

**SULIT**  
**4541/1**  
**Kimia**  
**Kertas 1**  
**September**  
**2004**  
1¼ jam



**PEPERIKSAAN PERCUBAAN SPM 2004**  
**MAKTAB RENDAH SAINS MARA**

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**KIMIA**

<http://cikguadura.wordpress.com/>

Kertas 1

Satu jam lima belas minit

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU**

1. *Kertas soalan ini dalam Bahasa Inggeris.*
2. *Calon dikehendaki membaca maklumat di halaman 2*

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Kertas soalan ini mempunyai 39 halaman bercetak

**INFORMATION FOR CANDIDATES**

1. *This question paper consists of 50 questions.*
2. *Answer **all** questions*
3. *Answer each question by blackening the correct space on the answer sheet.*
4. *Blacken only **one** space for each question*
5. *If you wish to change your answer, erase the blackened mark that you have made. Then blacken the space for the new answer*
6. *The diagrams in the questions provided are not drawn to scale unless stated*
7. *You may use a non-programmable scientific calculator*

Question 1 to Question 50, are followed by four options **A, B, C, and D**. Choose *the best option* for each question and **blacken** the corresponding space on the objective answer sheet.

- 1 Figure 1 shows the electron arrangement for atom Y

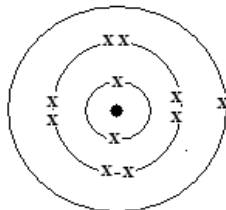


FIGURE 1

What is the nucleon number for atom Y?

- A 11
  - B 12
  - C 23
  - D 34
- 2 Figure 2 shows the symbol for an atom of element X.

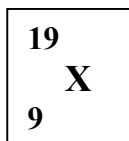
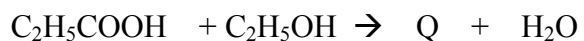


FIGURE 2

Which of the following group in the Periodic Table is X found?

- A 1
  - B 7
  - C 9
  - D 17
- 3 The following salts are soluble **except**
- A copper(II) carbonate
  - B copper(II) nitrate
  - C copper(II) chloride
  - D copper(II) sulphate

- 4 The following equation represents a reaction between propanoic acid and ethanol.



Which of the following homologous series does Q belongs to?

- A Ester
  - B Alkene
  - C Alcohol
  - D Carboxylic acid
- 5 Figure 3 shows the apparatus set – up for the separation of silver chloride salt from the mixture of reaction products.



FIGURE 3

Which of the following reactants is most suitable for the preparation of silver chloride?

- A Silver and hydrochloric acid
  - B Aqueous silver nitrate and aqueous sodium chloride
  - C Solid silver carbonate and hydrochloric acid
  - D Aqueous silver nitrate and sodium hydroxide
- 6 Figure 4 shows the arrangement of atoms in bronze.

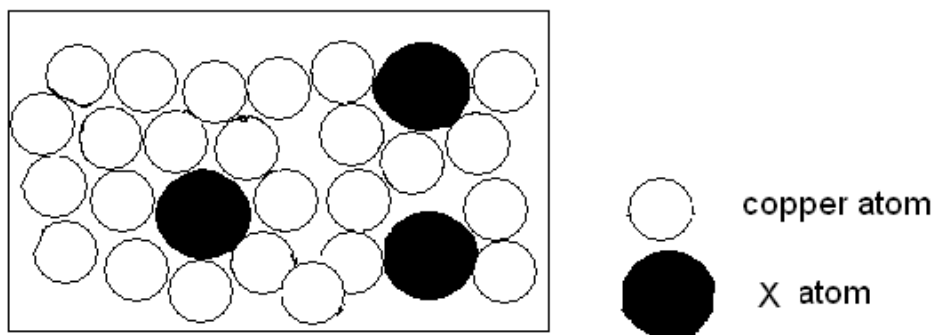


FIGURE 4

What is X?

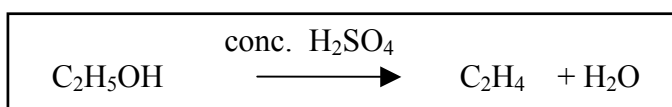
- A Zinc
- B Lead
- C Carbon
- D Tin

- 7 The following are the characteristics of a glass:-

- No resistance to heat
- Malleable

Which of the following glass has the above characteristics?

- A** Lead glass  
**B** Soda-lime glass  
**C** Borosilicate glass  
**D** Fused silica glass
- 8 The equation below represents the reaction in the preparation of ethylene.



What is the name of the reaction?

- A** Substitution  
**B** Oxidation  
**C** Dehydration  
**D** Addition
- 9 Figure 5 shows the structural formula for a hydrocarbon compound

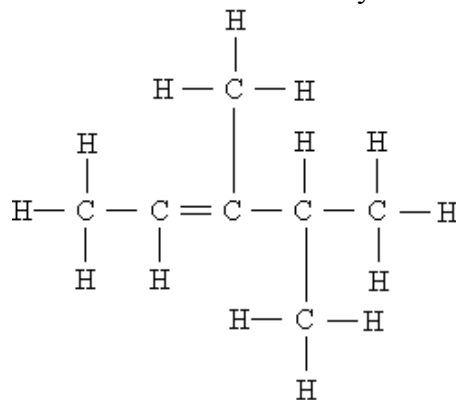


FIGURE 5

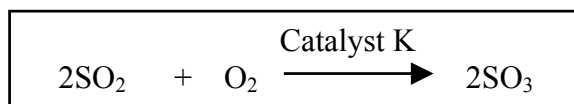
Which of the following IUPAC nomenclature represents the compound in Figure 5?

- A** 3, 4 - dimethyl pent-2-ene  
**B** 2, 3 - dimethyl pent-3-ene  
**C** 1,2,3 - trimethyl but-1-ene  
**D** 3 - propyl but-2-ene

- 10 Which of the following statements is true about subatomic particles?
- A The number of protons changes in a chemical reaction.
  - B Protons and neutrons are found in the nucleus of an atom.
  - C In an atom, the number of protons equals the number of neutrons.
  - D Subatomic particles have the same mass but differ in charges.
- 11 Which of the following pairs is true about the additives in detergents and their function?

|   | Additive              | Function                                     |
|---|-----------------------|--|
| A | Phosphate compounds   | Whitens cloth                                |
| B | Fluorescent compounds | Acts on organic matters such as blood        |
| C | Biological enzyme     | Kills and prevents growth of micro organism. |
| D | Whitening agent       | Acts as bleaching agent                      |

- 12 Stimulants are drugs which are classified as
- A psychotherapeutic
  - B analgesic
  - C antibiotic
  - D hormone
- 13 The following equation represents the main reaction in the preparation of sulphuric acid.



What is catalyst K?

- A Iron
- B Platinum
- C Vanadium(V) oxide
- D Aluminium(III) oxide

- 14 Table 1 shows a segment of The Periodic Table.

|  |  |  |  |  |  |  |          |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|----------|--|--|--|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |          |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |          |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | <b>E</b> |  |  |  |  |  |  |  |  |  |  |  |  |  |

TABLE 1

Which of the following are the characteristics of element E?

- I** Can form complex ions.  
**II** Low melting and boiling points.  
**III** Can form coloured compounds.  
**IV** Can be used as catalyst.
- A** I and II only  
**B** II and IV only  
**C** I, III and IV only  
**D** I, II, III and IV
- 15 The acidity of hydrogen chloride gas cannot be shown when dissolved in the following solvents
- I** water  
**II** ethanol  
**III** benzene  
**IV** tetra chloromethane
- A** I and II only  
**B** III and IV only  
**C** I and III only  
**D** II, III and IV only
- 16 Which of the following ions will form precipitates that do not dissolve in excess aqueous ammonia?
- I** Copper(II) ions  
**II** Aluminium ions  
**III** Lead(II) ions  
**IV** Zinc ions
- A** I and IV only  
**B** II and III only  
**C** I, II and III only  
**D** II, III and IV only

- 17 Photochromic glass is used in making  
**I** spectacles.  
**II** office windows.  
**III** car screen.  
**IV** volumetric flask.  
**A** I and II only  
**B** III and IV only  
**C** I, II and III only  
**D** II, III and IV only
- 18 Which of the underlined substances in the following equations undergo oxidation?  
**I**  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$   
**II**  $\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$   
**III**  $\text{Mg} + \text{CuSO}_4 \rightarrow \text{MgSO}_4 + \text{Cu}$   
**IV**  $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$   
**A** I and III only  
**B** II and III only  
**C** I, II and IV only  
**D** I, III and IV only

- 19 Which of the following homologous series and its functional group are correctly paired?

|            | Homologous Series | Functional group |
|------------|-------------------|------------------|
| <b>I</b>   | Ester             | -COOH            |
| <b>II</b>  | Alkene            | -C=C-            |
| <b>III</b> | Alcohol           | -OH              |
| <b>IV</b>  | Carboxylic acid   | -COO-C-          |

- A** II and III only  
**B** I and IV only  
**C** II, III and IV only  
**D** I, II, III and IV
- 20 Excess powdered metal Z was added to aqueous copper(II) sulphate and stirred. After a few minutes, the solution turned colourless. Z could be  
**I** Mg  
**II** Ag  
**III** Al  
**IV** Zn  
**A** I and III only  
**B** II and IV only  
**C** I, II and III only  
**D** I, III and IV only



- 21 Figure 6 shows an experiment to compare the rate of diffusion between ammonia and hydrogen chloride gases.

