample answer: Heat of neutralization of hydrochloric acid and sodium hydroxide solution is higher than heat of neutralization of ethanoic acid and sodium hydroxide solution // Reaction of hydrochloric acid and sodium hydroxide solution produce higher heat of neutralization // Reaction of ethanoic acid and sodium hydroxide solution produce lower heat of neutralization	**2**
	Able to state the idea of hypothesis Sample answer: Reaction between hydrochloric acid and sodium hydroxide solution produce more heat	**1**
	No response or wrong response	**0**

3

Questions	Mark Scheme	Mark

1(e)	**Able to state the correct operational definition of heat of neutralization based on the following aspects:**
	
	   (i) What should be done
	   (ii) What should be observed
	
	<u>Sample answer:</u>
	
	The heat released that cause temperature to rise when 1 mole of water formed//
	Temperature rises when 1 mole of water is formed due to the heat released
		3

	Able to give the operational definition almost accurately <u>Sample answer:</u> The heat released that cause temperature to rise // Acid react with alkali released heat	**2**
	Able to state an idea of operational definition <u>Sample answer:</u> Heat released // temperature rise	**1**
	No response or wrong response	**0**

Questions	Mark Scheme	Mark
1(f)	**Able to state the relationship between manipulated variable and responding variable correctly** <u>Sample answer:</u> Reaction of hydrochloric acid/strong acid with sodium hydroxide solution produce higher heat of neutralization **AND** reaction of ethanoic acid/weak acid with sodium hydroxide solution produce lower heat of neutralization	**3**
	Able to state the relationship between manipulated variable and responding variable but in the opposite direction <u>Sample answer:</u> Reaction of hydrochloric acid/strong acid with sodium hydroxide solution produce higher heat of neutralization // Reaction of ethanoic acid/weak acid with sodium hydroxide solution produce lower heat of neutralization// Hydrochloric acid produce higher heat of neutralization **AND** ethanoic acid produce lower heat of neutralization	**2**
	Able to state an idea of the hypothesis <u>Sample answer:</u> Different acid produce different heat // Type of acid affect the heat of neutralization	**1**
	No response given / wrong response	**0**

4

Question	Mark Scheme	Mark
1(g)	**Able to classify all the five acids correctly** Sample answer |	Strong acids	Weak acids
	Hydrochloric acid Sulphuric acid	Carbonic acid Methanoic acid Phosphoric acid | *#Score 1 : If classification is reverse*	**3**
	Able to classify at least 3 acids correctly	**2**
	Able to classify at least 2 acids correctly	**1**
	No response or wrong response	**0**

Questions	Mark Scheme	Mark
1(h)	**Able to draw energy level diagram of the Set I correctly with the following aspects** 1. Axis labelled 'energy' and two different energy levels 2. Label reactants and products 3. ΔH with correct sign and unit[*a:wrong value of ΔH from calculation*] Sample answer : Energy $H^+ + OH^-$ $\Delta H = -54.6$ kJ mol^{-1} H_2O *a : chemical equation*	**3**
	Able to draw energy level diagram of the Set I less correctly with 2 aspects	**2**
	Able to draw energy level diagram of the Set I less correctly with 1 aspect *a: endothermic diagram*	**1**
	No response given / wrong response	**0**

5

Questions	Mark Scheme	Mark
2(a)(i)	**Able to write correct observations for both experiment** Oily stain in Experiment I is removed/disappeared **AND** oily stain in Experiment II remains // Sock in Experiment I is clean **AND** the stain remains in Experiment II	**3**
	Able to write correct observations for any one experiment Oily stain in Experiment I removed // Oily stain in Experiment II remains // Sock is clean in Experiment I // The stain remains in Experiment II // Sock in Experiment I is cleaner than in Experiment II	**2**
	Able to write generally observations for experiment Oily stain removed // Oily stain remains // Sock is clean	**1**
	No response given / wrong response	**0**

Questions	Mark Scheme	Mark
2(a)(ii)	**Able to write correct inferences for both experiment** <u>Cleansing action</u> of detergent is more effective in hard water compared to soap *a: vice versa*	**3**
	Able to write correct inferences for any one experiment Cleansing action of detergent is effective in hard water // Cleansing action of soap is less effective in hard water	**2**
	Able to write generally inferences for experiment Detergent is a good/better cleansing agent	**1**
	No response given / wrong response	**0**

6

Questions	Mark Scheme	Mark
2(b)	**Able to predict observations correctly for experiment** Oily stain is removed/ disappeared // Sock is clean	3
	Able to predict observations for experiment White precipitate not produced // No scum	2
	Able to give an idea for observations for experiment No stain	1
	No response given / wrong response	0

