233 CHEMISTRY PAPERS 2
FORM 3 EXAMS
END OF TERM II EXAM
TIME: 2HOURS

T/C

MAME..ADM NO..................

- *Answer all the questions in the spaces provided.*
- *Write your name and index number in the spaces provided above.*
- *Mathematical tables and electronic calculators may be used for calculations.*
- *All workings must be clearly shown where necessary*

Page No.

For Examiner's Use only:

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 8	80	

1. Study the table below and answer the questions that follow (The letters do not represent the actual Symbols)

element	Atomic number	Boiling point (oC)
R	13	2400
S	20	850
T	15	31
U	12	650
V	10	-249

i. Which elements belong to the same group, give a reason. (2marks)

   S and U

ii. Write the electron arrangement for the following ions

   U^{2+} 2:8   (1 mark)

   T^{3-} 2:8:8   (1mark)

iii. Which element is a gas at room temperature? Explain. (2marks)

   V – Has a very low Boiling point.

iv.   Write the formula of the compound formed when element **R** reacts with oxygen
(1mark) Al_2O_3 / R_2O_3
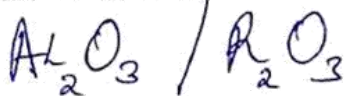
v.   Define the term Octet state; select an element from the table that shows octet state.
(2marks)   Having 8 electrons in the outermost energy
level.   V

vi.   Explain the difference in the boiling points of elements **R** and **S**.   (2 marks)
R has Smaller atomic radius than S, thus metalic
bond in R is Stronger than in S

2.   A form three student wanted to prepare carbon (IV) oxide gas. The diagram below is part of the set up.

Dilute Hydrochloric acid

Magnesium metal   Conc   Conc
#H₂SO₄   H₂SO₄
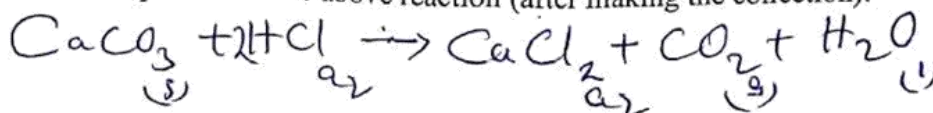water   dry CO_2
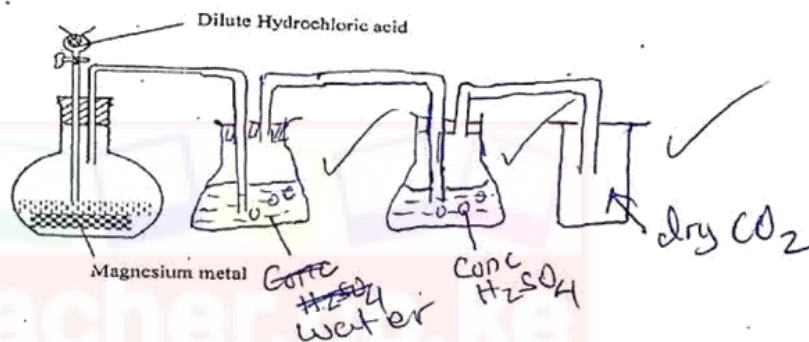
I.   Identify one mistake and correct it.   (2 marks)
Use of Magnesium Metal / It should be $CaCO_3$

II.   Complete the set up showing how a sample of dry carbon (IV) oxide can be collected.
(3marks)

III. Write an equation for the above reaction (after making the collection).   (1mark)
$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$

3.   (a) (i) Name two allotropes of sulphur.   (2marks)
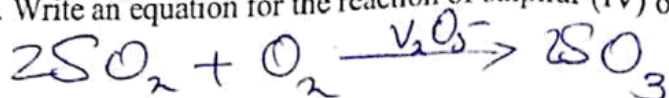- Monoclinic
- Rhombic

(ii) During extraction of sulphur super-heated water is used. State its two functions   (2 marks)
- Hot Compress Air
- To melt Sulphur
- To maintain water In Liquid form.
- To push molten sulphur out

