Name ……………………………………............Stream……….

545/2

CHEMISTRY

JULY,2022

BUSOGA COLLEGE MWIRI

Uganda Certificate of Education

CHEMISTRY

PAPER 2

2 HOURS

INSTRUCTIONS TO CANDIDATES

This paper consists of two sections A and B

Section **A** *consists of* **10** *structured questions. Attempt* **all** *the questions in*

this section. Answers to question 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 questions must be written on the answer sheets provided.

Start each number on a fresh page.

In both sections all working must be clearly shown.

FOR OFFICIAL USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total

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SECTION A:
Answer **all** the questions

1. (a) Write ionic equations to show how dilute hydrochloric acid reacts with

       i) Sodium hydrogen sulphite   (1½ marks)

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       ii) sodium carbonate   (1½ marks)

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   (b) (i) Name **two** other substances that react with dilute hydrochloric acid the same way as in a(i) and (ii) above   (1 mark)

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       (ii) The product in a(i) turns acidified potassium dichromate solution from orange to green. State the property shown by the products in a(i)   (1 mark)

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2. A colourless gas, G decolorized potassium manganate (VII) solution
   (a) Name **two** gases that are likely to be G.   (1 mark)

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   (b) G also decolorized a solution of bromine in tetra chloromethane, but did not have any effect on acidified potassium dichromate solution.
   (i) Identify G   (½ mark)

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(ii) Write an equation to show the reaction between G and bromine in tetra chloromethane.   (1 mark)

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(c). G was burnt in air containing plentiful supply of oxygen. Write equation for the reaction that took place.   (1½ marks)

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(d). Name **two** substances that can react to produce G.   (1 mark)

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3. (a) Write an ionic equation for the neutralization of potassium hydroxide with sulphuric acid   (1 ½ marks)

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(b)   When 100cm^3 of a 0.25M sulphuric acid was added to 100cm^3 of a 0.5M potassium hydroxide solution, the temperature of the solution rose from 25.6ºC to 28.9ºC. Calculate the enthalpy of neutralization of potassium hydroxide with sulphuric acid. (Density of water = 1g/cm^3; the specific heat capacity of water = 4.2Jg^{-1} ^{0}C^{-1})   (3 ½ marks)

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(c)   Ammonia solution was neutralized with sulphuric acid. Comment on the numerical value of the enthalpy of neutralization compared to that in (b); and give a reason for your answer.   (1 mark)

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4. (a) When mixed with a solution containing copper (II) ions, zinc granules react with sulphuric acid at room temperature to produce hydrogen gas.

(i) State the condition under which sulphuric acid reacts with the zinc granules   (½ mark)

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(ii) Suggest the property of sulphuric acid in this reaction (½ mark)

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(iii) What is the role of copper (II) ions in the reaction?
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(iv) Write an ionic equation for the reaction leading to the
formation of hydrogen gas   (1 ½ marks)

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(b) Dry hydrogen gas was passed over a strongly heated copper (II)
oxide
(i) State what was observed.   (1 ½ marks)

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

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5. Write equation only, to show the reaction that takes place when each
of the following substances is strongly heated in air.
(1 ½ marks @)
(a) copper metal

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(b) Potassium nitrate

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(c) Sodium hydrogen carbonate

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(d) Zinc nitrate

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6. 50.0cm³ of a 2M sodium hydroxide solution was accurately measured into a volumetric flask and water added to make 1 dm³ of dilute solution. Calculate the volume of the dilute solution that would be required to react completely with 25.0cm³ of a 0.04M copper (II) sulphate solution [copper (II) sulphate reacts with sodium hydroxide according to the following ionic equation:

$$Cu^{2+}(aq) + 20H^-(aq) \longrightarrow Cu(OH)_2(s)$$ (4 marks)

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7. (a) State what would be observed if each of the following substances was left exposed in air for some time.

(i) Sodium carbonate – 10 – water   (1 ½ marks)

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(ii) Fused calcium chloride   (1 ½ marks)

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(b) State **one** word which describes the property of each of the compounds shown in

(i)   (a) (i)   (1 mark)

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(ii)   (a) (ii)   (1 mark)

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(c) State **one** practical application of fused calcium chloride that is as a result of the property that you have stated in (b) (ii)   (1mark)

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8. Ammonia can react with lead (II) oxide to produce lead according to the following equation

$$3PbO(s) + 2NH_3(g) \longrightarrow 3Pb(s) + N_2(g) + 3H_2O(l)$$
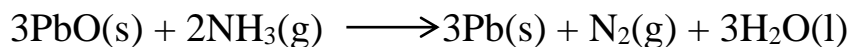
(a) State

(i) the condition(s) under which the reaction takes place (1 mark)

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(ii) the property of ammonia shown in the reaction   (1 mark)

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(b)   3.1g of lead was obtained when ammonia reacted with lead (II) oxide. Calculate the maximum volume of ammonia, measured at s.t.p that reacted with lead (II) oxide. (Pb = 207, O = 16, 1 mole of a gas occupies 22.4dm^3 at s.t.p)   (2 marks)

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9 (a) A dilute solution of copper (II) chloride was electrolyzed between graphite electrodes

(i) State what was observed at the cathode   (1 mark)

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(ii) Give a **reason** for your observation in (i)   (½ mark)

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(iii) Name the product obtained at the anode   (1 mark)

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(b). The electrolysis in (a) above was repeated using a concentrated solution of copper (II) chloride.

