**NAME………………………………………………INDEX NO:.…ADM NO………**

**SCHOOL**……………………………………**…SIGNATURE**…….…. **DATE**………

**233/1**

**CHEMISTRY Paper 1**

**THEORY**

**JULY 2024**

**2 HOURS**

**FORM 4**

**Kenya Certificate of Secondary Education (K.C.S.E)**

***INSTRUCTIONS TO CANDIDATES***

* Write your name and index in the **spaces** provided.
* Sign and write the date the examination is done.
* Answer **all** the questions in the spaces provided.
* Mathematical tables and **electronic calculators** may be used.
* ALL workings **MUST** be clearly shown where necessary.
* **This paper contains 12 printed pages.**
* **Candidates should check the question paper to ascertain that all pages are printed as indicated and that no question is missing.**
* **Candidates should answer questions in English.**

**For Examiner’s Use Only**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidates score** |
| 1-27 | 80 |  |

1. Below is a Bunsen burner flame. Study it and answer the questions that follow.



1. How is this type of flame is produced? (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Label on the diagram the least hot part of the flame. (1 mark)
2. Name the gas produced by a burning candle that is a non-pollutant. (1 mark)

………................................................................................................................................................

1. a) A hydrocarbon consists of 92.3% carbon. Its molecular mass is 26. Calculate its molecular formula. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

b) Draw the structure of the hydrocarbon. (1 mark)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Hydrogen sulphide gas is slightly soluble in water. The reaction is given by equation below.

 H+(aq)+HS-(aq)

State and explain the effect of addition of Potassium hydroxide pellets on the concentration of hydrogen sulphide. (3 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. In the presence of U.V light, ethane gas undergoes substitution reaction with chlorine.
2. What is meant by the term Substitution reaction? (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Give the structural formula and the name of the organic product formed when equal volumes of ethane and chlorine react together. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. The diagram below shows the bonding between aluminium chloride and ammonia.

 H Cl

 H N Al Cl

 H Cl

1. Name the types of bonds that exist in the molecule (1 mark)

……………………………………………………………………………………………………………………………………………………

……………………………………………………………………………………………………………………………………………………

1. How many electrons are used for bonding in the molecule? (1mark)

……………………………………………………………………………………………………………………………………………………

1. State one commercial use of dry ice (1 mark)

………................................................................................................................................................

1. a) Give one advantage of universal indicator over other indicators. (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Describe how a mixture of barium sulphate and lead (II) chloride be separated in to pure solids. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Substance Qhas a melting point of 15oC and boiling point of 70oC.
2. On the same axes, draw the heating curve for Q if temperature started rising from 0oC.

 (2 marks)

 

1. State the physical state of substance **Q** at room temperature (room temperature =25oC)

(1 mark)

………................................................................................................................................................

1. The set-up below is used to investigate the properties of ammonia.

 

i) On the diagram, indicate what should be done for the reaction at the combustion tube to occur. (**½** mark)

ii) Name another gas that can be used instead of ammonia gas. (**½** mark)

………................................................................................................................................................

iii) State and explain what happens to the red litmus paper. (1 mark)

………................................................................................................................................................

iv) Explain the observation made in the combustion tube. (1 mark)

………................................................................................................................................................

1. a) What is a binary electrolyte? (**½** mark)

………................................................................................................................................................

………................................................................................................................................................

1. In an experiment, the quantity of electricity passed to deposit 1.2g of metal Q from its salt, was 3860 coulombs. (RAM of Q=120, 1 faraday = 96500 coulombs)
2. How many faradays of electricity are required to deposit 1mole of Q? (2 marks)

………................................................................................................................................................

………................................................................................................................................................………................................................................................................................................................………................................................................................................................................................

1. One of the ions present in the solutions of the salt of Q has the formula Q**y+**. What is the numerical value of y? (**½** marks)

………................................................................................................................................................

………................................................................................................................................................

1. Study the diagram below which shows an energy level diagram.

Na+(g) + Cl-(g)

ΔH2 = - 680kJmol-1

ΔH3 = +20kJmol-1

Na+(aq) + Cl(aq)

ΔH1

NaCl(s)

Enthalpy

 Reaction path

1. Name enthalpy (1½ mark)

 ΔH1 ………............................................................................................

 ΔH2 ………............................................................................................

 ΔH3 ………............................................................................................

1. Calculate the ΔH1 from the energy level diagram (1½ mark)

………................................................................................................................................................

………................................................................................................................................................

1. Below is a table of 1st ionization energies for elements A, B, C, and D which are metals.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Elements | A | B | C | D |
| Ionization energies kJmol-1 | 494 | 418 | 519 | 376 |

a) What is meant by 1st ionization energy? (1 mark)

………................................................................................................................................................

………................................................................................................................................................

b) With an explanation, arrange the elements in order of increasing reactivities. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

1. In the manufacture of Sulphuric (VI) acid by contact process Sulphur (IV) oxide is made to

react with air to form Sulphur (VI) oxide as shown: -

2SO2(g) + O2(g) 2SO3(g) ΔH = -196KkJ

(i) Name the catalyst in this reaction (1 mark)

………................................................................................................................................................

