Name:.....

Signature:.....School: .....

545/2
CHEMISTRY
Paper 2
Jul / Aug. 2022
2 hours

UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Certificate of Education

CHEMISTRY

Paper 2

2 hours

INSTRUCTIONS TO CANDIDATES:

Section A consists of 10 structured questions. Answer **ALL** *questions in this section. Answers to the questions must be written in the spaces provided.*

Section B consists of 4 semi – structured questions. Answer only **two** *questions from this section. Answers to the questions* **must** *be written in the answer booklets provided.*

In both sections all working must be shown clearly.

Where necessary

[Zn = 65, O = 16, H = 1, Pb = 207]

1 mole of a gas occupies 22.4 dm^3 at s.t.p

1 mole of a gas occupies 24dm^3 at room temperature

For Examiner's use only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL

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SECTION A: (50 MARKS)

Answer **ALL** *questions in this section*

1. In an experiment, cooking oil was added into a beaker containing a large volume of water and the mixture was shaken then allowed to stand.

(a) State what was observed. (½ mark)

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.....

(b) (i) Name the piece of apparatus that can be used to separate the mixture. (½ mark)

.....

(ii) Give a reason for your answer in (b) (i) above. (½ mark)

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(c) In another experiment, ammonium chloride was heated as a mixture with sodium chloride.

State:

(i) What was observed during the process of heating? (01 mark)

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.....

(ii) The practical application of heating the mixture. (½ mark)

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(d) Mention one example of a mixture which can be separated by fractional distillation. (01 mark)

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2. The atomic numbers of elements, **X, Y** and **Z** are 6, 12 and 17. Respectively:-

(a) Write the electronic configuration for:-

(i) X: ..... (½ mark)

(ii) Y: ..... (½ mark)

(iii) **Z:** ..... (½ mark)

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(b) Write the formula for the product when:

(i) X, burns in the excess oxygen. (01 mark)

.....

.....

(ii) Atoms of **Y** are burnt in the molecules of **Z**. (01 mark)

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.....

(c) Water was added to the compound in (b) (i) and the product tested with litmus paper(s). State:

(i) What was observed? (01 mark)

.....

.....

(ii) Any one conclusion that can be drawn following your observation in (c)(i). (½ mark)

.....

.....

3. (a) Sodium peroxide reacts with water to produce oxygen according to the following equation.

$2Na_2O_2(s) + 2H_2O(l) \longrightarrow 4NaOH(aq) + O_2(g)$

(i) State what is observed during the reaction. (01 mark)

.....

.....

(ii) Calculate the volume of oxygen gas produced at room temperature when 3.12g of sodium peroxide were completer reacted with water.
($Na = 23, O = 16$, 1 mole of a gas occupies 24dm^3 at room temperature.
1 mole of a gas occupies 24dm^3 at room temperature. (02 marks)

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(b) A small sample of burning sulphur was plunged into a gas jar containing oxygen gas. State:

(i) What was observed? (01 mark)

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(ii) The effect of the product(s) in (c) (i) on litmus paper(s). (01 mark)