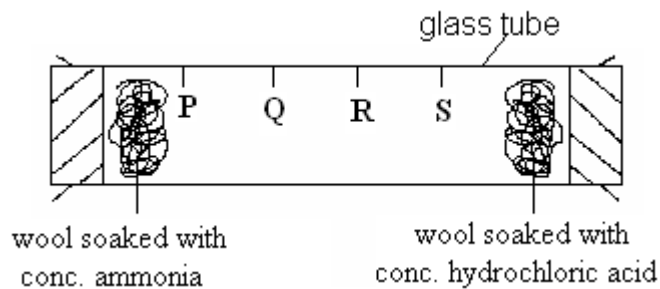


FIGURE 6

The bigger the mass of a particle, the slower the velocity of the particle.

Based on the above statement, where will the white fumes of ammonium chloride first formed? [Molar mass:  $\text{NH}_3$  ;  $17 \text{ gmol}^{-1}$  ,  $\text{HCl}$  ;  $36.5 \text{ gmol}^{-1}$  ]

- A P  
 B Q  
 C R  
 D S
- 22 Curve I in Figure 7 was obtained when 2.0 g magnesium strips react with nitric acid at  $40^\circ\text{C}$ .

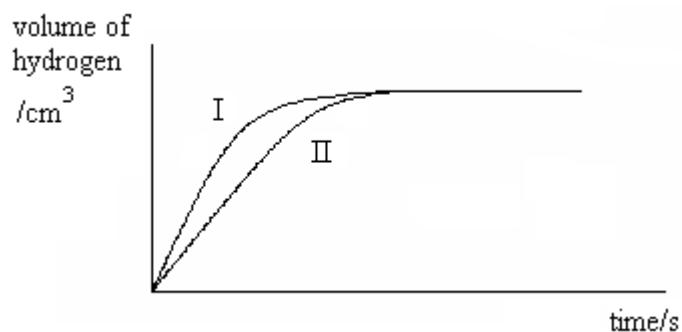


FIGURE 7

Which of the following will produce curve II?

- A Using 2.0 g of powdered magnesium  
 B Raising the temperature of nitric acid to  $50^\circ\text{C}$   
 C Using 1.0 g magnesium strips.  
 D Adding distilled water to nitric acid

- 23 Figure 8 shows the electron configuration for compound  $YZ_2$

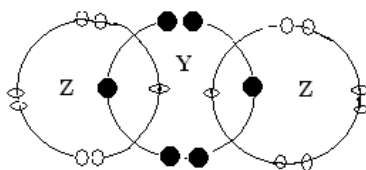


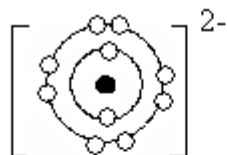
FIGURE 8

- valence electron for Z atom  
● valence electron for Y atom

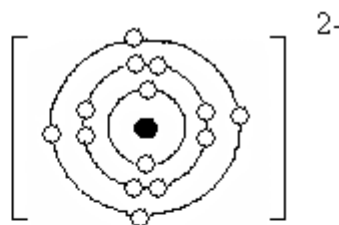
Which of the following pairs is the correct groups in which elements Y and Z belong to in the Periodic Table?

|   | Y  | Z  |
|---|----|----|
| A | 2  | 17 |
| B | 16 | 17 |
| C | 14 | 16 |
| D | 17 | 16 |

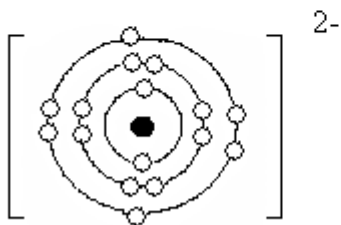
- 24 Which of the following diagram represents the correct electron configuration for sulphide ion?  
[Proton Number: S, 16]



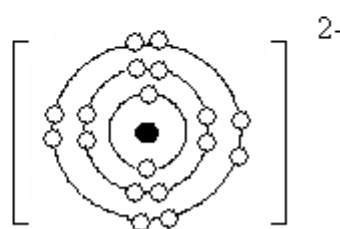
A



B



C



D

25 The reaction between chlorine water and iron(II) sulphate solution is a redox reaction. Which of the following is true?

- A Iron(II) ion is an oxidizing agent.
- B Electron is transferred from chlorine to iron(II) ion.
- C The oxidation number of chlorine reduces from 0 to -1.
- D The colour of the mixture changes from brown to green.

26 Figure 9 shows the apparatus set up of a chemical cell.

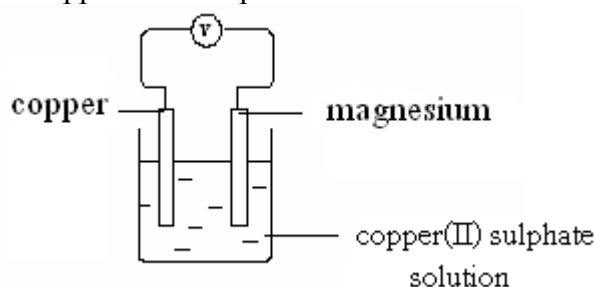
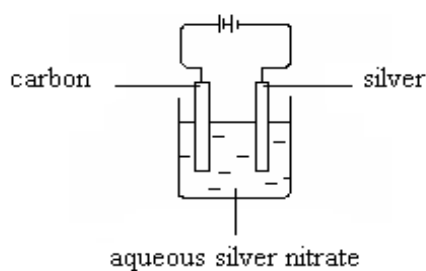


FIGURE 9

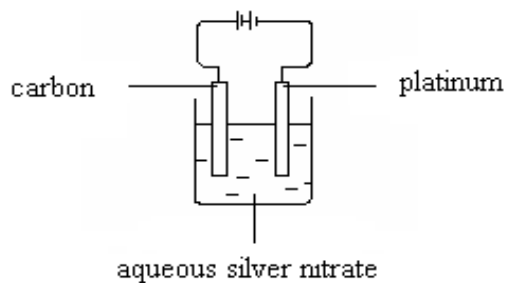
Which of the following is true?

- A Magnesium electrode is the positive terminal.
- B Reduction occurs at the copper electrode
- C Copper is more electropositive than magnesium.
- D Electron flows from copper to magnesium through the external circuit.

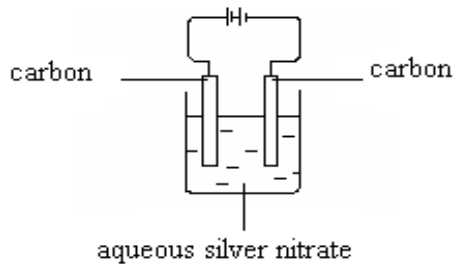
27 Which of the following apparatus set-up will **not** cause changes in silver nitrate concentration?



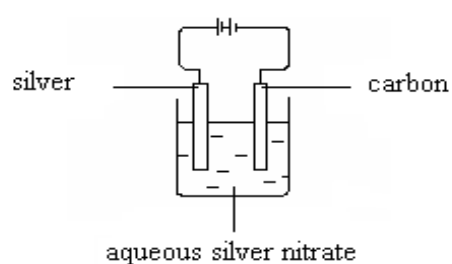
A



B

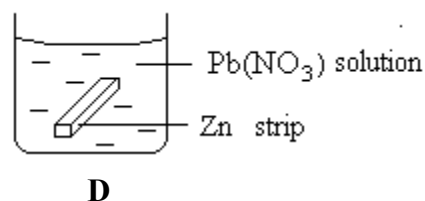
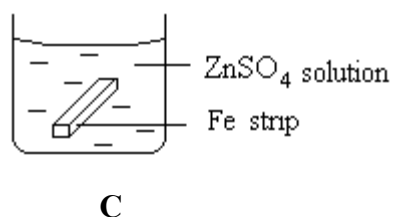
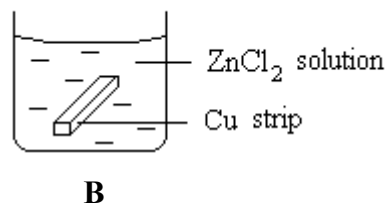
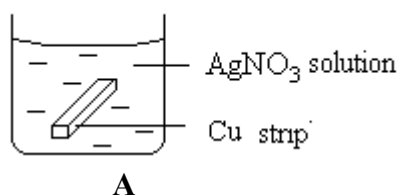


C

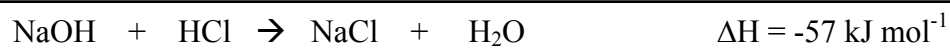


D

28 Which of the following solutions will show colour changes?



29 Below are two thermo chemical equations for the neutralization process.



The value of the heat of neutralization for both processes are different because

- A** the ethanoic acid is less soluble in water.  
**B** the production of sodium ethanoate salt absorbs heat.  
**C** the ethanoic acid produces only a small amount of hydrogen ions.  
**D** greater amount of heat is absorbed to ionize the ethanoic acid molecule.