(iV). Write an equation for the reaction of sulphur (IV) oxide and oxygen gas   (1mark)

$$2SO_2 + O_2 \xrightarrow{V_2O_5} 2SO_3$$

(b). The flow diagram below show some of the process involved in production of sulphuric (vi) acid . Use it to answer the questions that follow.
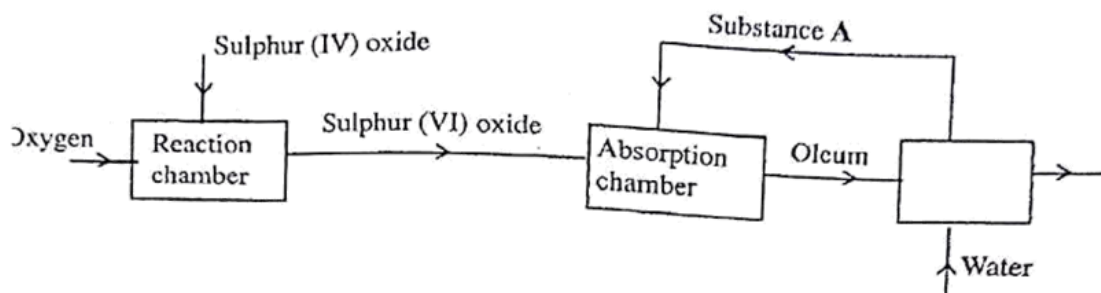
I.   Name substance A. 1mk

   Conc. H_2SO_4

II.   Write an equation for the reaction that takes place in the absorption chamber. 1mk

   $$H_2SO_4 + SO_3 \rightarrow H_2S_2O_7$$

III.   Vanadium V oxide is commonly used catalyst in contact process. Name another catalyst which can be used for this process.1mk

   Platinises Asbestos

IV.   Give two reasons why vanadium (v) Oxide is the commonly used catalyst.2mks

   It Cheap
   Not easily Poisoned.

V.   Explain the reason why sulphur (vi) oxide is not dissolved directly in water during manufacture of sulphuric (vi) acid. 2mks

   The reaction is extremely exothermic. It would boil the acid Producing a dangerous sulphuric acid spray

VI.   Give three uses four use of sulphuric (vi) acid. 3mks
   Weed in Car batteries / make fertilizes / manufacture of.

4.   The set up below is used to prepare nitric acid in the laboratory.
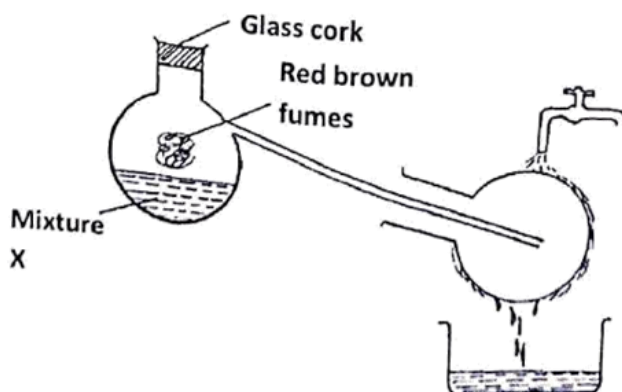
i. Name the reagents in mixture X (2mk)

Conc H_2SO_4 and $NaNO_3$

ii. Write an equation for the reaction which takes place in the glass retort (1mk)

$H_2SO_4 + NaNO_3 \longrightarrow NaHSO_4 + HNO_3$

iii. All the apparatus above must be made of glass give reason. 1mk

Nitric Acid attack rubber corrchon.

iv. Which property makes it possible to separate nitric (V) acid using sulphuric (VI) acid? 1mk

HNO_3 - acid is more valatile

v. Nitric (V) acid is colourless, but the one obtained in the above setup was yellow. Explain. 2mks

Impurities of NO_2 formed due to thermal decomposition of HNO_3 - acid

vi. How can the yellow colour from the acid be removed. 1mk

By bubling Air through the Acid.

vii. State thee uses of nitric acid. 3mks

- Manufacture of Nitrogenou ferilizer
- manufucture of explosives.

