

# KCSE 2023 PREDICTION CYCLES



## CHEMISTRY PAPER 1



### KCSE 2023 TOP PREREDICTION CYCLE 1-10

#### CLASS OF KCSE 2023 NOVEMBER

*The set Comprises of 10 Prediction Cycles prepared by a panel of Top Writers from KNEC Nairobi HQ*

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All KCSE 2023 November Candidates are advised to take the questions in this package of predictions serious as they prepare for the national exams!

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## KENYA EDUCATORS CONSULTANCY

NAME.....CLASS.....ADM.....SIGN...

**CHEMISTRY**

**FORM FOUR**

**(THEORY) PAPER ONE**

**TIME: 2 HOURS**

# **KCSE TOP PREDICTION MASTER CYCLE 1**

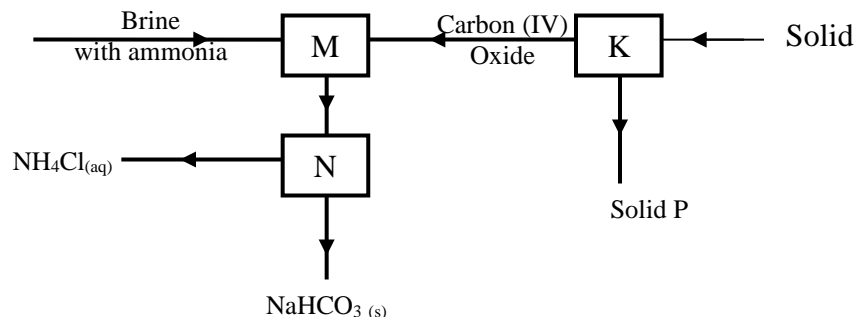
## **INSTRUCTIONS TO STUDENTS:**

- Write your **name** and **adm** 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.
- All working **must be** clearly shown where necessary
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing
- Candidates should answer the questions in English.

### **For Examiner's Use Only**

<b>Questions</b>	<b>Maximum Score</b>	<b>Candidate's Score</b>
<b>1 – 29</b>	<b>80</b>	

1. The diagram below shows part of Solvay process.



(a) Name solid P ( 1 Mark)

.....

(b) State the process taking place in chamber N. ( 1mark)

.....

(c) State two uses of calcium chloride which is a by-product in this process.( 1 mark)

.....

2.  $100\text{cm}^3$  of methane gas diffused through a porous partition in 40 seconds. How long would it take  $90\text{cm}^3$  of ozone gas to diffuse through the same partition? C = 12, H = 1, O = 16 (3marks)

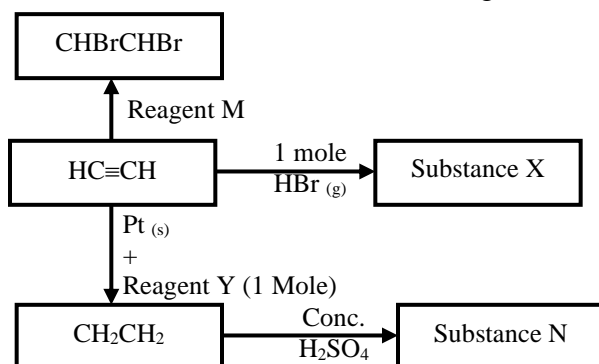
3. Ammonia is produced in large scale by Haber process.

(i) Write an equation for the formation of ammonia gas.

(1 mark)

(ii) State **two** optimum conditions for obtaining a high yield of ammonia in the process.  
(2 marks)

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



(a) Name substance X and N (1mark)

(b) Name reagent M

(1 Mark)

(c) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product.

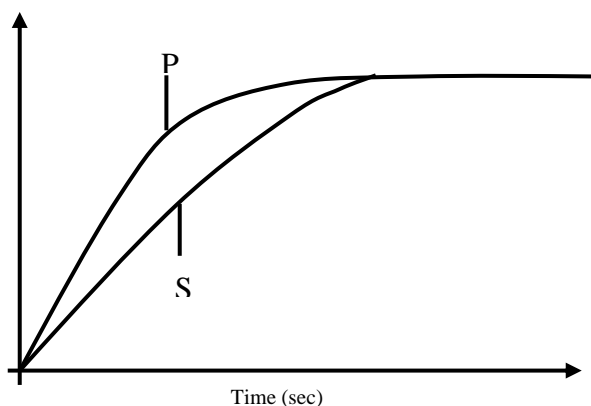
(i) Equation;

(1 mark)

(ii) Name:

(1mark)

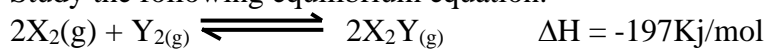
- .....
5. The curves below represent the volume of carbon (IV) oxide gas evolved once 2M(concentrated) hydrochloric acid was reacted with 100g of powdered calcium carbonate and also when 1M concentrated hydrochloric acid was reacted with the same quantity of carbonate.



- (i) Which of the two curves represents the reaction of 2M concentrated HCl with powdered calcium carbonate. Give a reason. (2 marks)

- .....
- .....
- .....
- (ii) Why do the two curves flatten at the same level of production of CO<sub>2</sub> (1 mark)

6. Study the following equilibrium equation.



Suggest two ways of increasing the yield of X<sub>2</sub>Y.

(1 mark)

7. The table below gives some elements in the periodic table. Use it to answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	A	B	C	D	E
Atomic number	12	13	14	15	16

Which of the above letters represent:

(a) A metallic element which forms ions with the smallest ionic radius? Explain(2 marks)

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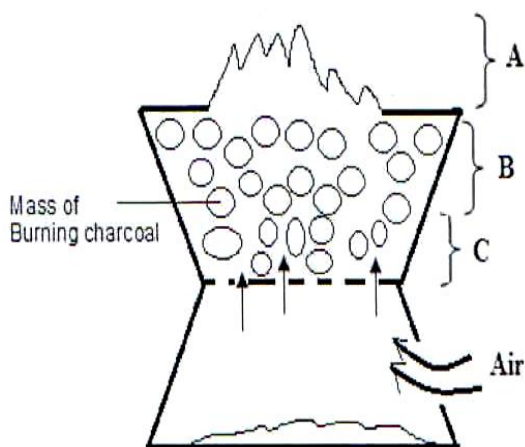
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(b) A non metallic element with the largest atomic size? Explain. (1 mark)

.....

.....

8. The diagram below shows a burning jiko. Study it and answer the questions that follow.



(a) Write the equation for the reaction taking place in region A. (1 Mark)

.....

(b) Name the gas produced at region B. (1 Mark)

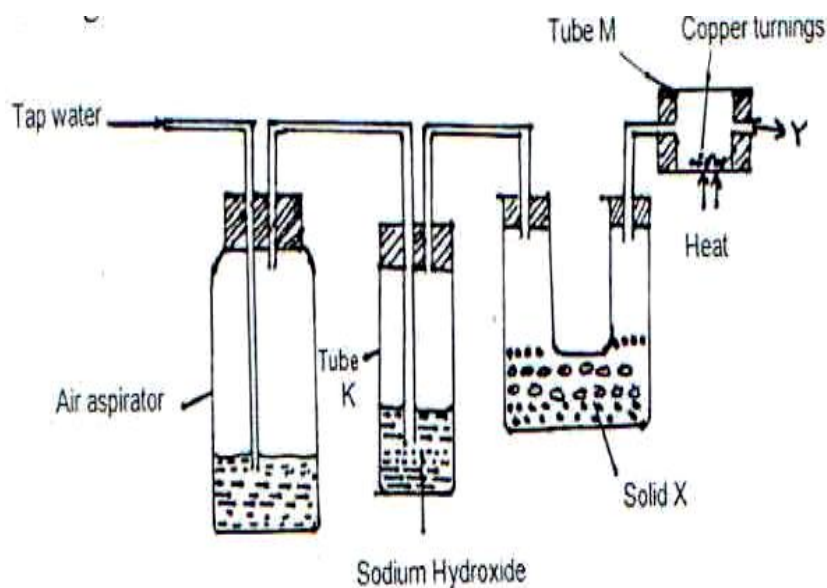
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(c) State ONE use of the gas named in (b) above.

(1 Mark)

.....

9. Study the diagram below and answer the questions that follow.



(i) What is the purpose of passing tap water through the air aspirator? (1 Mark)

.....

(ii) State and explain the observation that would be made in tube M after sometime. (1 Mark)

.....

10. 15g of sodium chloride was dissolved in 120cm<sup>3</sup> of distilled water. Calculate the concentration of the resulting solution in moles per litre. (Na = 23, Cl = 35.5) **(3Marks)**

11. (a) State Boyle's Law.

**(1 Mark)**

.....

.....

(c) The volume of a gas at 30<sup>0</sup>C and 780mmHg is 400cm<sup>3</sup>. What will be its volume at 50<sup>0</sup>C at 600 mmHg. **(3marks)**

12. Sulphur exhibits allotropy.

(a) What is allotropy?

**(1 Mark)**

.....

.....

(b) Name the **two** allotropes of sulphur.

**(2 Marks)**



(c) Sulphur powder was placed in a deflagrating spoon and heated on a Bunsen Burner.

(i) State the observation made. **(1 Mark)**

.....

(ii) The product obtained was dissolved in water. Comment on the PH of the solution formed.**(1 Mark)**

.....

13. 0.318g of an oxide of metal M was completely reduced by hydrogen gas to 0.254g of metal. Calculate empirical formula of the metal oxide. (M = 63.5, O = 16) **(3 Marks)**

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14. Given the following reagents: Solid sodium Carbonate, water, solid Lead (II) nitrate. Describe how a sample of Lead (II) Carbonate can be prepared in the laboratory.**(3 Marks)**

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15. Volume of liquids can be measured using a pipette; measuring cylinder or burette. Explain which one would be best for measuring 29.1cm<sup>3</sup> of liquid. **(1 Mark)**

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16. Study the information in the table and answer the questions below.

Substance	Solubility g/100g water
V	126
W	2

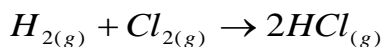
Describe how a solid sample of substance **V** could be obtained from a solid mixture of **V** and **W**. (2 Marks)

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17. Use the bond energies given below to calculate the heat of reaction for; (3 marks)



Bond	Energy (Kj/Mol)
H – H	435
Cl – Cl	243
H – Cl	431

18. The PH of a soil sample was found to be 5.7. An agricultural officer recommended addition of lime.

(a) State **two** functions of the lime. (2 Marks)

.....

.....

(b) Give the name of the process applied in (a) above. (1 mark)

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19. The electronic configuration of ions  $X^{2+}$  is 2.8 while that of ion  $Y^-$  is 2.8.8.

(a) Write down the electron arrangement of the atoms of X and Y **(2 Marks)**

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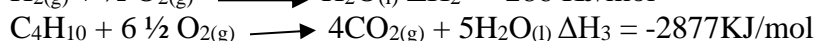
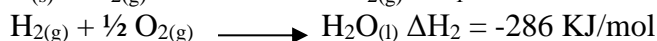
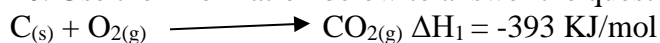
(b) Compare the atomic radii of the two elements. **(1 Mark)**

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(c) Give the name of the chemical family to which element X belongs **(1 Mark)**

.....

20. Use the information below to answer the questions that follow.



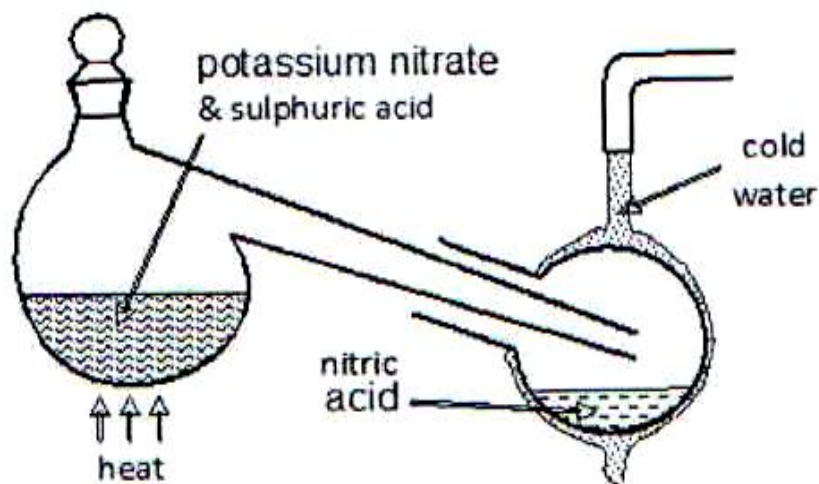
(a) Calculate the molar enthalpy of formation of butane ( $C_4H_{10}$ ) from its elements in their normal states.  
**(3mks)**

21. (a) (i) A student found a colourless liquid in the laboratory which he suspected to be water. Describe a chemical test he could have performed to confirm that the liquid is water. **(2 Marks)**

(ii) What other test could he have done to prove that the liquid is pure water?(1 Mark)

.....

22. The diagram below shows that the set-up that was used to prepare and collect a sample of nitric acid



(a) Give a reason why it is possible to separate nitric acid from sulphuric acid in the set-up.  
(1 Mark)

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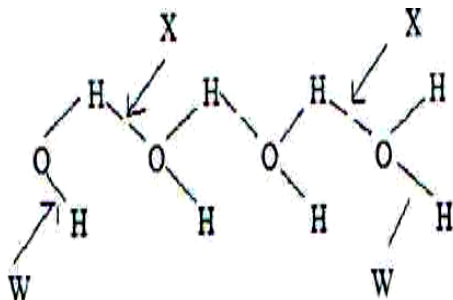
(b) Name another substance that can be used instead of potassium nitrate.(1 Mark)

.....

(c) Give one use of nitric acid.(1 mark)

.....

23. The structure of water molecules can be represented as shown below.



(i) Name the bond type represented by letter X and W.

*(1 Mark)*

(ii) Relative molecular mass of methane and water are almost similar, however the boiling of water is  $100^{\circ}\text{C}$  while that of methane is  $-161^{\circ}\text{C}$ . Explain.

*(1 Mark)*

24. Diamond and graphite are allotropes of carbon. In terms of structure and bonding, explain why?

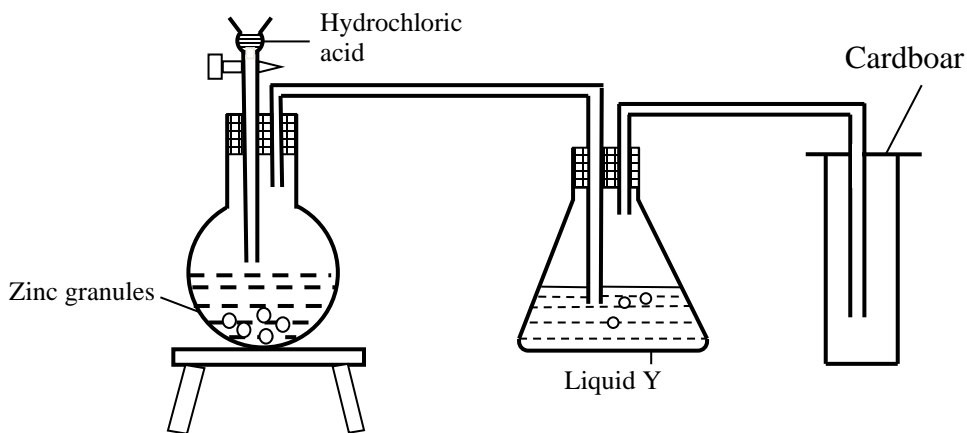
(i) Diamond is used in drilling of hard rocks.

*(1 Mark)*

(ii) Graphite is a lubricant.

*(1 Mark)*

25. The set up was used to prepare dry hydrogen gas. Study it and answer the questions that follow.



(i) Is set-up used to prepare the gas correct? Give reason.

**(1 Mark)**

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(ii) What would be liquid Y? **(1 mark)**

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(iii) Give two physical properties of hydrogen gas

**(1 Mark)**

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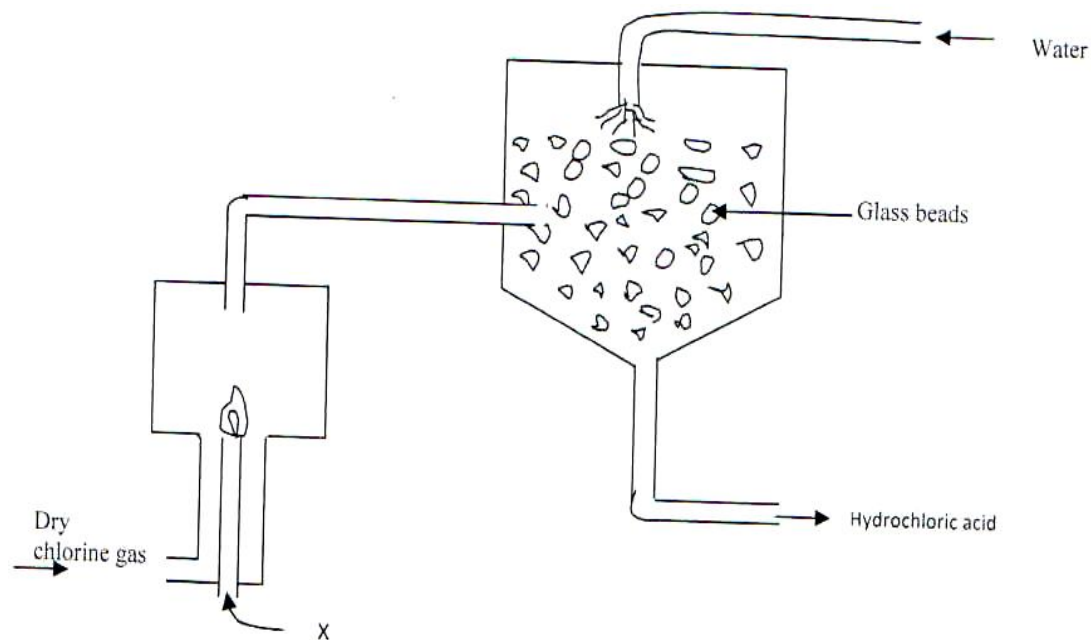
26. Given element W has atomic number 14 and consists of isotopes as shown below.

Isotope	A	B	C
Isotope mass	28	29	30

Percentage abundance                      92.2   4.7   3.1  
Determine the relative atomic mass of W

(2 Marks)

27. The diagram below represents a set up used for the large scale manufacture of hydrochloric acid.



(a) Name substance X

(1Mark)

(b) What is the purpose of the glass beads?

(1 Mark)

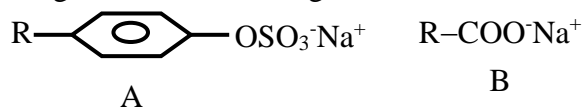
(c) Give one use of hydrochloric acid

(1Mark)

28. A mixture contains Iron (III) Chloride, calcium chloride and iron filings. Describe how one can separate and recover the substances in the mixture.(3marks)

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29. The structure below represents two cleansing agents A and B. Which cleansing agent would be suitable for washing in water containing calcium chloride? Give a reason. (2marks)



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NAME \_\_\_\_\_ ADMNNO \_\_\_\_\_ CLASS \_\_\_\_\_

SCHOOL \_\_\_\_\_ DATE \_\_\_\_\_ SIGN \_\_\_\_\_

233/1

**CHEMISTRY PAPER 1 THEORY**

**TIME: 2 HOURS**

# KCSE TOP PREDICTION MASTER CYCLE 2

**Instructions to students**

- Write your name, Admission number, school and class in the space provided above.
- All working must be shown clearly in the space provided.
- Non programmable silent electronic calculators may be used.
- Students should check the questions paper to ascertain that all the pages are printed.
- Students should answer the questions in English.
- Answer **ALL** questions in the spaces provided.

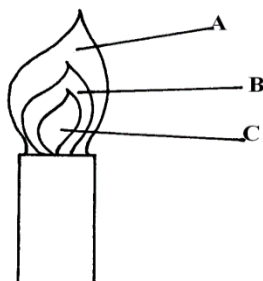
**FOR EXAMINERS USE ONLY**

QUESTION	MAXIMUM SCORE	CANDIDATES' SCORE
1-28	80	

1. Using reagents provided only, explain how you could prepare a salt of Zinc carbonate solid. Dilute nitric(v) acid, zinc, sodium carbonate (3mks)

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2. The diagram below shows a Bunsen burner when in use



Describe an experiment that would confirm that region labeled C is unsuitable for heating. (2mks)

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.....

