Name..... Index number .....

Signature .....

545/2
CHEMISTRY
PAPER 2
Jul/Aug, 2023
2Hours

MATIGO MOCK EXAMINATIONS BOARD

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 ten structured questions. Attempt all questions in this section in the spaces provided in the question paper. Section* ***B*** *consists of four semi structured questions .Attempt any two questions from this section*

$(H = 1;\ O = 16, Cu = 64, S = 32\ Zn = 65)$

Specific heat capacity of water is $4.2jg^{-1o}C^{-1}$
Density of water is $1gcm^{-3}$
1 mole of gas occupy24L at room temperature.
1 mole of gas occupy $22400cm^3$ *at s.t.p*

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

Turn Over

SECTION A

A coloured crystal of cobalt (II) chloride is placed at the bottom of a beaker containing water. Colour spreads throughout the water over time. Figure1 shows the spread of colour after two days.

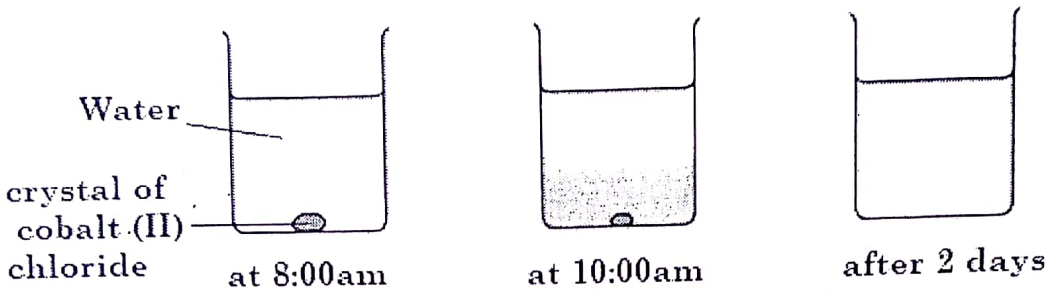

Figure 1

(a) Explain these observations. (03 marks)

.....

.....

.....

(b) Cobalt (II) chloride can be used to test for the presence of water.

$$\underset{\text{Anhydrous Cobalt (II) chloride}}{CoCl_2} + 6H_2O \rightleftharpoons \underset{\text{Hydrated cobalt (II) chloride}}{CoCl_2 \cdot 6H_2O}$$

(i) State the meaning of the symbol $\rightleftharpoons$ (01 mark)

.....

(ii) State the colour change when water is added to anhydrous cobalt (II) chloride. (01 mark)

from.....to.....

2. The electronic structures of five atoms, P, Q, R, S and T, are shown in figure 2.

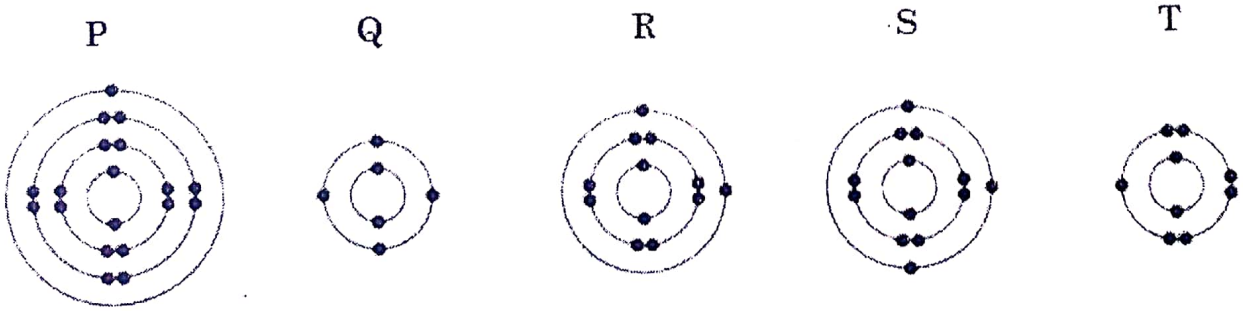

Figure 2

Answer the following questions about these electronic structures. Each electronic structure may be used once, more than once or not at all. State which electronic structure, P, Q, R, S or T, represents:

(i) an atom in Group II of the Periodic Table.

.....

(ii) an atom with a proton number of 13.

.....

(iii) an atom that forms a stable ion with a single negative charge.

.....

(iv) an atom of a non-metal that forms a giant covalent structure.

.....

(v) an atom of a metal used in food containers.

.....

3. Under suitable conditions hydrogen peroxide H_2O_2 can decompose rapidly to produce oxygen.

(a) (i) Write an equation for the decomposition of hydrogen peroxide. (01$\frac{1}{2}$marks)

.....

