NAMA:............................................. Tingkatan:..............................

SULIT
4541/2
Chemistry
Paper 2
MEI
2007
2 ½ jam

BAHAGIAN SEKOLAH
KEMENTERIAN PELAJARAN MALAYSIA
PEPERIKSAAN PERTENGAHAN TAHUN
FORM 5 CHEMISTRY
Paper 2

Dua jam tiga puluh minit

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

1. Tuliskan nama dan tingkatan pada ruang yang disediakan.
2. Jawab semua soalan daripada Bahagian A. Tuliskan jawapan anda dalam ruang yang disediakan
5. Anda hendaklah menyerahkan kertas tulis dan kertas tambahan, jika digunakan bersama-sama dengan kertas soalan.
6. Penggunaan kalkulator saintifik yang tidak boleh diprogramkan adalah dibenarkan.

<table>
<thead>
<tr>
<th>Bahagian</th>
<th>Soalan</th>
<th>Markah penuh</th>
<th>Markah diperoleh</th>
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Kertas soalan ini mengandungi 17 halaman bercetak

[lihat sebelah]

SULIT
Table 1 shows 3 halogens with their respective proton number.

<table>
<thead>
<tr>
<th>Halogen</th>
<th>Proton Number</th>
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<tbody>
<tr>
<td>P</td>
<td>9</td>
</tr>
<tr>
<td>Q</td>
<td>17</td>
</tr>
<tr>
<td>R</td>
<td>35</td>
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</tbody>
</table>

TABLE 1

(a) State the group number for the halogens in the Periodic Table.

............................................................................................................................................................... [1mark]

(b) Write the electron arrangement for

(i) atom P

............................................................................................................................................................... [1mark]

(ii) atom Q

............................................................................................................................................................... [1mark]

(c) Based on your answer in (b), deduce in which period in the Periodic Table the following elements are located.

(i) element P

............................................................................................................................................................... [1mark]

(ii) element Q

............................................................................................................................................................... [1mark]

(d) The number of neutrons for atom Q is 19. Write the symbol for atom Q in the form of \( ^{\text{A}}_{\text{Z}} \text{X} \).

............................................................................................................................................................... [1mark]
(e) As you go down the group for halogens from P to R, state the change in properties with respect to:
(i) the size of the atom
.........................................................................................................................
[1 mark]
(ii) electronegativity
.........................................................................................................................
[1 mark]
(iii) melting points and boiling points
.........................................................................................................................
[1 mark]
(f) Iron glows brightly when reacting with element Q. Write the chemical equation for the reaction.
.........................................................................................................................
[1 mark]
2 Figure 2 shows the set up of the apparatus used in an experiment to determine the empirical formula of an oxide of copper.

The following data was obtained:

<table>
<thead>
<tr>
<th>Description</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass of combustion tube + porcelain dish</td>
<td>25.30 g</td>
</tr>
<tr>
<td>Mass of combustion tube + porcelain dish + oxide of copper</td>
<td>53.30 g</td>
</tr>
<tr>
<td>Mass of combustion tube + porcelain dish + copper</td>
<td>47.70 g</td>
</tr>
</tbody>
</table>

(a) What is meant by empirical formula?

.......................................................................................................................
.......................................................................................................................
......................................................................................................................[1mark]

(b) Write the chemical equation for the reaction used to produce hydrogen gas.

.................................................................................................................................[1mark]

(c) Based on the data given

(i) Calculate the mass of copper and the mass of oxygen contained in the sample of oxide of copper.

Mass of copper .............................................g.

Mass of oxygen ..........................................g

[2 marks]
(ii) Calculate the mol ratio of copper to oxygen.

Given that the relative atomic mass of O = 16, Cu= 64

[2 marks]

(iii) Write the empirical formula of the oxide of copper.

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

[1 mark]

(iv) Write the chemical equation for the reaction between hydrogen and the oxide of copper.

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

[1 mark]

(d) The empirical formula for magnesium oxide can be determined by direct heating of magnesium. Draw the set up of the apparatus to carry out this experiment.

[2 marks]
3. Figure 3 shows the location of seven elements A, D, E, G, J, L and M in the Periodic Table. These are not the actual symbols of the elements.