3. a) On the grid provided sketch a graph of pressure against volume for fixed mass of a gas at constant temperature (1mk)



b) A fixed mass of a gas has a volume of  $250\text{cm}^3$  at  $27^\circ\text{C}$  and  $750\text{mmHg}$  pressure.

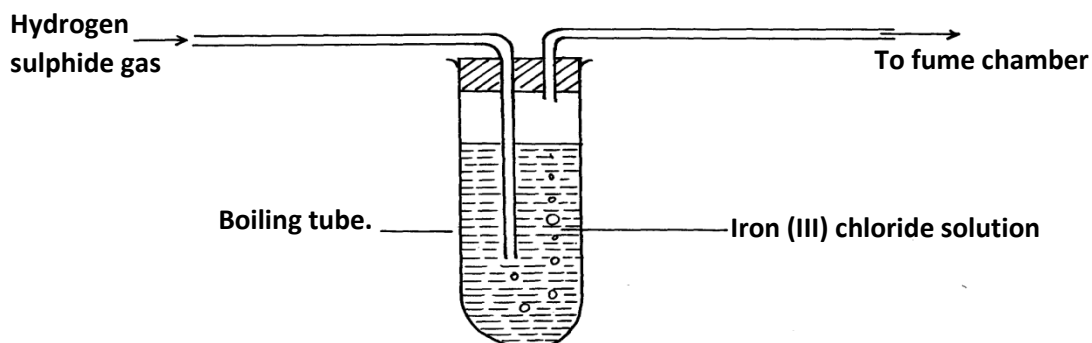
Calculate the gas volume that the gas would occupy at  $41^\circ\text{C}$  and  $750\text{mmHg}$  pressure. ( $0^\circ = 273\text{k}$ )

(2mks)

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4.  $22.2\text{cm}^3$  of sodium hydroxide solution containing  $4.0\text{g}$  per litre sodium hydroxide were required for complete neutralisation of  $0.1\text{g}$  of a dibasic acid. Calculate the relative formula mass of the dibasic acid. ( $\text{Na} = 23, \text{O} = 16, \text{H} = 1$ ) (3mks)

5. The diagram below represents a laboratory experiment to investigate the reaction between hydrogen - sulphide gas and an aqueous iron (III) chloride.



- a) Write chemical equation for the reaction which takes place in the boiling tube. (1mk)

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- b) What adjustment need to be made in the above set-up if the laboratory does not have a fume chamber. (1mk)

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- c) Describe a laboratory chemical test for a sample of hydrogen sulphide gas. (1mk)

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6. A group of compounds called chlorofluorocarbons have a wide range of uses but they have harmful effects on the environment. State and explain one harmful effect of chlorofluorocarbons on the environment. (2mks)

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7. X grams of a radioactive isotope takes 120 days to decay to 3.5 grams. The half-life period of the isotope is 20 days.

a) Calculate the initial mass of the isotope (2mks)

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b) State the application of radioactivity in agriculture. (1mk)

8. Sulphur and sodium belong to the same period on the periodic table. State and explain the difference in M.P of the oxide of sulphur and the oxide of sodium. (3mks)

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9. a) Water is an example of a polar solvent. What is a polar solvent? (1mk)

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b) Explain the following observations HCl gas dissolves in water to form an electrolyte, while the same chloride dissolves in methylbenzene to form a non-electrolyte (1mk)

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10. a) Define the term deposition (1mk)

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.....

b) Describe how you can obtain copper powder from a mixture containing copper and zinc powder. (2mks)

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11. a) Name the main ore from which iron is extracted. (1mk)

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.....

b) Name two substances that convert iron (III) oxide to iron in the blast furnace. (2mks)

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.....

12. a) Write an equation showing how boiling can remove temporary water hardness. (1mk)

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.....

b) Name one method that can be used to remove both temporarily and permanent water hardness. (1mk)

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c) Other than wastage of soap during cleaning, state one other disadvantage of hard water. *(1mk)*

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13. a) Name two pure allotropes of carbon. *(1mk)*

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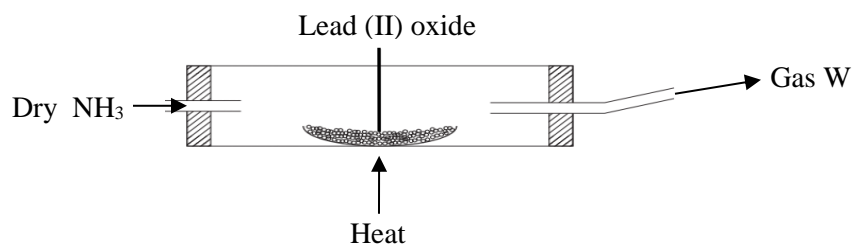
b) State and explain using relevant equations the observation made when carbon(IV) oxide is bubbled through calcium hydroxide solution for a long time. *(2mks)*

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14. When  $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$  is strongly heated it loses 63.2% of its mass. Determine the value of x in the compound (Na = 23, O = 16, H = 1) *(3mks)*

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15. Dry ammonia was passed over a heated lead(II) oxide in a combustion tube as shown



a) What observations would be made in the combustion tube (1mk)

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b) Write a chemical equation for the reaction in the combustion tube (1mk)

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.....

c) State one industrial use of ammonia (1mk)

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.....

16. An ion of P<sup>2+</sup> has a configuration of 2.8

a) Name the family to which P belong (1mk)

b) Compare the atomic and ionic radius of P. Explain (2mks)

17. a) Explain why alkanes are used as fuel (1mk)



.....  
.....

b) Draw the structure of the following compounds (2mks)  
i) 3-methylbut – 1 yne

ii) But – 2 –ene

18. a) Define solubility (1mk)

.....  
.....

b) Study the information in the table and answer the questions below

Salt	Solubility (g) 100g water	
	At 40 <sup>0</sup> C	At 60 <sup>0</sup> C
CUSO <sub>4</sub>	28	38
Pb(NO <sub>3</sub> ) <sub>2</sub>	79	98

i) Calculate the mass of CuSO<sub>4</sub> that would saturate 200g of water at 60<sup>0</sup>C (1mk)

.....  
.....

ii) A solution containing 80g of Pb(NO<sub>3</sub>)<sub>2</sub> in 100g of water at 60<sup>0</sup>C was cooled to 40<sup>0</sup>C.  
Calculate the mass of Pb(NO<sub>3</sub>)<sub>2</sub> that crystallized (1mk)

.....  
.....

19. Dilute hydrochloric acid was added to a compound Z of copper. The solid reacted with the acid to form a colourless gas which formed a white precipitate when bubbled through lime water.

a) Name solid Z

..... (1mk)

b) State the observation that would be made if a similar compound of lead is used.  
Explain. (2mks)

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20. a) Explain why the reactivity of group(VII) elements decrease down the group (2mks)

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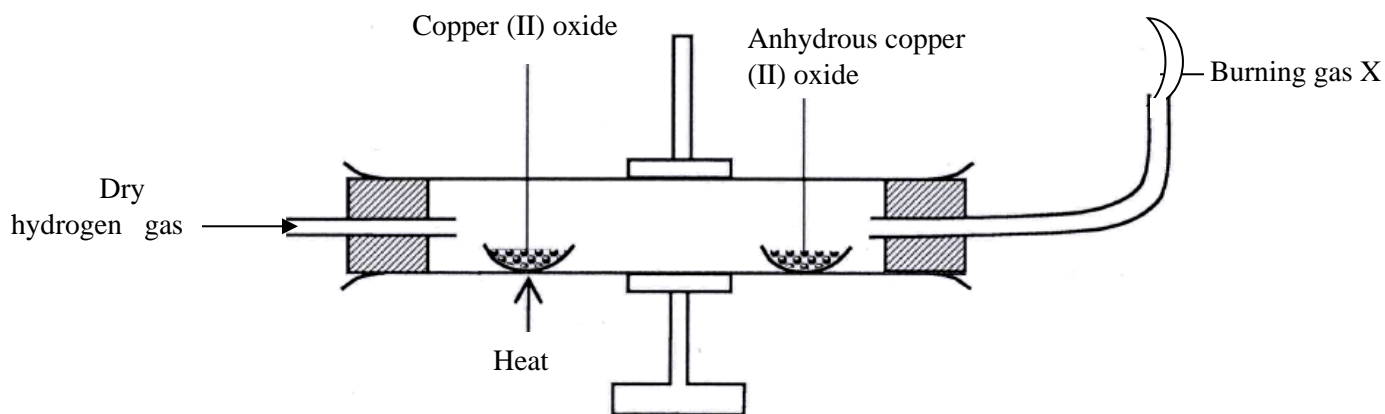
b) Moist blue litmus and dry blue litmus paper were introduced into gas jars of dry chlorine. State the observations that would be made. (1mk)

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21. a) Name the reagents that are commonly used in the preparation of hydrogen (1mk)

.....  
.....

b) Study the diagram below and answer the questions that follow



i) Name gas x (1mk)

.....

ii) State and explain the observation made in the anhydrous copper(II) sulphate after sometime (1mk)

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22. a) State two physical properties of sulphur (IV) oxide (1mk)

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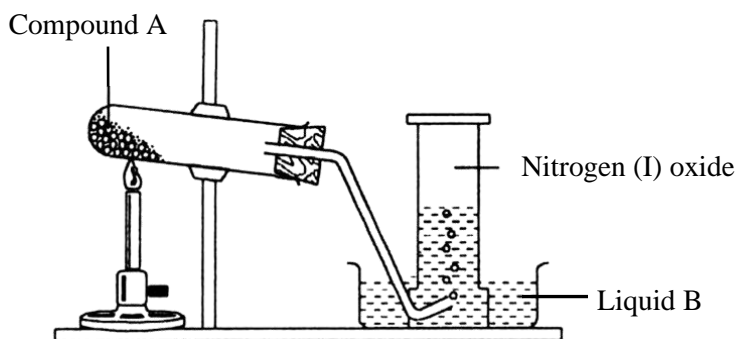
b) Explain why when sulphur (IV) oxide is bubbled into acidified potassium dichromate (VI) the solution changes colour from orange to green. Explain the observation (1mk)

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c) In the contact process of manufacture of sulphuric(VI) acid, explain how pollution by  $\text{SO}_2$  is reduced. *(1mk)*

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.....

23. Study the setup below and answer questions that follow



a) Name *(1mk)*

i) Compound A

.....

ii) Liquid B

.....

b) Why is the boiling tube tilted downwards *(1mk)*

.....

24. Explain why

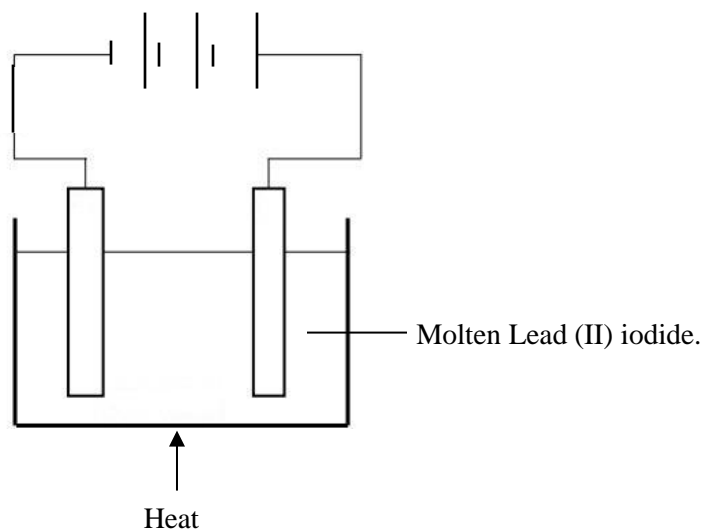
a) Aluminium is commonly used for making cooking pots and pans. *(1mk)*

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b) Silicon(IV) oxide is a poor conductor of heat and electricity *(1mk)*

.....  
.....

25. The set up below was used to show electrolysis in molten lead(II) iodide



- i) On the diagram label the cathode (1mk)
- ii) State the observation that was made at the anode during the electrolysis. Give a reason for your answer (2mks)

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26.  $100\text{cm}^3$  of carbon (II) oxide gas was reacted with  $100\text{cm}^3$  of oxygen. (All volume were measured under the same conditions of temple and pressure.

- a) Determine
  - i) Volume of the product formed (1mk)
  - ii) The gas which was in excess and by what volume (2mks)

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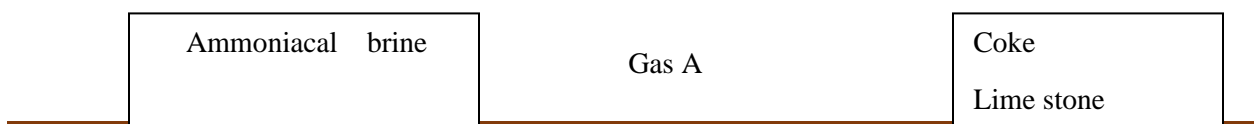
27. a) Using a dot(.) and cross(x) diagram of carbon(II) oxide, differentiate between a covalent and a co-ordinate bond (1mk)

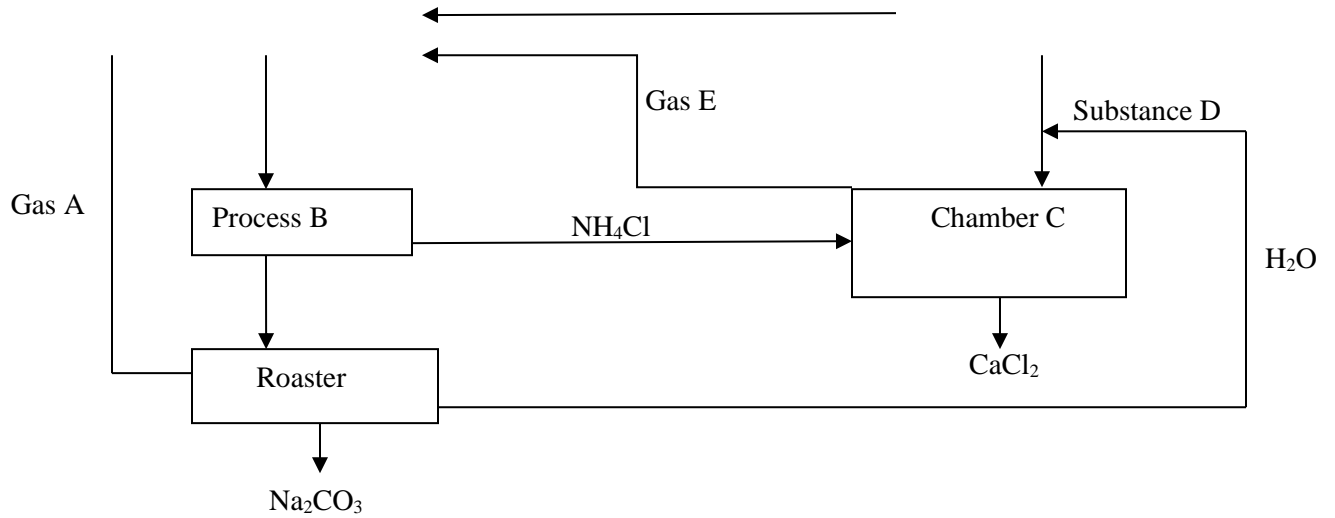
b) Use dot (.) and cross(x) diagrams to show bonding in between the elements represented by the following symbols.

(2mks)

i)  $\begin{matrix} 24 \\ X \\ 12 \end{matrix}$  and  $\begin{matrix} 19 \\ Y \\ 9 \end{matrix}$

28. Study the flow diagram below





a) Name

i) Gas A (1/2 mk)  
 .....

ii) Process B (1/2 mk)  
 .....

iii) Substance D (1/2 mk)  
 .....

iv) Gas E (1/2 mk)  
 .....

b) Write the equation for the reaction in chamber C (1mk)

.....  
 .....

NAME .....ADM NO .....

SCHOOL.....CANDIDATE'S SIGN.....

CLASS.....DATE.....

233/1  
CHEMISTRY  
PAPER 1  
(THEORY)  
JUNE-2022

TIME: 2 HOURS

CHEMISTRY  
PAPER 1  
(THEORY)  
TIME: 2 HOURS

## KCSE TOP PREDICTION MASTER CYCLE 3

### INSTRUCTION TO CANDIDATES

1. Write your name and Adm number in the spaces provided above
2. Sign and write the date of the examination in the spaces provided
3. Answer all the questions in the spaces provided
4. All working must be clearly shown where necessary.
5. **This paper consists of 11 printed pages**
6. **Candidates should check to ascertain that each page s printed as indicated and that no question is/are missing.**

### FOR EXAMINAER'S USE ONLY

Question	Maximum score	Candidate's score
1-28	80	



1. a) State Graham's law of diffusion. (1mk)

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.....  
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b) 50cm<sup>3</sup> of nitrogen (ii) oxide was allowed to diffuse through a porous membrane in 20 seconds.

Calculate the time taken by equal volume of carbon (ii) oxide to diffuse through the same membrane.

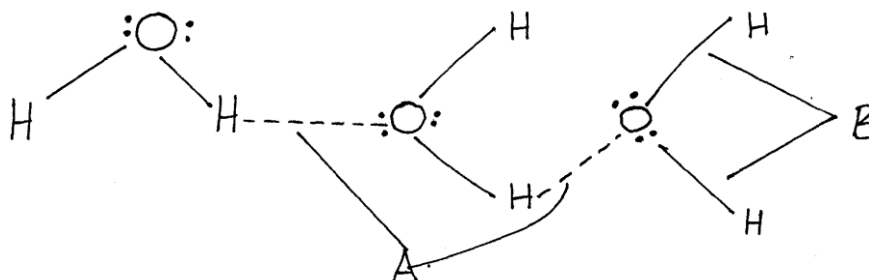
(C=12, N=14, O=16). (2mks)

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2. State two functions of a fume chamber in a laboratory. (2mks)

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3. The diagram below shows a structure of water molecule.



Name the bonds labelled. (2mks)

i) A

.....

ii) B

.....

4. Two samples of water were put in separate beakers. They were boiled for sometime and allowed to cool. Equal volumes of soap were added to each sample and stirred. Water in beaker C readily formed lather with soap while water in beaker D required more soap to lather.

i) Write the formula of one salt likely to be in water in beaker. (2mks)

.....

a) C

.....

b) D

.....

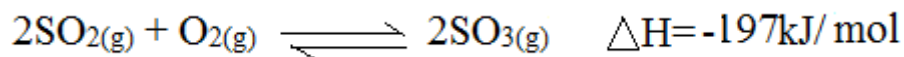
ii) Name one method that can be used to soften water in beaker D. (1mk)

.....  
.....

5. Describe how you would prepare lead (ii) sulphate given the following reagents: dilute nitric (v) acid, distilled water, sodium sulphate solid and lead metal. (3mks)

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.....

6. During manufacture of sulphuric (vi) acid, sulphur (iv) oxide is oxidised to sulphur (vi) oxide in the presence of vanadium oxide catalyst as shown below:



The reaction is carried out at a pressure of 3 atmospheres and a temperature of 450°C. State and explain the effect on the yield of sulphur (vi) oxide if the reaction is:

a) Carried out at 3 atmospheres and 600°C. (2mks)

.....  
.....  
.....

b) In absence of a catalyst. (2mks)

.....  
.....  
.....

7. a) Hydrogen gas was passed over 4.64g of an oxide of iron in a combustion tube until there was no further change. The mass of the final substance was found to be 3.36g. Determine the empirical formula of the oxide. (Fe=56, O= 16). (3mks)

.....  
.....  
.....  
.....  
.....

b) State the property of hydrogen demonstrated in the experiment above. (1mk)

.....  
.....

8. Atoms of element X exist as  $^{14}_6\text{X}$  and  $^{12}_6\text{X}$ .

a) What name is given to the two types of atoms? (1mk)

.....  
.....

b) Use dot (.) and (x) diagram to represent electrons draw the atomic structure of x. (2mks)

9. Hydrogen sulphide gas was passed through a solution of iron (ii) chloride.

i) State two observations made. (2mks)

.....  
.....  
.....  
.....

ii) Write an equation for the reaction taking place in (i) above. (1mk)

.....  
.....

