KALA JOINT TRIAL EXAMINATION-2024

Kenya Certificate of Secondary Education

233/1   - CHEMISTRY -   Paper 1

JULY 2024

2hrs

Name: …………………………………………..………… **Admission No** ………..….

Class…………………..   **Date:** ………………………………

                               Signature …………

Instructions to Candidates

- *Write your name, class, admission number, school, date and signature in spaces provided above.*
- *The paper consists of **15** printed pages.*
- *Answer **all** questions provided in the question paper.*
- *All working must be clearly shown where necessary.*
- *Non-programmable silent electronic calculator and mathematical tables may be used except where stated otherwise.*

For Examiner's Use Only

SECTION A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

SECTION B

17	18	19	20	21	22	23	24	25	26	**TOTAL**

1. Oxygen and Sulphur are both members of Group (VI) in the periodic table. Their atomic numbers are 8 and 16 respectively. Draw dot and cross diagrams to show bonding in molecules of:
   (a) (i) Water   (1mk)

       (ii)Hydrogen Sulphide   (1mk)

   (b) Compare the boiling points of the compounds formed in (a) above. Explain.   (2mks)
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2.An electric current is passed through two solutions separately. Solution K (ammonia gas in toluene) and Solution M (ammonia gas in water) to test for electrical conductivity. A bulb is connected to each circuit. State and explain the observations made in each set-up.

Solution	Observation	Explanation
Solution K	(½ mk)	(1mk)
Solution M	(½ mk)	(1mk)

3. (a) The chief ore of copper is copper pyrites. Name two other ores of copper.   (1mk)

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(b) Describe how the mass of copper in a sample of copper (II) carbonate can be determined in the laboratory.   (2mks)

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4. When hydrogen chloride gas is bubbled into water, the following equilibrium is established:

$$HCl_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + Cl^-_{(aq)}$$
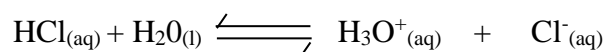
a) With reference to this equilibrium, identify the species which acts as an acid in the reverse reaction. Explain.   (1mk)

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b) State and explain the effect on the position of equilibrium if $4cm^3$ of aqueous lead (II) nitrate is added to the equilibrium mixture.   (2mks)

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5. Washing soda is a hydrated salt with the formula **$Na_2CO_3.yH_2O$** and it contains **4.20%** Carbon. Determine the value of y. (Na=23. 0, C=12.0, O=16.0, H=18.0)   (3mks)

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6. A hydrocarbon E with the formula C_2H_2 was reacted with one mole of hydrogen chloride gas to form compound F.
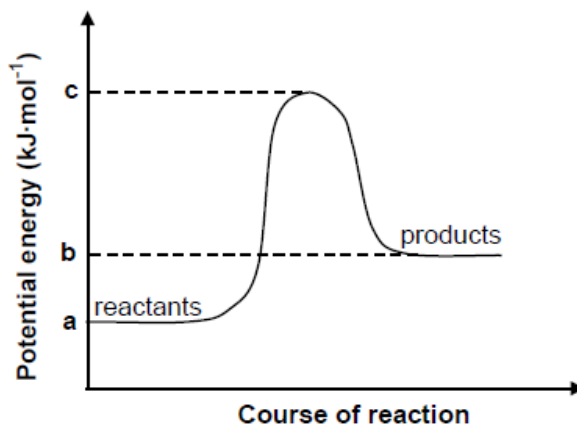
    (a) Give the IUPAC name of compound F. (1mk)

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    (b) Draw the structure of the polymer formed by compound F. (1mk)

    (c) State two uses of the polymer in (b) above. (1mk)

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7. The potential energy graph for a hypothetical chemical reaction is shown below.

(a) What type of reaction is taking place? (1mk)

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(b) Using the energy values **a, b** and **c** to write an expression for: (2mks)

(i) $\Delta H_{reaction}$

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(ii) E_a

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8.(a) State Boyles' law. (1mk)

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(b) A sealed glass tube contains $110cm^3$ of a gas at room temperature and pressure. Determine the change in volume of the gas that occurs if the sealed glass tube is immersed in boiling water at sea level. (Pressure was kept constant.) (2mks)

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9.Equal amounts of magnesium chloride and aluminum chloride were placed in separate test-tubes A and B containing cold distilled water mixed with methyl orange indicator .

(a) State and explain the observations that were made in each test-tube.