5. Study the information below and answer the questions that follow:

Formula of the chloride	NaCl	MgCl₂	AlCl₂	SiCl₄	PCl₃	SCl₂	
M.P(^{0}C)	801	714	-	-70	-91	-80	
Formula of the oxide	Na₂O	MgO	Al₂O₃	SiO₂	P₄O₁₀	SO₂	Cl₂O7
M.P(^{0}C)	1190	3080	2050	1730	560	-73	-90

i. Aluminium chloride $AlCl_3$, has an unexpected bond type and structure.
State the type of bond and the structure in $AlCl_3$
   a. Bond type (1 mk)

   b. Structure (1 mk)

ii. What type of bonding would $AlCl_3$ be expected to have why? (1mk)

Me Ionic Because metal reacts by lossing electrons while non-metal reacts by gaining Eletrons

iii. Why is the melting point of $AlCl_3$ not indicated in the table above? (1mk)

It sublimes

iv.   A piece of blue litmus paper is placed in a solution of sodium chloride and a solution of aluminium chloride. Explain what would be observed in each case.

a.   Sodium chloride solution – *Remains blue. Its a neutral* (1mk)
    Solution

b.   Aluminium chloride solution *Aluminium salts hydralives in water* (2mks) *water*
    Turns Red. Aluminium salts hydralives in water
    forming Acidic Solution.

v.   Explain the large difference in the melting point of the compound of formula MgO and P_4O_{10}
    MgO forms Ionic bond which is stronger (2mks)
    than covalent bond in P_4O_{10}

vi.   Write down the equations for the reaction between the compounds of formula Na_2O and water.   (1mk)
    $$Na_2O + H_2O \rightarrow 2NaOH$$
    (s)   (l)   (aq)

6. The following diagram below shows a series of steps followed in the manufacture of sodium carbonate.
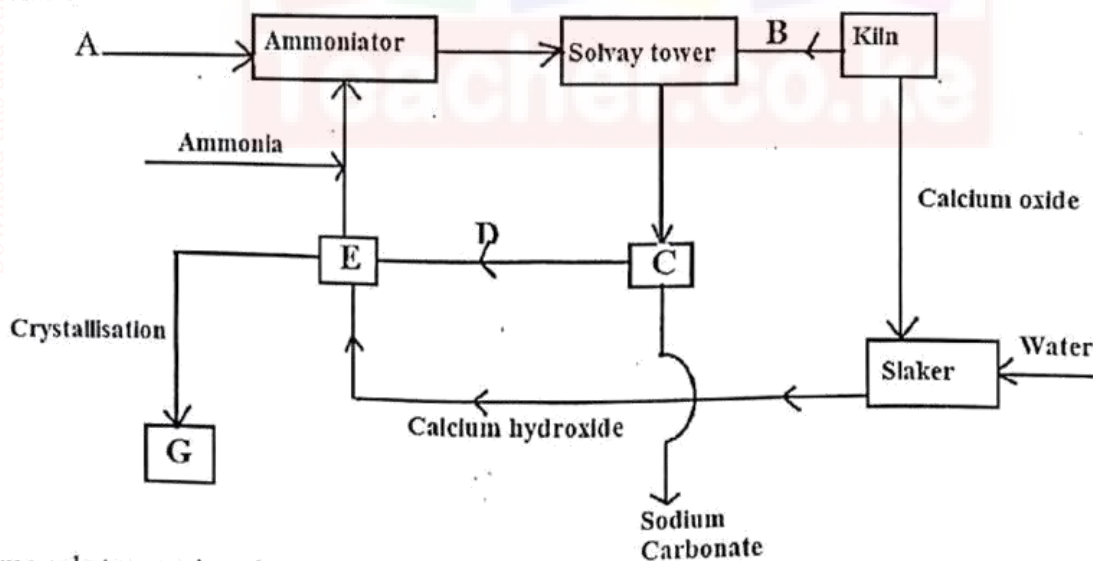
a)   Name substances A and B.   (2mks)
    A – *Brine (Conc. $NaCl_{aq}$)*

