Chemistry ***Paper 2*** **[4541/2]**

SECTION A

[60 marks]

Answer **All** Questions

1. Diagram 1 shows the atomic symbol of element X, Y and Z.

$$^{12}_{6}X \quad ^{14}_{6}Y \quad ^{16}_{8}Z$$

Diagram 1

Based on diagram 1, answer the following questions.

(a) What is represented by :

(i) The number 12 of the atom of element X?

_____

[1 mark]

(ii) The number 8 of the atom of element Z?

_____

[1 mark]

(b) (i) What is meant by isotopes?

_____

_____

[1 mark]

(ii) State which atoms are isotopes of the same element? [1 mark]

_____

(iii) Write the standard representation of an atom which is an isotope for the element stated (b)(ii).

_____

[1 mark]

(c) (i) How many electrons are present in atom Z-16 ?

_____

[1 mark]

(d) Y and Z are located in a same period in the periodic table. State the period and explain your answer.

_____

_____

_____

[2 marks]

2. Diagram 2 shows the setup apparatus to study the effect of heat on copper(II) carbonate.

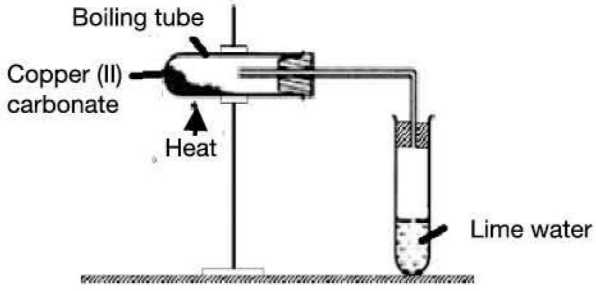


Diagram 2

There are two errors in the set up of the apparatus in Diagram 2 .

(a) Draw the correct set up of the apparatus in the space provided below.

[2 marks]

(b) After the correction done the heating of a sample of copper(II) carbonate was carried out and the lime water turns cloudy.

(i) Write the formula for the copper(II) carbonate.

_____

[1 mark]

(ii) Name the solid product formed after complete heating of copper(II) carbonate.

_____

[1 mark]

(iii) Name the gas released.

_____

[1 mark]

(iv) Write the equation for the heating of copper(II) carbonate.

_____

[1 mark]

(c) Table 2 shows the result of the experiment.

Materials	**Mass/g**
Mass of boiling tube	10.64
Mass of boiling tube and copper(II) carbonate	11.89
Mass of boiling tube and product from heating of copper(II) carbonate	11.45

Table 2

(i) What is the mass of gas released?

[1 mark]

(ii) Calculate the volume of the gas released at room temperature and pressure.
[Relative atomic mass; C=12, O=16, Cu=64, 1 mol of gas occupies a volume of 24 dm^3 at room temperature and pressure]

[2 marks]

(d) In a different experiment, 8.1 g of an oxide for element X with the formula XO reacts with excess sulphuric acid according to the following equation:

$$XO + H_2SO_4 \rightarrow XSO_4 + H_2$$

Calculate the number of moles of the salt XSO_4 produced.
[Relative formula mass : XO=81, XSO_4 = 161]

[1 mark]

3. Diagram 3 shows the electronic arrangement of atoms of six elements.

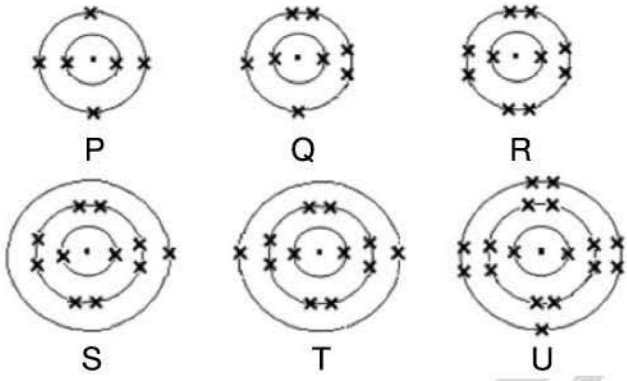
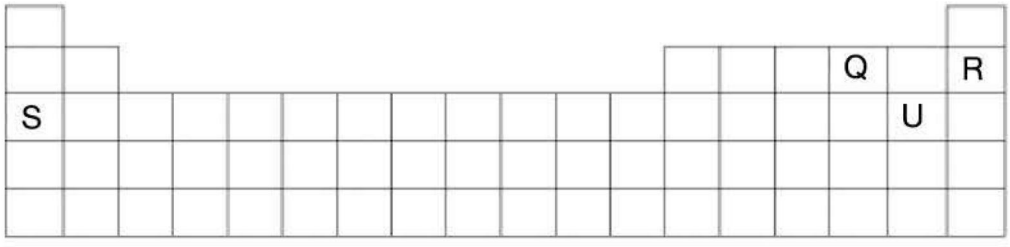