Test-tube A (1mk)

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Test-tube B (1mk)

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(b) Describe how the pH of a sample of the solutions formed in the set-ups above can be determined. (1mk)

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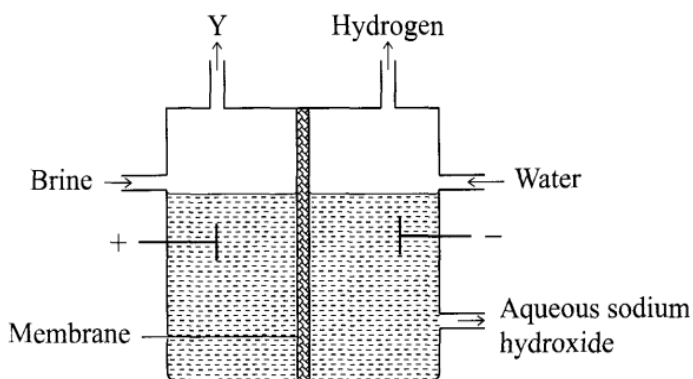10.Hydrogen gas can be obtained by electrolyzing brine using the electrolytic cell below.

(a) Name:
   (i)   The electrolytic cell   (½ mk)
          ……………………………………………………………………………………………

   (ii)   Gas Y   (½ mk)
          ……………………………………………………………………………………………

(b) Using two equations, show how sodium hydroxide solution is produced in the cell.
                                                                                            (2mks)
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11. (a) Calculate the number of hydrogen ions in $20cm^3$ of 0.5M sulphuric (VI) acid.

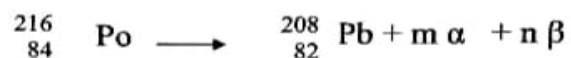(L= 6.0 x 10^{23})   (2mks)

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(b)When 2cm pieces of magnesium ribbon are placed in separate test-tubes containing 0.1M sulphuric (VI) acid and 1M sulphuric (VI) acid, more effervescence is observed in the test-tube containing 1M sulphuric (VI) acid. Explain.   (1mk)

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12.(a) Radioactive Polonium-216 decays as shown below:

$$^{216}_{84}\text{Po} \longrightarrow \ ^{208}_{82}\text{Pb} + m\,\alpha + n\,\beta$$

Determine the values of **m** and **n**   (2mks)

m………………………………………………………………………………………………………..

n………………………………………………………………………………………………………...

(b) State one application of radioactivity in tracers   (1mk)

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13. A student investigated the effect of an electric current by passing it through some substances. The student used graphite electrodes and connected an ammeter. The table below shows the substances used and their states.

Experiment	Substance	State
I	Ammonium nitrate	Solution
II	Concentrated sulphuric (VI) acid	Liquid
III	Aluminum Oxide	Molten
IV	Zinc (II) Chloride	Solution

(a) In which experiment was there no deflection on the ammeter? Explain. (1mk)

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(b) Calculate the quantity of electricity required to deposit 2.43 grams of zinc from a solution of zinc (II) chloride electrolyzed using inert electrodes. (Zn=65,1F=96500C)

(2mks)

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14. Oxygen gas can be prepared in the laboratory by thermal decomposition of sodium nitrate. Draw a diagram of a set-up that shows heating of sodium nitrate and collection of the gas.

(3mks)

15. Magnesium (Mg), Calcium (Ca) and Strontium (Sr) are group two elements that form ions by losing two electrons. Their first and second ionization energies are shown below.

	1st I.E kJ/mole	2nd I.E kJ/mole
Magnesium	736	1450
Calcium	590	1145
Strontium	550	1064

(a) Write an equation to represent the second ionization energy of calcium (1mk)

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(a) Explain why the 2nd ionization energies are higher than the 1st ionization energies

(2mks)

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16. The set-up below shows how small pieces of red phosphorous are heated in Nitrogen (I) Oxide.
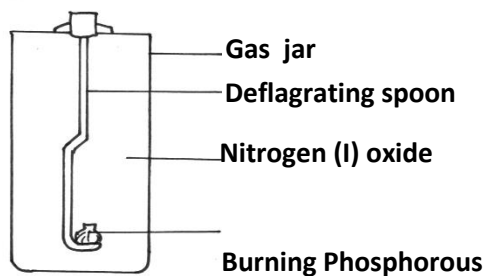
a) Write an equation for the reaction which occurs in the gas jar. (1mk)

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b) Give **one** use of Nitrogen (I) oxide. (1mk)

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c) With reference to the figure above, explain the pollution effect that may be caused by leakage of the products formed into the atmosphere. (1mk)

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17. The table below shows the molar heat of fusion and vapourization of ethanoic acid and ethanol.