30 Which of the following observations for the different mixtures of reactants is correct?

|          | Mixture of reactants   | The colour of tetra chloromethane layer |
|----------|--|---|
| <b>A</b> | Potassium iodide solution + bromine water + tetrachloromethane   | Brown                                   |
| <b>B</b> | Potassium chloride solution + bromine water + tetrachloromethane | Colourless                              |
| <b>C</b> | Potassium iodide solution + chlorine water + tetrachloromethane  | Purple                                  |
| <b>D</b> | Potassium bromide solution + iodine water + tetrachloromethane   | Brown                                   |

- 31 Figure 10 shows the apparatus set – up for the reaction between oxide T and mixture U.

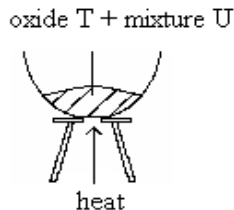


FIGURE 10

Which of the following pairs will react when heated strongly?

|          | Mixture U                         | Oxide T         |
|----------|-----------------------------------|-----------------|
| <b>A</b> | Aluminium powder + carbon powder. | Magnesium oxide |
| <b>B</b> | Iron powder + tin powder.         | Zinc oxide      |
| <b>C</b> | Carbon powder + copper powder.    | Lead(II) oxide  |
| <b>D</b> | Tin powder + copper powder.       | Aluminium oxide |

- 32 Figure 11 shows the arrangement of particles found in four substances as named.

| I           | II                     | III           | IV            |
|-------------|------------------------|---------------|---------------|
|             |                        |               |               |
| <b>Zinc</b> | <b>Sodium chloride</b> | <b>Helium</b> | <b>Oxygen</b> |

FIGURE 11

Which pairs of the arrangement of particles and the name of the substances are paired correctly?

- A** I dan III sahaja  
**B** I dan IV sahaja  
**C** II dan III sahaja  
**D** III dan IV sahaja

33. Table 2 shows the elements found in Period Three of the Periodic Table.

|    |    |    |    |   |   |    |    |
|----|----|----|----|---|---|----|----|
| Na | Mg | Al | Si | P | S | Cl | Ar |
|----|----|----|----|---|---|----|----|

TABLE 2

Which of the following statements is true?

- I** The boiling point of sulphur is higher than chlorine.  
**II** Aluminium is less electropositive than magnesium.  
**III** The size of sodium ion is bigger than magnesium ion.  
**IV** Oxide of elements changes from acidic to base as we go from left to right in Period Three.
- A** I dan II sahaja  
**B** III dan IV sahaja  
**C** I, II dan III sahaja  
**D** I, II, III dan IV

34. Figure 12 shows the apparatus set-up to determine the rate of reaction between calcium carbonate and hydrochloric acid.

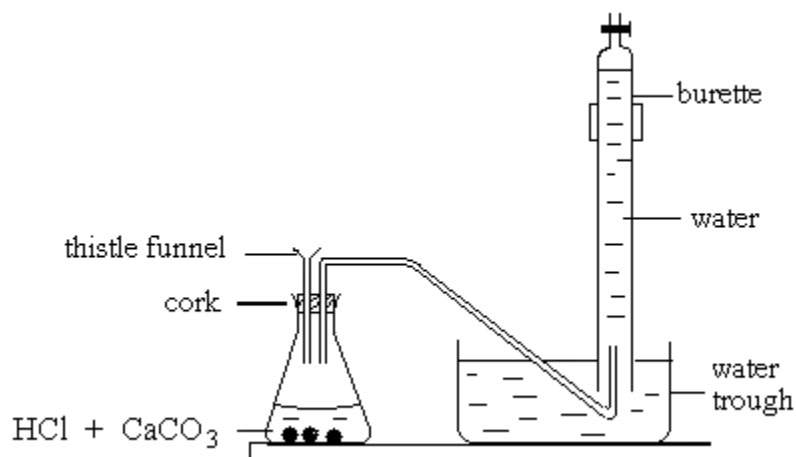
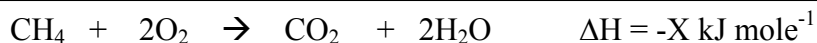


FIGURE 12

Which of the following is **not** correct in the apparatus set-up for this experiment?

- I** Fixing of cork  
**II** Position of thistle funnel  
**III** Position of the delivery tube in the basin.  
**IV** Position of the delivery tube in the conical flask.
- A** I and III only  
**B** II and III only  
**C** II and IV only  
**D** I, II, III and IV

- 35 Combustion of methane in excess oxygen can be represented by the equation below.



Which of the following is true?

- I** X kJ is released for every mole of methane burnt.  
**II** 1 dm<sup>3</sup> of methane gas releases 1 dm<sup>3</sup> carbon dioxide gas.  
**III** The formation of carbon dioxide and water molecules releases heat.  
**IV** The energy content of reactants is less than that of the products.

- A** I and III only  
**B** II and IV only  
**C** I, II and III only  
**D** I, II, III and IV

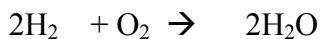
- 36 The information regarding elements M and T are as follows:

| Element           | M  | T  |
|-------------------|----|----|
| Proton number     | 12 | 9  |
| Number of neutron | 12 | 10 |

What is the molar mass of the compound formed when M and T react with each other?

- A** 62 g mol<sup>-1</sup>  
**B** 43 g mol<sup>-1</sup>  
**C** 32 g mol<sup>-1</sup>  
**D** 30 g mol<sup>-1</sup>

- 37 The equation below represents the reaction between hydrogen and oxygen gas to form water.



Calculate the volume of oxygen required at room condition when 0.24 dm<sup>3</sup> hydrogen gas reacts completely.

[1 mole of gas occupies 24 dm<sup>3</sup> at room condition]

- A** 0.12 dm<sup>3</sup>  
**B** 0.24 dm<sup>3</sup>  
**C** 0.48 dm<sup>3</sup>  
**D** 2.40 dm<sup>3</sup>

- 38 How many oxygen atoms are combined together in 24 g of ozone,  $O_3$ ?  
[Relative atomic mass: O, 16; Avogadro's constant:  $6 \times 10^{23} \text{ mol}^{-1}$ ]

- A  $14 \times 10^{23}$   
 B  $9 \times 10^{23}$   
 C  $6 \times 10^{23}$   
 D  $3 \times 10^{23}$

- 39 Figure 13 shows an experiment to determine the empirical formula for an iron oxide.

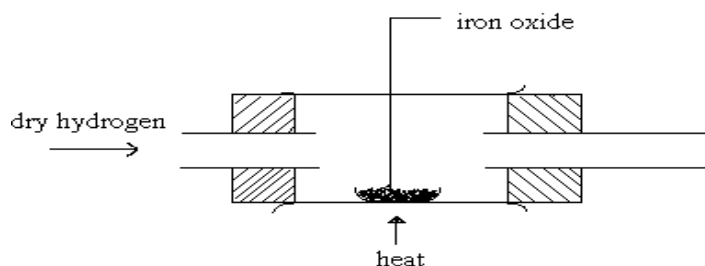


FIGURE 13

The experimental results are as follows:

|   |   |          |
|---|---|----------|
| Mass of an empty combustion tube                | = | 262.20 g |
| Mass of combustion tube + iron oxide            | = | 264.92 g |
| Mass of combustion tube + iron that is produced | = | 264.44 g |

What is the empirical formula for this iron oxide?

