545/2

S4 CHEMISTRY

Exam 1

PAPER 2

DURATION: 2 HOUR

Instructions to candidates;

- *Section **A** consists of **10** structured questions. Attempt **all** questions in this section.*

  *Answers to these questions **must** be written in the spaces provided.*
- *Section **B** consists of **4** semi-structured questions. Attempt any **two** questions from this section. Answers to the section must be written in the answer booklets provided. In both sections, all working must be shown clearly.*

FOR EXAMINER'S USE ONLY														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	**Total**

SECTION A: (50 MARKS)

1. a) State what would be observed if a mixture of Iron and Sulphur was shaken with;

i) Warm Carbon disulphide (1 mark)

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ii) Warm dilute Sulphuric acid (1½ marks)

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b) A portion of the Sulphur-iron mixture in (a) was strongly heated, cooled and the cool residue shaken with warm dilute sulphuric acid.

i) State what was observed (1 mark)

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ii) Write equation for the reaction that took place in b (i). (1 ½ marks)

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2. a) Write equation for the reaction that would take place if each of the following was burnt separately in excess oxygen

i) Magnesium (1 ½ marks)

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ii) Phosphorus (1 ½ marks)

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b) Each of the products from (a) was carefully collected, shaken with water and the resultant solution tested with litmus paper(s). State what was observed in the case of the solution of the product from;

i) burnt magnesium (½ mark)

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ii) burnt phosphorus (½ mark)

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c) Name the type of reaction that would take place if the aqueous solutions in (b) were mixed together. (1 mark)

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3. When excess hydrogen was passed over 2.50g of a strongly heated oxide, Z of iron, 1.82g of solid residue remained. Calculate the formula of Z. (O=16, Fe=56) (4 marks)

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4. Copper (II) nitrate was heated until there was no further change.
i) State what was observed. (2 ½ marks)

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ii) Write equation for the reaction that took place. (1 ½ marks)

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b) Concentrated Sulphuric acid was added to Copper(II) nitrate and the mixture heated.
i) Write an ionic equation for the reaction that took place. (1 ½ marks)

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ii) State the practical application of the reaction in b(i). (½ mark)
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5. a) Write an equation for the reaction between concentrated sulphuric acid and ethanol to form ethene. (1 mark)
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b) i) Name one reagent that could be used to identify ethene.
(½ mark)

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ii) State what would be observed if the reagent you have named in (b) (i) was used to test for ethene. (1 mark)

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iii) Write equation for the reaction that takes place between the reagent and ethene. (1 mark)

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c) Under appropriate conditions ethene molecules can react amongst themselves to form a compound with a much larger molecular mass than ethene itself.
i) State one word, which means conversion of a compound with a low molecular mass to one with a relatively larger molecular mass.
(½mark)

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ii) Name the compound with a much large molecular mass than ethene which is derived from ethene. (½mark)

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iii) State on use of the compound that you have named in (b) (ii). (½mark)

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6. a) An anhydrous acid Q, with the formula $H_xC_yO_z$ .nH_2O contains 26.7% Carbon, 2.2% hydrogen and 71.1% Oxygen by mass.
i) Calculate the empirical formula of anhydrous form of Q. (2 marks)
(H=1, C=12, O=16)

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ii) Determine the values of X, Y and Z in the formula of Q. (½mark)
($H_xC_yO_z$ = 90)

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b) 20.0cm^3 of a solution containing 6.3g of Q per litre required exactly 20.15cm^3 of a 0.1M sodium hydroxide solution for complete neutralization.
i) Calculate the concentration of Q in moles per dm^3 of the solution of the solution. (2 marks)

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ii) Deduce the value of n in $H_xC_yO_z.nH_2O$ (1½ marks)

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7. a) The reaction between a given mass of barium carbonate and dilute nitric acid gives a high yield of carbon dioxide, but a similar reaction between the same mass of barium carbonate and dilute sulphuric acid results into relatively lower yield of carbon dioxide under identical conditions.

i) Write equation for the reaction between barium carbonate and dilute nitric acid. (1 ½ marks)

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ii) Briefly explain why barium carbonate/nitric acid mixture gives a higher yield of carbon dioxide compared to barium carbonate/sulphuric acid mixture. (2 marks)

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b) When heated, sodium hydrogen carbonate decomposes giving carbon dioxide according to the following equation;

$2NaHCO_{3(s)} \longrightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$

Calculate the maximum volume of carbon dioxide, measured at s.t.p that would be given off if 3.5g of sodium hydrogen carbonate was heated until there was no further change.
(H=1, C=12, O=16, Na=23, 1 mole of a gas occupies 22.4dm^3 at s.t.p)

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8. The table below shows the number of electrons, neutrons and protons in particles A to F.