10. Two clean iron nails of the same size were connected with wire to magnesium and silver stripes as shown.



State and explain the observation made on nail x and y if they were left in the open for 2 weeks. (2mks)

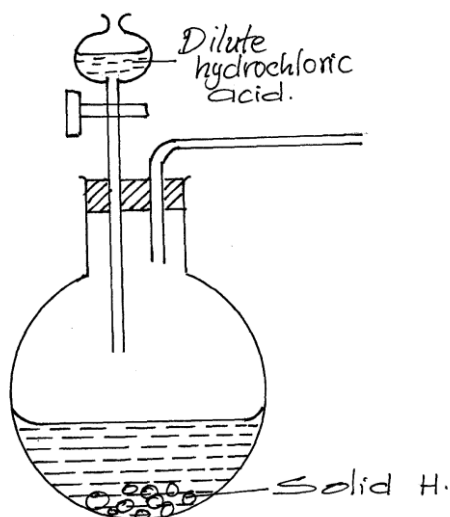
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11. The diagram below shows an incomplete setup used to prepare sulphur (iv) oxide in the laboratory.



a) Identify solid H. (1mk)

.....

b) Complete the set up above to show how dry sulphur (iv) oxide may be collected. (2mks)

12. Some average bond energies are given below.

Bond	Energy in kJ/MOL
C-C	348
C-H	414
Cl- Cl	243
H-Cl	340
C - Cl	432

Determine whether the reaction below is exothermic or endothermic.

(3mks)



.....

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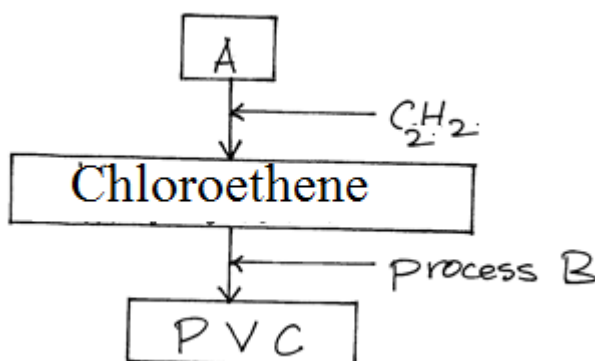
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13. Study the scheme below and answer questions that follow



a) Identify reagent A.

(1mk)

.....

b) Name process B

(1mk)

.....

c) What does PVC stand for?

(1mk)

.....

14. Ethanedioic acid ( $\text{H}_2\text{C}_2\text{O}_4$ ) is used instead of methanoic acid ( $\text{HCOOH}$ ) to prepare carbon (ii) oxide in the laboratory. It gives equal volume of carbon (ii) oxide and carbon (iv) oxide.

a) Write an equation for the dehydration of ethanedioic acid.

(1mk)

.....

.....

b) Explain how pure carbon (ii) oxide can be obtained from the mixture.

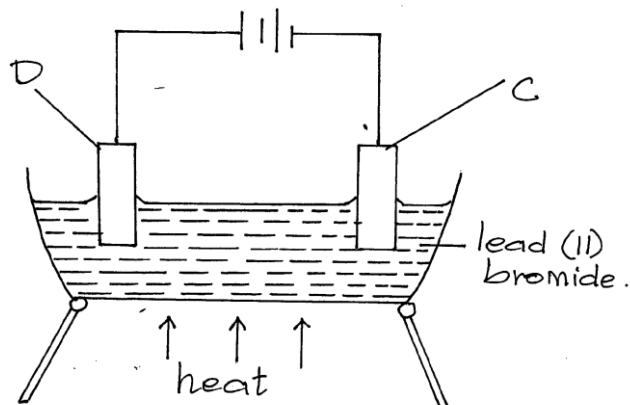
(2mks)

.....

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.....

15. The diagram below represents a set-up of apparatus used to investigate the effect of an electric current on lead (ii) bromide.



a) Describe the observation made at electrode C. (2mks)

.....

.....

.....

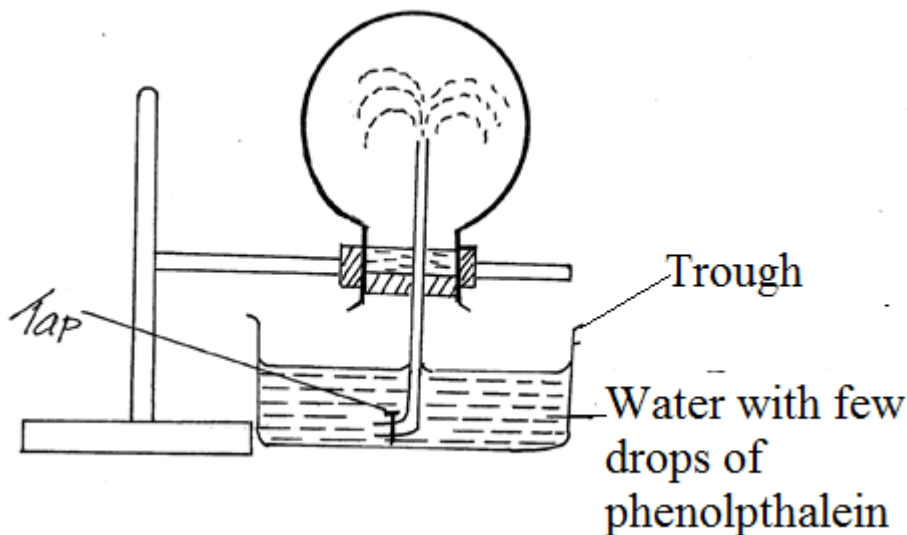
.....

b) State two applications of electrolysis. (1mk)

.....

.....

16. The set up below was used to investigate a property of ammonia gas.



i) What property of ammonia gas is being investigated? (1mk)

.....  
.....

ii) The experiment above is commonly known as ‘the fountain experiment’; explain. (2mks)

.....  
.....  
.....

iii) Identify another gas that may be used instead of ammonia gas. (1mk)

.....

17. Draw a well labelled diagram to show how crystals of sodium chloride can be obtained from sodium chloride solution. (3mks)

18. a) Define the term solubility. (1mk)

.....  
.....

b) 40g of a saturated solution yields 15g of salt when evaporated to dryness. Calculate the solubility of the salt. (2mks)

.....  
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19. Increased levels of carbon (ii) oxide leads to global warming. Give two reasons why the amount of carbon (iv) oxide in the atmosphere is increasing gradually. (2mks)

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20. Explain the observation made when a blue litmus paper is dipped in methylbenzene in which hydrogen chloride gas is bubbled through. (2mks)

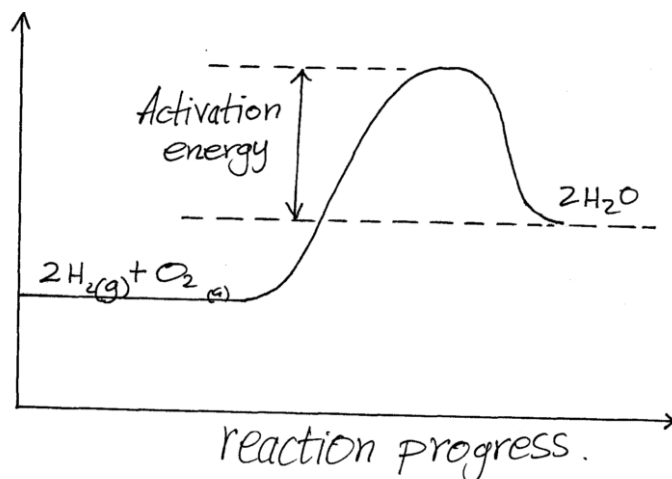
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21. The reaction between hydrogen gas and oxygen releases energy. A student drew the reaction profile for the reaction between hydrogen gas and oxygen gas.



State two errors made when drawing the reaction profile. (2mks)

.....

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22. Both water (18) and hydrogen sulphide (34) are molecular substances. However water has a higher boiling point than hydrogen sulphide. Explain. (2mks)

.....

.....

.....

.....



23. The grid below represents part of a periodic table. Study it and answer the questions that follow.

	E				A		X	
R				G			C	
					Q			

a) How do the atomic radii of R and G compare. (1mk)

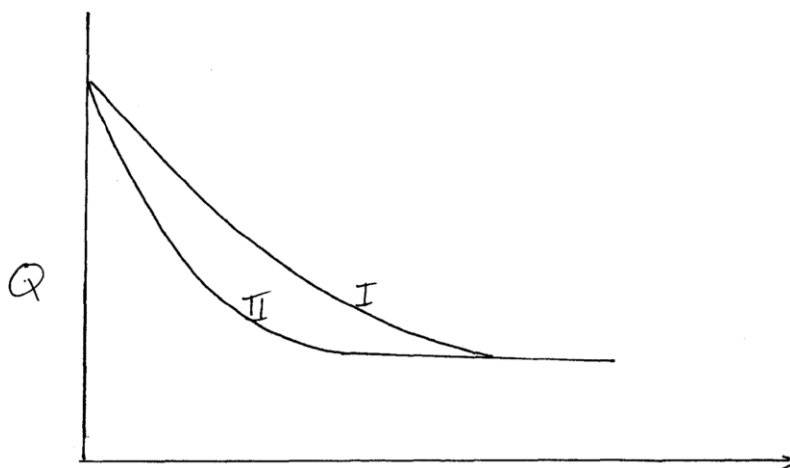
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b) How do the pH of the oxides of A and E compare. (1mk)

.....  
 .....

c) On the grid, indicate with a tick (✓) the position of K which is found on the third period and forms  $K^{3-}$  ions. (1mk)

24. The curves below were obtained when equal volumes of nitric (v) acid of same concentration were reacted with 25.0g of calcium carbonate, labelled Y. In one case, the acid was first warmed before the reaction.



a) Which curve represents the reaction involving warm nitric (v) acid? (1mk)

b) Sketch the curves obtained if the graph of the volume of  $CO_2$  produced against time were plotted. (NB: on the same axis) (2mks)

25. i) State two observations made when a small piece of potassium metal is put in a beaker full of water.

(2mks)

.....  
.....  
.....

ii) Name the group of the periodic table to which potassium belongs.

(1mk)

.....  
.....

26. When a hydrocarbon with formula  $C_xH_y$  burns in chlorine gas, black specks and a colourless gas are obtained.

a) To which homologous series does the hydrocarbon belong?

(1mk)

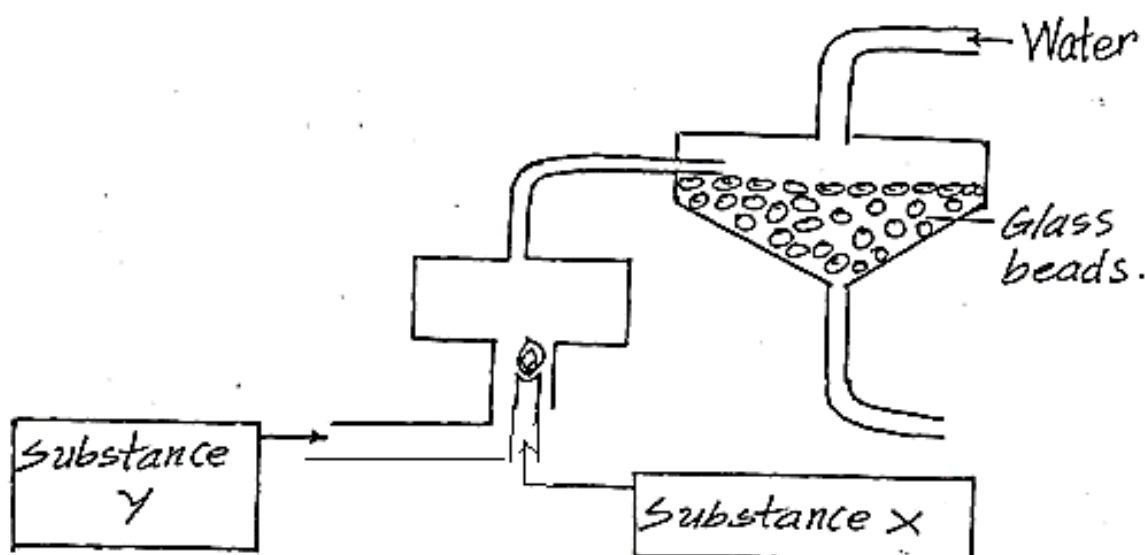
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b) Write the general equation for the reaction between the hydrocarbon and chlorine gas.

(1mk)

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.....  
.....

27. The diagram below represents a set up for large scale manufacture of hydrochloric acid. Study it and answer the questions that follow.



i) Name the substance X. (1mk)

.....  
.....

ii) What is the purpose of glass beads? (1mk)

.....  
.....

iii) Give one use of hydrochloric acid. (1mk)

.....

28. When 25cm<sup>3</sup> of 0.5M HCl is added to 25cm<sup>3</sup> of 0.5M NaOH, the temperature of the solution rose from 23<sup>0</sup>C to 26<sup>0</sup>C. Given that the density of the solution is 1g/cm<sup>3</sup> and its specific heat capacity is 4.2Jg<sup>-1</sup>k<sup>-1</sup>.

a) Determine the amount of heat evolved that caused the temperature to rise. (1mk)

.....  
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.....

b) Work out the molar enthalpy of neutralization for this reaction. (2mks)

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Name.....Adm No.....  
Class..... Date.....

**233/1**

**Chemistry**

**Paper 1**

**2 hours**

## **KCSE TOP PREDICTION MASTER CYCLE 4**

### **Instructions to candidates**

- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above
- (c) Answer **ALL** the questions in the spaces provided in the question paper
- (d) KNEC Mathematical tables and electronic calculators may be used for calculations
- (e) All working **MUST** be clearly shown where necessary
- (f) **This paper consists of 12 printed pages**
- (g) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing**
- (h) **Candidates should answer the questions in English**

### **FOR EXAMINER'S ONLY**

<b>QUESTION</b>	<b>MAXIMUM SCORE</b>	<b>CANDIDATES SCORE</b>
<b>1-28</b>	<b>80</b>	

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1. In the industrial preparation of oxygen, state:

(a) How dust particles are removed from air.

(1 mark)

.....

(b) Why carbon (IV) oxide is removed before the mixture is cooled to  $-25^{\circ}\text{C}$  (1 mark)

.....

.....

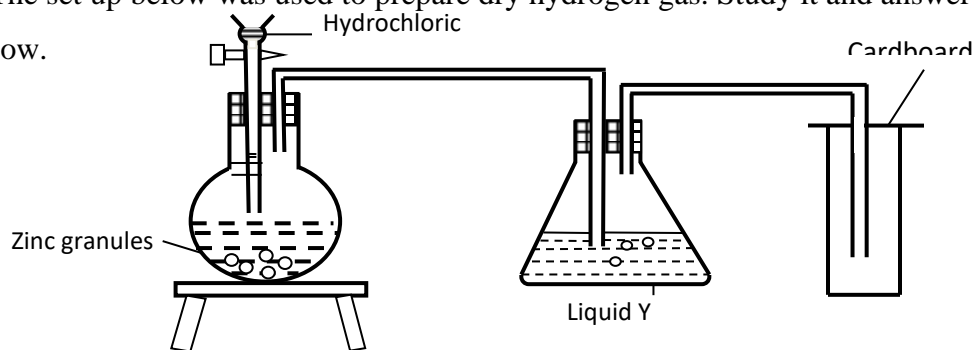
2. A form four student accidentally mixed Sodium Carbonate and Calcium Carbonate. Describe how he would obtain a dry sample of Sodium Carbonate from the mixture. (3 marks)

.....

.....

.....

3. The set up below was used to prepare dry hydrogen gas. Study it and answer the questions that follow.



(i) Identify a mistake in the set up

(1 mark)

.....

(ii) Write an equation for the reaction for the reaction that produces hydrogen gas (1 mark)

.....

(iii) State the chemical test for hydrogen

(1 mark)

.....

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4. When air is bubbled through pure water (pH 7), the pH drops to 6.0. Explain (2mks)

.....  
.....

5. Explain why iron III chloride is fairly soluble in methylbenzene while Magnesium chloride is insoluble. (2 mks)

.....  
.....

6. 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. (3marks)

.....  
.....  
.....

7.  $50\text{cm}^3$  of Carbon (IV) Oxide diffuses through a porous plate in 15 seconds. Calculate the time taken by  $75\text{cm}^3$  of Nitrogen (IV) Oxide to diffuse through the same plate under similar conditions. (C = 12, O = 16, N = 14) (2marks)

.....  
.....  
.....

8.(a). Carbon (IV) oxide is bubbled through Calcium hydroxide until there is no further change. Explain using equations the changes observed. (2 marks)

.....  
.....

(b) Explain why diamond is used in cutting of glass and drilling. (1 mark)

.....  
.....

9. Study the table for certain properties of substances A, B, C and D.

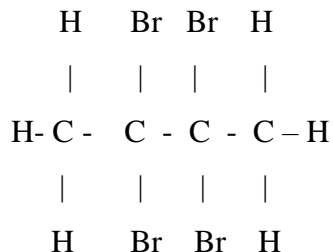
	Melting point $^{\circ}\text{C}$	Solubility in water	Electrical conduct
A	$-119^{\circ}\text{C}$	Soluble	Solution does not conduct
B	$1020^{\circ}\text{C}$	Soluble	Solution conducts
C	$1740^{\circ}\text{C}$	Insoluble	Doesn't not conduct
D	$1600^{\circ}\text{C}$	Insoluble	Conducts at room temperature

Which of the substances A, B, C and D: (4 mks)

(i) Is a metal .....

- (ii) Has a simple molecular structure.....
- (iii) Has a giant ionic structure.....
- (iv) Has a giant covalent structure.....

10. A compound G reacts with 2 moles of bromine to form another compound whose structural formula is.



i) What is the formula and name of compound G (2 marks)

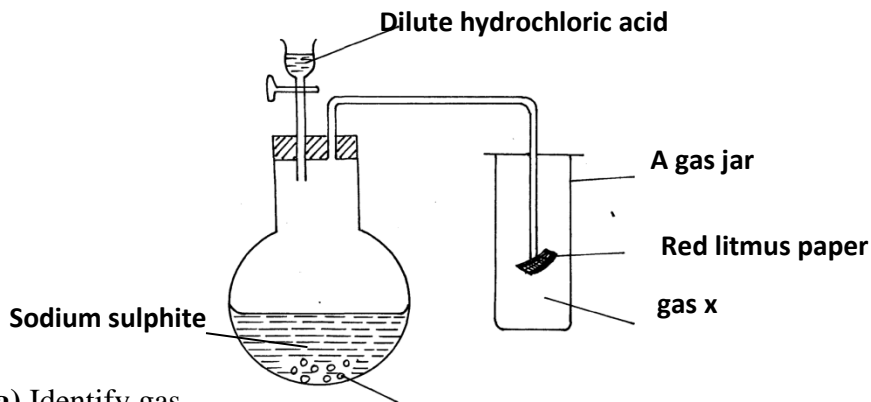
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ii) State the observations made when acidified potassium chromate (VI) is added to compound G (1 mark)

.....

11. Study the set-up below and answer the questions that follow



(a) Identify gas (1 mark)

.....

(b) Write an equation for the reaction that produces gas x. (1 mark)

.....

(c) What is the effect of the gas x above on the red-litmus paper (1 mark)

.....

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(d) State and explain two observations made when hydrogen sulphide is bubbled through a solution containing iron (III) chloride. (2mks)

.....

12. Aluminium (III) chloride sublimes. Explain why this is possible. (2mks)

.....

.....

.....

13. The table below shows the solubility of a substance at various temperatures. Study it and answer the questions that follow.

Temperature ( $^{\circ}\text{C}$ )	Solubility in g/100g of water
0	36
40	30
80	25
110	20

(a) What is the meaning of solubility? (1 mark)

.....

(b) What is the physical state of the substance? (1 mark)

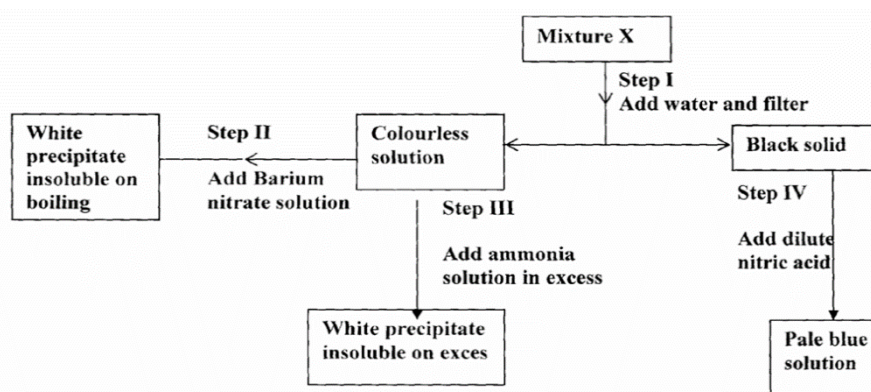
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(c) State and explain what would happen if a sample of a saturated solution of the substance at  $40^{\circ}\text{C}$  was heated to  $110^{\circ}\text{C}$ . (1 mark)

.....