Write an ionic equation to show the reaction at the anode. (1 ½ marks)

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10. When a mixture of a compound **R** and concentrated sulphuric acid was warmed, a vigorous effervescence took place and a colourless gas W with a choking smell was evolved. W gave dense white fumes with concentrated ammonia solution.

(a)(i) Name W   (1 mark)

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(ii)Suggest a possible identity of the anion in **R**   (1 mark)

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(iii) Name **one** reagent which would be used to confirm the identity of

the anion which you have suggested in (ii)   (½ mark)

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(b) Write an ionic equation to show the reaction that can take place

between lead (II) nitrate solution and an aqueous solution of **R**

(1 ½ marks)

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SECTION B:

Attempt any **two** questions in this section

11. A compound Q consists of 26.7% carbon and 2.2% hydrogen by mass, the rest being oxygen.
    (a) Calculate the empirical formula of Q.   (3 ½ marks)
         (H = 1, C = 12, O = 16)
    (b) An aqueous solution of Q turns blue litmus paper pale red.
    (i) Suggest how the pH value of a 2M aqueous solution of Q would compare with the pH value of a 2M hydrochloric acid. Give a reason for your suggestion   (2 marks)
    (ii) Predict how Q would react with sodium hydrogen carbonate.
       (2 marks)
    (iii) Write an ionic equation for the reaction that you have predicted in **(ii)** above   (1 ½ marks)
    (c) 20cm^3 of a solution containing 4**.**5g of per dm^3 of the solution required exactly 25cm^3 of a 0**.**08M sodium hydrogen carbonate solution for complete reaction. (1 mole Q reacts with 2 moles NaHCO$_3$)
    Calculate:
                (i) The concentration of Q in mol dm^{-3} (3 marks)
                (ii) The molar mass of Q   (1½ marks)
    (d) Determine the molecular formula of Q   (1 ½ marks)

12. (a) With the help of a labelled diagram, briefly describe how a sample of dry chlorine can be prepared in the laboratory, starting from concentrated hydrochloric acid   (9 marks)
    (b) Chlorine was bubbled through a dilute solution of potassium hydroxide
                (i) State what was observed   (1 mark)
                (ii) Write an equation for the reaction that takes place
                    (1 ½ marks)

     (c) When exposed to sunlight, chlorine water produces a colourless gas, Name the gas   (1 mark)

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(d) (i) Write an equation for the reaction that can take place between iron and chlorine. (1 ½ marks)

(ii) Give a reason why the reaction in (i) is regarded as oxidation of iron. (1 mark)

13. (a) (i) Outline an experiment which can be carried out to show that the rate of the reaction between calcium carbonate and dilute hydrochloric acid depends on the surface area of the calcium carbonate. (No equations or diagrams required) (7 marks)

(ii) State two conditions that would affect the rate of the reaction in (i) other than the surface area of the calcium carbonate. (1marks)

(b) In an experiment to investigate the rate of the reaction of magnesium with dilute sulphuric acid, a flask containing magnesium and sulphuric acid was weighed after every 10 minutes for a total time interval of 50 minutes. The results obtained are shown in the table below.

Time/minutes	0	10	20	30	40	50
Mass of flask + contents/g	95.0	64.5	39.0	24.4	15.0	11.9

(i) Plot the graph of mass of flask + contents against time (4 marks)

(ii) Determine the rates of the reaction after 15.0 and 27.5 minutes respectively and comment on your results (3 marks)

14. Iron (III) oxide (haematite) is one of the common ores of iron from which iron can be extracted in a blast furnace.
(a) Name
    (i) **one** common ore of iron other than iron (III) oxide (1 mark)

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(ii) One major impunity that can be found in the ore you have named in (i)   (1 mark)

(b) Outline the reactions which occur in the blast furnace during the extraction of iron from iron (III) oxide ore.   (7 marks)

(c) (i) Name the major components of stainless steel   (1 mark)

    (ii) State **one** use of stainless steel   (½ mark)

    (iii) Give a reason why stainless steel is more used than pure iron   (1 mark)

(d) Most common compounds of iron are either those of iron (II) or iron (III). Write the formula of one compound of

       (i) Iron (II)   (½ mark)

       (ii) Iron (III)   (½ mark)

(e) Name **one** reagent that could be used to distinguish between iron (II) and iron (III) compounds and in each case state the observations that would be made if the reagent you have named was used.
(2 ½ marks)

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