Compound	Molar heat fusion (kJ/mol)	Molar heat of vaporization(kJ/mol)
CH_3COOH	6.02	40.7
C_2H_5OH	2.39	18.7

(a) Molar heat of fusion of ethanoic acid is higher than molar heat of fusion of ethanol. Explain. (2mks)

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(b) Apart from cost, state one reason why ethanol would be preferred over wood as a fuel. (1mk)

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18. Carbon is an allotropic element.

a) State one structural difference between diamond and graphite. (1mk)

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b) Charcoal is an amorphous form of carbon which has various uses. State the properties which make charcoal suitable for the uses stated below.
I: Used in making gas masks

Property-
……………………………………………………………………………………………… (1mk)

II: Used in the sugar refining industry

Property-
……………………………………………………………………………………………… (1mk)

19. Study the set-up below and answer the questions that follow
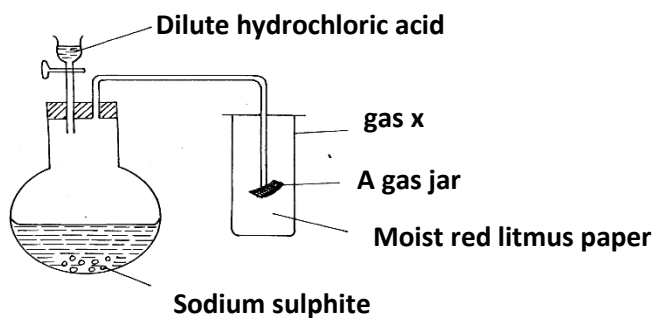
a) Write a chemical equation for the formation of gas X.   (1mk)

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b) State and explain the observation made on the moist red litmus paper.   (2mks)

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20. Consider the following equation:

$$Na_2S_2O_{3(aq)} + 4Cl_{2(g)} + 5H_2O_{(l)} \longrightarrow 2NaCl_{(aq)} + 2H_2SO_{4(aq)} + 6HCl_{(aq)}$$

    (a) Use oxidation numbers to determine the oxidizing agent. Explain   (1 mk)

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    (b) Explain how the presence of sulphate ions in the resulting solution can be confirmed .

                                                                             (2mks)

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21. Excess dilute sulphuric (VI) acid was added to a metal bar made of brass in a beaker

    (a) State the observations made.   (1mk)

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    b) Excess aqueous sodium hydroxide was added to 2 cm^3 of the solution obtained in the reaction. Write **two** ionic equations for the reactions that occurred.   (2mks)

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22. An element W has 20 neutrons and mass number of 39.

   i) Write the electron arrangement of the atom.   (1mk)

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   ii) Draw the structure of the ion of the element W.   (2mks)

23. (a) Apart from choice of electrodes, state **two** other factors that affect the preferential discharge of ions at the anode.   (1mk)

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(b) Complete the table below to show products of electrolysis under the conditions indicated.

(2mks)

	Anode	**Cathode**
Acidified water using graphite electrodes		
Copper (II) sulphate solution using copper electrodes		

24. Describe an experiment that can be used to show that air contains water vapour.   (3mks)

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25. Three pure pigments were prepared and their spots placed on a filter paper as shown below. The three pigments are A, B and C. A mixture F was also placed on the filter paper at the same time with the pure pigments. The filter paper was then dipped in ethanol solvent and left for half an hour. The results were obtained as follows:
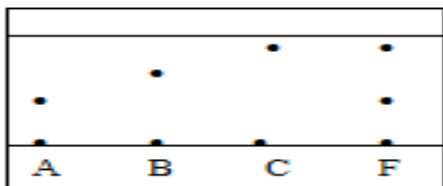
a) Name the method of separation illustrated above.   (1mk)

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b) State the observations that would be made if the following changes were made to the set-up used.
I: water is used as a solvent in place of ethanol.   (1mk)

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II: the baseline is drawn using an ink pen instead of a pencil.   (1mk)

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26.(a) Write a balanced chemical equation for the reaction that takes place when butanol burns in excess air   (1mk)

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(b) Use the bond energies in the table below to calculate the enthalpy change for the reaction in (a) above. (3mks)

Bond	Bond energy (kJ/mol)
O = O	496
O – H	463
C-H	412
C=O	743
C-C	348
C-O	358

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