KAPSABET HIGH SCHOOL

233/1 - CHEMISTRY - Paper 1

MOCK 2023

Name ……..…… Index No. ..……..……

Candidates Sign: ……..…..……. Date: ……

Kenya Certificate of Secondary Education (K.C.S.E)
233/1
CHEMISTRY
Paper 1
THEORY
Time: 2 Hours

INSTRUCTIONS TO CANDIDATES

- Write your **name** and **index number** in the spaces provided above.
- **Sign and write the date of examination in the spaces provided above.**
- Answer **ALL** the questions in the spaces provided.
- **Mathematical tables and electronic calculators may be used.**
- All working **MUST** be clearly shown where necessary.

FOR EXAMINERS USE ONLY

Questions	Maximum Score	Candidate's Score
1 – 28	80	

This paper consists of 13 printed pages.
Candidates should check the question paper to ensure that all the Pages are printed as indicated and no questions are missing.

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

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

2. a) Explain why melting point of chlorine gas is greater than that of Argon. (l mark)

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b) Using dot(•) and cross (×) to represent electrons draw a diagram to show bonding in carbon (iv) oxide. (l mark)

c) In terms of structure and bonding. Explain why Graphite is used as a lubricant. (1 mark)

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3. a) What is observed when a few drops of phenolphthalein indicator is added to a solution whose pH value is 3.0? (l mark)

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b) Write an equation for the reaction between Lead (ii) oxide and dilute Nitric acid. (l mark)

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4. State and explain the observation that would be made when zinc powder is heated with copper (II) oxide. (2 marks)

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5. Why is it dangerous to run a motor car engine in a closed garage? (2 marks)

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6. 2 grams of sodium hydroxide is added to 30 cm3 of IM sulphuric (VI) acid. What volume of 0. 1M potassium hydroxide solution will be needed to neutralize the excess acid. (Na23,016,H1) (3 marks)

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7. An aqueous solution of hydrogen chloride gas reacts with manganese (IV) oxide to form chlorine gas while a solution of hydrogen chloride gas in methylbenzene does not react with manganese (iv) oxide. Explain (2 marks)

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8. A small piece of potassium Manganate (VII) was placed in a glass of water and was left standing for 6 hrs without shaking. State and explain the observations made. (2 marks)

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9. Magnessium reacts with both dilute and concentrated sulphuric (VI) acid. Write a balanced equation for the two reactions. (2 marks)

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10. The table below gives the atomic numbers of elements **W, X, Y** and **Z**.

Element	W	X	y	Z
Atomic number	14	17	16	19

a) Name the type of bonding that exists in the compound formed when **X** and **Z** reacts. (1 mark)

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b) Select the letter representing the strongest reducing agent. Give a reason for your answer. (2 marks)

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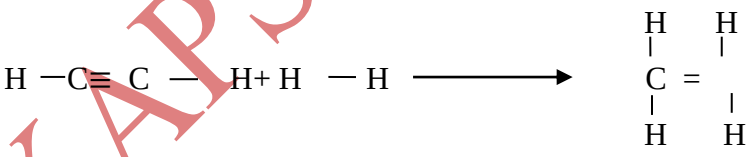
11. Ethyne reacts with hydrogen as shown below



Use the bond energies below to calculate the enthalpy changes for the above reaction. (3 marks)

BOND	ENERGY
H-H	435
C-H	413
C ≡ C	835
C=C	611

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12. a) Explain the role of common salt in defrosting ice on roads in ice cold countries. (1 mark)

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b) Explain why the long term effects of use of common salt is costly to motorists. (1 mark)

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13. Given the equation below

$NH_{3(aq)} + H_2O_{(l)} \longrightarrow NH_4^+{}_{(aq)} + OH^-_{(aq)}$

Identify the species that acts as;

i) A base. Explain (1 mark)

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ii) An acid. (½ mark)

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14. a) State Grahams law of diffusion. (1mark)

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b) The rate of diffusion of sulphur(IV)oxide gas through a porous material is 40cm3s $^{-1}$.

