**TERM 2 - 2023**

**CHEMISTRY – PAPER ONE (233/1)**

**FORM THREE (3)**

**Time - 2 Hours**

**Name ……………………………………………. Admission Number ………………………...**

**Candidate’s Signature ………………….…...………. Class ……………………………………**

**Instructions to candidate**

1. Write your name, admission number, and stream in the spaces provided.
2. Answer **ALL** questions in the spaces provided.
3. All working **MUST** be clearly shown where applicable.
4. KNEC mathematical tables and silent non-programmable electronic calculators may be used.
5. This paper consists of ***10 printed pages****.*
6. The candidate should check the question paper to ascertain that all the pages are printed as indicated and that no question is missing.

**FOR EXAMINERS’ USE ONLY**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum Score** | **Candidate’s Score** |
| **1 – 28** | **80** |  |

1. Hydrogen is a **group I** element:
2. It is the lightest known element but cannot be used in hot air balloons. Explain (1 mark)

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1. State any one use of hydrogen gas which is also a use of carbon (II) oxide gas (1 mark)

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1. A piece of burning magnesium was lowered into a gas jar of nitrogen gas, and it was observed to be burning even brighter.
2. Explain this observation (1 mark)

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1. Write an equation for the reaction which took place in the gas jar in **(a)** above (1 mark)

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1. Water was added to the product formed above and the resultant solution was tested with litmus paper. State and explain the observation that was made. (2 marks)

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1. What is a saturated solution? (1 mark)

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1. Describe a laboratory procedure that can be used to determine that a given solution is saturated. (2 marks)

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1. Trona is a double salt that contains sodium carbonate and sodium hydrogen carbonate. It exists in alkaline lakes, mixed with sodium chloride. Name the method of separation that is used to obtain it from its mixture with sodium chloride. (1 mark)
2. Using the listed reagents only, describe the steps that can be used to obtain a dry sample of lead (II) sulphate in the laboratory: lead (II) carbonate powder, sodium sulphate solution, and dilute nitric (V) acid solution. (3 marks)

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1. Iron (II) bromide can be prepared in the laboratory by passing dry bromine vapour over hot iron wool.
2. Name this method of salt preparation (1 mark)

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1. Iron (II) bromide must be prepared in a dry environment. Explain. (1 mark)

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1. During this preparation, calcium oxide is preferred to anhydrous calcium chloride as a drying agent. Explain. (1 mark)

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1. When iron filings and sulphur powder are put together in a glass beaker, the resultant substance is only said to be a mixture. When the beaker is heated gently, a red glow is observed, and the resultant substance is now said to be a compound.
2. Explain these observations. (2 marks)

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1. State any characteristics of the type of change that occurs when the glass beaker is heated (2 marks)

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1. State Charles’ Law. (1mark)

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1. An L.P.G. gas cylinder had gas which occupied 300cm3 when the warehouse temperature was 47oC. what volume will the gas occupy when the warehouse temperature is reduced to the s.t.p. in readiness for refilling? (2 marks)

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1. 15cm3 of an acid with the formula **H2Y** required 25cm3 of 0.1M NaOH for complete neutralization.
2. How many moles of sodium hydroxide reacted with the acid? (1 mark)

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1. Calculate the concentration of the acid in moles per litre. (2 marks)

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1. An oxide of element **Q** has the formula **Q2O3**.
2. State the valency and oxidation number of element **Q** (1 mark)

Valency\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Oxidation number \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is the most likely structure of the compound **Q2O3**? (1 mark)

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1. Distinguish the term ‘allotrope’ from ‘isotope’. (2 marks)

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1. A hot piece of aluminium metal was lowered into a gas jar of chlorine gas. The resulting residue was mixed with water and filtered. 3 drops of methyl orange indicator were added to the filtrate.
2. State and explain the observation made when methyl orange was added to the filtrate. (2 marks)

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1. Name the process that occurred when the residue was added to water (1 mark)

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1. A hydrated salt has the following composition by mass: Iron 20.2%, Oxygen 23.0%, sulphur 11.5% and the rest is water. Determine the formula of the hydrated salt (Fe = 56, S = 32, O = 16, H = 1) (3 marks)

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1. A sample of the compound **CH3CCH** was burnt in the laboratory. State and explain the observations made during the burning process. (2 marks)