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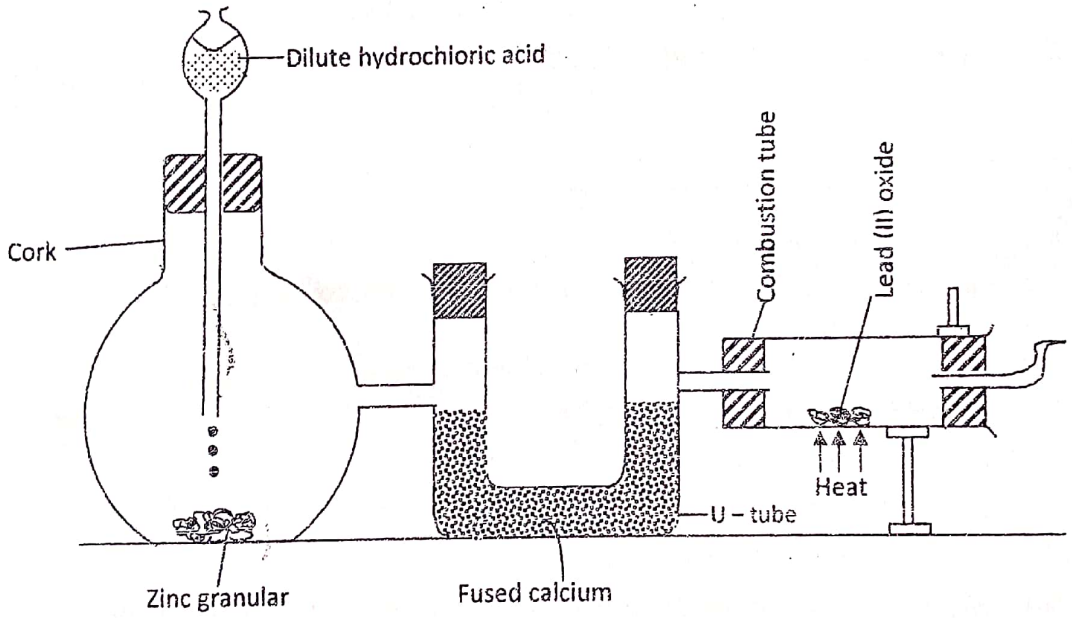
4. Dilute hydrochloric acid was added until in excess to zinc granules and the gas evolved was passed over heated lead (II) oxide as shown in the **figure 1**. Below.



(a) State;

(i) What was observed in the combustion tube? (01 mark)

.....

.....

(ii) The role of fused calcium chloride in the U-tube. (½ mark)

.....

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(b) Write equation for the reaction.

(i) between zinc and dilute hydrochloric acid. (1 ½ mark)

.....

.....

(ii) that takes place in the combustion tube. (1 ½ marks)

.....

.....

(c) Give **one** other oxide besides Lead (II) oxide that could have been used in the combustion tube. (½ mark)

.....

.....

5. A solid compound, Q, reacts with dilute sulphuric acid to produce a colourless gas that has the following properties.

(i) Turns acidified potassium dichromate solution from orange to green.

(ii) Bleaches moist blue flowers to white.

(a) Name:

(i) Compound Q. (½ mark)

.....

(ii) The colourless gas. (½ mark)

.....

(b) Write an equation for the reaction between Q and dilute sulphuric acid. (1 ½ marks)

.....

.....

(c) State;

(i) the practical application of the reaction when the gas was bubbled through acidified potassium dichromate solution. (½ mark)

.....

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.....

(ii) what would be observed if the colourless gas was passed through a solution of Iron (III) sulphate. (01 mark)

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(d) The bleaching action of the colourless gas is by reduction. Write equation for the reaction to show how the gas reduces moist blue flowers. (01 mark)

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6. When magnesium powder was added into $25cm^3$ of 0.2M solution of copper (II) chloride in a plastic beaker, some heat was evolved.

(a) State;

(i) What else was observed apart from the evolution of heat? (01 mark)

.....

.....

(ii) Why the reaction liberates heat. (01 mark)

.....

.....

(b) Write an ionic equation for the reaction that took place. (01 mark)

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(c) Calculate the;

(i) Number of moles of copper (II) ions contained in the $25.0cm^3$ of the solution. (01 mark)

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(ii) The mass of copper that was displaced by one mole of magnesium if 1.92g of Magnesium were used in the reaction. *(Cu=64, Mg = 24).* (02 marks)

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7. The diagram in the Figure 2 below shows the set up of apparatus that was used to carry out electrolysis of different electrolytes in the laboratory. Carbon electrodes were used in the experiment.

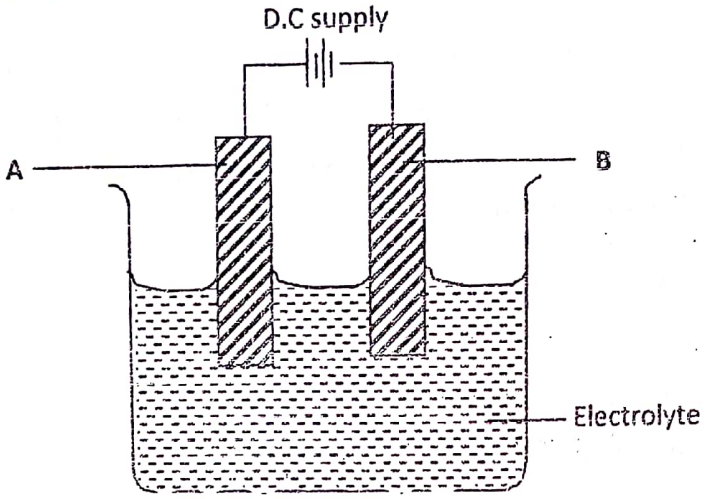

Fig. 2

(a) Name the substance that was formed at electrode, A, if the following electrolytes were used.