Particle	**Electrons**	**Neutrons**	**Protons**
A	19	20	19
B	18	22	18
C	19	22	19
D	10	8	8
E	10	14	13
F	2	2	2

a) Identify the letters that present
i) a cation (½ mark)

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ii) an anion (½ mark)

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iii) a pair of isotopes (½ mark)

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iv) atoms of elements in the same group of the periodic table.

(½ mark)

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b) Particle E combined with particle D to from a compound W. write what would be the most accurate formula of W. (1 mark)

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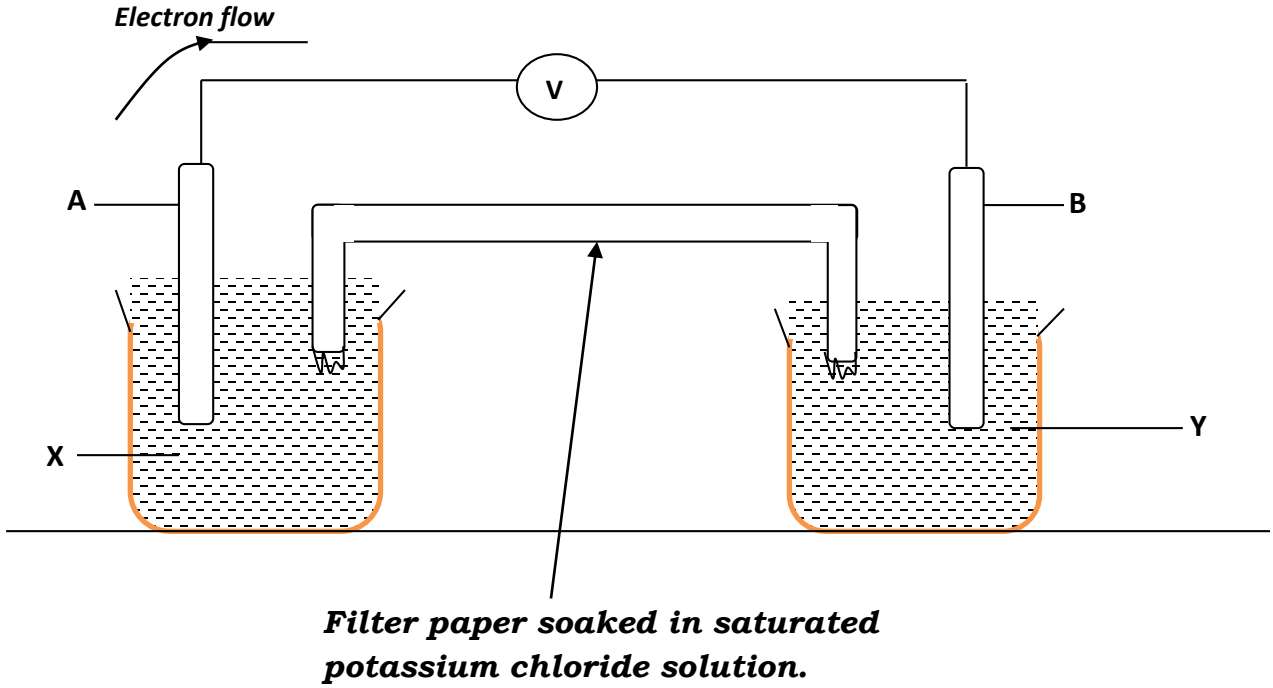
9. The diagram below shows an electrochemical cell that was made to compare the reactivities of iron and copper.



a) Name the metal strip

i) A (1 mark)

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ii) B (1 mark)

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b) Identify liquid

i) X (½ mark)

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ii) Y (½ mark)

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b) State the purpose of the strip of filter paper soaked with a saturated potassium chloride solution. (1 mark)

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c) Write the overall cell reaction equation (1 mark)

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10. a) State what would be observed if into aqueous potassium iodide was;

i) bubbled chlorine (1 ½ marks)