(ii) State effect of the following changes on the yield of Sulphur (VI) oxide

I. Increasing the pressure (**½** mark)

………................................................................................................................................................

II. Using a catalyst (**½** mark)

………................................................................................................................................................

(iii) Explain why Sulphur (VI) oxide gas is absorbed in concentrated Sulphur (VI) acid before dilution (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. a) What are isotopes? (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Determine the number of neutrons in $$(1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. An isotope of element E has 34 neutrons and its mass number is 64. E forms a cation with 28 electrons. Write the formula of the cation formed by the element E. (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. The standard electrode potentials of four half-reactions are: -

I. Sn2+ (aq) + 2e- → Sn(s) Eθ = -0.14V

II. Fe3+(aq) + e-  → Fe2+(aq) Eθ = + 0.77V

III. V2+(aq) + 2e- → V(s) Eθ = -1.20V

IV. Br2(aq) + 2e-  → 2Br-(aq) Eθ = + 1.07V

1. Identify the strongest oxidizing agent. (1 mark)

………................................................................................................................................................

1. Calculate the electrode potential for the electrochemical cell constructed from half-cell III and IV (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. State two applications of electrolysis (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. A sample of river water is suspected to contain magnesium salt. Describe how the presence of Mg2+ ions can be established. (3 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. The solubility curve of potassium nitrate is shown below.



* 1. Determine the solubility of potassium nitrate at 80°C. (1 mark)

………................................................................................................................................................

* 1. Determine the molar concentration of saturated potassium nitrate at 50°C. (K = 39.0, O = 16.0, N = 14.0 and density of water = 1 g/cm3). (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Galvanization is an example of the efficient methods used in preventing rusting.
2. What is meant by galvanisation? (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Other than galvanisation, name 2 methods of preventing rusting. (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. State the use of the mixture of hydrazine with oxygen. (1 mark)

………................................................................................................................................................

1. a) Name 2 gases that are collected during fractional distillation when the temperature of liquefied air is raised from -200℃ to -185℃of the distillation chamber. (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Name 2 gases that are removed at the temperature between 25℃ and -25℃ (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Why is it necessary to remove the gases named in (b) above before the cooling dust free air to -200℃? (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. The structure of protein is shown below. Study it and answer the questions that follow.



1. Draw the structure of the monomer that undergoes polymerization to form protein.

(1 mark)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Which type of polymerization is the formation of protein? Explain. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Study the flow chart below and answer the question that follows.

****

Identify: (3 marks)

a) Solution K

………................................................................................................................................................

b) Solid L

………................................................................................................................................................

c) Gas M

………................................................................................................................................................

1. 50cm3 of oxygen gas diffused through a porous plug in 80 seconds. How long will it take 100cm3 of Sulphur (IV) oxide to diffuse through the same plug? (S = 32, O = 16). (3 Marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. 15.0cm3 of ethanoic acid (CH3COOH) was dissolved in water to make 500cm3 of solution. Calculate the concentration of the solution in moles per litre. (C=12.0; H=1.0; O=16.0; density of ethanoic acid is 1.05 g/cm3) (3 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. When excess chloride gas is bubbled through dilute sodium hydroxide solution the resulting solution acts as a bleaching agent.
2. Write an equation for the reaction between chlorine gas and sodium hydroxide solution.

(1 mark)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Explain how the resulting solution acts as a bleaching agent. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

1. Calcium oxide can be used to dry ammonia gas.

a) Explain why calcium oxide is not used to dry hydrogen chloride gas. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

b) Name one drying agent for hydrogen chloride gas. (1 mark)

………................................................................................................................................................

1. a) Explain why it is not advisable to prepare a sample of carbon(IV)oxide using barium carbonate and dilute Sulphuric(VI) acid. (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................

b) State a method that can be used to collect dry carbon(IV)oxide gas. Give a reason.

 (1 mark)

………................................................................................................................................................

………................................................................................................................................................

1. Study the information in Table 3 and use it to answer the questions that follow.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Elements** | **Na** | **Mg** | **Al** | **Si** | **P** | **S** | **Cl** |
| Atomic Numbers | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Atomic radii(nm) | 0.157 | 0.136 | 0.125 | 0.117 | 0.110 | 0.104 | 0.099 |

* 1. Explain the trend in atomic radii from sodium to chlorine. (1 mark)

………................................................................................................................................................

………................................................................................................................................................

* 1. Explain how the chloride of aluminium differs from those of other metals in the period. (2 marks)

………................................................................................................................................................………................................................................................................................................................

1. When solid magnesium carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no apparent reaction. On addition of water to the resulting mixture, there was vigorous effervescence. Explain these observations (2 marks)

………................................................................................................................................................

………................................................................................................................................................

………................................................................................................................................................………................................................................................................................................................

………................................................................................................................................................

**The Last Printed Page**