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<tr>
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**FIGURE 3**

Using the letters in the Periodic Table of the elements in Figure 3, answer the following questions:

(a) Write the formula for the ion formed from an atom of

(i) element L ........................................................................................................... [1 mark]

(ii) element E ........................................................................................................... [1 mark]

(b) Which of the element is not chemically reactive? Explain why.

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

................................................................................................................................. [2 marks]

(c) Element L reacts with element J to form a compound

(i) State the type of bond present in this compound

................................................................................................................................. [1 mark]
(ii) Write the chemical formula of this compound

........................................................................................................
[1 mark]

(iii) Draw the diagram of electron arrangement for the compound that is formed between L and J.

[2 marks]

(iv) State one condition by which the compound in c (iii) conducts electricity. Explain your answer.

........................................................................................................
........................................................................................................
[2 marks]
4. Figure 4 shows the set up of the apparatus used to electrolyse copper(II) sulphate solution using copper electrodes

(a) Write the formula of all the anions present in the solution.

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

[1 mark]

(b) Write the half ionic equation for the reaction at the

(i) anode

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

[1 mark]

(ii) cathode

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

[1 mark]

(c) (i) From your observations, what happens to the intensity of the blue colour of the copper(II) sulphate solution during electrolysis?

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

[1 mark]
(ii) Explain your answer.

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

[2 marks ]

(d) If the experiment is repeated with the copper electrodes being replaced by carbon electrodes, name the products formed at the

(i) anode

..........................................................................................................................
[ 1 mark ]

(ii) cathode

..........................................................................................................................
[ 1 mark ]

(e) The volume of the gas collected at the anode is 24 cm$^3$. Determine the number of molecules of the gas collected at room temperature. Use the information that 1 mole of gas occupies a volume of 24.0 dm$^3$ at room conditions. Avogadro’s Number = 6.02 X 10$^{23}$ mol$^{-1}$

..........................................................................................................................
[ 2 marks ]
5 Figure 5 shows a series of changes involving solid W.

Gas Y is colourless. Gas Z is brown in colour. Solid X is brown in colour when hot and yellow in colour when cold.

(a) Identify:

(i) gas Y: .................................................................................................

(ii) gas Z: .................................................................................................

(iii) solid X: .................................................................................................

[3 marks]

(b) Describe a chemical test to identify the gas Y.

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

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

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

[2 marks]

FIGURE 5

Potassium iodide

Solid W

Solution W

Ammonia solution

White precipitate R

Solid X

Y

Z

Heat

Water

Q

White precipitate R

Potassium iodide

Solid W

Solution W

Ammonia solution

White precipitate R

Solid X

Y

Z

Heat

Water

Potassium iodide

Solid W

Solution W

Ammonia solution

White precipitate R

Solid X

Y

Z

Heat

Water

Potassium iodide

Solid W

Solution W

Ammonia solution

White precipitate R

Solid X

Y

Z

Heat

Water

Potassium iodide
(c) (i) Name the cation in solution W.

................................................................................................................................. [1 mark]

(ii) Write the ionic equation for the reaction between solution W and ammonia solution.

................................................................................................................................. [1 mark]

(iii) Name the white precipitate R.

................................................................................................................................. [1 mark]

(d) In another experiment, potassium iodide solution is added to solution W.

(i) State what can be observed.

................................................................................................................................. [1 mark]

(ii) Name the reaction that takes place in d (i)

................................................................................................................................. [1 mark]
6 Figure 6 shows some common polymers.

- Polyethene
- Perspex
- Polymer Q
- PVC
- Protein

FIGURE 6

(a) What is meant by ‘polymer’.
........................................................................................................................................
........................................................................................................................................

(b) The polymerization of glucose produces polymer Q. Name polymer Q.
........................................................................................................................................ [1 mark]

(c) Name the monomer of
   (i) protein : ..........................................................................................................
   (ii) polyethene : ..........................................................................................................

[1 mark]

(d) Draw the structural formula for the polymerization of the monomers of polyethene.

........................................................................................................................................
........................................................................................................................................ [2 marks]
(e) State one example of a natural polymer other than those in the list in Figure 6.

........................................................................................................................................... [1 mark]

(f) What is the main source of polyethylene, perspex and PVC?