[Relative atomic mass: Fe, 56; O, 16]

- A FeO  
 B  $Fe_2O_3$   
 C  $Fe_3O_4$   
 D  $Fe_2O_5$
- 40 Table 3 shows the proton number of four elements represented by letters P, Q, R and S.

| Element       | P | Q | R  | S  |
|---------------|---|---|----|----|
| Proton number | 6 | 8 | 17 | 20 |

TABLE 3

Which of the following pairs will form compounds with high melting and boiling points?

- A P and Q  
 B Q and S  
 C P and R  
 D Q and R



- 41 Figure 14 shows the cooling curve for gas J.

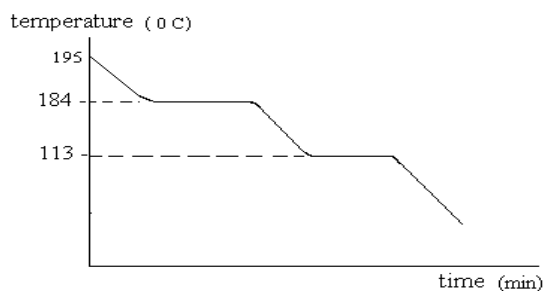
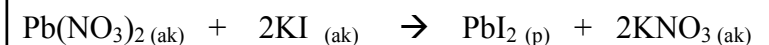


FIGURE 14

Which of the following is true for substance J?

|   | Physical state at room temperature | Types of particles |
|---|------------------------------------|--------------------|
| A | Solid                              | Molecule           |
| B | Liquid                             | Molecule           |
| C | Solid                              | Ion                |
| D | Gas                                | Atom               |

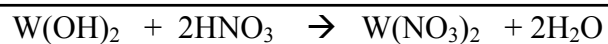
- 42 The reaction between lead(II) nitrate solution and potassium iodide solution can be represented by the following equation:



25.0 cm<sup>3</sup> potassium iodide solution 1.0 mol dm<sup>-3</sup> is added to 25.0 cm<sup>3</sup> lead(II)nitrate solution 1.0 mol dm<sup>-3</sup>. What is the maximum mass of lead(II) iodide produced in this reaction?

[ Relative Atomic Mass: I , 127 ; Pb , 207 ]

- A 4.175 g  
 B 5.76 g  
 C 8.35 g  
 D 11.52 g
- 43 The equation below represents the neutralization reaction of aqueous W hydroxide and nitric acid.



20 cm<sup>3</sup> of aqueous W hydroxide 0.5 mol dm<sup>-3</sup> neutralizes 20 cm<sup>3</sup> of nitric acid. What is the concentration of the nitric acid?

- A 0.25 mol dm<sup>-3</sup>  
 B 0.50 mol dm<sup>-3</sup>  
 C 1.00 mol dm<sup>-3</sup>  
 D 2.00 mol dm<sup>-3</sup>

- 44 The equation below represents the combustion of ethane in excess oxygen.



What is the value of **a**, **b**, **c** and **d**?

|          | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|----------|----------|----------|----------|----------|
| <b>A</b> | 1        | 7        | 2        | 3        |
| <b>B</b> | 2        | 7        | 4        | 6        |
| <b>C</b> | 1        | 1        | 2        | 3        |
| <b>D</b> | 2        | 7        | 2        | 3        |

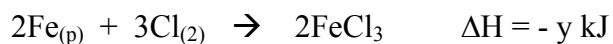
- 45 Table 4 shows the total volume of gas evolved at different intervals for the dissociation of hydrogen peroxide.

|                                       |     |      |      |      |      |      |
|---------------------------------------|-----|------|------|------|------|------|
| <b>Time (min)</b>                     | 0.0 | 1.0  | 1.5  | 2.0  | 2.5  | 3.0  |
| <b>Volume of gas (cm<sup>3</sup>)</b> | 0.0 | 10.0 | 20.0 | 28.0 | 35.0 | 35.0 |

TABLE 4

What is the average rate of reaction in the second minute?

- A** 14.0 cm<sup>3</sup> min<sup>-1</sup>  
**B** 16.0 cm<sup>3</sup> min<sup>-1</sup>  
**C** 18.0 cm<sup>3</sup> min<sup>-1</sup>  
**D** 28.0 cm<sup>3</sup> min<sup>-1</sup>
- 46 Below is a thermochemical equation.



What is the amount of heat released if 1 mol iron reacts with 3 mol chlorine gas?

- A**  $y/3$  kJ  
**B**  $y/2$  kJ  
**C**  $y$  kJ  
**D**  $2y$  kJ

- 47 Which of the following quantities contains the same number of molecules as in 2.2 g of carbon dioxide?  
[Relative atomic mass: H, 1; C, 12; O, 16; 1 mole of gas occupies 24 dm<sup>3</sup> at room condition ; Avogadro's constant:  $6 \times 10^{23} \text{ mol}^{-1}$ ]
- I 0.8 g methane gas, CH<sub>4</sub>
  - II 1.4 g carbon monoxide, CO
  - III  $3.0 \times 10^{23}$  molecules of nitrogen dioxide, NO<sub>2</sub>
  - IV 1.2 dm<sup>3</sup> oxygen, O<sub>2</sub> at room condition.
- A I and III only
  - B I, II and IV only
  - C II, III and IV only
  - D I, II, III and IV
- 48 Which of the following statements are true regarding the magnesium chloride and hydrogen chloride?
- I Both are soluble in water producing colourless solutions.
  - II Magnesium chloride has a higher melting point than hydrogen chloride.
  - III Hydrogen chloride dissolves in methylbenzene while magnesium chloride does not.
  - IV Solid magnesium chloride can conduct electricity while hydrogen chloride does not.
- A I and III only.
  - B II and IV only.
  - C I, II and III only.
  - D I, II, III and IV

- 49 Figure 15 shows the electrolysis of molten lead(II) bromide.

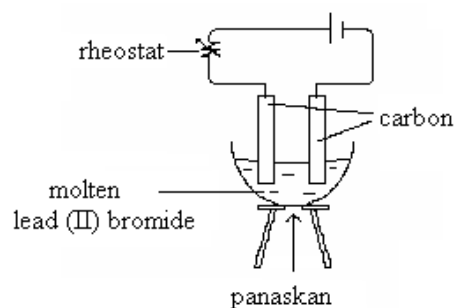


FIGURE 15

Which of the following is true about the above process?

- I Bromide ions lose electron.
- II Shiny grey solid formed at anode.
- III Oxidation number of bromine changes from -1 to 0
- IV Lead(II) ions undergo oxidation.

- A I and III only
- B II and III only
- C I, II and IV only
- D I, II, III and IV

- 50 An experiment was carried out to determine the heat of precipitation for the reaction between silver nitrate and sodium chloride. Table 5 shows the temperature reading of both solutions.

|   |       |
|---|-------|
| Initial temperature for 50 cm <sup>3</sup> silver nitrate 1 mol dm <sup>-3</sup>  | 30 °C |
| Initial temperature for 50 cm <sup>3</sup> sodium chloride 1 mol dm <sup>-3</sup> | 30 °C |
| Maximum temperature for mixture of both solutions                                 | 35 °C |

TABLE 5

Based on Table 5, which of the following is true?

[Specific heat capacity: 4.0 J g<sup>-1</sup> °C<sup>-1</sup>; Relative atomic mass: Ag, 108; Cl, 35.5]

- I 7.2 g white precipitate is formed.
- II Heat released during the experiment is 2000 J
- III The amount of silver nitrate used is 0.05 mole
- IV Heat released during the formation of bonds is more than heat absorbed during the breaking of bonds.

- A I and III only
- B II and IV only
- C II, III and IV only
- D I, II, III and IV

END OF QUESTION PAPER  
<http://cikguadura.wordpress.com/>

4541/2  
Kimia  
Kertas 2  
Sept  
2004  
2 ½ jam

NAMA: .....

ANGKA GILIRAN: .....