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1. Concentrated hydrochloric acid was added to potassium manganate (VII) crystals in flat bottomed flask. The gas produced was bubbled through water.
2. State the colour of solution formed (1 mark)

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1. Blue litmus paper was dipped into the solution. State and explain the observation made. (2 marks)

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1. Write an equation for the reaction that occurred in **(b)** above. (1 mark)

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1. Solid **W** is a white crystalline substance. It readily dissolves in water to form a colourless solution. It melts at low temperature to yield a liquid that does not conduct electricity. Its solution does not cause a bulb to light when inert electrodes are introduced. State and explain the most likely structure of solid **W**. (2 marks)

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1. Study the compound shown and use it to answer the questions that follow.



1. To which homologous series does the compound belong? (1 mark)

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1. State the IUPAC name of the compound (1 mark)

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1. Draw the structure of any isomer of the compound. (1 mark)

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1. A form three student weighed a piece of plain paper and wrote his name on it using a pencil of pure graphite. He then re-weighed the paper and obtained the following results:

Mass of plain paper = 1.042g

Mass of paper after writing = 1.143g

Determine the number of carbon atoms present in the pencil marks (C = 12.0, L = 6.023X1023) (2 marks)

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1. The scheme below shows a series of reactions, starting with a solid **W**.



1. Identify solid **W**  (½ mark)

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1. Write an equation for the reaction that occurs between solid **W** and dilute hydrochloric acid (1 mark)

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1. Write the formula of the complex ion present in solution **Y**. (½ mark)

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1. The setup below was arranged and used to study the characteristics of a Bunsen burner flame.



1. What does the experiment show? (1 mark)

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1. Name the type of flame labelled **flame 1**. (1 mark)
2. What type of flame is shown by **flame 2**? Explain. (2 marks)

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1. Some potassium carbonate of unknown mass was dissolved in water and the solution made up to the 250cm3 mark. 25cm3 of this solution neutralized 20cm3 of 0.25M nitric (V) acid solution. Determine the unknown mass of potassium carbonate used. (K = 39, O = 16, C = 12) (3 marks)

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1. State Gay Lussac’s Law. (1 mark)

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1. What volume of a hydrocarbon gas (CH4) would remain if a burner containing 40cm3 of the gas burns in 40cm3 of enclosed air? (Assume oxygen is 20% by volume of air) (2 marks)

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1. During the laboratory preparation of carbon (II) oxide, an acid **G** is added to solid substance **L**. The product is bubbled through concentrated potassium hydroxide solution, and carbon (II) oxide gas collected over water.
2. Name:
3. Acid **G** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(1 mark)
4. Solid **L** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(1 mark)
5. What is the role of the concentrated potassium hydroxide solution? (1 mark)

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1. What would be observed if the concentrated potassium hydroxide solution was replaced with calcium hydroxide solution? (1 mark)

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1. Organic compounds **CH3CH2OH** and **CH3CH2CH2CH3** have close molecular masses. However, **CH3CH2OH**exists as a liquid at room temperature, while **CH3CH2CH2CH3** exists as a gas at room temperature. Explain this observation (2 marks)

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1. Element **R** has two isotopes $69 31 $**R** and $71 31 $**R** the percentage composition of the isotope with lower mass is 60%.
2. Calculate the R.A.M. of **R**. (2 marks)

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1. Isotopes have similar chemical properties but may have different physical properties. Explain this observation. (2 marks)

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1. A 5.0g of an alloy of platinum and zinc was reacted with excess dilute hydrochloric acid. 840cm3 of hydrogen gas was evolved at s.t.p. Calculate the percentage of zinc in the alloy. (Zn = 56, molar gas volume at s.t.p. = 22400cm3). (3 marks)

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1. When a few drops of aqueous ammonia are added to a copper (II) nitrate solution, a pale blue precipitate is formed. On addition of more aqueous ammonia, a deep blue solution is formed.
2. Identify the pale blue precipitate (1 mark)

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1. Write the formula of the complex ion present in the deep blue solution (1 mark)
2. The diagram below shows a part of the Solvay Process



1. Write the overall equation for the reaction that takes place in **A** (1 mark)

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1. Name solid **E** (1 mark)

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1. State any **one** use of solid **H** (1 mark)

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1. Name any one apparatus/material that can be used in the laboratory to carry out the process that takes place in chamber **B** (1 mark)

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