.....

14. Study the chart below and answer the questions that follow.



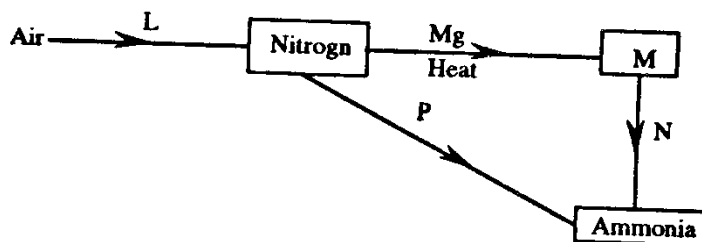
(a) Name:

(i) Cations present in mixture X. (1mark)

(ii) Anions present in the solution. (1mark)

(b) Write an equation to show how the white precipitate in step III is formed. (1mark)

15. Study the diagram below and answer the questions



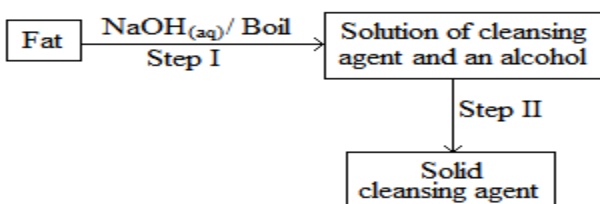
(i) What is the process involved in step L (1mark)

(ii) Explain how process N and P can be affected (2marks)

N.....

P.....

16. The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follow.



(i) Given to the type of cleansing agent prepared by the method above? (1 mark)

(ii) Name one chemical substance added in step II (1 mark)

(iii) What is the purpose of adding the chemical substance named in c (ii) above? (1 mark)

17. Nitrates of metals A, B, C were heated and the products of the reactions recorded in the table below.

Nitrate of metal	Products
A	Metal nitrate and oxygen
B	Free metal, nitrogen (IV) Oxide and oxygen gas
C	Metal oxide, nitrogen (IV) oxide and oxygen gas

a) Name two possible identities of metal A. *(1mk)*

.....  
 .....

b) Name the two possible identity of metal B *(1mk)*

.....  
 .....

c) Calcium nitrate is one of the nitrate which forms the products in C. Using chemical equation show how the products are formed. *(1mk)*

18. State and explain what happens to the masses of the following substances when they are separately heated in open crucibles ; *(3mks)*

(i)copper metal

.....

(ii) Sulphurpowder

.....  
 .....

19.The table below gives the first ionization energies of the alkali metals.

Element	1 <sup>st</sup> ionization energy kJ mol <sup>-1</sup>
A	494
B	418
C	519

a) Define the term ionization energy. *(1mk)*

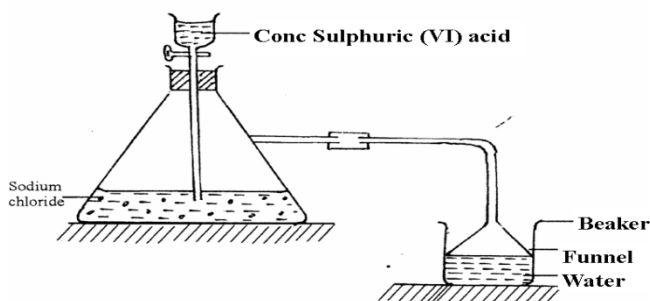
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b) Which of the three metals is the least reactive? Give a reason. *(2mks)*

.....  
 .....

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20. Study the set-up below and answer questions that follow.



i) Name the gas that is produced when concentrated sulphuric (VI) acid reacts with the Sodium chloride (1 mark)

.....

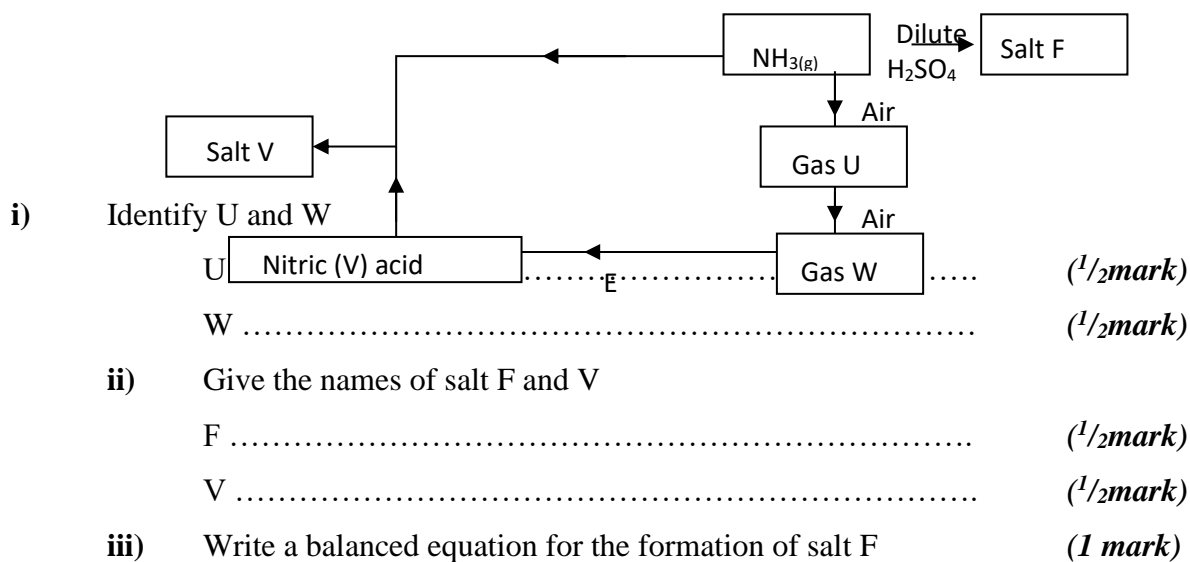
ii) Why is it necessary to use a funnel in the beaker? (1 mark)

.....

iii) How does the gas affect the P<sup>H</sup> of the water in the beaker? (1 mark)

.....

21. The flow chart/diagram below outlines a method of preparing a fertilizer



22.(a) Draw a dot (•) and a cross (x) diagram to show bonding in Cl<sub>2</sub>O. (1 mark)

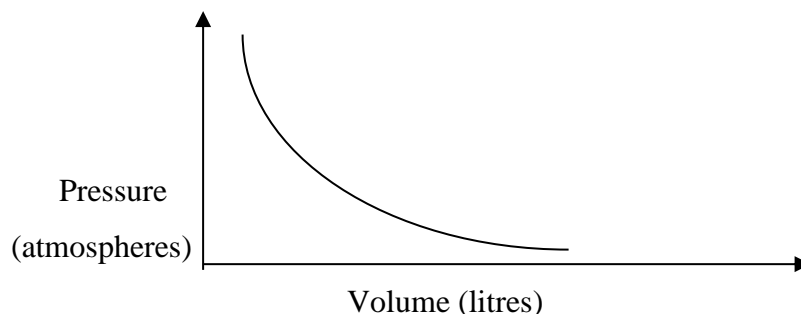
b) Explain why the compound  $\text{Cl}_2\text{O}$  has a very low melting and boiling point. (1 mark)

.....  
.....  
23. Ethene reacts with oxygen according to the equation.



15.0 cm<sup>3</sup> of ethene were mixed with 50cm<sup>3</sup> of oxygen and mixture was sparked to complete the reaction. If all the volumes were measured at a pressure of one atmosphere and 25<sup>0</sup>C. Calculate the volume of resulting gaseous mixture. (3 marks)

.....  
.....  
24. The graph below shows the behavior of a fixed mass of a gas at constant temperature.



(a) What is the relationship between the volume and the pressure of the gas? (1 mark)

.....  
.....  
(b) 3 litres of oxygen gas at 1atm atmosphere pressure were compressed to 2atm at constant temperature. Calculate the volume occupied by the oxygen gas. (2marks)

.....  
.....  
25. Temporary water hardness can be removed by boiling

(a) What is hard water. (1 mark)

.....  
.....  
(b) Write a chemical equation to show how temporary hardness is removed by boiling. (1 mark)

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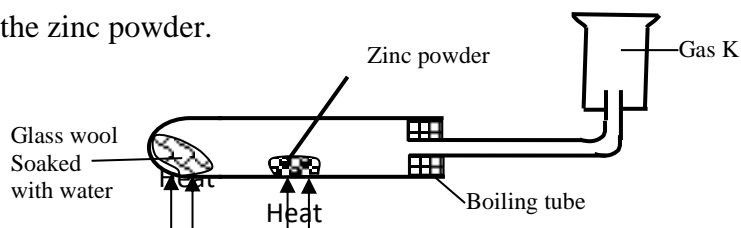
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.....  
(c) State **one** advantage of hard water.

(1 mark)

.....  
26. A student set-up the experiment below to collect gas K. The glass wool was heated before heating the zinc powder.

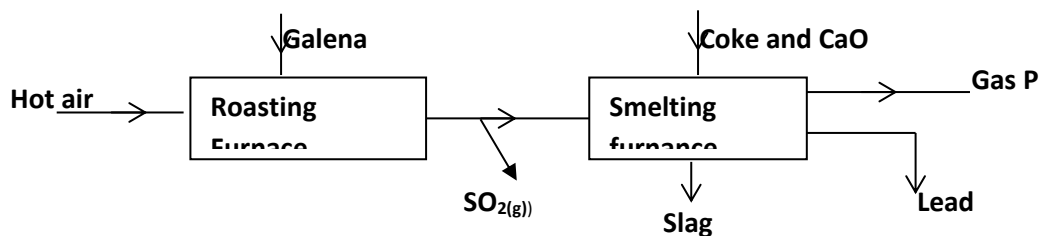


(a) Why was it necessary to heat the moist glass wool before heating the zinc powder? (1 mark)

.....  
(b) What observation was made in the boiling tube.

(1 mark)

.....  
27. During the extraction of lead from its ores one of the main ore used is Galena



(i) Write an equation for the reaction in roasting furnace.

(1 mark)

.....  
(ii) Name gas P

(1 mark)

.....  
(iii) State **one** use of lead metal.

(1 mark)

.....  
28. The empirical formula of a compound is CH<sub>2</sub> and it has a molecular mass of 42.

(a) What is the molecular formula of this compound?

(1 mark)

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.....  
(b) Write the general formula of the homologous series to which the compound belongs.

*(1mk)*

.....  
(c) Draw the structural formula of the third member of this series and give its IUPAC name.

*(1mark)*

.....  
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School: \_\_\_\_\_ Candidate's Sign \_\_\_\_\_

Date: \_\_\_\_\_

233/1  
CHEMISTRY  
Paper 1  
THEORY

## KCSE TOP PREDICTION MASTER CYCLE 5

**Instructions to candidates:**

- Write your **Name** and **Index Number** in the spaces provided.
- Sign and write the date of examination in the spaces provided above.
- Answer **ALL** questions in spaces provided.
- **ALL** working must be shown clearly where necessary.
- Mathematical tables and silent non-programmable calculators may be used.

**For Examiner's Use Only**

Questions	Maximum Score	Candidate's Score
1 -30	80	



1. (a) Draw a labeled diagram showing the structure of  ${}_{13}^{27}\text{Al}^{3+}$  ion (2 marks)

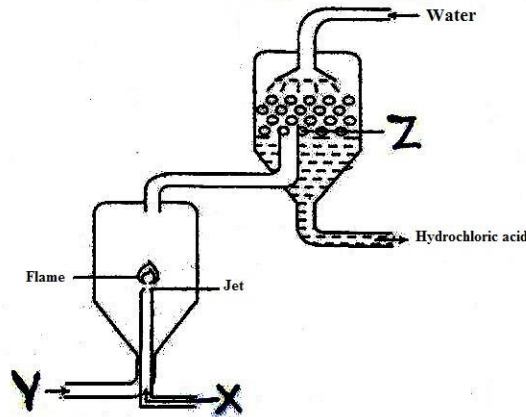
(b) Explain why the atom is said to be electricity neutral. (1 mark)

.....  
.....

2. Explain why luminous flame is yellow and sooty. (2 marks)

.....  
.....  
.....

3. The diagrams below represent a simplified industrial process for manufacturing hydrochloric acid. Study it and answer the question that follows.



a) Give two sources of substance X (1 mark)

.....  
.....  
State the role of the substance labeled Z. **(1 mark)**

.....  
.....  
b) State two uses of dilute hydrochloric acid. **(1 mark)**

.....  
.....  
4. During laboratory preparation of oxygen reagent H is added to Sodium Peroxide.  
a) Name the equation for the reaction that takes place. **(1 mark)**

.....  
.....  
b) Write the equation for the reaction that takes place. **(1 mark)**

.....  
.....  
c) Name a gas that is mixed with oxygen to be used in welding. **(1 mark)**

.....  
.....  
5. The elements fluorine, Chlorine, Bromine and Iodine belong to group (VII). Select the element with lowest melting point, Give a reason. **(2 marks)**

.....  
.....  
6. Starting with magnesium granules, describe how you can suitably obtain magnesium hydroxide solid. **(3 marks)**

.....  
.....  
7. Aqueous Copper (II) Sulphate was electrolyzed using graphite electrodes.  
a) How does PH of the electrolyte change during electrolysis? **(1 mark)**

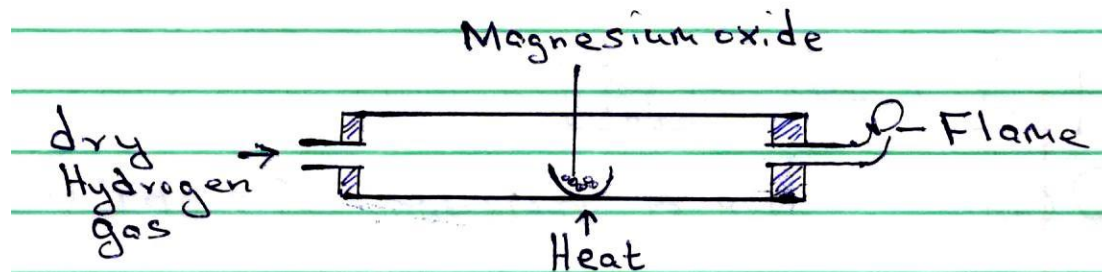
.....  
.....  
Write the cathode equation.

**(1 mark)**

.....  
.....  
b) The experiment was repeated using copper electrodes. Write the anode equation.

**(1 mark)**

.....  
.....  
8. In an experiment, dry hydrogen gas was passed Overheated magnesium oxide as shown in the diagram below.



a) State and explain the observations made in the combustion tube.

**(1 mark)**

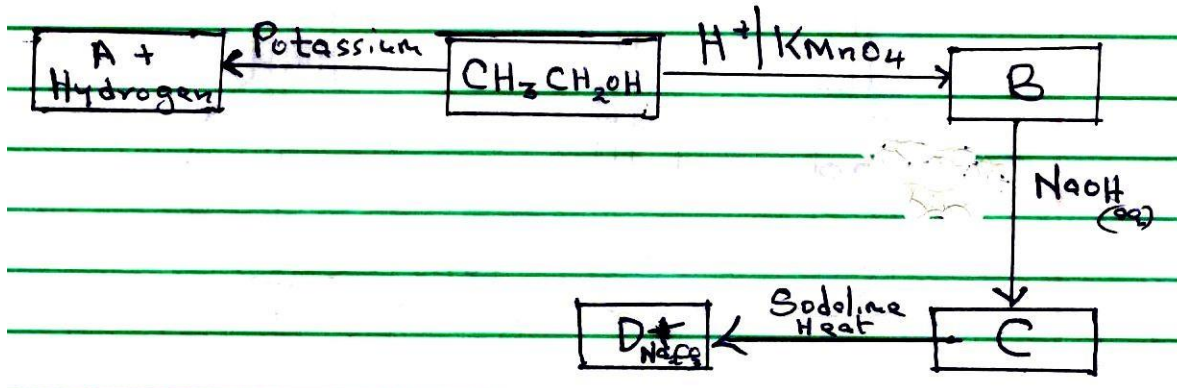
.....  
.....  
b) The experiment was repeated using Lead (II) oxide. State the observations made in the combustion tube.

**(1 mark)**

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.....  
9. Explain why an increase in temperature increases the rate of a reaction. **(2 marks)**

.....  
.....  
10g of an oxide of Sodium contains 5.9g of sodium. Its molar mass is 78. Determine its molecular formula. (Na = 23, O = 16) **(3 marks)**

10. Study the flow chart below and answer the questions that follow:



a) Identify substance B and C (1 mark)

b) Name and draw the structure of substance A (1 mark)

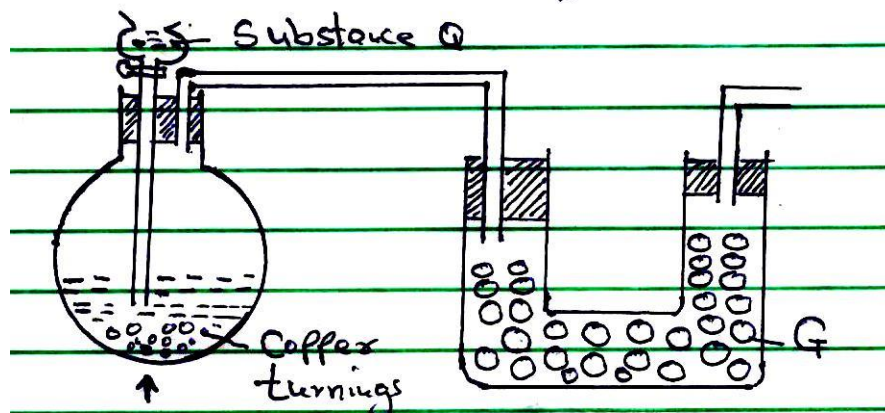
c) Write the equation for the reaction that occur when D react with excess Bromine gas in presence of sunlight. (1 mark)

11. A piece of sodium metal was placed in a beaker containing pure water.

a) Write the equation for the reaction that occurs. (1 mark)

b) Using oxidation numbers show that the reaction in (a) above is redox. (2 marks)

12. (a) The set up in the figure below can be used to prepare dry nitrogen (iv) oxide. Use it to answer the questions that follow.



(i) Name the substance G and Q (1 mark)

.....  
 .....  
 .....

(ii) Complete the set up to show how nitrogen (iv) oxide is exposed to air. (1 mark)

(b) State the observation made when a gas jar containing nitrogen (II) oxide is exposed to air. (1 mark)

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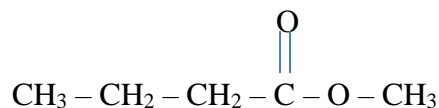
13. The table below shows ammeter readings recorded when 2M potassium hydroxide and 2M aqueous ammonia were tested separately.

Electrolyte	Current (A)
2M Potassium Hydroxide	8.1
2M Ammonia	2.5

Explain the difference in the ammeter readings. (2 marks)

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14. Compound H has the following structure



a) Give the name of the compound H. (1 mark)

.....

b) In which group of compounds does H belong? (1 mark)

.....

c) Name the reagents that were used to prepare compound H. (1 mark)

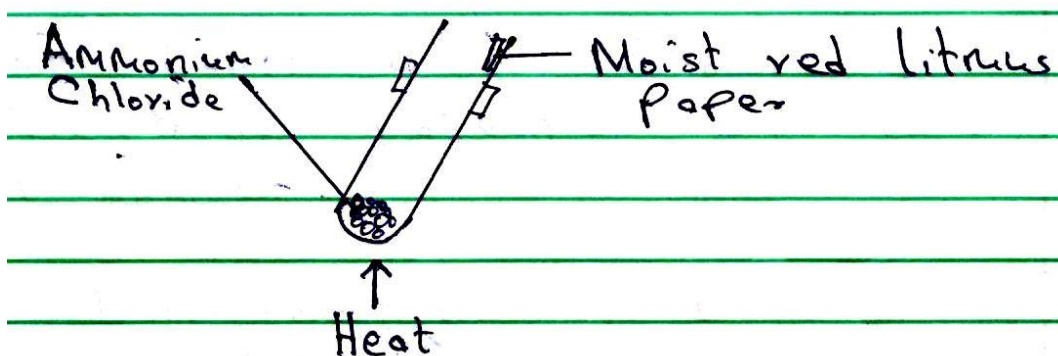
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15. (a) State Boyle's law. (1 mark)

.....