**PEPERIKSAAN PERCUBAAN SPM 2004  
MAKTAB RENDAH SAINS MARA**

<http://cikguadura.wordpress.com/>

**KIMIA**

Kertas 2

Dua jam tiga puluh minit

**JANGAN BUKA KERTAS SOALAN INI  
SEHINGGA DIBERITAHU**

1. *Tuliskan nama dan angka giliran anda pada ruang yang disediakan.*
2. *Kertas soalan ini bahasa Inggeris.*
3. *Calon dibenarkan menjawab keseluruhan atau sebahagian soalan sama ada dalam bahasa Melayu atau bahasa Inggeris.*
4. *Calon dikehendaki membaca maklumat di halaman 2*

| <i>Kod Pemeriksa</i> |        |              |                  |
|----------------------|--------|--------------|------------------|
| Bahagian             | Soalan | Markah Penuh | Markah Diperoleh |
| A                    | 1      | 8            |                  |
|                      | 2      | 8            |                  |
|                      | 3      | 10           |                  |
|                      | 4      | 11           |                  |
|                      | 5      | 11           |                  |
|                      | 6      | 12           |                  |
| B                    | 1      | 20           |                  |
|                      | 2      | 20           |                  |
| C                    | 3      | 20           |                  |
|                      | 4      | 20           |                  |
| Jumlah               |        |              |                  |

Kertas soalan ini mengandungi 20 halaman bercetak

**INFORMATION FOR CANDIDATES**

1. *This question paper consists of **three sections**: **Section A**, **Section B** and **Section C**.*
2. *Answer **all** questions in **Section A**. Write your answers for **Section A** in the spaces provided in the question paper.*
3. *Answer **one** question from **Section B** and **one** question from **Section C**. Write your answers for **Section B** and **Section C** on the lined pages provided at the end of this question paper. Answer questions in **Section B** and **Section C** in detail. Answers should be clear and logical. Equations, diagrams, tables, graphs and other suitable methods can be used to explain your answer.*
4. *The diagrams in the questions provided are not drawn to scale unless stated.*
5. *The marks allocated for each question and sub-section of a question are shown in brackets.*
6. *If you wish to cancel any answer, neatly cross out the answer.*
7. *You may use a non-programmable scientific calculator. However, steps in calculation must be shown.*
8. *The time suggested to complete **Section A** is 90 minutes, **Section B** is 30 minutes and **Section C** is 30 minutes.*

For  
Examiner's  
Use

### Section A

[60 marks]

Answer **all** questions in this section.  
The time suggested to complete **Section A** is 90 minutes.

- 1 Table 1 shows the proton number and part of the nucleon number for the elements C, O, Na and Cl.

| Elements       | C | O  | Na | Cl |
|----------------|---|----|----|----|
| Proton number  | 6 | 8  | 11 | 17 |
| Nucleon number |   | 16 | 23 |    |

TABLE 1

1 (a)

- (a) What is meant by proton number?

.....

[ 1 mark ]

1 (b)

- (b) Write the atomic symbol for sodium including the proton number and nucleon number in the box provided.

1 (c)

- (c) State the number of neutron for Cl atom.

.....

[ 1 mark ]

- (d) Element C has a few isotopes.

[ 1 mark ]

1 (d)(i)

- (i) Suggest a possible nucleon number for the element C.

.....

[ 1 mark ]

1 (d)(ii)

- (ii) Name an isotope that is radioactive.

.....

[ 1 mark ]

For  
Examiner's  
Use

1 (e)

(e) Write the electron arrangement for the ion of element O.

.....  
[ 1 mark ]

(f) The element Na is very reactive chemically.  
Explain this statement based on electron arrangement.

1 (f)

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

2 Figure 1 shows the elements in period 3 of the Periodic Table.

|    |    |  |  |    |    |   |   |    |    |
|----|----|--|--|----|----|---|---|----|----|
| 1  |    |  |  |    |    |   |   | 18 |    |
|    | 2  |  |  |    |    |   |   |    |    |
| Na | Mg |  |  | Al | Si | P | S | Cl | Ar |

FIGURE 1

Based on Figure 1, answer the following questions:

2 (a)

(a) State an example of metal.

.....  
[ 1 mark ]

(b) The size of the Al atom is bigger than the P atom.  
Explain.

2 (b)

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



For  
Examiner's  
Use

2 (c)(i)

(c) The elements Mg and S can react with oxygen to form their oxides.

(i) Write the formulae of the oxides formed.

.....

[ 1 mark ]

(ii) Compare the chemical properties of these oxides.

.....

.....

[ 1 mark ]

2 (c)(ii)

(d) Magnesium can react with chlorine to form a compound.

(i) Draw the electronic configuration diagram for the compound formed.

2 (d)(i)

[ 2 marks ]

2 (d)(ii)

(ii) State a physical property of the compound formed.

.....

[ 1 mark ]

For  
Examiner's  
Use

3 Figure 2 shows the apparatus set-up for the electrolysis of copper(II) chloride solutions of different concentration.

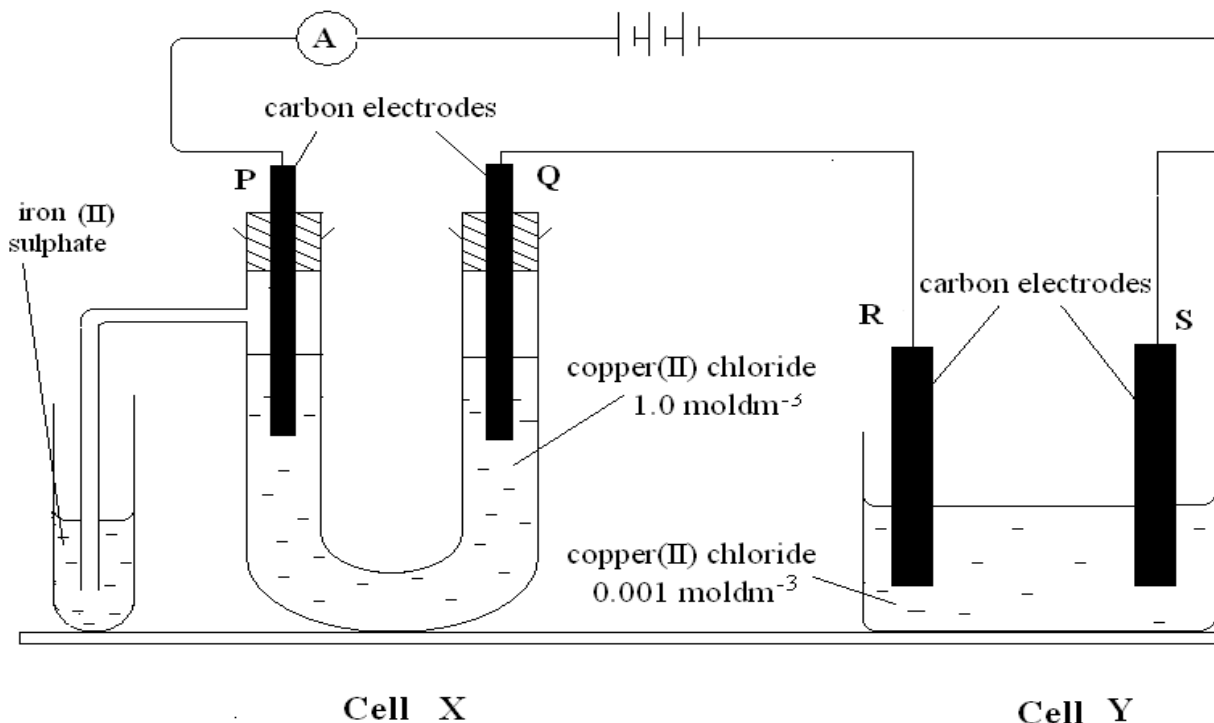


FIGURE 2

3 (a)

(a) Write the formulae of all the ions present in the copper(II) chloride solution.

.....  
[ 1 mark ]

3 (b)

(b) State the observation that can be seen at the electrode S during the electrolysis.

.....  
[ 1 mark ]

3 (c)(i)

(c) (i) Name the products formed at electrode P and R.

Electrode P: .....

Electrode R: .....

[ 1 mark ]

(ii) Explain your answer.

3 (c)(ii)

.....  
.....

[ 2 marks ]

For  
Examiner's  
Use

3 (d)(i)

- (d) (i) What can be observed at the iron(II) sulphate solution after a few minutes?

.....  
[ 1 mark ]

3 (d)(ii)

- (ii) State the change in the oxidation number of iron in the iron(II) sulphate solution.

.....  
[ 1 mark ]

3 (d)(iii)

- (iii) Write the ionic equation for the reaction that occurred in the test tube.

.....  
[ 1 mark ]

- (e) Draw the modification to the apparatus set-up in cell Y so that the product at the electrode R can be collected.



CELL Y

3 (e)

[ 2 marks ]

For  
Examiner's  
Use

- 4 Figure 3 shows a series of reactions for the production of magnesium nitrate and substance G with magnesium as the initial reactant.