    B – CO_2

b) Write equations for the reactions taking place in:
    i) The Solvay tower. $NaCl + H_2O + NH_3 + CO_2 \rightarrow NaHCO_3 + NH_4Cl$ (2mks)
                                                    (s)   *aq*

    ii) Chamber E. $NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + NH_3 + H_2O$ (1mk)
                aq   *aq*   *aq*   *(g)* *(l)*

c) i) Identify substance G.   (1mk)

$CaCl_2$

ii) State one laboratory use of substance G.
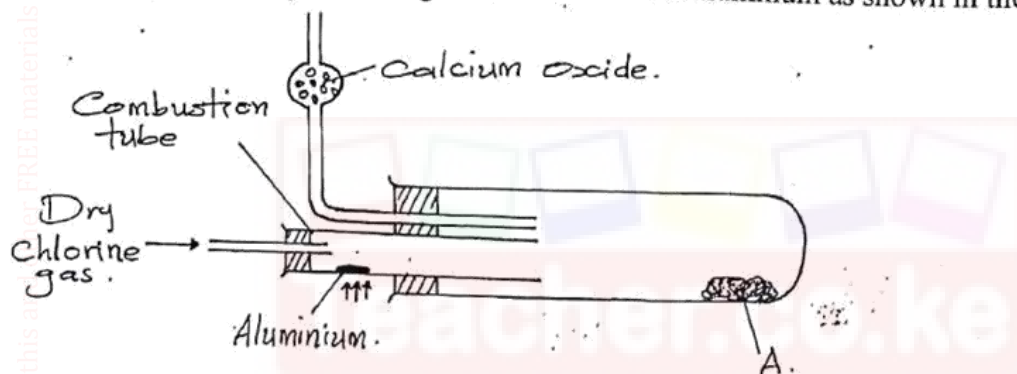   I. Laboratory use   (1mk)
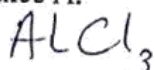   Used as a drying Agent

d) Name two important industrial use of sodium carbonate.   (2mks)
    - Used in manufacture of glasses
    - Used to soften hard water
    - Used in paper Industries

7. In an experiment dry chlorine gas was reacted with aluminum as shown in the diagram below.
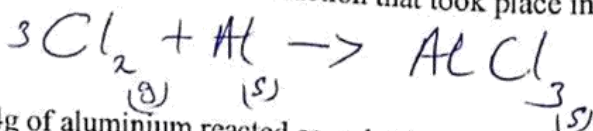

i) Name substance A.   (1mk)
   $AlCl_3$

ii). which property makes it possible to collect A as shown in the diagram.   (1mk)
   $AlCl_2$ Sublimes

iii) Write an equation for the reaction that took place in the combustion tube.   (1mk)

$$3Cl_{2(g)} + Al_{(s)} \rightarrow AlCl_{3(s)}$$

iv) 0.84g of aluminium reacted completely with chlorine gas. Calculate the volume of chlorine gas used. (Molar gas volume is 24dm³ Al = 27).   (3mks)

$moles = \frac{0.84}{27} = 0.031$ | $moles\ of\ Cl = 0.031 \times 3$ | $0.093\ mole = x$
                                          = 0.093   1 mole = 24dm³

$x = \frac{24 \times 0.093}{1} = 2.24 dm^3$

v). what is the purpose of calcium chloride.   1mk
   Prevent entry of moisture

8. Air was passed through several reagents as shown in the flow chart below.

Gas P

Air → Electrostatic Precipitation → Concentrated Sodium Hydroxide → Excess heated Copper turnings → Excess heated Magnesium Powder