(i) Aqueous silver nitrate solution. (½ mark)

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.....

(ii) Copper (II) chloride solution in dilute form. (½ mark)

.....

.....

(b) Write an equation for the electrode reaction in (a) (i). (01 mark)

.....

.....

(c) If the electrolyte used was concentrated sodium chloride solution, name the product(s) that was formed at electrode:

(i) A: ..... (½ mark)

(ii) B: ..... (½ mark)

(d) State how the product you have given in (c) (ii) can be identified in the laboratory. (01 mark)

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(e) If the electrodes were replaced with Copper electrodes and the electrolysis in (a) (ii) done for some time, state what was observed at A. (½ mark)

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8. (a) State what would be observed if each of the following reagents was added to a solution of aluminium chloride.

(i) Lead (II) nitrate solution. (½ mark)

.....

.....

(ii) Ammonia solution dropwise until in excess. (01 mark)

.....

.....

(b) Write an equation for the reaction that took place in (a) (i) above. (01 mark)

.....

.....

(c) To the resulting mixture in (a) (ii) was added sodium hydroxide solution dropwise until in excess.

(i) State what was observed. (01 mark)

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.....

(ii) Give a reason to support your answer in (c) (i). (01 mark)

.....

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9. (a) In the presence of a catalyst, glucose can be converted to ethanol.

(i) Name the catalyst used. (½ mark)

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(ii) Write equation for the reaction in which glucose is converted to ethanol. (01 mark)

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(iii) State how the purity of ethanol can be determined. (½ mark)

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(b) The ethanol obtained can be converted to carbon dioxide gas according to the following equation:

$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(l) + Heat$

Calculate the mass of ethanol that was burnt in oxygen to produce 544.0KJ of heat.
(C = 12, O = 16, H = 1; 1 mole of ethanol burns to produce 1360KJ of heat)
(02 marks)

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(c) State what:

(i) is formed when ethanol is heated with concentrated sulphuric acid.
(½ mark)

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(ii) is observed when the product in (c) (i) is treated with bromine.
(01 mark)

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.....

10. When concentrated hydrochloric acid was added to manganese (IV) oxide and the mixture heated, a gas was evolved.

(a) (i) Name the gas that was evolved. (½ mark)

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

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.....

(b) State what is observed when the gas is bubbled through:

(i) Cold dilute potassium hydroxide solution. (01 mark)

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(ii) A beaker containing moist red flowers. (½ mark)

.....

.....

(c) The gas in (a) (i) was bubbled through a solution of sodium iodide until no further change.

(i) Write equation for the reaction. (1 ½ marks)

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(ii) Suggest any conclusion that can be drawn from the equation you have written in (c) (i). (1 mark)

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SECTION B (30 MARKS)

Answer any TWO questions from this section

11. Calcium oxide is regarded as a hygroscopic substance.

(a) (i) Define the term a hygroscopic substance. (01 mark)

(ii) Give one other example of a hygroscopic substance. (½ mark)

(iii) State one laboratory use of hygroscopic substance. (01 mark)

(b) A gas A, is mainly dried in the laboratory using calcium oxide.

(i) Identify gas A. (½ mark)

(ii) Write an equation for the reaction that leads to the formation of gas A, in the laboratory. (1 ½ marks)

(c) Excess water was added on to calcium oxide until there was no further change.