.....

(b) Study the set up below and answer the questions that follow.



State and explain the observations made. (2 marks)

.....

.....

16. Draw a well labeled diagram that can be used to electroplate iron spoon with silver. (3 marks)

17. 2g of sodium hydroxide is added to 40cm<sup>3</sup> of 1M sulphuric (vi) acid. What volume of 0.1M potassium hydroxide solution will be needed to neutralize the excess acid?  
(Na = 23.0 O = 16.0 H = 1.0) (3 marks)

18. (a) Explain why it is not advisable to prepare a sample of carbon (iv) oxide using calcium carbonate and dilute sulphuric (vi) acid. (2 marks)

.....  
 .....

- (b) Give one use of coke. (1 mark)

.....  
 .....

19. The table below shows the standard electrode potentials of the elements P and Q.

Half reactions	E°V
$P^{2+}_{(aq)} + 2e \longrightarrow P_{(s)}$	-0.44
$Q^{2+}_{(aq)} + 2e \longrightarrow Q_{(s)}$	-2.37

Use the information to predict whether the reaction represented below can take place. (2 marks)



20. The table below shows the atomic numbers and electron affinities of three elements. The letters are not actual chemical symbols. Use it to answer the questions that follow.

Element	Atomic number	Electron Affinity kJ/mol
A	17	-349 kJ/mol
B	35	-325 kJ/mol
C	53	-295kJ?mol

- a) What is electron affinity? (1 mark)

b) Explain the trend in electron affinity from A to C. (2 marks)

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21. A sample of herbicide in solution form is suspected to contain Lead (II) ions. Describe how the presence of Lead (II) ions can be established. (2 marks)

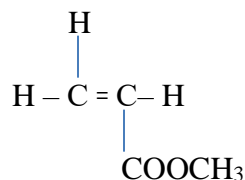
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22. A monomer has the following structure.

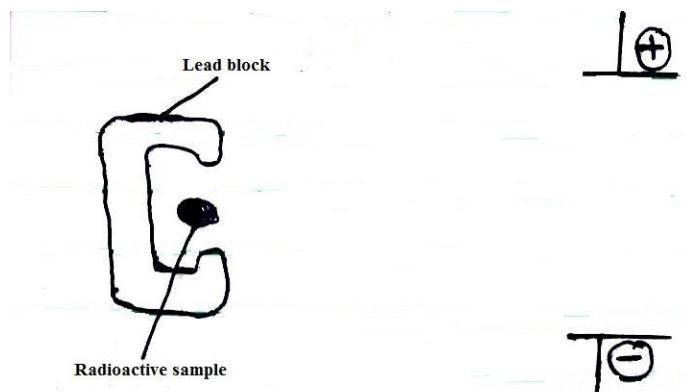


a) Draw the structure of the polymer that contain three monomers. (1 mark)

b) A sample of the polymer formed from the monomer has a molecular mass of 7740. Determine the number of monomers that formed the polymer. 2 marks)  
(C = 12.0 H = 1.0 O = 16.0)

23. (a) The figure below is an incomplete diagram that can be used to illustrate how alpha, beta and gamma radiations can be distinguished from each other





Complete the diagram above (1½ marks)

(b) Radioactive decay of  $^{212}_{82}\text{Pb}$  gives  $^{212}_{83}\text{Bi}$ , gamma radiations and X.

(i) Identify X. (½ mark)

(ii) Write a nuclear equation for the decay. (1 mark)

24. A small amount of sulphur was burnt in a deflagrating spoon. The burning sulphur was then lowered into a gas jar full of oxygen.

a) The product formed is dissolved in water. Suggest the PH of the resulting solution. Give a reason. (1 mark)

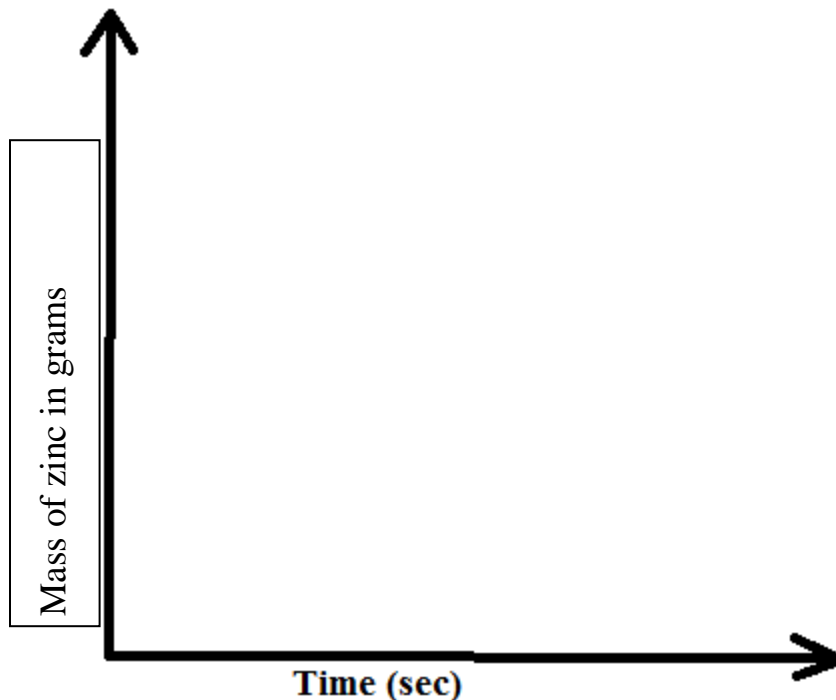
b) Explain the observation made when pink flower is immediately dropped in the solution obtained in (a) above. (2 marks)

25. The table below gives three experiment on the reaction of excess dilute hydrochloric acid and 0.5g of zinc done under different conditions. In each the change in mass of the reactant was recorded at different time intervals.

Experiment	Forms od Zinc	Hydrochloric acid
I	Powder	0.6M
II	Granules	0.6M

III	Powder	1M
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On the axis below, draw and label the three curves that could be obtained from such results. *(3 marks)*

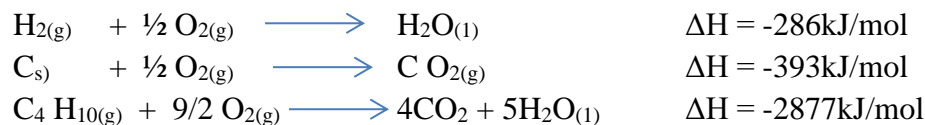


26. The relative atomic mass of an element is 10.28, it has two isotopes  $^{10}\text{R}$  and  $^{11}\text{R}$ . Calculate the relative abundance of each isotope. *(2 marks)*

27. (a) Define the standard enthalpy of formation of a substance. *(1 mark)*

.....  
 .....

(b) Use the thermochemical equations below to answer the questions that follow.



(i) Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion of its constituent elements. **(2 marks)**

(ii) Calculate the heat of formation of butane. **(1 mark)**

28. Name an appropriate apparatus that can be used to measure 29.3cm<sup>3</sup> of 0.1M sodium hydroxide solution in the laboratory. **(1 mark)**

---

29. Copper is mostly extracted from copper pyrite.

a) Give the chemical formula of copper pyrite. **(1 mark)**

.....  
 .....

b) State the role of silica that is added during extraction of copper from copper pyrite. **(1 mark)**

.....  
 .....

# KCSE TOP PREDICTION MASTER CYCLE 6

Name: ..... Admission No: .....

Candidate's Signature: ..... Date: .....

## CHEMISTRY

### PAPER 1 (233/1)

Time: 2 Hours

### INSTRUCTIONS TO CANDIDATES

- Write your *Name*, *Index Number* and *School* in the spaces provided above.
- Answer *all* the questions in the spaces provided after each question.
- *KNEC* Mathematical tables and *silent non-programmable* electronic calculators may be used.
- *ALL* working *must* be clearly shown where necessary.
- Candidate should *check* the question paper to ascertain that *all* the pages are printed and that no questions are missing.
- Candidates should answer the questions in **English**.

### FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1 – 29	80	

*This paper consists of 13 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*

**1** (a) Give the name of the first member of the alkyne homologous series *(1 mark)*

.....

(b) Describe a chemical test that can be used to distinguish ethanol from ethanoic acid. *(2 marks)*

.....

.....

.....

**2** (a) Name the raw material from which aluminium is extracted *(1 mark)*

.....

(b) Give a reason why aluminium is extracted using electrolysis. *(1 mark)*

.....

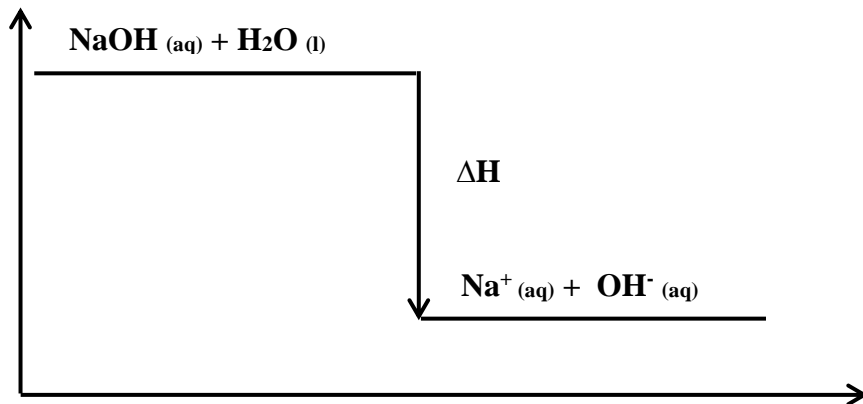
(c) Give **one** use of aluminium metal. *(1 mark)*

.....

**3** (a) What is meant by lattice energy? *(1 mark)*

.....

(b) Study the energy level diagram below and answer the question that follows:



What type of reaction is represented by the diagram? (1 mark)

.....

4 (a) Sketch a graphical representation of Boyles law on the axes below. (1 mark)



(b) A gas occupies 400 cm<sup>3</sup> at 25°C and 100,000 Pa. What will be its volume at 27°C and 101325 Pa? (2 marks)

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 .....  
 .....

.....  
**5** (a) What is half- life? **(1 mark)**

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.....  
.....  
(b) The half-life of protactinium - 234 is 1.17 minutes. Determine the mass that decays in 5.85 minutes starting with 100 g of the sample. **(2 marks)**

.....  
**6** State **two** disadvantages of hard water. **(2 marks)**

.....  
**7** Hydrogen chloride gas can be prepared by reacting sodium chloride with an acid.

(a) Name the acid. **(1 mark)**

.....  
(a) Write an equation for the reaction between sodium chloride and the acid. **(1 mark)**

.....  
(c) State **two** uses of hydrogen chloride. **(1 mark)**

.....  
.....

8 When solid **B** was heated strongly, it gave off water and a solid residue. When water was added to the solid residue, the original solid **B**, was formed.

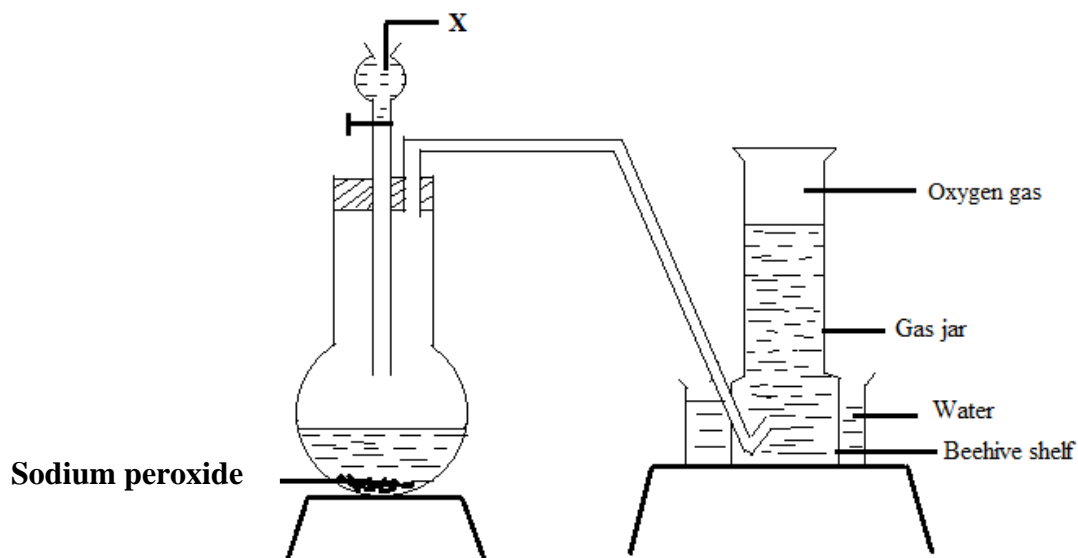
(a) What name is given to the process described? (1 mark)

.....  
.....

(b) Give **one** example of solid **A**. (1 mark)

.....  
.....

9 The set up below can be used to prepare oxygen gas. Study it and answer the questions that follow.





(a) Identify **X**. (1 mark)

.....

(c) Write the equation for the reaction which occurs in the flask. (1 mark)

.....

(d) State **one** use of oxygen other than in welding (1 mark)

.....

**10** The atomic number of an element, **M** is 13.

(a) Write the electronic configuration of the ion **M<sup>3+</sup>**. (1 mark)

.....

(b) Write the formula of the chloride of **M**. (1 mark)

.....

.....

(c) State the structure of the compound formed in (b) above (1 mark)

.....

**11** Concentrated sodium chloride was electrolysed using graphite electrodes. Name the product formed at the anode and give a reason for your answer. (2 marks)

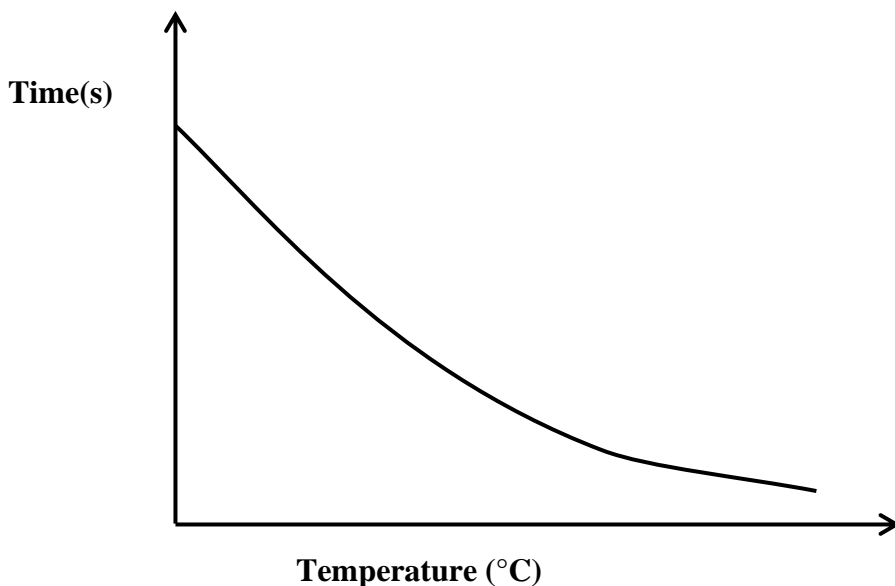
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**12** The curve shown below shows the variation of time against temperature for the reaction between sodium thiosulphate and hydrochloric acid.



(a) Explain the shape of the curve. (2 marks)

.....

.....

.....

(b) Other than temperature name **one** factor that affects the rate of reaction. (1 mark)

.....

**13** (a) Dry ammonia was passed over heated copper (II) oxide in a combustion tube.

(i) State the observations made in the tube (1 mark)

.....

(ii) Write an equation for the reaction that occurs. (1 mark)

- .....
- (b) What products would be formed if red hot platinum is introduced into a mixture of ammonia and oxygen? *(1 mark)*
- .....

**14** The table below shows behaviour of metals P, Q, R and S. Study it and answer the questions that follow:

<b>Metal</b>	<b>Appearance on exposure to air</b>	<b>Reaction with water</b>	<b>Reaction with dilute sulphuric (VI) acid</b>
<b>P</b>	Remains the same	Doesn't react	Reacts moderately
<b>Q</b>	Remains the same	No reaction	Doesn't react
<b>R</b>	Slowly tarnishes	Slow	Vigorous
<b>S</b>	Slowly turns white	Vigorous	Violent

- (a) Arrange the metals in the order of reactivity starting with the most reactive. *(2 marks)*
- .....
- .....

- (b) Name a metal which is likely to be **R** *(1 mark)*
- .....
- .....

15 Given the following substances: sodium carbonate, orange juice and sodium bromide.

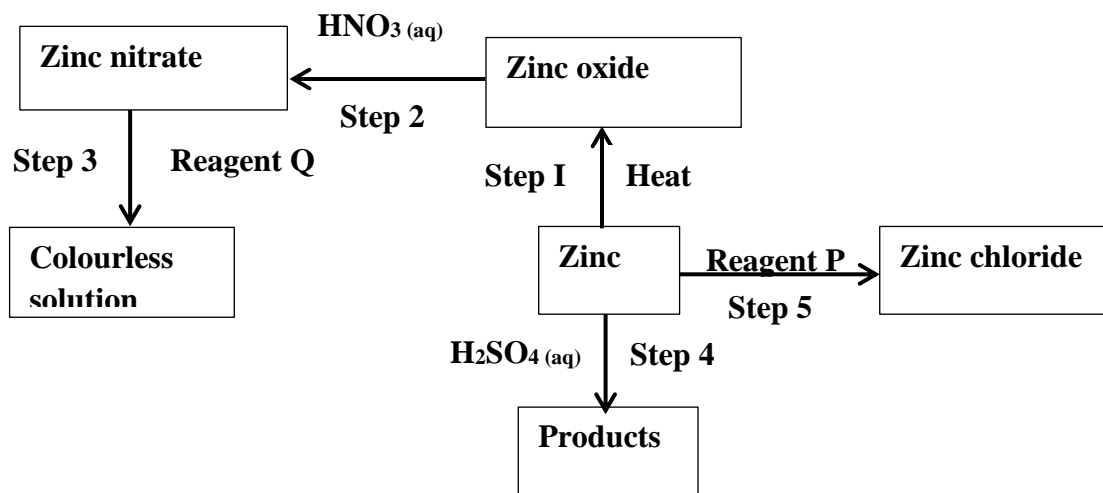
(a) Name **one** commercial indicator that can be used to show whether sodium carbonate, orange juice and sodium bromide are acidic, basic or neutral. *(1 mark)*

.....  
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(b) Classify the substances in 15 (a) above as acids, bases or neutral. *(2 marks)*

<b>Acid</b>	
<b>Base</b>	
<b>Neutral</b>	

16 The flow chart below shows various reactions of zinc metal. Study it and answer the questions that follow:



(a) (i) Other than water, name another reagent that could be **Q**. *(1 mark)*

.....

(ii) Write the formula of reagent **P**. *(1 mark)*

.....

(b) Write an equation for the reaction in **step 4**. *(1 mark)*

17 (a) One of the allotropes of sulphur is monoclinic sulphur, name the other allotrope *(1 mark)*

(b) Concentrated sulphuric (VI) acid reacts with copper and propanol. State the property of the acid shown in each case. *(2 marks)*

Copper .....

Propanol .....

18 Study the standard electrode potentials in the table below and answer the questions that follow.

Half -reaction	E <sup>θ</sup> (V)
$\text{Ag}^+(\text{aq}) + \text{e} \longrightarrow \text{Ag}(\text{s})$	+ 0.80
$\text{Cu}^{2+}(\text{aq}) + 2\text{e} \longrightarrow \text{Cu}(\text{s})$	+ 0.34
$\text{Mg}^{2+}(\text{aq}) + 2\text{e} \longrightarrow \text{Mg}(\text{s})$	- 2.38
$\text{Ca}^{2+}(\text{aq}) + 2\text{e} \longrightarrow \text{Ca}(\text{s})$	- 2.87

(a) Which of the metals is the strongest oxidising agent? *(1 mark)*

.....

(b) What observations will be made if a copper coin was dropped into an aqueous solution of calcium nitrate? Explain. *(2 marks)*

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**19** Calculate the number of sulphate ions present in 22.5 cm<sup>3</sup> of 2 M aluminium sulphate solution. (L=6.0 × 10<sup>23</sup>) *(3 marks)*

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**20** (a) A crystal of iodine, heated gently in a test tube gave off a purple vapour.  
(i) Write the formula of the substance responsible for the purple vapour. *(1 mark)*

.....