Concentrated Sodium Hydroxide → Compressor → Fractionating column

Fractionating column → Nitrogen (-196°C) | Argon (-186°C) | C (-183°C)
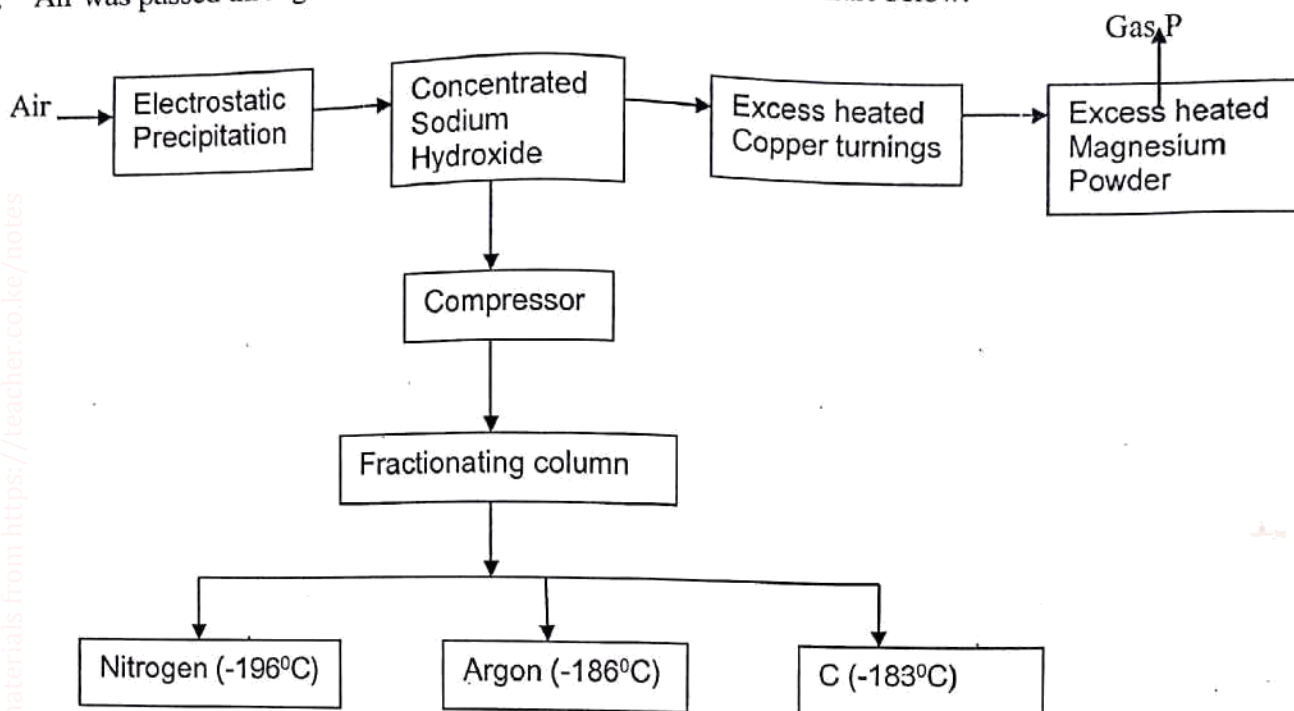
i. Name the major component of air. (1mks)

   Nitrogen

ii. Write an equation for the reaction which takes place in the chamber with:
a) Concentrated sodium hydroxide. (1mk)

   $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

b) Excess heated copper turnings. (1mk)

   $2Cu_{(s)} + O_{2(g)} \rightarrow 2CuO_{(s)}$

c) Excess heated magnesium powder. (1mk)

   $3Mg_{(s)} + N_{2(g)} \rightarrow Mg_3N_{2(s)}$

iii. Name **one** gas which escapes from the chamber containing magnesium powder. Give a reason for your answer. (2mks)

   Argon - Its Inactive

iv. Name the substance that was eliminated by electrostatic precipitation. (1mk)

   Dust Particles

v. Name a reagent that can be used in place of concentrated sodium hydroxide. (1mk)

   KOH

vi. State **three** uses of gas C. (3mks)

   - Used In welding
   - Used In hospital by patient with breathing problem
   - Used by mountain climbers