Calculate the rate of diffusion of carbon(IV)oxide gas through the same porous material *(S=32,O=16,C=12)* (2 marks)

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15. Describe how a solid sample of lead(II) chloride can be prepared using the following reagents : dilute nitric acid, dilute hydrochloric acid and lead carbonate (3 marks)

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16. The production of ammonia is given by the equation

$$3H2\,(g) + N_2(g) \rightleftharpoons 2NH_3\,(g);\ \Delta H\text{=-ve}$$

(i) State and explain the effect of addition of dilute hydrochloride acid on equilibrium. (2 marks)

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(ii) Explain the effect of increase in temperature on the yield of ammonia. (2 marks)

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17. $Cr_2O_7^{2-} + 14\ H^+\ (aq) + 6Fe^{2+} \longrightarrow Cr_2^{3+} + 7H_2O(l) + 6Fe^{3+}$.

The above equation show a redox reaction

(a) Calculate the oxidation state of chromium in $Cr_2O_7^{2-}$ (2 marks)

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(b) What is the role of H^+ in the above reaction. (1 mark)

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18. a) Define the standard heat of formation. (1 mark)

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b) Draw energy cycle diagram to show how the standard heat of formation of ethanol (C_2H_5OH) can be determined from standard heats of combustion of its elements. (2 marks)

c) Given that $\Delta H_C(C) = -393 kJmole^{-1}$, $\Delta H_C(H_2) = -286 kJmole^{-1}$ and $\Delta H_C(C_2H_5OH) = -1368 kJmole^{-1}$. Calculate the enthalpy of formation of C_2H_5OH. (2 marks)

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19. 3.78g of a hydrated salt of iron (II) sulphate, $FeSO_4$, in H_2O were heated until all the water of crystallization was driven off. The anhydrous salt left had a mass of 1.52g. Determine the formula of the hydrated salt. (Fe = 56, S = 32, H = 1, O = 16) (3 marks)

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20. A steady current of 0.2 Amperes was passed through molten silver bromide for 80 minutes.

a) Calculate the quantity of electricity that passed through the set up. (1 mark)

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b) Calculate the mass of product deposited at the cathode. (1F = 96500C; Ag = 108, Br = 80) (2 marks)

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c) If a sample of cobalt has an activity of 1000 counts per minute, determine the time it would take for its activity to decrease to 62.50 if the half-life of the element is 30 minutes. (2 marks)

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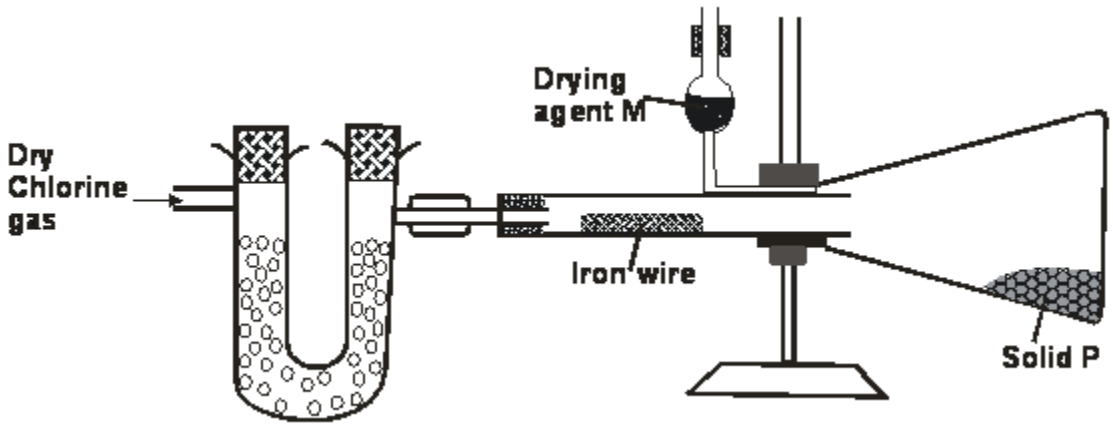
21. The apparatus set up below was used to prepare an anhydrous solid P



a) Write an equation for formation of solid P (1 mark)