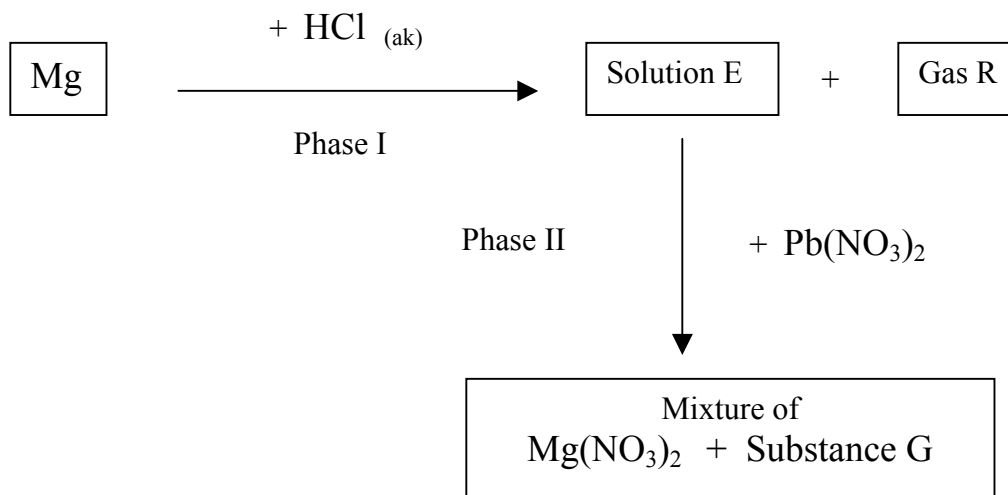


FIGURE 3

- (a) Name solution E and substance G.

4 (a)

Solution E : .....

Substance G : .....

[ 2 marks ]

- (b) Explain how you can identify and confirmed the presence of gas R.

4 (b)

.....

.....

[ 2 marks ]

For  
Examiner's  
Use

4 (c)(i)

(c) In phase I, 20 cm<sup>3</sup> of hydrochloric acid 1.0 mol dm<sup>-3</sup> is reacted with excess magnesium powder.

(i) Write the chemical equation for this reaction.

.....  
[1 mark]

(ii) Calculate the maximum volume of gas R that can be produced at room condition.

[ Molar volume of gas : 24 dm<sup>3</sup> mol<sup>-1</sup> at room condition ]

4 (c)(ii)

[3 marks]

4 (d)(i)

(d) (i) Name the type of reaction that took place in phase II.

.....  
[1 mark]

(ii) Explain how you can separate substance G from the product's mixture.

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

4 (d)(ii)

[2 marks]

For  
Examiner's  
Use

- 5 An experiment was done to determine the rate of reaction between 50 cm<sup>3</sup> hydrochloric acid 0.1 mol dm<sup>-3</sup> and excess calcium carbonate chips. The volume of gas evolved during the reaction is recorded every 20 seconds as shown in Table 2.

| Time ( s )  | 0    | 20    | 40    | 60    | 80    | 100   | 120   | 140   | 160   |
|---|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Total volume of CO <sub>2</sub> gas evolved ( cm <sup>3</sup> ) | 0.00 | 24.00 | 33.00 | 39.00 | 43.50 | 46.50 | 48.00 | 49.00 | 49.00 |

TABLE 2

5 (a)

- (a) Write the chemical equation for this reaction.

.....  
[1 marks ]

5 (b)

- (b) Draw the graph of the volume of carbon dioxide gas against time on the graph paper on page 19.

[4 marks ]

Graph of the volume of carbon dioxide gas against time

For  
Examiner's  
Use

5 (c)

(c) Based on the graph in (b), how does the rate of reaction changes with time?  
Explain your answer.

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

[2 marks ]

5 (d)

(d) Calculate the rate of reaction at 80 seconds.

[2 marks ]

5 (e)

(e) Suggest **two** ways to increase the rate of reaction between calcium carbonate and hydrochloric acid.

.....  
.....

[2 marks ]



For  
Examiner's  
Use

6 Figure 4 shows the structural formulae of compounds J and K.

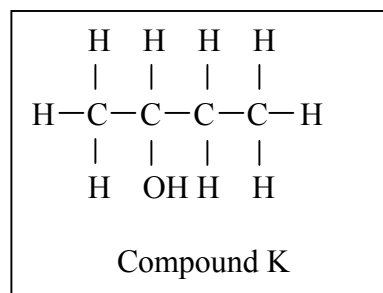
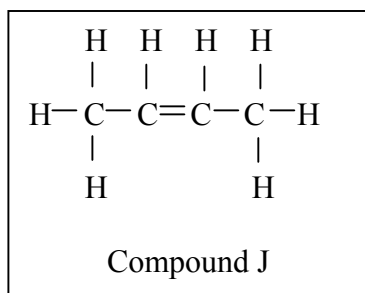


FIGURE 4

(a) State the homologous series for compounds J and K.

Compound J: .....

Compound K: .....

[1 mark]

6 (a)

6 (b)(i)

(b) (i) Name compound K.

.....  
[1 mark]

6 (b)(ii)

(ii) Write the molecular formula for a compound that has 7 carbon atoms and in the same homologous series as K.

.....  
[1 mark]

(c) Draw the structural formulae for another **two** isomers of compound J.

6 (c)

[2 marks]

For  
Examiner's  
Use

6 (d)(i)

(d) Compound J combines with each other at high temperature and pressure in the presence of a catalyst to form a new substance.

(i) Name the process for the formation of this new substance.

.....  
[1 mark]

(ii) Draw the structural formula of this new substance.

6 (d)(ii)

[1 mark]

(e) Compound K is added into a test tube containing acidic potassium permanganate solution and heated for a few minutes.

6 (e)(i)

(i) State **one** observation for this experiment.

.....  
[1 mark]

6 (e)(ii)

(ii) Write an equation for this reaction.

.....  
[1 mark]

(f) Both of compounds J and K are combustible in air.  
Explain the difference in the quantity of soot produced by the two compounds during combustion.  
[Relative Atomic Mass: H, 1; C, 12; O, 16]

6 (f)

.....

.....

[3 marks]

## Section B

[20 marks]

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

- 1 The empirical formula of substance Z is



- (a) What is the information that can be deduced from this formula? [ 2 marks ]
- (b) The molar mass for substance Z is  $180 \text{ gmol}^{-1}$ . Determine the molecular formula of substance Z. [ 2 marks ]  
[Relative Atomic Mass: H , 1 ; C , 12 ; O , 16 ]
- (c) A student carried out two experiments to determine the empirical formulae for magnesium oxide and copper(II) oxide. Figure 5 shows the apparatus set-up for both experiments.

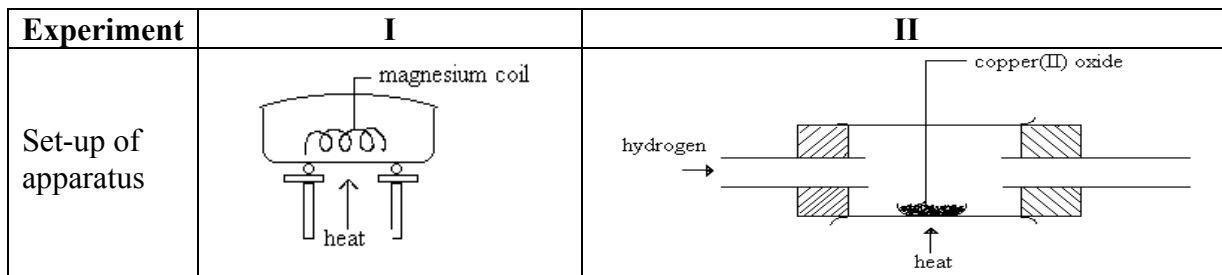
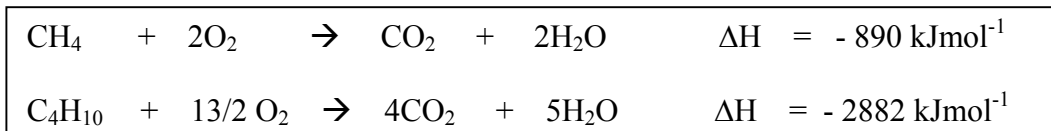


FIGURE 5

- (i) Suggest one industrial application for the reaction in experiment II and give an example. [2 marks ]
- (ii) Explain the differences in the method used for the determination of the empirical formulae for both oxides. [4 marks ]
- (iii) Compare the precautionary steps that need to be taken in both experiments to obtain an accurate result. [4 marks ]
- (iv) The reactions in both experiments are redox reactions. Explain this statement based on the changes in the oxidation number. [6 marks ]

- 2 (a) A student holding an ice cube discovers that ice turned into water after a few minutes. Explain this phenomenon. [2 marks]
- (b) Methane is the main component in liquid natural gas while butane is the main component in liquid petroleum gas. Both gases are used as fuel.