(ii) State two ways in which the decomposition of hydrogen peroxide can be made to occur rapidly. (01marks)

.....

.....

.....

(b) Burning magnesium ribbon was lowered in a jar of oxygen.

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

.....

.....

.....

(ii) Write an equation for the reaction that took place. (01$\frac{1}{2}$marks)

.....

.....

4. Write an equation only, to show the reaction that takes place when each of the following substances is strongly heated in air. (05marks)

(a) Copper metal

.....

(b) Potassium nitrate

.....

(c) Sodium hydrogen carbonate

.....

(d) Zinc nitrate

.....

(e) Magnesium metal

.....

5. (a) Define the term **isotopes.** (01mark)

.....

.....

(b) Carbon is an isotopic element.

(i) State the isotopes of carbon. (01 mark)

.....

(ii) Which isotope of carbon is used in carbon dating? (01mark)

.....

(c)Other than carbon, state any other element which is isotopic and state its isotopes. (02 marks)

Element.....

Isotopes.....

6. A hydrated salt T, consists of 20.2% iron, 11.5% sulphur, 23% oxygen and 45.3% water of crystallisation.

(a) Calculate the empirical formula of T. (02 marks)

($Fe = 56, S = 32, O = 16, H = 1$)

.....

.....

.....

.....

(b) Deduce the molecular formula of T(RFM of T = 278) (01$\frac{1}{2}$marks)

.....

.....

.....

(c) Write an equation for the reaction between a solution of T and chlorine. (01$\frac{1}{2}$ marks)

.....

.....

.....

.....

.....

7. Ammonia reacts with copper (ii) oxide according to the following equations.

$$3CuO_{(s)} + 2NH_{3(g)} \rightarrow 3Cu_{(s)} + N_{2(g)} + 3H_2O_{(l)}$$

(a) State the;

(i) Effect of passing excess dry ammonia over heated copper (ii) oxide on the appearance of the oxide. (01 mark)

.....

(ii) Property of ammonia which causes the reaction shown above.
(01 mark)

.....

(b) Calculate the maximum volume of ammonia measured at s.t.p that would be required to react with 14.4g of copper (ii) oxide.
($Cu = 64, O = 16$, *1 mole of a gas at s.t.p occupies* $22.4dm^3$. (03 marks)

.....

.....

.....

8. Fermentation is one of the reactions that increase the concentration of carbon dioxide in the atmosphere.
(a) State;
(i) One difference between fermentation and combustion. (01mark)

.....

(ii) Two uses of the non-gaseous product of fermentation. (01 mark)

.....

(b) Name one natural process that reduces carbon dioxide concentration in the atmosphere.
(01marks)

.....

(c) When sugar oxidized in an animal or a plant during respiration, energy is evolved according to the following equation;
$C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 6CO_{2(g)} + 6H_2O_{(l)}, \quad \Delta H = -2800Jmol^{-1}$
Calculate the mass of sugar in **kg** that would produce 14000KJ of energy in a body during respiration. (1 mole of sugar weigh 180g). (02 marks)

.....

.....

.....

.....

9. An electric current was passed through concentrated sodium chloride solution using a graphite anode and a platinum cathode.

(a) State what was observed at each electrode.

(i) Cathode ($\frac{1}{2}$mark)

.....

(ii) Anode ($\frac{1}{2}$ mark)

.....

(iii) What is the volume ratio of the products ($\frac{1}{2}$ mark)

.....

(b) Write an equation for the reaction if any

(i) At the anode. (01 mark)

.....

(ii) Between the products at the anode and potassium bromide solution ($1\frac{1}{2}$ marks)

.....

(iii) Briefly explain why the anode must be made of graphite and not platinum. (01 mark)

.....

.....

10. (a) Iron is extracted from its main ore in a blast furnace as shown in figure

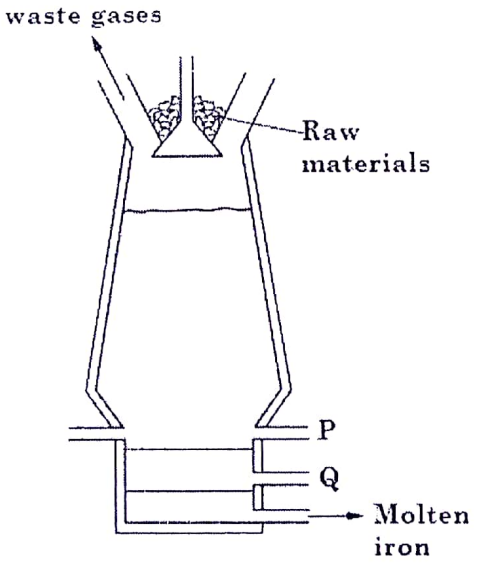

Figure 3

(i) Name the main ore of iron used in the blast furnace. (01 mark)

.....

