Name: …… **Adm No**: …….

School: …….. **Class**: ……..

Signature: …….. **Date**: ……...

CHEMISTRY (233/1)
PAPER 1
FORM FOUR (4)
Time: 2 Hours

KCSE TOP PREDICTION MASTER CYCLE 7

Instructions to candidates

(a) Write your name, stream, and admission number in the spaces provided above.
(b) Answer **ALL** the questions in the spaces provided, and working **MUST** be clearly shown
(c) This paper consists of **11 printed pages**; Candidates 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

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 28	80	

1. A magnesium ribbon sample was heated in separate volumes of pure oxygen and air.

a) In which sample was the mass of the product higher? Explain. ***(2 Marks)***

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b) Write the equations for the reactions in the sample with air. ***(2 Marks***)

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2. Give the systematic name of the following compound and draw the structure of the polymer it forms: **CH_2CHCl**

Name ……***(1 Mark)***

Structure ***(1 Mark*)**

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3. When aqueous sodium hydroxide solution was added to freshly prepared acidified iron (II) sulphate solution, a green precipitate was formed. When hydrogen peroxide was first added to iron (II) sulphate solution followed by sodium hydroxide solution, a brown precipitate was formed. Explain these observations. ***(3 Marks)***

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4. Study the following nuclear reaction and complete it by giving the values of **m** and **n**

$$^{232}_{92}\text{X} \rightarrow ^{m}_{n}\text{Y} + 2\ ^{0}_{-1}\text{e}^{-} + ^{4}_{2}\text{He}$$

m ……***(1 Mark)*** **n** ……***(1 Mark)***

5.

a) State Charles' Law ***(1 Mark***)

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b) A certain mass of carbon (IV) oxide gas occupied 200cm^3 as 25^{o}C and 750mmHg pressure. Calculate the volume occupied by the same mass of gas if pressure is lowered to 300mmHg and the temperature raised to 30^{o}C. ***(2 Marks)***

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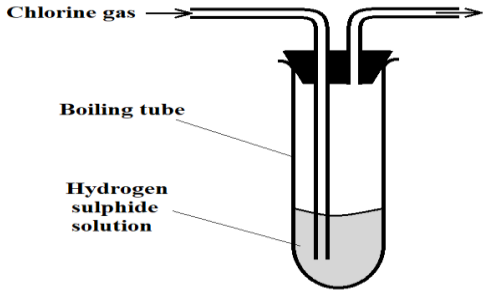
6. Chlorine gas was bubbled into as solution of hydrogen sulphide as shown in the diagram below.



a) Explain the observation made in the boiling tube ***(2 Marks)***

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b) What precaution should be taken in this experiment? ***(1 Mark)***

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c) Distinguish between the bleaching action of chlorine and that of sulphur (IV) oxide***. (1 Mark)***

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7. Concentrated sulphuric (VI) acid was left exposed in air for a few days. It was found that the level of the acid had risen.

a) Why did the level of the acid in the container rise? ***(1 Mark)***

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b) How is this property useful in the laboratory? **(1 Mark)**

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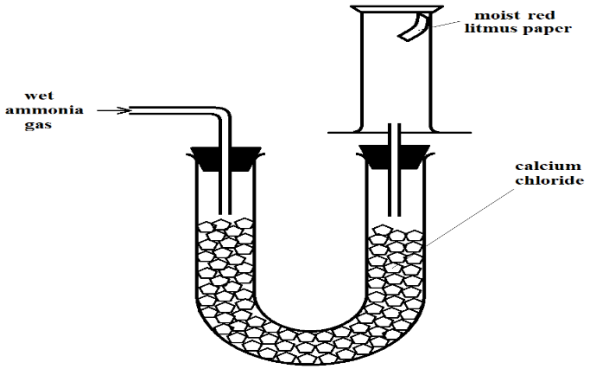
8. The setup below can be used to dry and collect ammonia gas. Use it to answer the questions that follow.



a) The wet red litmus paper remained red. Explain. **(1 Mark)**

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b) Name the method used when collecting ammonia gas. ***(1 Mark)***

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9. 400cm^3 of **gas D** diffuses from a porous plug in 50 seconds while 600cm^3 of oxygen gas diffuses from the same apparatus in 30 seconds. Calculate the relative molecular mass of **gas D.** ***(3 Marks)***

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10. Use the information in the table below on solubility to answer the questions that follow.