The complete combustion of methane and butane can be shown by the following equations:



- (i) A student heats up  $1 \text{ dm}^3$  of water at 1 atmosphere from room temperature ( $30^\circ\text{C}$ ) till it started boiling. Calculate the minimum mass of butane gas needed to heat the water.  
[Specific heat capacity of water;  $4.2 \text{ Jg}^{-1}\text{C}^{-1}$ , Density of water  $1 \text{ gcm}^{-3}$ , Relative Atomic Mass: C,12; H,1] [3 marks]
- (ii) Calculate the amount of heat released by each gram of methane and butane. Based on your answer compare the efficiency of these two substances as a fuel.  
[Molar mass: methane,  $16 \text{ gmol}^{-1}$ ; butane,  $58 \text{ gmol}^{-1}$ ] [4 marks]

- (c) A student carried out two experiments to determine the heat of precipitation. Table 3 shows the results of the experiments.

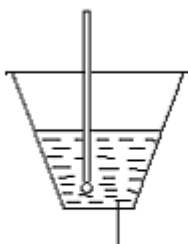
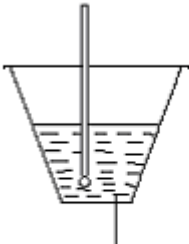
| Experiment                       | I   | II  |
|----------------------------------|---|---|
| Set-up of apparatus              |  <p>sodium sulphate +<br/>lead(II) nitrate</p> |  <p>calcium nitrate +<br/>sodium carbonate</p> |
| Initial temperature of solutions | Sodium sulphate : 27 °C<br>Lead(II) nitrate : 27 °C   | Calcium nitrate : 27 °C<br>Sodium carbonate : 27 °C   |
| Maximum temperature of mixture   | 38 °C   | 24 °C   |

TABLE 3

- (i) Write the chemical equations for both reactions in experiments I and II. [2 marks]
- (ii) Compare the changes in temperature for both experiments I and II. Using the energy level diagram, explain why there are differences in the observation. [5 marks]
- (iii) The 'ice pack' that is commonly used by sportsmen is made based on the thermo chemical principle. This pack requires suitable chemical. Name the chemical used and explain how this pack function. [4 marks]

## SECTION C

[ 20 marks ]

Answer any **one** question from this section.  
The time suggested to complete **Section C** is 30 minutes.

- 3 (a) Magnesium hydroxide is one of the chemical compounds found in tooth paste. Write the chemical formula for magnesium hydroxide and explain its function in toothpaste.

[ 3 marks ]

- (b) Figure 6 shows two beakers containing  $0.1 \text{ mol dm}^{-3}$  solution X and solution Y and their pH readings.

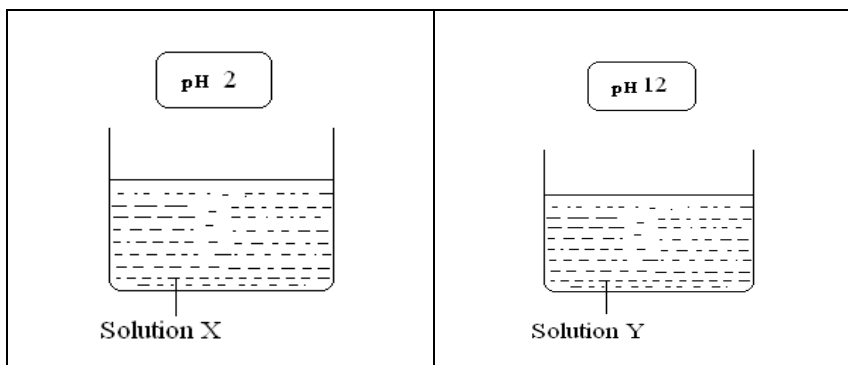


FIGURE 6

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

[ 8 marks ]

- (c) You are required to prepare dry pure zinc carbonate salt. The chemicals supplied are

- Zinc oxide powder
- Dilute nitric acid
- Sodium carbonate solution

Describe a laboratory experiment to prepare the salt. In your description, include the chemical equations involved.

[ 9 marks ]

- 4 (a) The iron grills of houses situated near beaches become rusty easier than those situated away from beaches.  
Explain this phenomenon.

[ 2 marks ]

- (b) Figure 7 shows the changes undergoes by iron(II) ion.

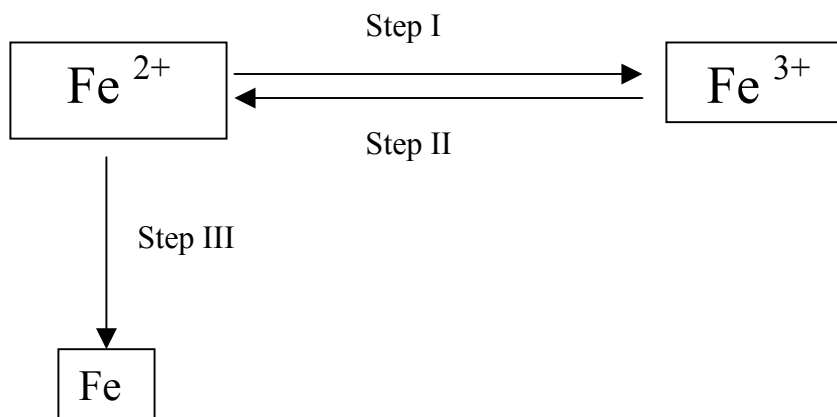


FIGURE 7

Complete the flow chart by using named reagent to show the changes in step I,II and III. Include the observation and ionic equations for each step.

[ 9 marks ]

- (c) Electric energy can be produced by chemical reactions.

Design an experiment to produce electric energy from the transfer of electrons at a distance using the chemicals listed below.

List of chemicals:

- Potassium iodide solution
- Potassium permanganate solution
- Dilute sulphuric acid

Include the diagram for the apparatus set – up and ionic equations in your answer.

[ 9 marks ]

**END OF QUESTION PAPER**

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Untuk  
Kegunaan  
Pemeriksa /  
For  
examiner's  
use

**RUANGAN JAWAPAN / SPACE FOR YOUR ANSWERS**

**Bahagian/Section:** ..... **No. Soalan/Question No:** .....

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Nama : .....

No Giliran : .....

**SULIT**  
**Kimia**  
**Kertas 3**  
**September**  
**2004**  
1½ jam



**PEPERIKSAAN PERCUBAAN SPM 2004**  
**MAKTAB RENDAH SAINS MARA**

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**KIMIA**

Kertas 3  
Satu jam tiga puluh minit

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**JANGAN BUKA KERTAS SOALAN INI**  
**SEHINGGA DIBERITAHU**

1. *Tuliskan **nama dan angka giliran** anda pada ruang yang disediakan.*
2. *Kertas soalan ini adalah dalam Bahasa Inggeris.*
3. *Calon dibenarkan menjawab keseluruhan atau sebahagian soalan sama ada dalam bahasa Melayu atau bahasa Inggeris*
4. *Calon dikehendaki membaca maklumat di halaman 2 dan 3*

| <i>Kod Pemeriksa</i> |              |                  |
|----------------------|--------------|------------------|
| Soalan               | Markah Penuh | Markah Diperoleh |
| 1                    | 21           |                  |
| 2                    | 12           |                  |
| 3                    | 15           |                  |
| Markah Kecemerlangan | 2            |                  |
| Jumlah               |              |                  |

---

Kertas soalan ini mempunyai 9 halaman bercetak.

**INFORMATION FOR CANDIDATES**

1. Answer **all** questions.
2. Write your answers for **Question 1** and **Question 2** in the spaces provided in the question paper.  
Write your answers for **Question 3** in the lined pages provided at the end of this question paper.
3. Answer the questions in detail. Answers should be clear and logical. Equations, diagrams, tables, graphs and other suitable methods can be used to explain your answer
4. If you wish to cancel any answer, neatly cross out the answer.
5. Diagrams in the questions provide you with useful information. The diagrams in the questions provided are not drawn to scale unless stated
6. You may use a non-programmable scientific calculator.
7. This question paper must be handed in at the end of the examination.

Marks awarded:

| <b>Mark</b> | <b>Description</b>                                 |
|-------------|--|
| <b>3</b>    | <b>Excellent</b> : The best response provided      |
| <b>2</b>    | <b>Satisfactory</b> : An average response provided |
| <b>1</b>    | <b>Weak</b> : An inaccurate response provided      |
| <b>0</b>    | No response <b>or</b> wrong response provided      |

For  
Examiner's  
Use

- 1 A student carried out an experiment to determine the end point for the neutralization process between  $50.0 \text{ cm}^3$  barium hydroxide  $0.1 \text{ mol dm}^{-3}$  solution and sulphuric acid. The apparatus set – up for this experiment is shown in Figure 1.