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b) Suppose the gas used in the set up was dry hydrogen chloride gas; what would be the product obtained after the reaction? Give a reason for your answer. (1 mark)

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22. Aluminium is obtained from the ore with the formula Al_2O_3. $2H_2O$. The ore is first heated and refined to obtain pure aluminium oxide (Al_2O_3). The oxide is then electrolysed to get Aluminium and oxygen gas using carbon anodes and carbon as cathode.

a) Give the common name of the ore from where aluminium is extracted from. (½ mark)

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b) What would be the importance of heating the ore first before refining it? (1 mark)

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c) The refined ore has to be dissolved in cryolite first before electrolysis. Why is this necessary? (1 mark)

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d) Why are the carbon anodes replaced every now and then in the cell for electrolysing aluminium oxide? (1 mark)

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23. Use the cell representation below to answer the questions that follow

$V(s) / V^{3+}(aq) // Fe^{2+}(aq) / Fe(s)$

i. Write the equation for the cell reaction (1 mark)

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ii. If the E.M.F of the cell is 0.30 volts and the E^{θ} value for $V^{3+}aq$ / V (s) is -0.74V, calculate the E^{θ} of $Fe^{2+}(aq)$/ Fe(s) (2 marks)

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24. When $50cm^3$ 1M potassium hydroxide was reacted with $50cm^3$ of 1M hydrochloric acid, the temperature rose by 8^0C. When the same volume of Potassium hydroxide was reacted with $50cm^3$ of 1M Pentanoic acid, the temperature rose by 3^0C.

i) Give reasons for the above difference in temperature. (2 marks)

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ii) Write an equation to show dissociation of pentanoic acid? (1 mark)

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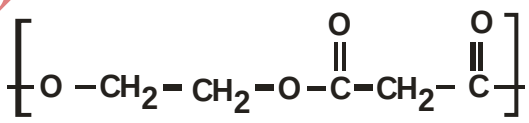
25. The following is structural formula of polyester.



a) Draw the structural formula and name the alkanoic acid and alkanol that react to form the polymer. (2 marks)

b) Give **one** use of polyester. (1 mark)

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26. A heavy metal P was dissolved in dilute nitric acid to form a solution of compound $P(NO_3)_2$. Portions of the resulting solution were treated as follows:
    a) To the first portion a solution of dilute hydrochloric acid is added, where a white precipitate (S) is formed, which dissolves on warming.
    b) The second portion is treated with two drops of 2M Sodium hydroxide solution where a white precipitate T is formed. The white precipitate dissolved in excess sodium hydroxide to form a colourless solution.
    c) A solution of potassium iodide is added to the third portion where a yellow precipitate (U) is formed.
    d) When the resulting solution is evaporated to dryness and heated strongly a yellow solid (V) is formed and a brown gas (W) and a colourless gas (X) are formed.

i. Identify the substances P, S, T, U, V, W. (3 marks)