Diagram 3

P, Q, R, S, T and U do not represent the actual symbol of the elements. Use the letters to answer the following questions.

(a) Determine and fill the position of P and T in the Periodic Table of Elements given below.



[2 marks]

(b) State one element which:

(i) Is a metal: _____ [1 mark]

(ii) Forms an ion with +2 charge: _____ [1 mark]

(iii) Is used in advertising light: _____ [1 mark]

(c) Name the products formed when S reacts with water.

_____

[2 marks]

(d) State one usage of U in water treatment plant.

_____

[1 mark]

(e) The atomic radius of T is smaller than S. Explain Why.

_____

_____

_____

[1 mark]

4. Diagram 4 shows the elements in Period 3 of the Periodic Table.

Diagram 4

Based on Diagram 4, answer the following questions:

(a) State an example of metal.

_____

[1 mark]

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

_____

_____

_____

[2 marks]

(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]

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

(i) Draw the electron arrangement diagram for the compound formed.

[2 marks]

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

_____

[1 mark]

5. Diagram 5 shows the apparatus set-up for the electrolysis of copper(II) chloride solutions of different concentration.

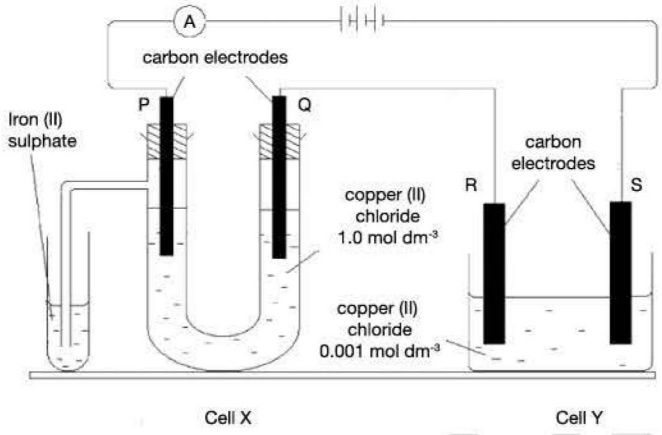


Diagram 5

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

_____

[2 marks]

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

_____

[1 mark]

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

Electrode P : _____

Electrode R : _____

[2 marks]

(ii) Explain your answer.

_____

_____

_____

[2 marks]

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

_____

[1 mark]

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

_____

[1 mark]

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

_____

[2 marks]

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

[2 marks]

6. An experiment was done to determine the rate of reaction between 50 cm^3 hydrochloric acid 0.1 mol dm^{-3} and excess calcium carbonate chips. The volume of gas evolved during the reaction is recorded every 20 seconds as shown in Table 6.

Time (s)	0	20	40	60	80	100	120	140	160
Total volume of CO_2 gas evolved (cm^3)	0.00	24.00	33.00	39.00	43.50	46.50	48.00	49.00	49.00

Table 6

(a) Write the chemical equation for this reaction.