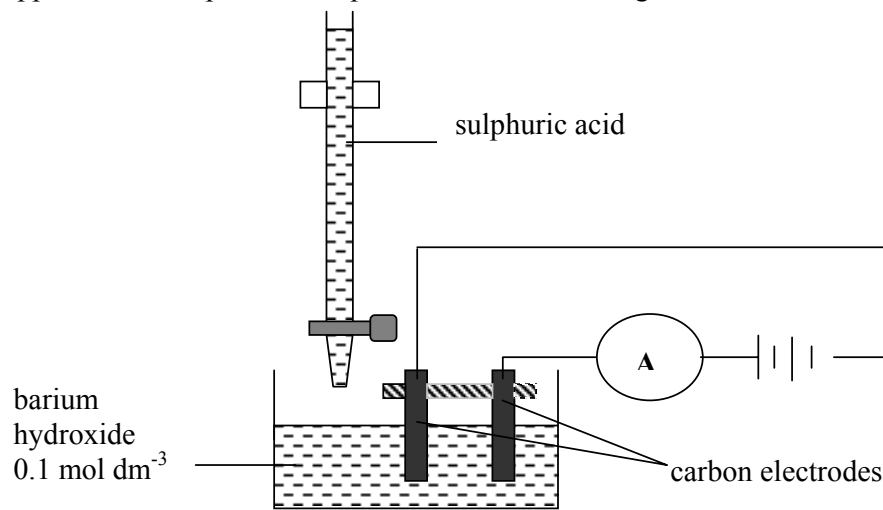


FIGURE 1

Table 1 shows several ammeter readings for every addition of  $1.0 \text{ cm}^3$  of sulphuric acid to barium hydroxide solution.

|   |     |     |     |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Volume of $\text{H}_2\text{SO}_4$ ( $\text{cm}^3$ ) | 0.0 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 |
| Ammeter readings (A)                                | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 |     |     |     |     |     |

TABLE 1

Figure 2 shows the ammeter readings when  $5.0 \text{ cm}^3$ ,  $6.0 \text{ cm}^3$  and  $7.0 \text{ cm}^3$  sulphuric acid were added.

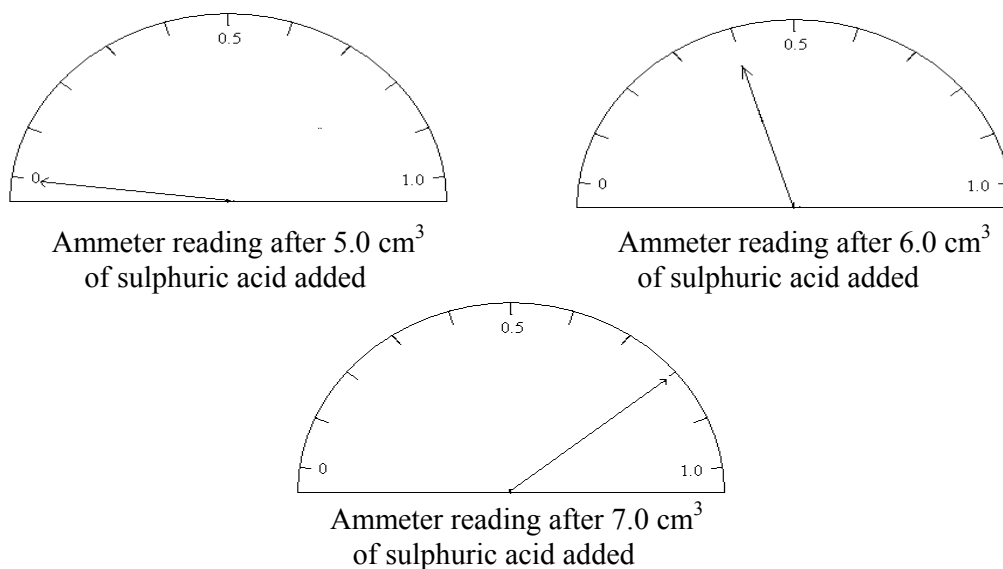


FIGURE 2

|        |
|--------|
| KK0503 |
|        |

(a) Referring to Figure 2, record the ammeter readings for the addition of 5.0 cm<sup>3</sup>, 6.0 cm<sup>3</sup> and 7.0 cm<sup>3</sup> of sulphuric acid in Table 1.

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(b) State one observation for this experiment.

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(c) Based on your answer in (b) what is your inference for this experiment?

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(d) Plot a graph of ammeter reading against the volume of sulphuric acid added on the graph paper on page 7.

Graph of ammeter reading against the volume of sulphuric acid added

For  
Examiner's  
Use

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- (e) On the graph plotted in (d), mark and write down the minimum volume of sulphuric acid needed to neutralize  $50.0 \text{ cm}^3$  of aqueous barium hydroxide  $0.1 \text{ mol dm}^{-3}$ .

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- (f) Estimate the reading of the ammeter if  $8.5 \text{ cm}^3$  of sulphuric acid is added to the mixture in the beaker.
- \_\_\_\_\_

- (g) This experiment is repeated using aqueous sodium hydroxide  $0.2 \text{ mol dm}^{-3}$  to replace the aqueous barium hydroxide. Table 2 shows the ammeter readings for every addition of  $1.0 \text{ cm}^3$  of sulphuric acid to sodium hydroxide.

|   |     |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|-----|
| Volume of $\text{H}_2\text{SO}_4$ added ( $\text{cm}^3$ ) | 0.0 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 |
| Ammeter readings (A)                                      | 0.8 | 0.7 | 0.6 | 0.5 | 0.3 | 0.2 | 0.4 | 0.6 |

TABLE 2

Derive a relationship between the end point of neutralization and the ammeter readings in Table 1 and 2.

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- 2 Figure 3 shows two different bimetallic strips immersed in beakers M and N containing aqueous sodium chloride. The apparatus set – up is left for 24 hours. A few drops of potassium hexacyanoferric(III) is added to both beakers. The observation is recorded in Table 3.

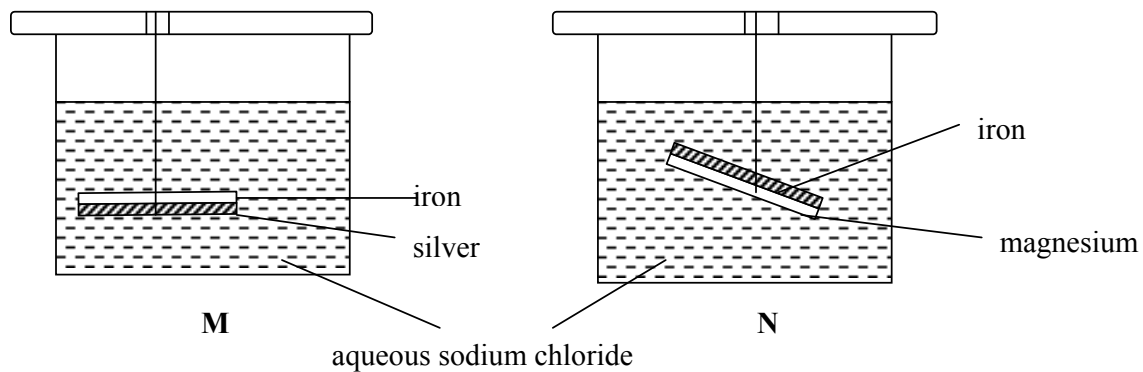


FIGURE 3

| Beaker | Observation                  |
|--------|------------------------------|
| M      | Dark blue precipitate formed |
| N      | No dark blue precipitation   |

TABLE 3

- (a) State the variables involved in this experiment.

Manipulated variable:

\_\_\_\_\_

Responding variable:

\_\_\_\_\_

Constant variable:

\_\_\_\_\_

KK0510

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| KK0511 |
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(b) State the hypothesis for this experiment.

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(c) Categorize the metals used in beakers M and N into anode and cathode.

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| KK0507 |
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(d) State the relationship between the amounts of dark blue precipitate formed with time if beakers M and N are left for 5 days.

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3

**Experiment I:**

When strips of silver and copper are immersed in sulphuric acid solution, the voltmeter shows a reading and the copper strip acts as the negative terminal

**Experiment II:**

When the silver strip is replaced with magnesium coil, the voltmeter reading increases and the copper strip act as the positive terminal

Referring to the above observation, design a laboratory experiment to compare the magnitude of different chemical cells' potential between copper and the following metals; silver, iron, aluminium and magnesium. In addition, you need to identify the polarity of the cells.

In designing your experiment it must include the following items:

- (i) Problem statement
- (ii) Hypothesis
- (iii) List of substances and apparatus
- (iv) Procedure
- (v) Tabulation of data

[KK051201 –Stating the problem]

[KK051202 –Making the hypothesis]

[KK051203 –Displaying the plan]

[KK051204 –Choosing the technique]

[KK051205 –Listing the substances and apparatus]

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**END OF QUESTION PAPER**