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ii) added 2-3 drops of lead(II)nitrate solution. (½ marks)

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b) i) Give a reason for the reaction in (a) (i). (1 mark)

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ii) Write an ionic equation for the reaction in (a) (ii). (1 mark)

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SECTION B (30 MARKS)

*Answer **two** questions from this section.*

11. a) State the conditions under which Sulphur dioxide can be produced from
i) Sulphur
ii) Sodium sulphide; and write equations for the reaction leading to the formation of Sulphur dioxide in each case. (5 marks)

b) State the application of the reaction in (a) (i) and that in (a) (ii). (2 marks)

c) State what would be observed and in each case, give a reason for your observation if
i) Sulphur dioxide was bubbled through an acidified potassium dichromate (VI) solution. (2 marks)
ii) A blue coloured flower was dropped into a wet gas jar containing Sulphur dioxide. (1 ½ marks)

d) Write an equation only, to show the reaction in which sulphuric acid acts as;
i) a dehydrating agent (1 ½ marks)
ii) acid (1 ½ marks)
iii) an oxidizing agent (1 ½ marks)

12. a) Write an ionic equation for the reaction between magnesium and hydrochloric acid. (1 ½ marks)

b) Concentration of hydrochloric acid and surface area of magnesium are some of the factors which can affect the rate of reaction between magnesium and hydrochloric acid.
i) State one factor other than those mentioned above that can as well affect the rate of reaction between magnesium and hydrochloric acid,

and briefly explain the effect that the factor you have stated would have on the rate of the reaction. (2 marks)
ii) Outline an experiment that would be carried out to show that surface area of magnesium has an effect on the rate of the reaction. (No diagram is required) (6 ½ marks)

c) In an experiment to investigate the effect of concentration of the acid on the rate of the reaction in (a), equal volumes of dilute hydrochloric acid of various concentrations were placed in five different beakers. 1.0g portions of same magnesium ribbon were added to each beaker. The times taken for the reactions to reach completion were recorded and are shown in the table below;

Concentration of HCL($moldm^{-3}$)	0.5	0.6	0.8	1.3	2.0
Time (s)	200	150	100	50	10

i) Draw a graph of concentration of hydrochloric acid. (Vertical axis) against time. (horizontal axis) (4 marks)
ii) State any conclusion that you can make from the graph. (1 mark)

13. a) Sewage consists of a sludge and an effluent.
i) Define the term Sewage. (1 mark)
ii) Distinguish between the terms Sludge and Effluent. (1 mark)
iii) State one use of sludge. (1 mark)
iv) Explain how sewage can cause water pollution. (2 ½ marks)

b) Sedimentation, aeration and chlorination are some of the methods of sewage treatment. Describe what each of the methods involves and indicate how it results into treated water. (6 marks)

c) During sedimentation, a mixture of some gases is produced, and is useful
i) Name one major component of the gas mixture. (½ mark)
ii) Explain with the aid of equation, why the gas mixture is useful (3 marks)

14. a) Under suitable condition(s) a dry sample of ammonia can be prepared in the laboratory using ammonium chloride mixed with calcium hydroxide according to the following equation.

$$Ca(OH)_{2(s)} + 2NH_4Cl_{(s)} \longrightarrow CaCl_{2(s)} + 2NH_{3(g)} + 2H_2O_{(l)}$$

i) State;
- the condition(s) for the reaction leading to the formation of ammonia. (1 mark)
- how ammonia is collected and give a reason for your answer . (1 mark)

ii) Briefly explain why ammonia is not dried suing fused calcium chloride or concentrated sulphuric acid.(No equation is required). (1 ½ marks)

iii) Name the substance, which is usually used as a drying agent for ammonia. (½ mark)

b) When X g of ammonium chloride were used in the preparation of ammonia as shown by the equation in (a), 3.40g of pure and dry calcium chloride were obtained.

i) Determine the value of x. (2 ½ marks)
(H=1.0, N=14.0, Cl=35.5, Ca=40.0).

ii) Calculate the volume of dry ammonia, measured at room temperature that was collected. (2 marks)
(1 mole of a gas occupies 24.0dm^3 at room temperature)

c) State the conditions under which dry ammonia can react with oxygen and write equation(s) for the reaction(s) that take(s) place. (5 marks)

d) Write equation to show how ammonia reacts with chlorine. (1 ½ marks)

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