_____

[2 marks]

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

[4 marks]

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

_____

_____

_____

[2 marks]

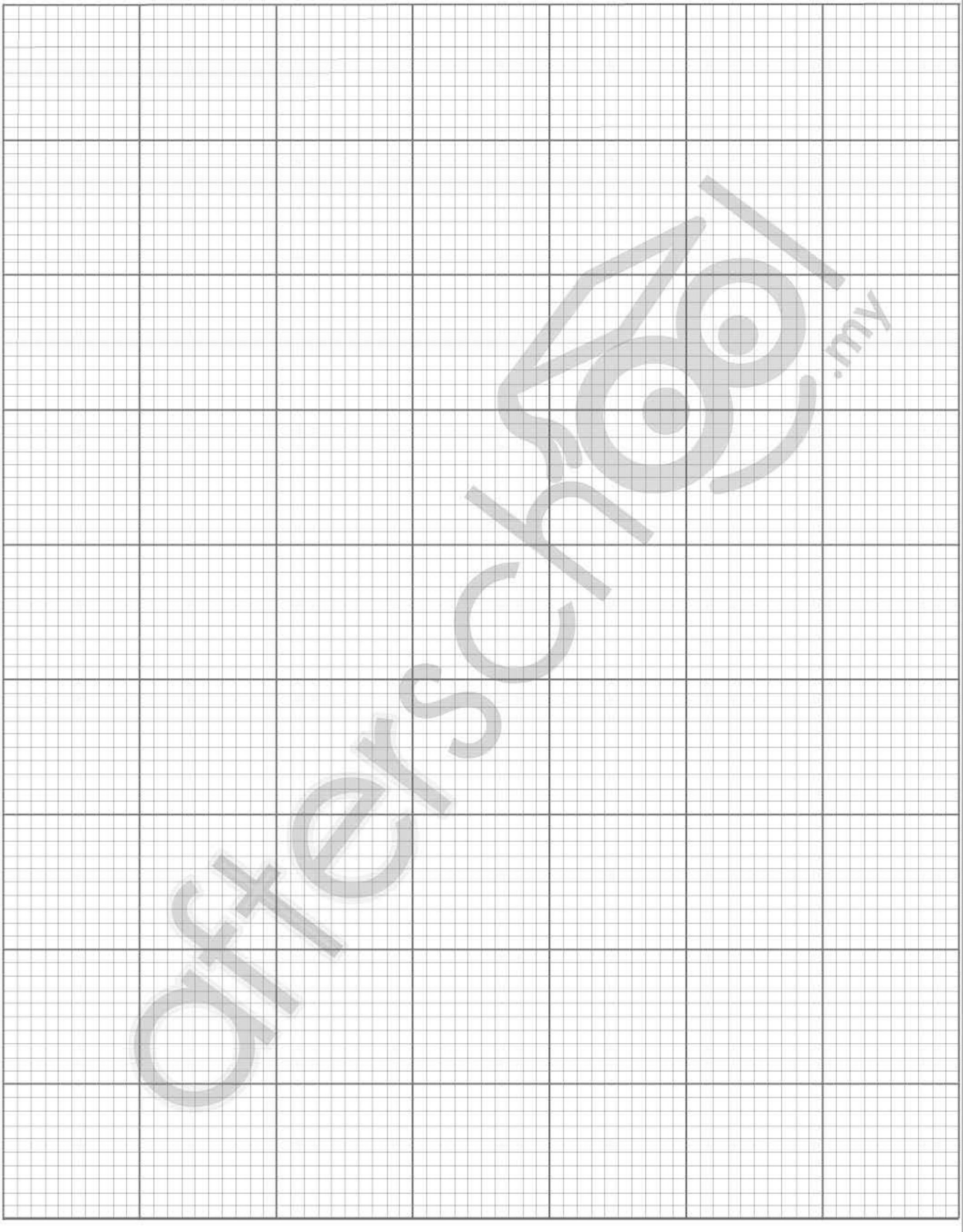
(d) Calculate the rate of reaction at 80 seconds.

[2 marks]

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

_____

[2 marks]



SECTION B
[20 marks]
Answer any **one** Questions

7. (a) Table 7 shows the pH of two solutions.

Solution	pH
0.1 mol dm^{-3} of potassium hydroxide solution	13
0.1 mol dm^{-3} of aqueous ammonia	11

Table 7

Explain why the two solutions have different pH.

[4 marks]

(b) An unlabeled reagent bottle is said to contain sulphuric acid solution.
Describe how you would confirm the solution.

[4 marks]

(c) The structural formula of ethanoic acid is shown in Diagram 7.