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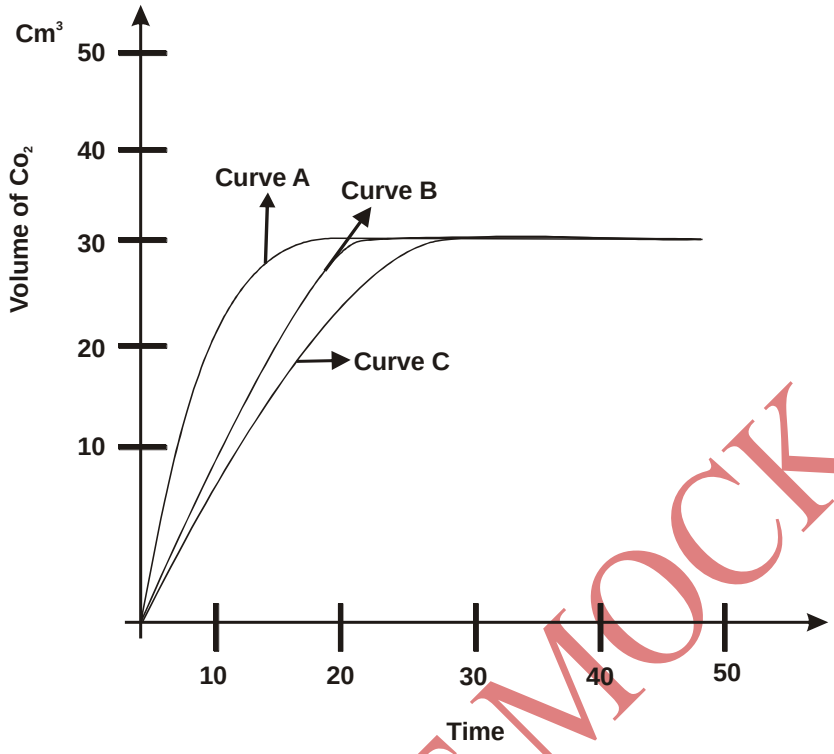
27. The graphs below were drawn when 15g of marble chips in different physical states were reacted with 50cm^3 of 2M Hydrochloric acid. They are drawn by measuring the volume of carbon (iv) oxide produced with time.



a) Which curves corresponds to the reactions involving powdered calcium carbonate and large sized marble chips with the dilute acid?

(i) Powdered calcium carbonate (½ mark)

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(ii) Large sized calcium carbonate (½ mark)

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b) All the graphs eventually flatten out at the same level but at different time. Why do the graphs flatten out at the same level? (1 mark)

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c) Why is curve A very steep at any given point compared to the other curves. (1 mark)

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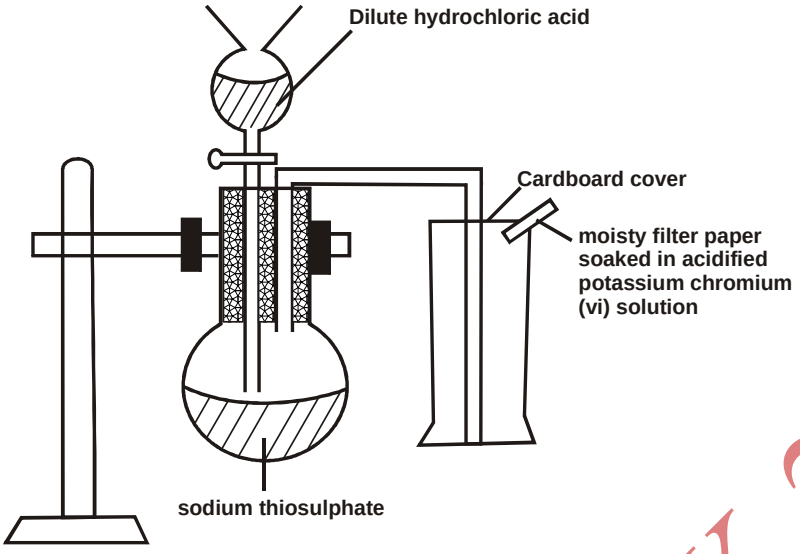
28. Sodium thiosulphate was reacted with dilute hydrochloric acid in a round bottomed flask as shown below. The gas evolved was collected by downward delivery in a gas jar.



a) Write an equation to show the reaction going on in the reaction in vessel. (1 mark)

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b) State the observation noted on the filter paper. Give a reason for your answer.

(1 mark)

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c) Give a reason why the filter paper soaked in the acidified potassium chromium (VI) is used at the top of the flask (1 mark)

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