(ii) Name the substance that enters the blast furnace at P. (01 mark)

.....

(iii) Name the substance that leaves the blast furnace at Q. (01 mark)

.....

(iv) Give two reasons for using coke in the blast furnace. (02 marks)

.....

.....

.....

SECTION B

11. (a) A crystalline carbonate of sodium of formular $Na_2CO_3XH_2O$ decomposes into a white powdery residue W, when it was heated to constant mass. Write the name and formula of W. (02 marks)

(b) When 7.29g of sample of the crystalline sodium carbonate in (a) was heated to constant mass, 2.7g of W was collected.

(i) Calculate the value of x in the formular, $Na_2CO_3XH_2O$ (03 marks)

(ii) Write the correct name of the crystalline sodium carbonate. (01 mark)

(c) (i) Name two substances which when reacted together would be most suitable for preparing zinc carbonate.

(ii) Write the equation for the reaction that would lead to formation of zinc carbonate in c(i) above. (01$\frac{1}{2}$mark)

(d) State what would be observed and write the equation for the reaction that would take place if zinc carbonate was strongly heated strongly and then allowed to cool.

(03 marks)

(e)(i) Name one reagent that can be used to differentiate between zinc ions and lead (ii) ions in solution. (01 mark)

(ii) State what would be observed in each case if zinc ions and lead ions were treated separately with the reagent you have mentioned in e(i). (02 marks)

12. (a) Calcium oxide is made by the thermal decomposition of calcium carbonate.

(i) State the meaning of the term **thermal decomposition**. (02 marks)

(ii) Describe a chemical test for calcium ions in the laboratory. (02 marks)

(b) Carbon dioxide is produced when dilute hydrochloric acid reacts with calcium carbonate.

$$CaCO_3 + HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

(i) Draw a well labeled diagram to show how to measure the volume of carbon dioxide produced during this reaction. (03 marks)

(c) Describe the effect of each of the following on the rate of reaction of dilute hydrochloric acid with calcium carbonate from part (b).

(i) The concentration of hydrochloric acid is decreased. (All other conditions kept constant). (01 mark)

(ii) The temperature is increased. (All other conditions are kept constant). (01 ark)

(d) Carbon dioxide is also formed when the hydrocarbon C_3H_8 is completely combusted.

(i) State the meaning of the term **Hydrocarbon**. (02 marks)

(ii) The hydrocarbon C_3H_8 is called propane, Name the homologous series that propane belongs to. (01 mark)

(iii) Name two substances formed by the incomplete combustion of propane. (02marks)

(e) State one use of carbon dioxide. (01 mark)

13. Under suitable conditions, oils and fats can react to form soap

(a)(i) Define the term soap. (01 mark)

(ii) State the process of soap formation. (01 mark)

(b) Name one;

(i) Locally available material in each case that provides oils and fats. (01 mark)

(ii) Substance which when reacted with fat or oil can produce soap. (01 mark)

(c) Describe briefly how;

(i) Soap solution can be prepared in the laboratory using oil or fat from the source you have named in (b)(i) and the substance you have named in (b)(ii). (05 marks)

(ii) A sample of dry soap can be obtained from the solution you have prepared in (c)(i). (02marks)

(d) State what was observed and write the equation for the reaction that took place. When soap solution was shaken separately with a sample of;

(i) Rain water

(ii) Water in which calcium hydrogen carbonate was dissolved. (03 marks)

(iii) Suggest a name that is given to the water that contains calcium hydrogen carbonate. (01 mark)

14. (a) Define the terms;

(i) Molarity (01 mark)

(ii) Standard solution (01 mark)

(iii) Primary standard (01 mark)

(b) 2.75g of impure sodium carbonate was dissolved in water to make $500cm^3$ of Solution and 25 cm^3 of this solution was completely neutralized by 20.8 cm^3 of $0.12M$ hydrochloric acid.
Calculate;

(i) Concentration in moles per litre of sodium carbonate solution. (04marks)

(ii) Percentage impurity of the original sample of sodium carbonate. (04marks)

(c) $2.5g$ Of silver nitrate was heated to constant mass and two gaseous products were produced. Calculate the volume of the gaseous products at room temperature. (04marks)
(1 mole of gas at room temperature occupies $24dm^3$,
$Ag = 108, N = 14, 0 = 16$)

END