Salt	**Solubility at**	
	70°C	**35°C**
$CuSO_4$	38	28
$Pb(NO_3)_2$	78	79

A mixture containing 38g copper (II) sulphate and 78g of lead (II) nitrate in 100g of water at 70^{o}C is cooled to 35^{o}C.

a) Which of the two salts will crystallize? ***(1 Mark)***

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b) Calculate the mass of crystals formed. ***(1 Mark)***

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c) State the salt that will be unsaturated at 35^{o}C ***(1 Mark)***

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d) How much of the salt in **c)** above would be required to make a saturated solution at 35^{o}C? ***(1 Mark)***

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11. Methane burns in oxygen as shown by the equation below.

$$\mathbf{CH_4\,(g) + 2O_2\,(g) \rightarrow CO_2\,(g) + 2H_2O\,(g)}$$

Given the following bond energies:

Bond	**Bond Energy (kJ/mole)**
C – H	413
O = O	497
C = O	740
O – H	463

a) Calculate the heat change for the reaction. ***(2 Marks)***

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b) Define molar heat of combustion. ***(1 Mark)***

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12. Given solid sodium carbonate, lead (II) nitrate crystals and water, explain how you can obtain a solid sample of lead (II) carbonate. ***(3 Marks)***

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13. Calculate the volume of oxygen produced when 10g of silver nitrate was completely decomposed by heating at s.t.p. (Ag = 108, N = 14, O = 16, MGV at s.t.p. = 22.4dm^3) ***(3 Marks)***

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14. A solution of hydrogen chloride gas in water conducts an electrical current, while that of hydrogen chloride in methylbenzene does not conduct. Explain. ***(2 Marks)***

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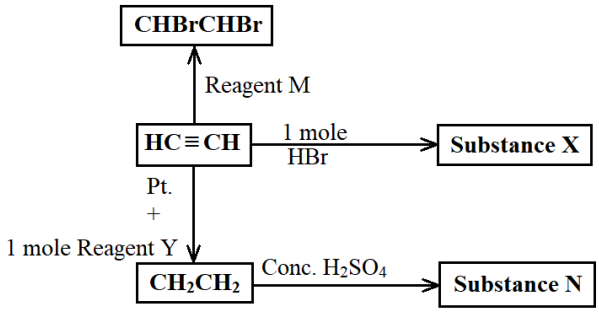
15. The scheme below shows some reactions, starting with ethyne. Study it and answer the questions that follow.



a) Name substance

i) **X** ……***(½ Mark)***

ii) **N** ……***(½ Mark)***

iii) **M**…….. ***(½ Mark)***

b) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product. ***(1½ Marks)***

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16. When 16g of ammonium nitrate was dissolved in 100cm^3 of water at 25^{o}C, the temperature of the solution drops to 19^{o}C.

a) Calculate the molar enthalpy of solution of ammonium nitrate ***(3 Marks)***

(N = 14, O = 16, H = 1, Specific Heat Capacity for Water = 4.2kJ/kg/k)

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b) Is the enthalpy change endothermic or exothermic? Give a reason ***(1 Mark)***

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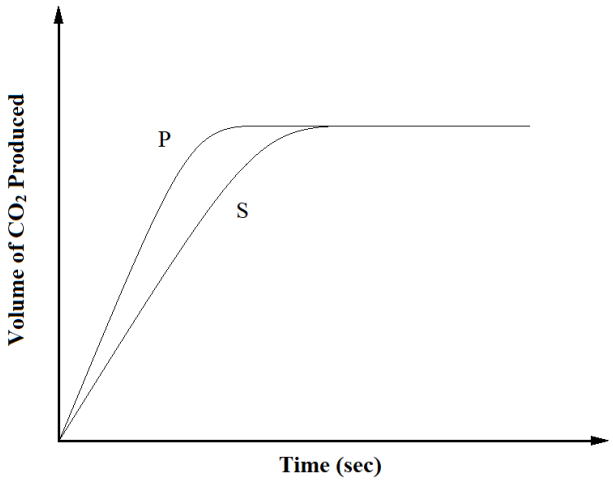
17. The curves below represent the volume of carbon (IV) oxide gas evolved when 2M hydrochloric acid was reacted with 100g of powdered calcium carbonate and when 1M hydrochloric acid was reacted with the same quantity of calcium carbonate.



a) Which of the two curves represents the reaction of 2M concentrated hydrochloric acid? Explain. ***(2 Marks)***

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b) Why do the two curves flatten at the same level of production of CO_2? ***(1 Mark)***

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18. The electron arrangement of ions $\mathbf{X^{3+}}$ and $\mathbf{Y^{2-}}$ are **2.8**, and **2.8.8** respectively.

a) In which groups do **X** and **Y** belong? ***(1 Mark)***

X……. **Y**…….

b) State the formula of the compound that would be formed between **X** and **Y** ***(1 Mark)***

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a) State **two** ores from which sodium metal can be extracted. ***(1 Mark)***

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b) During the extraction, calcium chloride solid is added into the sodium chloride solid. Why is calcium chloride added to the sodium chloride? ***(1 Mark)***

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c) State **two** uses of sodium metal. ***(2 Marks)***

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19. Using and energy cycle diagram, calculate the enthalpy change of formation of carbon disulphide, given: ***(3 Marks)***

$S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H = -294kJ/mole$

$CS_2(g) + 3O_2(g) \rightarrow CO_2(g) + 2SO_2(g)$ $\Delta H = -1072kj/mole$

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393kJ/mole$

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20. The table below shows tests carried out in a sample of water and the results obtained.