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

(ii) Using equations, explain the changes that would result if carbon dioxide gas was bubbled through the product(s) in (c) (i) until in excess. (4 ½ marks)

(d) State;

(i) The conditions for the reaction of calcium oxide with nitric acid. Write equation for the reaction that takes place. (2 ½ marks)

(ii) Why the reaction in (d) (i) is not possible with sulphuric acid. (Equation not require). (02 marks)

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12. Hydrogen chloride gas can be prepared in the laboratory by reacting sodium chloride crystal and an acid.

(a) (i) Name the acid commonly used for this preparation. (½ mark)

(ii) State the conditions for the reaction. (1 mark)

(iii) Write equations for the reaction. (1 ½ marks)

(b) Iron fillings when heated in dry hydrogen chloride react according to the following equation:

$$Fe(s) + 2HCl(g) \longrightarrow FeCl_2(s) + H_2(g)$$

(i) Calculate the volume of hydrogen chloride gas that would be required to react with iron at s.t.p to produce 5.0g of Iron (II) chloride.
(Fe = 56, Cl = 35.5; 1 mole of a gas occupies 22.4 dm^3 at s.t.p).
(2 ½ marks)

(ii) The anhydrous Iron (II) chloride formed in (b) was dissolved in water. State what was observed and write an ionic equation for the reaction.
(2 ½ marks)

(c) Dilute sodium hydroxide solution was added to the solution (product) in (b) (ii) drop wise until in excess.

(i) State what was observed. (01 mark)

(ii) Write an ionic equation for the reaction. (1 ½ marks)

(d) Explain;

(i) The effect of bubbling hydrogen chloride gas through a solution of silver nitrate. (2 ½ marks)

(ii) Why aqueous hydrogen chloride liberates hydrogen with zinc metal whereas hydrogen chloride in methyl benzene does not. (2 ½ marks)

13. Nitrogen can react with hydrogen in the Haber process to produce ammonia gas.

(a) State the;

(i) Source of nitrogen and hydrogen (01 mark)

(ii) Factors that can affect the yield of ammonia in the Haber process.
(1 ½ marks)

(b) Write an equation for the reaction leading to the formation of ammonia in the Haber process. (01 mark)

(c) Write an equation for the reaction to show oxidation of ammonia gas;

(i) by Copper (II) oxide (1 ½ marks)

(ii) in the presence of hot platinum. (1 ½ marks)

(d) Using equations, outline how the product(s) in (c) (ii) can be converted to nitric acid. (3 ½ marks)

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(e) Ammonia gas can react with concentrated sulphuric acid to produce ammonium sulphate according to the following equation:

$2NH_3(g) + H_2SO_4(l) \longrightarrow (NH_4)_2SO_4(S)$

(i) Calculate the mass of ammonium sulphate that would be produced by 0.96 dm^3 of ammonia gas at room temperature.
(N = 14, S = 32, O = 16, one mole of a gas occupies $24dm^3$ at room temperature. (02 marks)

(ii) Explain why an aqueous solution of ammonium sulphate turns blue litmus paper red. (02 marks)

(f) When aqueous ammonia solution was added to a solution containing zinc ions, a white precipitate **Y** which dissolved in excess ammonia to give a colourless solution was formed.

(i) Identify Y. (½ mark)

(ii) Write the formula for the cation in the colourless solution. (½ mark)

14. (a) State the difference between an acid and a salt. (02 marks)

(b) Describe;

(i) how a pure dry sample of lead (II) carbonate can be prepared in the laboratory. (no diagram is required) (04 marks)

(ii) the effect of heat on lead carbonate . (02 marks)

(c) Lead (II) carbonate reacts with dilute nitric acid according to the following equation.

$PbCO_3(s) + 2HNO_3(aq) \longrightarrow Pb(NO_3)_2(aq) + CO_2(g) + H_2O(l)$

Calculate the mass of lead (II) carbonate that is required to react completed with $200cm^3$ of 0.2M dilute nitric acid. (Pb = 207, C = 12, O = 16). (2 ½ marks)

(e) State what would be observed if into a solution of lead (II) ions was added;

(i) Drops of potassium iodide. (½ mark)

(ii) Ammonia solution drop wise until in excess. (01 mark)

(iii) Dilute hydrochloric acid and the mixture heated then allowed to cool. (1 ½ marks)

(f) Write an equation to illustrate your answer in (d) (ii) above. (1 ½ marks)

END

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