(b) What type of bond is broken when the iodine crystal is heated gently? *(1 mark)*

.....

(b) State **one** use of chlorine. *(1 mark)*

.....

**21** Describe how samples of barium (II) sulphate, ammonium chloride and common salt can be obtained from a mixture of the three. *(3 marks)*

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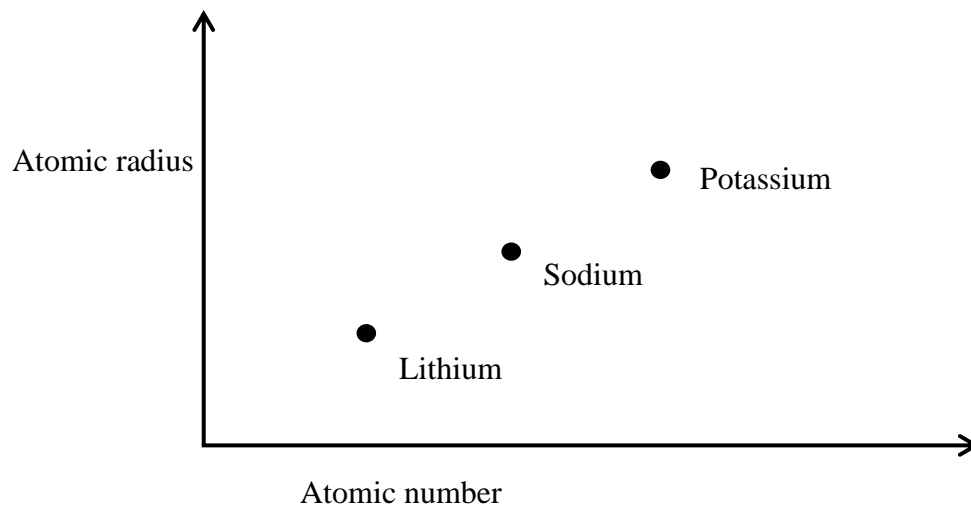
22 (a) Give the name of the process which takes place when maize flour is converted to ethanol *(1 mark)*

.....

(b) Write the formula of the compound formed when ethanol reacts with sodium metal. *(1 mark)*

.....

23 (a) Study the graph below which shows variation of atomic radius with atomic number



State and explain the trend shown in the graph above. (2 marks)

.....

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.....

(b) State **one** use of sodium. (1 mark)

.....

.....

**24** A farmer intended to plant blueberries in her farm. She first tested the pH of the soil and found it to be 10.0. In order to obtain high yield, what advice would be given to the farmer if blueberries do well in acidic solution? (2 marks)

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.....

**25** Starting with calcium nitrate solution, describe how a pure dry sample of calcium carbonate can be prepared in the laboratory. (3 marks)

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26 A hydrocarbon contains 81.82% of carbon. If the molar mass of the hydrocarbon is 44, determine the molecular formula of the hydrocarbon. (C = 12.0; H = 1.0) (3 marks)

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27 (a) Describe how Carbon (II) Oxide can be distinguished from Carbon (IV) Oxide using calcium hydroxide solution. (2 marks)

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(b) What is the role of carbon (IV) oxide in fire extinguishing? (1 mark)

.....  
.....

28 (a) Name **one** source of alkanes. (1 mark)

.....

(b) Methane gas was reacted with one mole of chlorine gas. State the condition necessary for this reaction. (1 mark)

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.....

**29** (a) What is meant by heating value of a fuel? *(1 mark)*

.....

(b) Other than heating value, name **one** factor to be considered when choosing a fuel.

*(1 mark)*

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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**

<b>QUESTIONS</b>	<b>MAXIMUM SCORE</b>	<b>CANDIDATE'S SCORE</b>
<b>1 – 28</b>	<b>80</b>	

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)

.....  
 .....

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

.....

2. Give the systematic name of the following compound and draw the structure of the polymer it forms: **CH<sub>2</sub>CHCl**

Name .....(1 Mark)

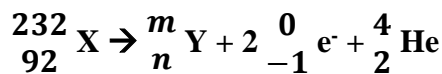
Structure (1 Mark)

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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**



**m** .....(1 Mark)                      **n** .....(1 Mark)

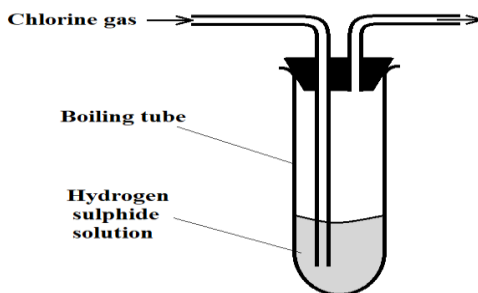
5. a) State Charles' Law (1 Mark)

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

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6. Chlorine gas was bubbled into a 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.

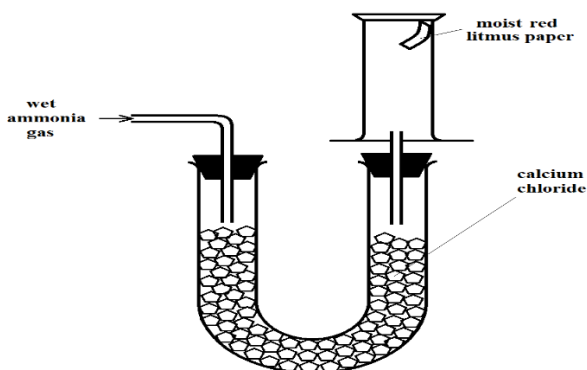
- a) Why did the level of the acid in the container rise? **(1 Mark)**

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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)

.....

9.  $400\text{cm}^3$  of **gas D** diffuses from a porous plug in 50 seconds while  $600\text{cm}^3$  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 <sub>4</sub>	38	28
Pb(NO <sub>3</sub> ) <sub>2</sub>	78	79

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

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

.....

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

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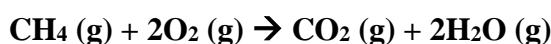
c) State the salt that will be unsaturated at 35°C (1 Mark)

.....

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

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



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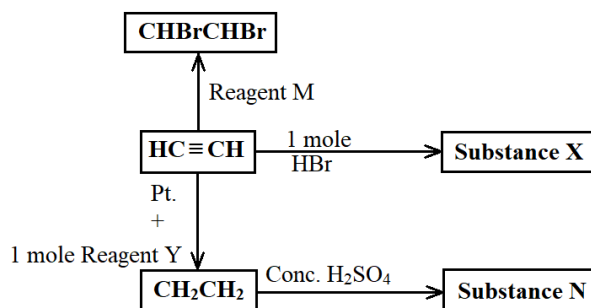
13. Calculate the volume of oxygen produced when 10g of silver nitrate was completely decomposed by heating at s.t.p. (Ag = 108, N = 14, O = 16, MGv at s.t.p. = 22.4dm<sup>3</sup>) (3 Marks)

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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 .....(1/2 Mark)

ii) N .....(1/2 Mark)



iii) M..... (1/2 Mark)

b) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product. (1 1/2 Marks)

.....  
.....

16. When 16g of ammonium nitrate was dissolved in 100cm<sup>3</sup> of water at 25°C, the temperature of the solution drops to 19°C.

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

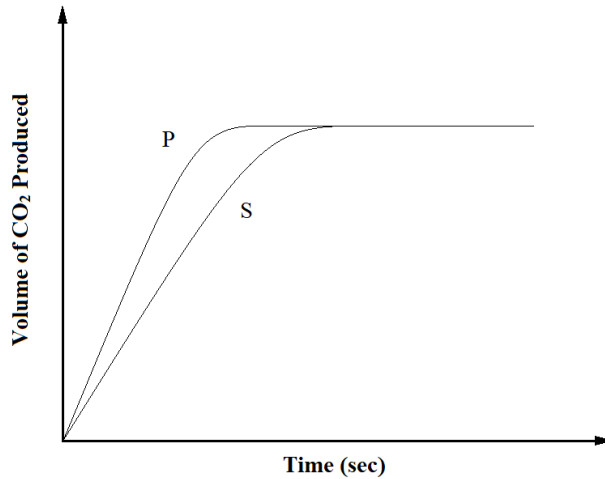
(N = 14, O = 16, H = 1, Specific Heat Capacity for Water = 4.2kJ/kg/k)

.....  
.....  
.....

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<sub>2</sub>? (1 Mark)

.....  
 .....

18. The electron arrangement of ions X<sup>3+</sup> and Y<sup>2-</sup> 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)

.....

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

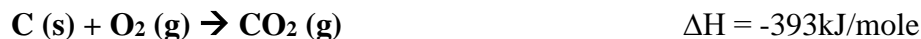
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b) During the extraction, calcium chloride solid is added into the sodium chloride solid. Why is calcium chloride added to the sodium chloride? (1 Mark)

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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)



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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)

.....

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

.....

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



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

.....

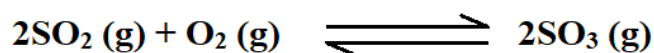
- b) Identify the reducing species (1 Mark)

.....

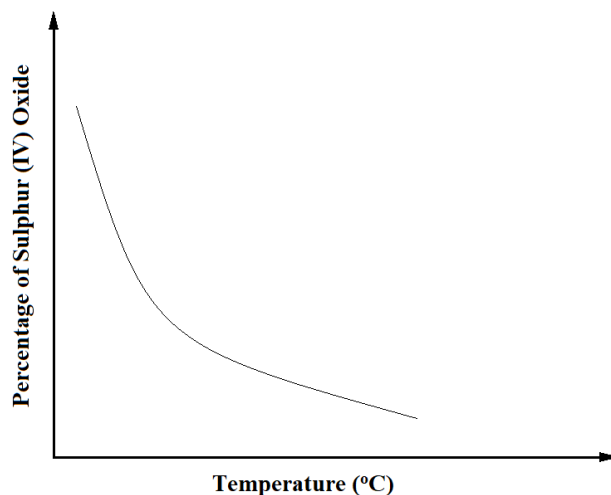
- c) Calculate the  $E^{\theta}$  value for the cell (1 Mark)

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.....

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



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)*

.....  
 .....  
 .....

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

.....  
 .....

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)*

.....  
 .....

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

.....

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

.....

24. Name and give the formula of:

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

.....

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

.....

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

.....  
.....

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

a) H<sub>2</sub>S ..... (1 Mark)

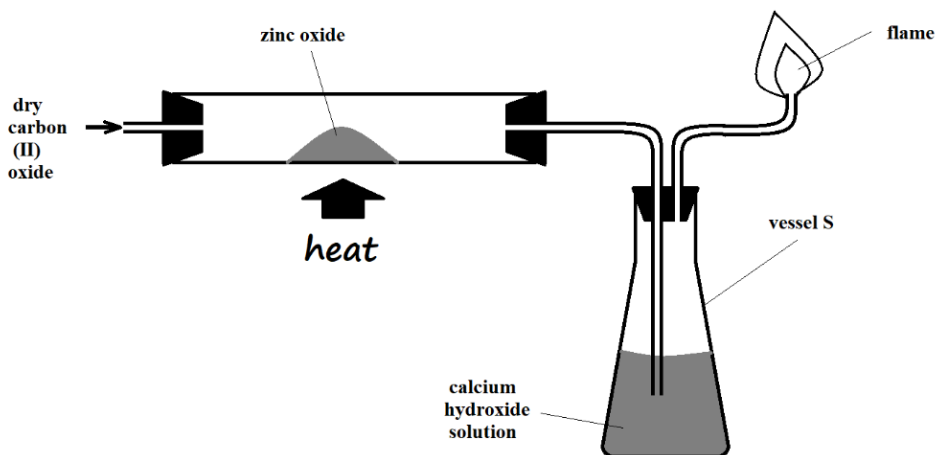
b) SO<sub>3</sub><sup>2-</sup> .....(1 Mark)

26. For the reaction: Cl<sub>2</sub> (g) + 2I<sup>-</sup> (aq) → 2Cl<sup>-</sup> (aq) + I<sub>2</sub> (s)

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

.....  
.....

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)

.....  
 .....

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

.....  
 .....

Name: ..... Admission No: .....

Candidate's Signature: ..... Date: .....

FORM 4

CHEMISTRY PAPER 1 (233/1)

Time: 2 Hours

# KCSE TOP PREDICTION MASTER CYCLE 8

## INSTRUCTIONS TO CANDIDATES

- Write your **Name**, **Index Number** and **School** in the spaces provided above.
- Answer **all** the questions in the spaces provided after each question.
- **KNEC** Mathematical tables and **silent non-programmable** electronic calculators may be used.
- **ALL** working **must** be clearly shown where necessary.
- Candidate should **check** the question paper to ascertain that **all** the pages are printed and that no questions are missing.
- Candidates should answer the questions in **English**.

### FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1 – 29	80	

*This paper consists of 13 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*



1 (a) Give the name of the first member of the alkyne homologous series (1 mark)

.....

(b) Describe a chemical test that can be used to distinguish ethanol from ethanoic acid. (2 marks)

.....

.....

.....

2 (a) Name the raw material from which aluminium is extracted (1 mark)

.....

(b) Give a reason why aluminium is extracted using electrolysis. (1 mark)

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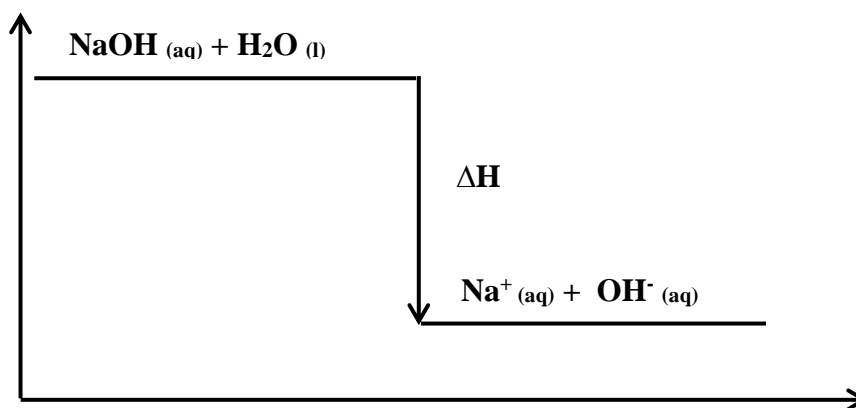
(c) Give **one** use of aluminium metal. (1 mark)

.....

3 (a) What is meant by lattice energy? (1 mark)

.....

(b) Study the energy level diagram below and answer the question that follows:



What type of reaction is represented by the diagram? *(1 mark)*

.....

4 (a) Sketch a graphical representation of Boyles law on the axes below. *(1 mark)*



(b) A gas occupies  $400 \text{ cm}^3$  at  $25^\circ\text{C}$  and  $100,000 \text{ Pa}$ . What will be its volume at  $27^\circ\text{C}$  and  $101325 \text{ Pa}$ ? *(2 marks)*

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.....  
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.....

5 (a) What is half- life? *(1 mark)*

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.....

(b) The half-life of protactinium - 234 is 1.17 minutes. Determine the mass that decays in 5.85 minutes starting with 100 g of the sample. *(2 marks)*

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**6** State **two** disadvantages of hard water. *(2 marks)*

.....  
.....

**7** Hydrogen chloride gas can be prepared by reacting sodium chloride with an acid.

(a) Name the acid. *(1 mark)*

.....

(a) Write an equation for the reaction between sodium chloride and the acid. *(1 mark)*

.....

(c) State **two** uses of hydrogen chloride. *(1 mark)*

.....

.....

**8** When solid **B** was heated strongly, it gave off water and a solid residue. When water was added to the solid residue, the original solid **B**, was formed.

(a) What name is given to the process described? *(1 mark)*

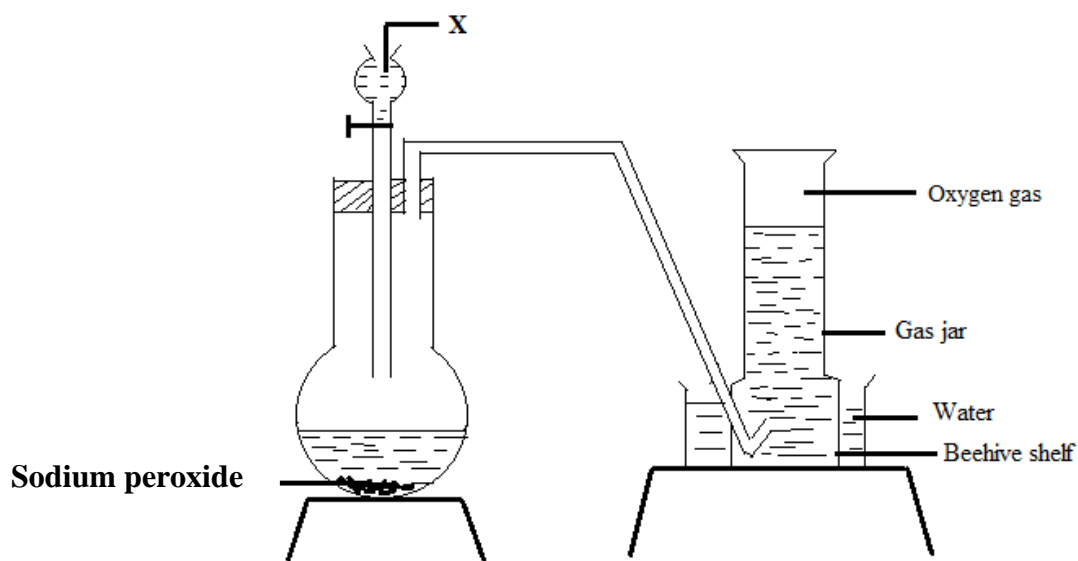
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(b) Give **one** example of solid A. (1 mark)

.....  
.....

9 The set up below can be used to prepare oxygen gas. Study it and answer the questions that follow.



(a) Identify X. (1 mark)

.....

(c) Write the equation for the reaction which occurs in the flask. (1 mark)

.....

(d) State **one** use of oxygen other than in welding (1 mark)

.....

10 The atomic number of an element, **M** is 13.

(a) Write the electronic configuration of the ion  $M^{3+}$ . (1 mark)

.....

(b) Write the formula of the chloride of **M**. (1 mark)

.....

.....

(c) State the structure of the compound formed in (b) above (1 mark)

.....

11 Concentrated sodium chloride was electrolysed using graphite electrodes. Name the product formed at the anode and give a reason for your answer. (2 marks)

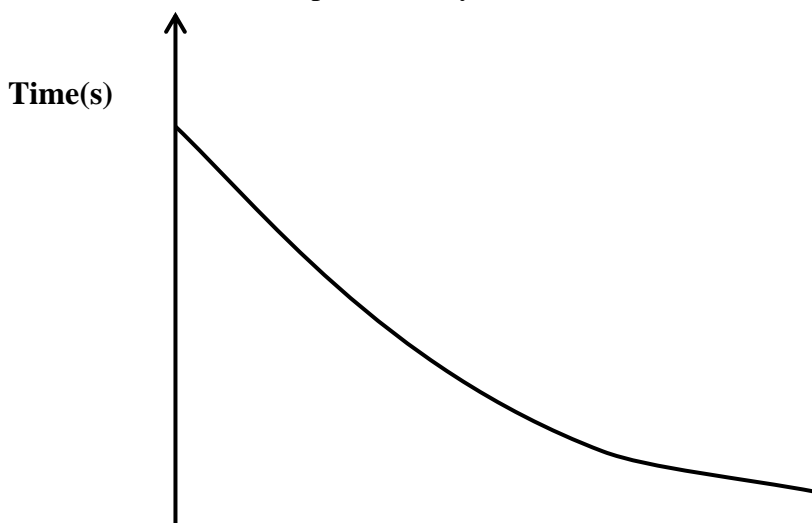
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12 The curve shown below shows the variation of time against temperature for the reaction between sodium thiosulphate and hydrochloric acid.





Temperature (°C)

- (a) Explain the shape of the curve. (2 marks)

.....  
.....  
.....

- (b) Other than temperature name **one** factor that affects the rate of reaction. (1 mark)

.....

- 13** (a) Dry ammonia was passed over heated copper (II) oxide in a combustion tube.

- (i) State the observations made in the tube (1 mark)

.....

- (ii) Write an equation for the reaction that occurs. (1 mark)

.....

- (b) What products would be formed if red hot platinum is introduced into a mixture of ammonia and oxygen? (1 mark)

.....