Sample	Results	observations
A	Addition of sodium hydroxide dropwise until excess	Whit precipitate which dissolves in excess
B	Addition of excess ammonia solution	White precipitate
C	Addition of dilute nitric (V) acid followed by barium chloride	White precipitate

a) Identify the **anion** present in the water sample ***(1 Mark)***

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b) Write an ionic equation for the reaction in **C** ***(1 Mark)***

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21. Use the following information to answer the questions that follow:

Sn^{2+} **(aq) + 2e⁻ → Sn (s)** E^{θ} **= -0.14V**

Cu^{2+} **(aq) + 2e⁻ → Cu (s)** E^{θ} **= +0.34V**

a) Write the cell representation for the cell made up of the two half cells ***(1 Mark)***

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b) Identify the reducing species ***(1 Mark)***

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c) Calculate the E^{θ} value for the cell ***(1 Mark)***

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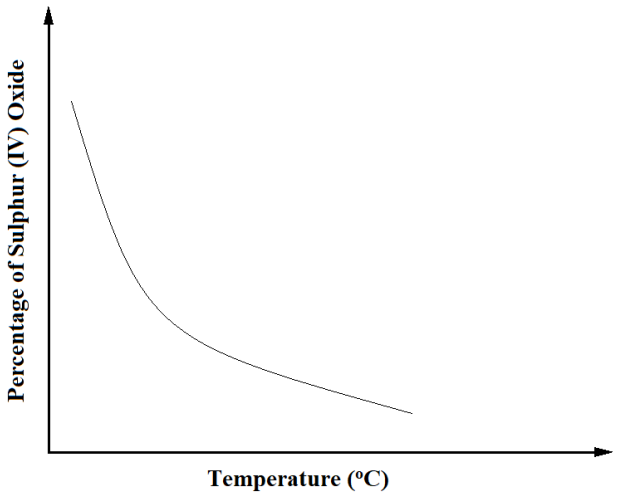
22. The following is a reaction of an equilibrium mixture:

$$2SO_2\,(g) + O_2\,(g) \rightleftharpoons 2SO_3\,(g)$$

The percentage of sulphur (VI) oxide in the equilibrium mixture varies with temperature as illustrated in the sketch graph below



a) How does the percentage of sulphur (VI) oxide in the equilibrium mixture vary as the temperature increases? Explain. ***(1½ Mark)***

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b) Is the forward reaction in the equilibrium exothermic or endothermic? Give a reason for your answer. ***(1½ Mark)***

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23. Radioactive polonium (Po) with a mass number of 212 and atomic number of 84 was detected in a sample of water. The water had an activity of 1000 counts per second.

a) If the water is boiled, explain whether the activity would be affected or not. ***(1 Mark)***

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b) Given that polonium resulted from bitumen (B) following emission of a beta (β) particle, write a nuclear equation for the decay. ***(1 Mark)***

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c) State **one** medical application of radioactivity. ***(1 Mark)***

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24. Name and give the formula of:

a) The **chief ore** from which zinc is extracted ***(1 Mark)***

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b) The **main impurity** in the ore. ***(1 Mark)***

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c) The ore is concentrated by froth floatation. What is froth floatation? ***(1 Mark)***

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25. The atomic number of sulphur is 16. Write the electron arrangement of sulphur in the following compounds

a) H_2S …….. ***(1 Mark)***

b) SO_3^{2-} ……..***(1 Mark)***

26. For the reaction: $\mathbf{Cl_2\ (g) + 2I^-\ (aq) \rightarrow 2Cl^-\ (aq) + I_2\ (s)}$

Using oxidation numbers, state and explain the reducing species. ***(2 Marks)***

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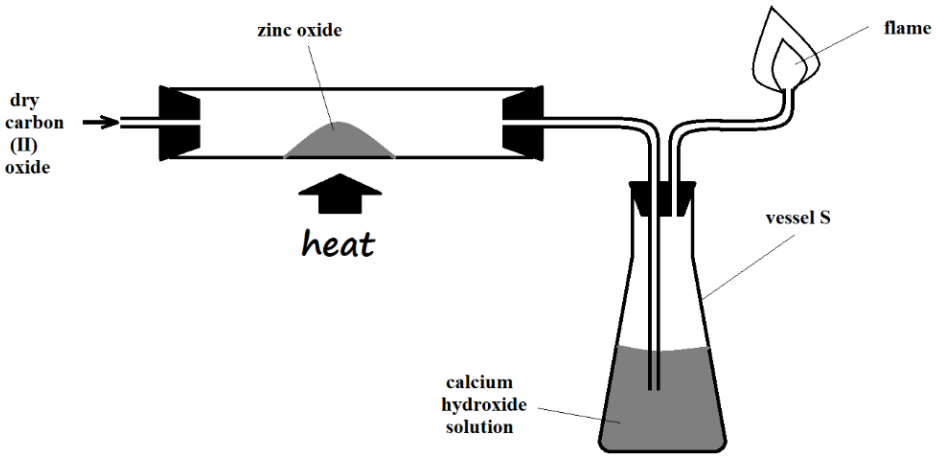
27. The setup below was used to investigate the effect of carbon (II) oxide on zinc oxide.



a) State the observations made on the setup. ***(2 Marks)***

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b) Write equations for the reactions that took place. ***(2 Marks)***

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