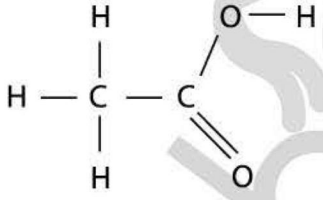


Diagram 7

(i) Explain why ethanoic acid is a monoprotic acid.

[2 marks]

(ii) Glacial ethanoic acid does not conduct electricity but the aqueous solution of ethanoic acid does.
Explain why.

[3 marks]

(iii) When zinc powder is added into aqueous ethanoic acid, bubble of colourless gas are evolved.
Write a chemical equation for the reaction.

[2 marks]

(d) The equation below shows the reaction between hydrochloric acid and magnesium.

$$Mg + 2HCl \text{ --> } MgCl_2 + H_2$$

50.0 cm3 of hydrochloric acid solutions react with excess magnesium to produced 48 cm3 of hydrogen gas.
Write the ionic equation for the reaction and calculate the concentration of the hydrochloric acid used.
[Molar volume of gas = 24.0 dm3mol-1]

[5 marks]

8. (a) Compound T contains 82.75% carbon and 17.25% of hydrogen of the mass.

(i) Determine the empirical formula of compound T.
[Relative atomic mass: C=12; H=1 ; Relative molecular mass of T is 58]

[4 marks]

(ii) Based on the answer in 2(a)(i), draw all the possible the structural formula of compound T and name the isomer.

[4 marks]

(b) Two bottle with no label, contain the cyclohexane and cyclohexene.
Describe the chemical test to determine the both of the two liquid.

butanoate acid
Pure of ethanol
Concentrated sulphuric acid

[5 marks]

(c) By using the substances above and the suitable apparatus, state the observation and write the chemical equation for the reaction involved.

[7 marks]

SECTION C
[20 marks]
Answer any **one** questions

9. (a) The major component of glass is silica while in ceramic is silicate. Compare and contrast the properties of glass and ceramic.
[4 marks]

(b) Diagram 9 shows the arrangement of atoms of two substances, X and Y in solid state.

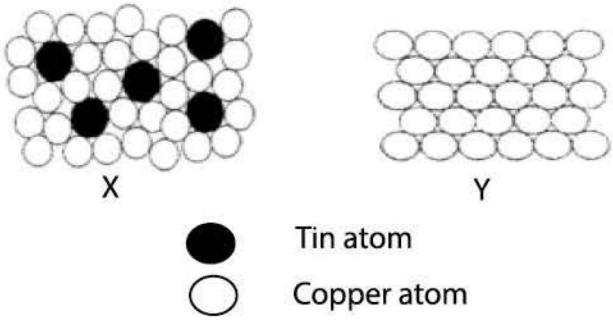


Diagram 9

(i) Based on Diagram 9, differentiate the arrangement of atoms and the properties of substance X and Y.
[7 marks]

(ii) What is the meaning of alloy?
[1 mark]

(iii) State the two aims of alloying.
[2 marks]

(iv) Alloy is harder than pure copper. By using example, explain the above statement.
[6 marks]

10. (a) Tin is used to electroplate food can in industries. Explain why food in a dented can should not be consumed.
[4 marks]

(b) Diagram 10 shows two electrolytic cells using different electrodes.

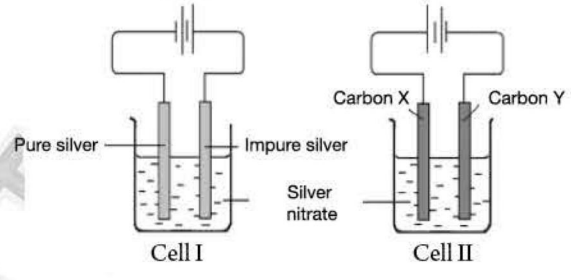


Diagram 10

Compare and contrast Cell I and Cell II.
Your answer should include observation and half equation for the reaction at both electrodes.
[6 marks]

The displacement of Iodine, I_2 from potassium iodide, KI solution is a redox reaction.

(c) Based on the above statement, describe an experiment to verify the reaction that occurred is the redox reaction.
[10marks]

END OF QUESTIONS PAPER