........................................................................................................................................... [1 mark]

(g) Explain how PVC causes the environmental problem.

........................................................................................................................................... [1 mark]

(h) State one use of perspex in our daily life.

........................................................................................................................................... [1 mark]
Section B (20 marks)

Answer any one question from this section.
The suggested time to answer section B is 30 minutes.

7. (a) Fried rice stored in a refrigerator lasts longer than fried rice stored in a kitchen cabinet. Explain why.  
(4 marks)

(b) A group of pupils carried out three experiments to investigate the factors affecting the rate of a reaction. Table 7 shows information about the reactants and the temperature used in each experiment.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Reactants</th>
<th>Temperature / ºC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Excess zinc granules and 25 cm³ of 0.5 mol dm⁻³ hydrochloric acid</td>
<td>30</td>
</tr>
<tr>
<td>II</td>
<td>Excess zinc granules and 25 cm³ of 0.5 mol dm⁻³ hydrochloric acid</td>
<td>40</td>
</tr>
<tr>
<td>III</td>
<td>Excess zinc powder and 25 cm³ of 0.5 mol dm⁻³ hydrochloric acid</td>
<td>40</td>
</tr>
</tbody>
</table>

TABLE 7

The graph shows the result of these experiments.
(i) Calculate the average rate of reaction for Experiment I. [2 marks]

(ii) Based on the table and graph, compare the rate of reaction between:

   - Experiment I and II
   - Experiment II and III

   In each case, explain the difference in rate of reaction with reference to the collision theory. [10 marks]

(iii) The chemical equation below shows the reaction between zinc and hydrochloric acid.

\[
\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2
\]

Given that the relative atomic mass of Zn = 65, and the molar volume of any gas is 24 dm³ mol⁻¹ at room conditions.

Calculate the maximum volume of hydrogen gas produced in Experiment III. [4 marks]

---

8 Figure 8.1 shows the chemical symbols which represent three elements, P, Q and R. These letters are not the actual symbols of the elements.

![Figure 8.1](https://example.com/figure81.png)

(a) Write the electron arrangement for atoms P and Q [2 marks]

(c) Using the information in the Figure 8.1, explain how two different compounds can be formed from the following pairs of elements.
   (i) P and R
   (ii) Q and R [12 marks]
(d) Table 8.2 shows the melting and boiling points of two chemical compounds at room temperature.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Melting Point ($^\circ$C)</th>
<th>Boiling Point ($^\circ$C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrachloromethane</td>
<td>-23</td>
<td>76.8</td>
</tr>
<tr>
<td>Aluminium oxide</td>
<td>2030</td>
<td>2970</td>
</tr>
</tbody>
</table>

Table 8.2

Compare the melting and boiling points of tetrachloromethane and aluminium oxide. Explain why the two compounds have different physical states at room temperature.

[6 marks]
Section C (20 marks)
Answer any one question from this section.
The suggested time to answer section C is 30 minutes.

9 (a) (i) What is the functional group of alkenes?
(ii) Write the molecular formula and the name for the fourth member of alkenes.
(iii) Based on your answer in (a) (ii), draw the structural formulae of three possible isomers.

[6 marks]

(b) The flow chart below shows the chemical conversion of propan-1-ol to gas X and then gas X to gas Y.

Propan-1-ol dehydration Gas X hydrogenation Gas Y

(i) With the help of suitable diagrams, describe a laboratory experiment to prepare gas X from the dehydration reaction of propan-1-ol.
In your answer, include the chemical equation and explanation on how to ensure that gas X is already produced.

[10 marks]

(ii) Name gas Y.
Gas X burns with a more sooty flame than gas Y. Explain why.
Given that the relative atomic mass of C = 12 and H = 1.

[4 marks]

10 (a) Describe an experiment to determine the concentration of an alkali solution by using the titration method.
In your answer include the chemical equation and all the relevant calculations involved.

[12 marks]

(b) Describe an experiment to prepare a pure sample of dry copper (II) carbonate using only the chemical substances given. You are provided with sodium carbonate, nitric acid solution, copper (II) oxide and all the required apparatus. In your answer, write down the chemical equations for the reactions.

[8 marks]

END OF QUESTION PAPER