Questions	Mark Scheme	Mark
3(a)	**Able to state the problem statement correctly** Sample answer Does different concentration of sodium chloride solution affect the product formed at anode?// Does dilute sodium chloride solution produce oxygen gas/gas ignite the glowing wooden splinter at anode **AND** does concentrated sodium chloride solution produce chlorine gas/gas turns moist blue litmus paper to red and then bleached at anode?	3
	Able to state the problem statement less correctly Sample answer Does different concentration of sodium chloride solution affect the product formed at anode/electrode? // Different concentration of solution affects the product formed at anode/electrode // Does dilute sodium chloride solution produce oxygen gas/gas ignite the glowing wooden splinter at anode? // Does concentrated sodium chloride solution produce chlorine gas/gas turns moist blue litmus paper to red at anode?	2
	Able to give an idea of problem statement Sample answer Concentration affect the product formed.	1
	No response or wrong response	0

7

Questions	Mark Scheme	Mark

3(b)	**Able to state all the variables correctly**
	
	Sample answer
	
	  Manipulated variable
	  Concentration of sodium chloride solution
	
	   a: Dilute(concentration ≤ 0.001 M)
	
	      Concentrated (concentration ≥ 0.1 M)
	
	  Responding variable
	  Product formed at anode // Ion discharged at anode
	
	  Fixed variable
	  Sodium chloride solution // Type of electrode // Carbon electrode
		3

	Able to state any two variables correctly	**2**
	Able to state any one variable correctly	**1**
	No response or wrong response	**0**

Questions	Mark Scheme	Mark
3(c)	**Able to state the relationship between the manipulated variable and the responding variable and state the direction correctly** Sample answer When higher concentration of sodium chloride solution is used, chlorine gas/ gas then turns moist blue litmus paper to red is produced / Cl^- ion is discharged at anode **AND** when lower concentration of sodium chloride solution is used, oxygen gas/ gas ignite the glowing wooden splinter is produced / OH^- ion is discharged at anode	**3**
	Able to state the relationship between the manipulated variable and the responding variable Sample answer When higher concentration of sodium chloride solution is used, chlorine gas/ gas then turns moist blue litmus paper to red is produced / Cl^- ion is discharged at anode **//** When lower concentration of sodium chloride solution is used, oxygen gas/ gas ignite the glowing wooden splinter is produced / OH^- ion is discharged at anode	**2**
	Able to state an idea of hypothesis Sample answer Different concentration of electrolyte will influence the ion to be discharged at anode // Different concentration of electrolyte used will produce different product at anode. Different concentration of solution will produce different product/ion will be discharged	**1**
	No response or wrong response	**0**

Questions	Mark Scheme	Mark
3(d)	**Able to list all the materials and apparatus completely** Sample answer Materials 1. [*concentration ≥ 0.1*] mol dm^{-3} /concentrated sodium chloride solution [*concentration ≤ 0.001*] mol dm^{-3}/ dilute sodium chloride solution 2. Wooden splinter// any suitable material used for testing a gas or any product at anode. 3. Blue litmus paper 4. Battery Apparatus 5. Electrolytic cell // Beaker 6. Connecting wire 7. Test tube 8. Carbon rod	**3**
	Able to list the following materials and apparatus. Sample answer Materials 1. [*concentration ≥ 0.1*] mol dm^{-3} /concentrated sodium chloride solution [*concentration ≤ 0.001*] mol dm^{-3}/ dilute sodium chloride solution 2. Wooden splinter 3. Battery Apparatus 4. [Any suitable container] 5. Connecting wire 6. Carbon rod	**2**
	Able to list the following materials and apparatus. Sample answer Materials 1. [Any solution] Apparatus 2. [Any container] 3. Battery 4. Carbon rod	**1**
	No response or wrong response	**0**

10

Questions	Mark Scheme	Mark
3(e)	**Able to state all the steps of procedures correctly** Sample answers $\sqrt{1}$ 1. Fill the electrolytic cell /beaker with half full of [*concentration ≥ 0.1*] mol dm^{-3} of sodium chloride solution $\sqrt{2}$ 2. Invert a test tube filled with sodium chloride solution on the **anode carbon** electrode. $\sqrt{3}$ 3. Complete the circuit. $\sqrt{4}$ 4. Collect and test the gas released at anode $\sqrt{5}$ 5. Record observation. $\sqrt{6}$ 6. Repeat step 1-5 by using [*concentration ≤ 0.001*] moldm^{-3} sodium chloride solution to replace [*concentration ≥ 0.1*] mol dm^{-3} of sodium chloride solution	**3**
	Able to state steps 1 , 3 , 5 and 6	**2**
	Able to state idea of procedure for electrolysis [step 1 and 3]	**1**
	No response or wrong response	**0**

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Questions	Mark Scheme	Mark
3(f)	**Able to tabulate the data with the following aspects** 1. Correct headings 2. List of the concentration of sodium chloride solution <u>Sample answer</u> | **Concentration of sodium chloride solution / mol dm^{-3}**	**Observation** | |---|---|
[*concentration ≥ 0.1*] mol dm^{-3} / Concentrated	
[*concentration ≤ 0.001*] mol dm^{-3} / Dilute			**2**
	Able to tabulate the data <u>Sample answer</u> 1. One correct headings or list of concentration of sodium chloride solution | Concentration / mol dm^{-3}	Observation | |---|---|
			1
	No response or wrong response or empty table	**0**

END OF MARKING SCHEME