- 14** The table below shows behaviour of metals P, Q, R and S. Study it and answer the questions that follow:

<b>Metal</b>	<b>Appearance on exposure to air</b>	<b>Reaction with water</b>	<b>Reaction with dilute sulphuric (VI) acid</b>
<b>P</b>	Remains the same	Doesn't react	Reacts moderately
<b>Q</b>	Remains the same	No reaction	Doesn't react
<b>R</b>	Slowly tarnishes	Slow	Vigorous
<b>S</b>	Slowly turns white	Vigorous	Violent

(a) Arrange the metals in the order of reactivity starting with the most reactive. *(2 marks)*

.....

.....

(b) Name a metal which is likely to be **R** *(1 mark)*

.....

.....

**15** Given the following substances: sodium carbonate, orange juice and sodium bromide.

(a) Name **one** commercial indicator that can be used to show whether sodium carbonate, orange juice and sodium bromide are acidic, basic or neutral. *(1 mark)*

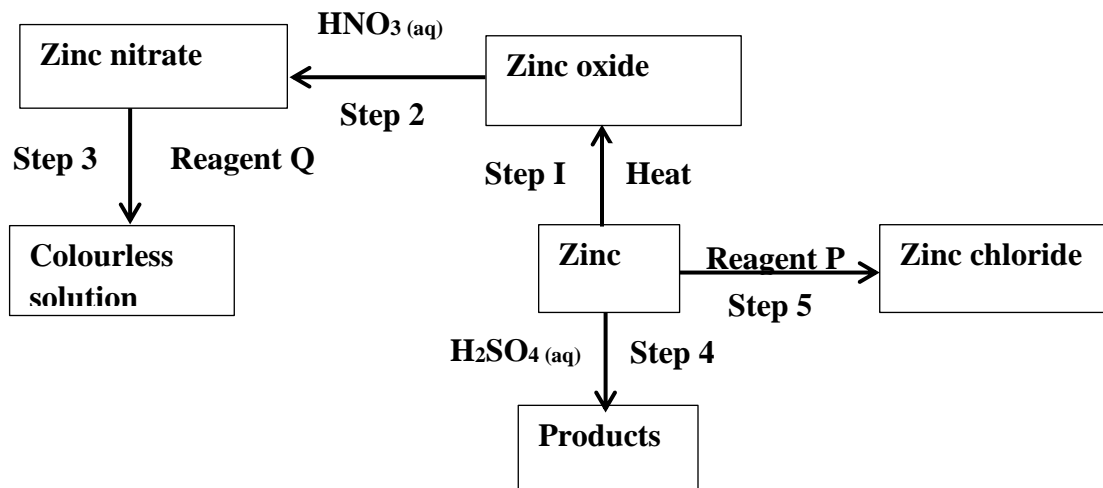
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(b) Classify the substances in 15 (a) above as acids, bases or neutral. *(2 marks)*

<b>Acid</b>	
<b>Base</b>	
<b>Neutral</b>	

16 The flow chart below shows various reactions of zinc metal. Study it and answer the questions that follow:



(a) (i) Other than water, name another reagent that could be Q. (1 mark)

.....

(ii) Write the formula of reagent P. (1 mark)

.....

(b) Write an equation for the reaction in step 4. (1 mark)

.....

17 (a) One of the allotropes of sulphur is monoclinic sulphur, name the other allotrope (1 mark)

.....

(b) Concentrated sulphuric (VI) acid reacts with copper and prapanol. State the property of the acid shown in each case. (2 marks)



Copper .....

Propanol .....

- 18 Study the standard electrode potentials in the table below and answer the questions that follow.

Half -reaction	$E^{\circ}(\text{V})$
$\text{Ag}^+(\text{aq}) + e \longrightarrow \text{Ag}(\text{s})$	+ 0.80
$\text{Cu}^{2+}(\text{aq}) + 2e \longrightarrow \text{Cu}(\text{s})$	+ 0.34
$\text{Mg}^{2+}(\text{aq}) + 2e \longrightarrow \text{Mg}(\text{s})$	- 2.38
$\text{Ca}^{2+}(\text{aq}) + 2e \longrightarrow \text{Ca}(\text{s})$	- 2.87

- (a) Which of the metals is the strongest oxidising agent? (1 mark)

.....

- (b) What observations will be made if a copper coin was dropped into an aqueous solution of calcium nitrate? Explain. (2 marks)

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.....

- 19 Calculate the number of sulphate ions present in  $22.5 \text{ cm}^3$  of 2 M aluminium sulphate solution. ( $L=6.0 \times 10^{23}$ ) (3 marks)

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**20** (a) A crystal of iodine, heated gently in a test tube gave off a purple vapour.  
(i) Write the formula of the substance responsible for the purple vapour. *(1 mark)*

.....

(b) What type of bond is broken when the iodine crystal is heated gently? *(1 mark)*

.....

(b) State **one** use of chlorine. *(1 mark)*

.....

**21** Describe how samples of barium (II) sulphate, ammonium chloride and common salt can be obtained from a mixture of the three. *(3 marks)*

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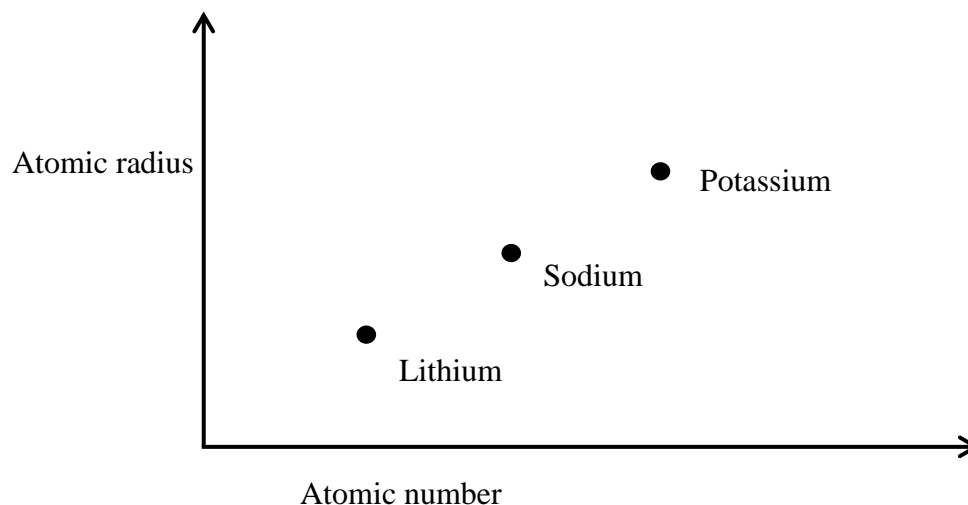
22 (a) Give the name of the process which takes place when maize flour is converted to ethanol *(1 mark)*

.....

(b) Write the formula of the compound formed when ethanol reacts with sodium metal. *(1 mark)*

.....

23 (a) Study the graph below which shows variation of atomic radius with atomic number



State and explain the trend shown in the graph above. *(2 marks)*

.....  
.....  
.....  
.....

(b) State **one** use of sodium. *(1 mark)*

.....  
.....

**24** A farmer intended to plant blueberries in her farm. She first tested the pH of the soil and found it to be 10.0. In order to obtain high yield, what advice would be given to the farmer if blueberries do well in acidic solution? *(2 marks)*

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**25** Starting with calcium nitrate solution, describe how a pure dry sample of calcium carbonate can be prepared in the laboratory. *(3 marks)*

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.....

**26** A hydrocarbon contains 81.82% of carbon. If the molar mass of the hydrocarbon is 44, determine the molecular formula of the hydrocarbon. (C = 12.0; H = 1.0) *(3 marks)*

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27 (a) Describe how Carbon (II) Oxide can be distinguished from Carbon (IV) Oxide using calcium hydroxide solution. (2 marks)

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.....

.....

(b) What is the role of carbon (IV) oxide in fire extinguishing? (1 mark)

.....

.....

28 (a) Name **one** source of alkanes. (1 mark)

.....

(b) Methane gas was reacted with one mole of chlorine gas. State the condition necessary for this reaction. (1 mark)

.....

.....

29 (a) What is meant by heating value of a fuel? (1 mark)

.....

(b) Other than heating value, name **one** factor to be considered when choosing a fuel.

*(1 mark)*

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**233/1**  
**CHEMISTRY**  
**PAPER 1**  
**Time: 2 hours**

**KCSE 2023 TOP PREDICTION MASTER CYCLE**  
**9**

Name ..... Index Number...../.....

Signature ..... Date ...../...../.....

**INSTRUCTIONS TO CANDIDATES**

1. Write your name and index no in the spaces provided above.
2. Sign and write the date of exam in the spaces provided above.
3. Answer all the questions in the spaces provided after each.
4. Mathematical tables and silent electronic calculators may be used.
5. All working must be clearly shown where necessary.
6. This paper consists of 12 printed pages. Candidates should check to ensure that all pages are printed as indicated and that no questions are missing.
7. All answers should be written in English.

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**For Examiner's Use Only**

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

<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>

**Grand  
Total**

--

1. Metal **Q** displaces metals **T** and **U** from their oxides but does not displace metal **R**. Metal **T** displaces **U** from its oxide. Arrange the metals according to their reactivity starting with the strongest reducing agent. (1 mark)

.....  
.....

2. Chlorine gas can be prepared in the laboratory using the following two methods;

*Solid substance X and concentrated Hydrochloric acid*

*Solid substance X, concentrated sulphuric (VI) acid and solid Sodium Chloride.*

- a) Name the solid substance X (1 mark)

.....  
.....

- b) What is the role of concentrated sulphuric acid in the reaction? (1 mark)

.....  
.....

- c) State how dry chlorine gas is collected. (1 mark)

.....  
.....

3. A white crystalline solid **Q** when heated forms a brown gas, colourless gas that relights a glowing wooden splint and a yellow residue which turns white on cooling. Aqueous solution of **Q** reacts with excess aqueous ammonia solution to form a colourless solution **P**.

- a) Write the name and chemical formulae of complex ion in solution **P**. (2 marks)

**Name;**

.....  
.....

**Chemical formula;**

.....  
.....



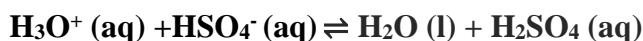
b) State the observation made when the aqueous solution of P is reacted with few drops of sodium hydroxide. (1 mark)

.....  
.....

4(a) Define an acid in terms of hydrogen ions. (1 mark)

.....  
.....

b) Study the reaction below and answer the questions that follow.



Identify the acid and base in the forward reaction. Explain. (2 marks)

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.....  
.....

5. Ammonia gas is one of the substances recycled in the Solvay process.

a) Other than water name another substance that is recycled in the process. (1 marks)

.....  
.....

b) Write a balanced chemical equation for the reaction that regenerates Ammonia gas in the process. (1 mark)

.....  
.....

c) State an industrial use of the only waste product in the Solvay process. (1 mark)

.....  
.....

6. Lead (II) iodide is a toxic bright yellow solid which was used as a paint pigment known as 'iodine yellow'. Describe briefly how you would prepare lead (II) iodide in the laboratory starting with lead (II) oxide. (3 marks)

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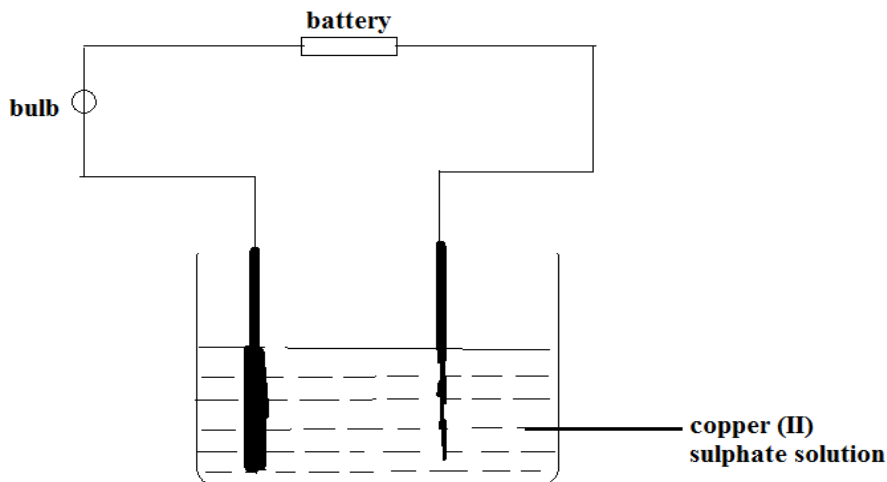
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7. 5.0g of zinc carbonate were allowed to react with 25cm<sup>3</sup> of 1M hydrochloric acid until there was no further reaction. Calculate the volume of gas that was formed at s.t.p. (Zn = 65.4, O = 16, C = 12, molar gas volume at s.t.p = 22400 cm<sup>3</sup>) (3 marks)

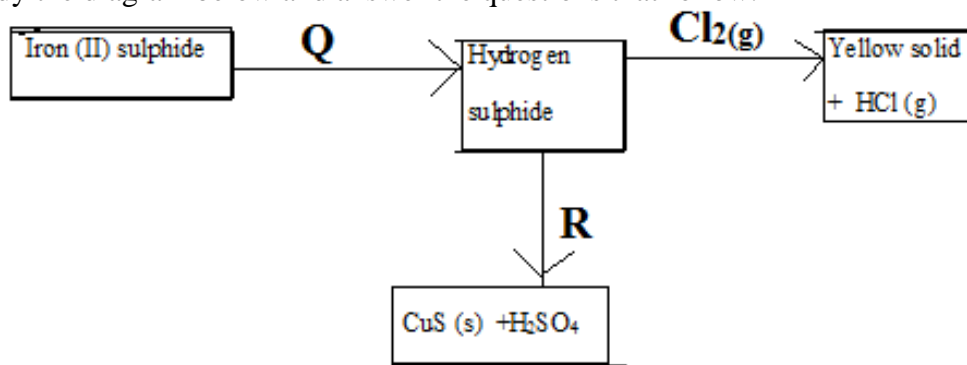
8. Atoms of element P can be represented as  ${}_{11}^{23}\text{P}$ . Element P reacts with sulphur to form a yellow solid. Using dots (•) and crosses (X) to represent electrons, draw the structure of the yellow solid. (S=16). (2 marks)

9. The set up below was used by a student to carry out the electrolysis of aqueous copper (II) sulphate using copper electrodes.



- a) On the diagram, label the anode and cathode. (1 mark)
- b) Write the half ionic equation for the reaction that undergoes oxidation. (1 mark)
- .....
- .....
- c) Explain the observation made on the electrolyte when the copper electrodes are replaced with graphite electrodes. (1 mark)
- .....
- .....
- .....
- .....
10. A fuel gas contains 50% of hydrogen gas and 44% of carbon (II) oxide by volume. The rest of is incombustible. Calculate the volume of gas that remains at room temperature when the 100 cm<sup>3</sup> fuel gas was ignited. (3 marks)

11. Study the diagram below and answer the questions that follow.



- a) Name substances; ( 1 mark)
- Q  
.....
- R  
.....
- b) Write the equation for the reaction that leads to the formation of the yellow solid. (1 mark)
- .....
- .....
- .....
- c) Using a chemical test, describe how you would distinguish between hydrogen sulphide and sulphur (IV) oxide. (1 mark)
- .....
- .....
- .....
12. State **two** differences between luminous and non luminous flame of the Bunsen burner. (2 marks)
- .....
- .....
- .....
- .....
13. A gas occupies a volume of 400cm<sup>3</sup> at 227°C and 760mmHg. What will be the temperature of the gas when the volume and pressure of the gas is 100cm<sup>3</sup> and 380mmHg respectively. (2 marks)

14. For each of the following experiments, give the observations, and the type of change that occurs (Physical or chemical) (3 marks)

Experiment	Observation	Type of change
A few drops of concentrated sulphuric acid added to small amounts of sugar		
A few crystals of Iodine are heated gently in a test tube		
A few crystals of copper (II) Nitrate are heated strongly in a test tube.		

- 15(a) Define solubility of a solute. (1 mark)

.....  
 .....

- b) The solubility of potassium nitrate is 120g/100g of water at 80 °C and 70g/100g of water at 20°C. What mass of the salt would crystallize if 80g of potassium nitrate solution saturated at 80 °C was cooled to 20 °C? (2 marks)

16. Zinc metal reacted with dilute hydrochloric acid. The gas produced was then passed over heated copper (II) oxide in a combustion tube.
- a) State two precautions that must be considered when the gas reacts with copper (II) Oxide in the combustion tube. (2 marks)

.....  
.....  
.....

b) Write a balanced chemical equation between zinc and dilute hydrochloric acid. (1 mark)

.....  
.....

17. The table below shows ammeter readings recorded when two equimolar solutions were tested separately.

Electrolyte	Current (A)
Dilute Sulphuric (VI) Acid	7.210
Ethanoic Acid	4.011

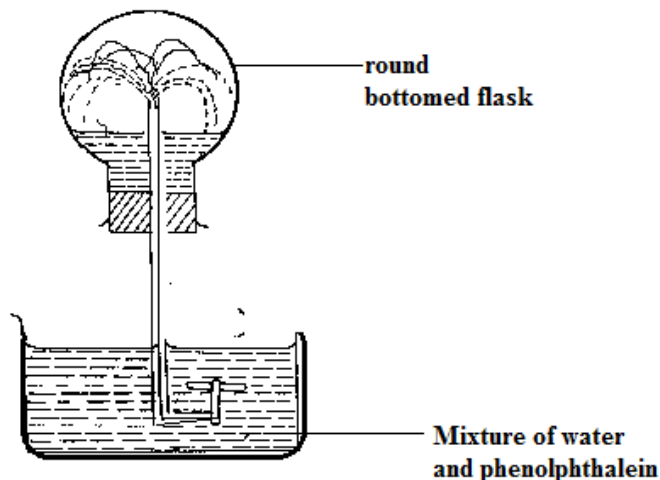
a) Explain the difference in the ammeter readings. (2marks)

.....  
.....

b) Compare the reactivity of equal length of magnesium ribbon with each of the electrolytes. (1 mark)

.....  
.....

18. The set up below was used to show the solubility of ammonia gas in water.



- (a) State and explain the observations made in the flask. (2 marks)

.....  
 .....  
 .....

- (b) Write a balanced equation to show how ammonia gas reacts with water. (1 mark)

.....  
 .....

19. Magnesium ribbon was added to a solution of hydrogen chloride in methylbenzene. Another piece of Magnesium ribbon was added to distilled water. State and explain observations made. (2 marks)

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 .....  
 .....

20. One of the disadvantages of hard water is wastage of soap.

- a) Write the chemical formula of a salt that causes permanent water hardness. (1 mark)

.....  
 .....

- b) Given the chemical formula of soap as  $\text{RCOONa}$ . Write a balanced equation show how soap reacts with the salt stated in (a) above. (1 mark)

.....  
.....  
c) State **two** advantages of water hardness. (1 mark)  
.....  
.....  
.....

21. A piece of sodium was burnt in excess oxygen gas. The product obtained was shaken with water to make a solution.  
(a) Write a balanced equation for reaction between the product formed and water. (1 mark)  
.....  
.....  
(b) State and explain the observation made when red and blue litmus papers are dipped into the solution. (2 marks)  
.....  
.....

22. Aluminium chloride and sodium chloride are both chlorides of period 3 elements in the periodic table. Use this information to explain the following observations.  
a) A solution of  $Al_2Cl_6$  in water turns blue litmus paper red while that of sodium Chloride does not. (1½ marks)  
.....  
.....

b) Sodium chloride has a melting point  $801^\circ C$  is while  $Al_2Cl_6$  sublimes  $183^\circ C$ . (1½ marks)



.....  
.....  
.....

23. The ionization energies of elements A and B are 495.9kJ/mol and 739.9kJ/ mol respectively. Both elements are in the same group of the periodic table.

a) What is ionization energy? (1 mark)

.....  
.....

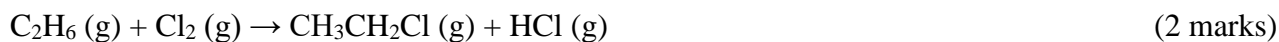
b) Compare the reactivity of elements A and B . Explain your answer. (2 marks)

.....  
.....

24. Study the information given in the table below and answer the questions below.

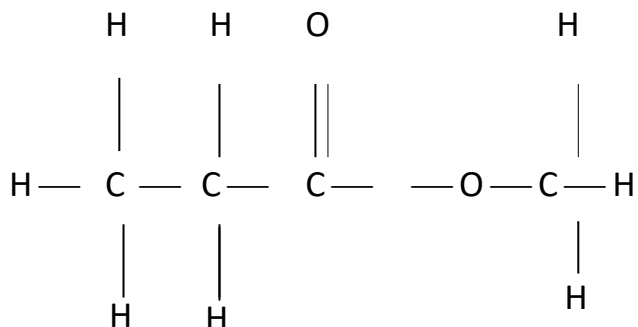
Bond	Bond energy(kJ/mol)
C-H	413
H-Cl	431
C-Cl	346
Cl-Cl	244
C - C	347

a) Calculate the enthalpy change for the reaction below.



b) State a condition required for the reaction in (a) above to take place. (1 mark)

25. Study the organic compound below:

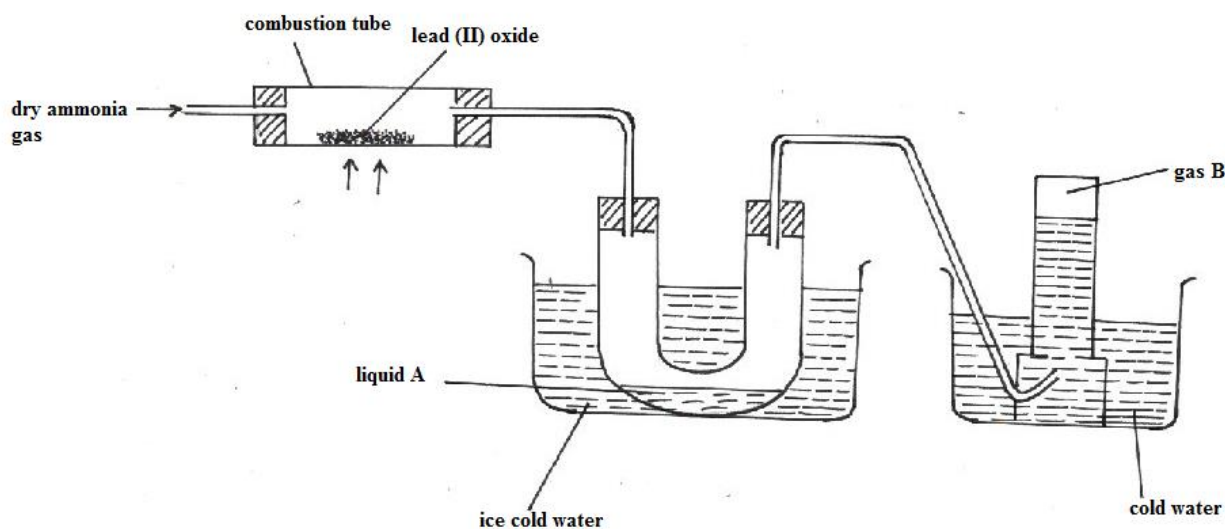


(a) In which homologous series does the compound belong to? (1 mark)

.....

(b) Name and draw the structures of two compounds that can be used to prepare the above compound. (3 marks)

26. The diagram below represents a set-up that can be used to obtain nitrogen gas in the laboratory. Use the information on the diagram to answer the questions that follow



(a) Describe the chemical test for liquid A. (1 mark)

.....  
.....  
(b) What observation is made in the combustion tube during the reaction? (1 mark)

.....  
.....  
(c) State two uses of gas B. (1 mark)

.....  
.....  
27. Analysis of an organic acid isolated from red ants shows that it contains 0.06 g of carbon, 0.01g of hydrogen and 0.16 g of oxygen.(H=1,O=16, C=12)

a) Calculate the empirical formula for this acid. (1½ marks)

b) What is the basicity of the acid if the empirical formula of the acid is the same as its molecular formula. (½ mark)

.....  
.....  
28. Nitrogen (IV) oxide dissolves and reacts with Sodium hydroxide solution to form two salts and water.

a) What is the nature of Nitrogen (IV) oxide? { 1 mark }

.....  
.....  
b) Write the Ionic equation for the reaction that takes place. { 1 mark }

29. When powdered brass was reacted with excess dilute sulphuric (VI) acid, a solid residue was left.

(i) Name the residue. (1 mark)

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(ii) Explain why the residue was left. (1 mark)

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(iii) State another observation made (1 mark)

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NAME.....ADM.....CLASS.....

233/1

# CHEMISTRY

Paper 1

2 Hours

## KCSE TOP PREDICTION MASTER CYCLE 10

### INSTRUCTIONS TO CANDIDATES

1. Answer ALL questions in the spaces provided
2. Mathematical tables and electronic calculators may be used.
3. All working MUST be shown clearly where necessary.

### FOR EXAMINERS USE ONLY

Maximum score	Candidate's score
80	

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

1. Study the information given below and use it to answer the questions that follow;

Red dye is more soluble than green dye, green is more soluble than yellow whereas blue dye is the least soluble.

i) Represent the three dyes on a round paper chromatography. *(2marks)*

ii) Name one industrial application of chromatography. *(1mark)*

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2. a) What is a fuel? *(1mark)*

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b) Calculate the heat value of ethanol if its molar enthalpy of combustion is  $-1360\text{kJmol}^{-1}$   
(C=12.0, O=16.0, H=1.0) *(2marks)*

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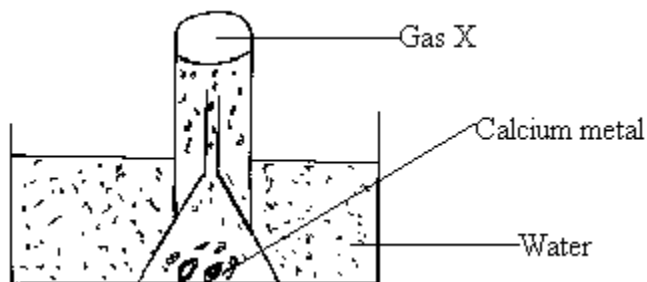
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3. Study the set up below and use it to answer the questions that follow.



a) What physical property of calcium metal is demonstrated in the diagram above? **(1mark)**

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b) What would be observed if water was replaced with dilute Sulphuric (VI) acid? **(2marks)**

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4. A hydrocarbon decolorizes chlorine gas in presence of ultra violet light but does not decolorize acidified potassium manganate (VII) solution.

i) Name the homologous series to which the hydrocarbon belongs. **(1mark)**

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ii) Draw the structural formula and name the fourth member of the homologous series to which the hydrocarbon belongs? **(2marks)**

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5. Explain why a solution of hydrogen chloride in water turns blue litmus paper red but a solution of hydrogen chloride in methylbenzene has no effect on litmus papers. **(2marks)**

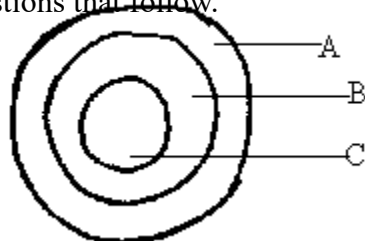
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6. The diagram below represents a cross section of the apparatus used to extract sulphur from its deposits. Study it and answer the questions that follow.



a) State the role of the substance that is passed through;

i) A ..... **(1mark)**

ii) C..... **(1mark)**

b) Give one reason why the method shown in the diagram is suitable for extraction of sulphur. **(1mark)**

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7. Explain how you would obtain magnesium carbonate from a mixture of magnesium carbonate and sodium carbonate. **(2mark)**

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8. 20g of potassium carbonate were dissolved in 50cm<sup>3</sup> of water in a conical flask. Lemon juice was then added drop wise while shaking until there was no further observable change.  
a) Explain the observation that was made in the conical flask when the reaction was in progress. *(1mark)*

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b) What observation would be made if lemon juice had been added to copper turnings in a conical flask? Give a reason. *(2marks)*

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9. Explain why a burning magnesium continues to burn in a gas jar full of carbon (IV) oxide while a burning candle would be extinguished. *(2marks)*

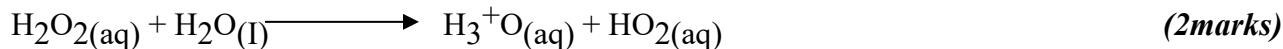
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10. 8.4g of carbon (IV) oxide and 3.42g of water are formed when a hydrocarbon is burnt completely in oxygen. Determine the empirical formula of the hydrocarbon.

(H=1.0; C=12.0; O=16.0) *(3marks)*

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11. The melting point of nitrogen is  $-196^{\circ}\text{C}$  while that of sodium is  $98^{\circ}\text{C}$ , in terms of structure and bonding explain the differences in the melting points of nitrogen and sodium. **(2marks)**

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12. a) What is an amphoteric substance? **(1mark)**

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b) Identify the reagent that acts as a base in the equation below. Give a reason for your answer.



13. In the industrial manufacture of ammonia gas by Harber process, Nitrogen and hydrogen gases are reacted

together.

a) State any two conditions necessary for ammonia to be formed in the Harber process. **(1mark)**

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b) Nitrogen and hydrogen must be purified before they are reacted. Give a reason. **(1mark)**

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c) Other than manufacture of fertilizers state one use of ammonia. **(1mark)**

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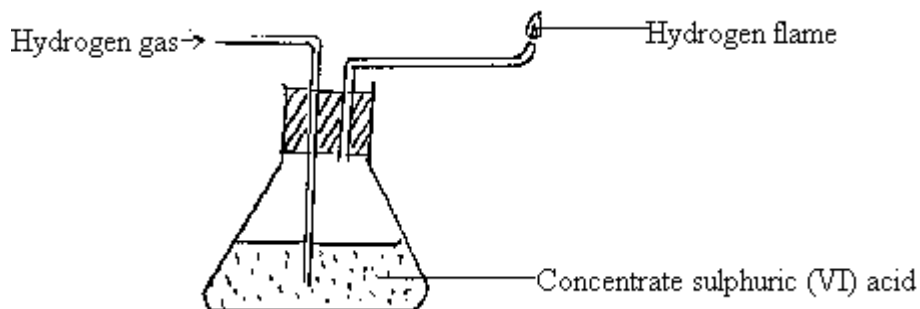
14. Describe how you would prepare crystals of potassium sulphate starting with  $100\text{cm}^3$  of 0.5M potassium hydroxide. **(3marks)**

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15. Distinguish between atomic mass and relative atomic mass. **(2marks)**

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16. Study the diagram below and answer the questions that follow:



a) Name one chemical and one physical property of hydrogen being demonstrated in the set-up above.

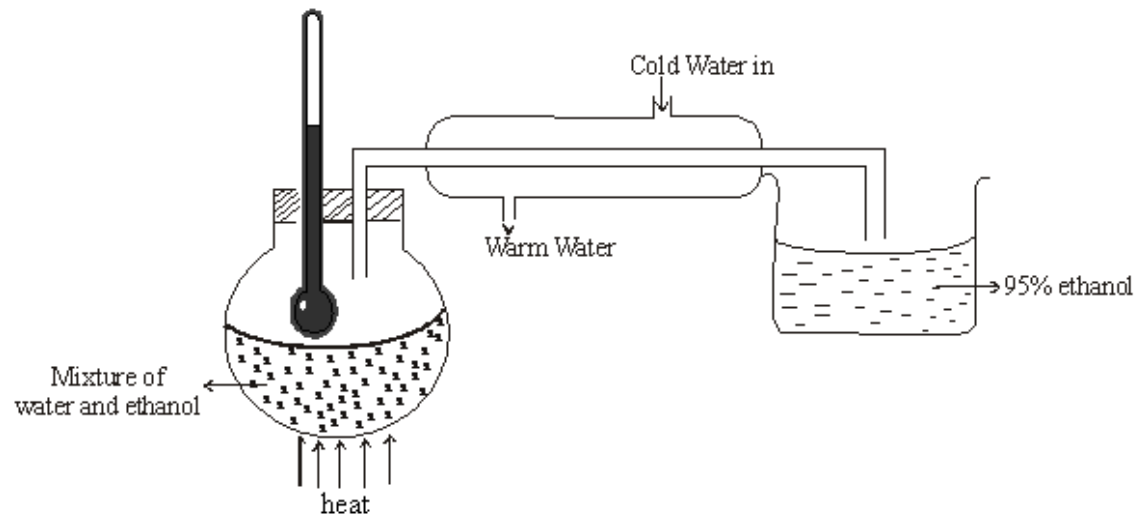
i) Chemical property. **(1mark)**  
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ii) Write a chemical equation for the reaction taking place. **(1mark)**

b) Name any other substance that can be used in place of concentrated sulphuric (VI) acid. **(1mark)**  
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c) Give a reason why it is necessary to burn the hydrogen gas as shown in the set-up. **(1mark)**  
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17. The diagram below shows a simple distillation to separate water and ethanol.



a) State one of the conditions for the above process to take place. (1mark).

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b) Ethanol collected is 95% pure. Secondary distillation is carried out in which calcium metal is placed in ethanol to react with water. Give a reason why the following cannot be used. (2marks)

i. Sodium

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ii. Copper.....

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18. A solution of potassium chloride was added to a solution containing a lot of lead (II) nitrate. A precipitate that weighed 5.56g was formed. Find the amount of potassium chloride in the solution (3marks)

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19. 1.9g of Magnesium chloride was dissolved in water. Silver nitrate solution was added till excess. Calculate the mass of silver nitrate that was added for complete reaction. (3marks)

(MgCl<sub>2</sub>= 95, N=14, O=16, Ag = 108)

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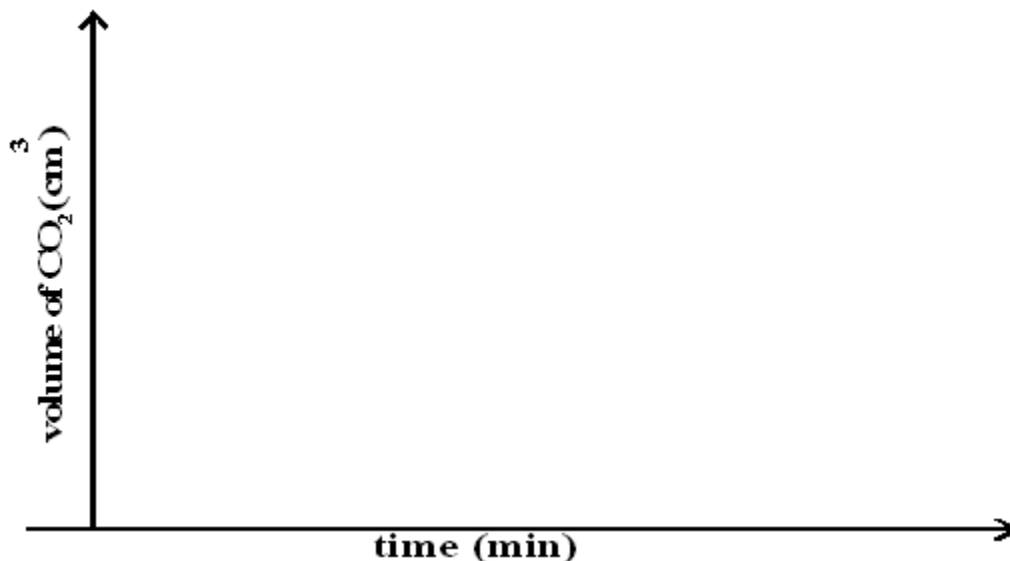
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20. In an experiment  $40\text{cm}^3$  of  $0.5\text{M}$  nitric acid was reacted with excess Sodium Carbonate and the volume of Carbon (IV) Oxide produced recorded with time. In another experiment, the same volume and concentration of ethanoic acid was reacted with excess Sodium Carbonate and the volume of Carbon (IV) Oxide produced recorded with time.

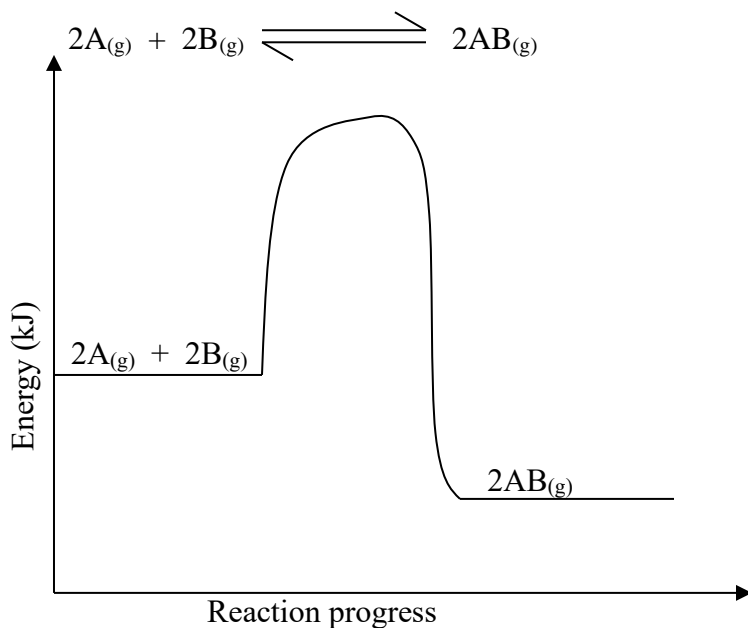
a) Why was Sodium Carbonate used in excess? *(1marks)*

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b) On the graph below sketch and label the curves of the volumes of Carbon (IV) Oxide produced against time. *(2marks)*



21. The figure below is an energy level diagram for the reaction.



Explain how the following conditions would affect the yield of AB.

(i) Increase in pressure.

(2marks)

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(ii) Decrease in temperature.

(2marks)

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22. A white solid K was heated. It produced a brown gas A and another gas B which relights a glowing splint. The residue left was yellow even after cooling.

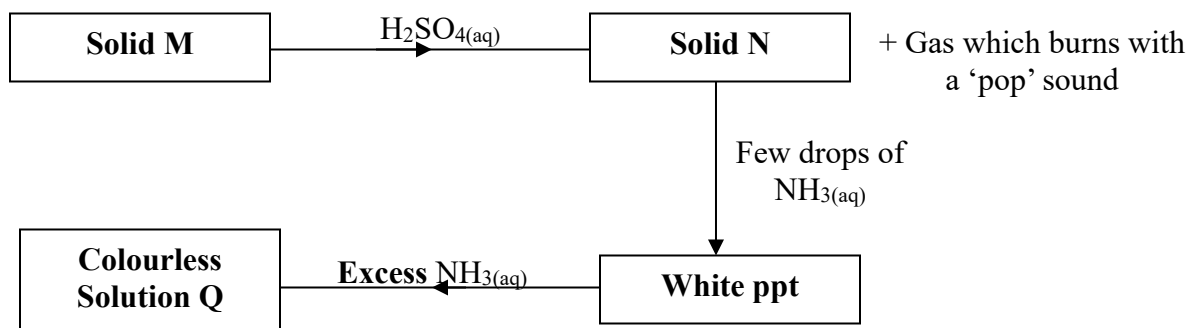
a) Identify gases **A** and **B**. (2marks)

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b) Write a balanced chemical equation for the decomposition of solid K. (1mark)

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23. The scheme below shows some reaction sequence starting with solid M.



a) Name solid **M**. (1mark)

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b) Write the formula of a complex ion present in solution **Q**. (1mark)

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Write an ionic equation of the reaction between barium nitrate and solution **N**. (1mark)

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24. (a) What is meant by a saturated solution? (1mark)

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(b) In an experiment to determine the solubility of solid Y in water at 30°C the following results were obtained.

Mass of evaporating dish = 26.2g

Mass of evaporating + saturated solution = 42.4g

Mass of evaporating dish + dry solid Y = 30.4g

Using the information, determine the solubility of solid Y at 30°C. (2marks)

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25. Compare the electrical conductivity of dilute Sulphuric (VI) acid and concentrated Sulphuric (VI) acid. Explain your answer. (2marks)

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26. Draw a well labelled diagram of a setup used to prepare and collect dry Sulphur IV oxide. (3marks)

27. The molar heat of formation of carbon (II) oxide is  $-105\text{kJmol}^{-1}$ , molar heat of combustion of carbon is  $-393\text{kJmol}^{-1}$ .

By using an energy cycle diagram, determine the molar heat of combustion of carbon (II) oxide.

(3marks)

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28. In an experiment, a small amount of charcoal was added into a test tube and 5cm<sup>3</sup> of concentrated nitric (V) acid added, then warmed.

(i) State the observation that was made. *(1mark)*

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(ii) Explain the observation made in (i) above. *(1mark)*

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(iii) Write an equation for the reaction that took place. *(1mark)*

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