CHEMISTRY FORM 3

END TERM 1 2022

TIME: $2\frac{1}{2}$ HOURS

Instructions:

This paper consists of two sections, **EACH** section **50** marks.

All working **MUST** be clearly shown.

SECTION A

1. 60 ml of ozone gas diffused through a porous partition in 5 min 10 sec. how many seconds would it take 80 ml of nitrogen (i) oxide to diffuse through the same partition under same condition. (N=14, O=16) (3mks)

60 ml ⇒ 310 sec
80 ml ⇒ ?
$\frac{80 \times 310}{60} = 413$ sec ✓

$\frac{T_{N_2O}}{T_{O_3}} = \sqrt{\frac{N_2O}{O_3}}$

$\therefore T_{N_2O} = T_{O_3}\sqrt{\frac{N_2O}{O_3}}$ ✓

$= 413 \times \sqrt{\frac{14\times2+16}{16\times3}}$

$= 395.4$ sec ✓

2. Below are 3 isotopes of element Neon. Study it and answer the questions that follows.

Ne- 20	90.9%
Ne – 21	0.3%
Ne – 22	8.8%

(i) What are isotopes (1mk)

Atoms of elements that have same atomic number but different mass number ✓

(ii) Calculate the relative atomic mass of Neon (3mks)

$R.A.M = \frac{(20\times90.9)+(21\times0.3)+(22\times8.8)}{3}$ ✓✓

$= 20.179$ ✓

3. 0.28g of Aluminium reacted completely with Oxygen gas. Calculate the volume of oxygen used. [molar gas volume = 24= dm^3 Al =27 O = 16] (3mks)

$4Al_{(s)} + 3O_{2(g)} \rightarrow 2Al_2O_{3(s)}$ ✓

Moles of Al $= 0.28/27 = 0.0104$

Moles of O_2 (Mole ratio 4:3) $= \frac{0.0104\times3}{4}$

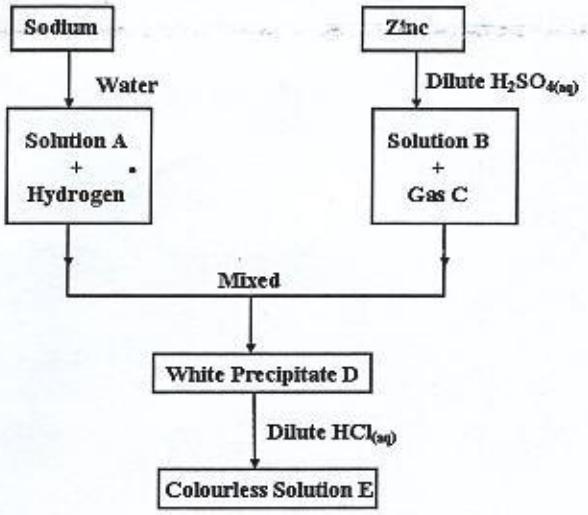
$= 0.0078$ moles ✓

But moles $= m/M.C$ ✓

Volume $= 0.0078 \times 24$

$= 0.187\ dm^3$ ✓

10



a) Give the name and the formula of the following (2mk)

	Name	Formula
Solution A	Sodium hydroxide ✓	NaOH ✓
* Precipitate D Solution B.	Zinc Chloride ✓	$ZnCl_2$. ✓

b) Give the equation for the;

i) Formation of B and gas C (2mk)

$Zn_{(s)} + H_2SO_{4(aq)} \rightarrow ZnSO_{4(aq)} + H_{2(g)}$ ✓✓ 5/5

ii) Formation of solution A and hydrogen gas

(1mk) $2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$ ✓

c) Describe a chemical test for gas C (2mk)

Insert a burning splint in gas jar containing gas C, it extinguished ~~with~~ with a pop sound ✓✓

d) Give two observations made when sodium metal is placed on water (2mk)

i. darts on surface ✓

ii. Melts forming silver ball ✓

(d) Name the process that takes place in chamber Y. (1 mark)

Filtration ✓

(e) State any 2 by-products recycled in the process. (2 marks)

Ammonia ✓

Carbon(IV) oxide ✓

(f) state one use of calcium chloride

drying agent in preparation of hydrogen gas ✓ // in extraction of Na from NaCl by lowering mpt of NaCl).

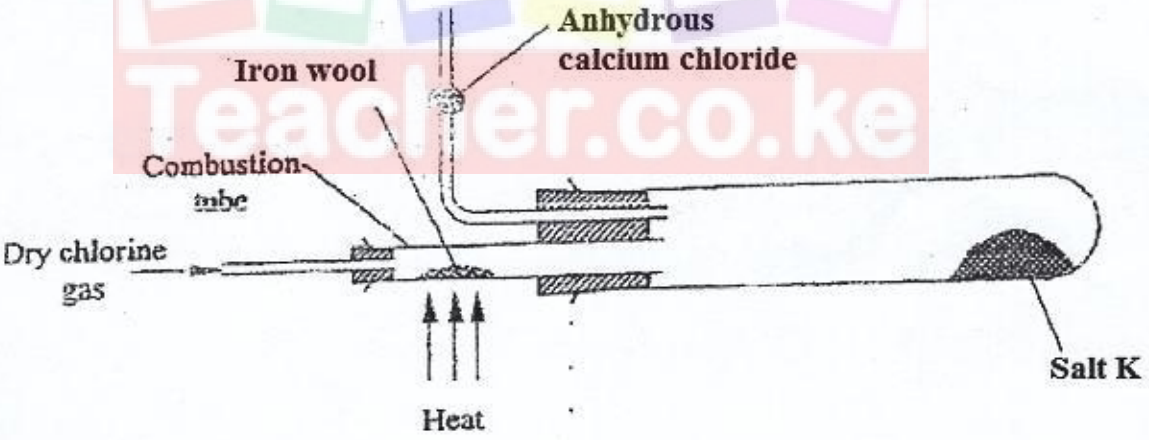
1mks

(g) Mention any 2 uses of sodium carbonate. (2 mark)

Soften hard water ✓

used in making glass ✓

18. Study the set up below.



a) Name salt K (1mk)

Iron(III) Chloride ✓

(b) Write the equation for the reaction for the formation of salt K (1mk)

$2Fe_{(s)} + 3Cl_{2(g)} \rightarrow 2FeCl_{3(s)}$ ✓

(c) What property of salt A is exhibited as shown in the experiment.(1mk)

It Sublimes ✓

(d) What is the purpose of anhydrous calcium chloride? Explain (2mk)

To keep moisture at bay since $FeCl_3$ is deliquescent substance ✓ ✓

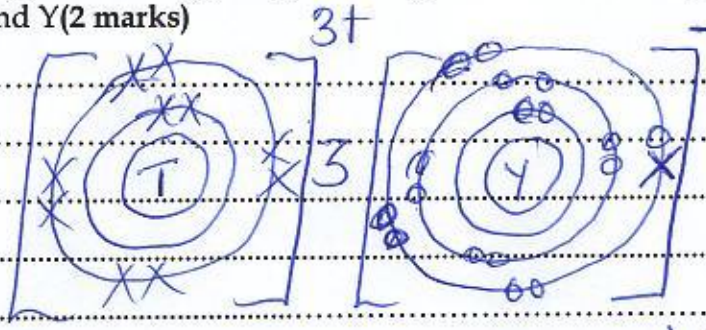
(e) Name another metal that can be used to produce similar results (1mk)

Aluminium ✓

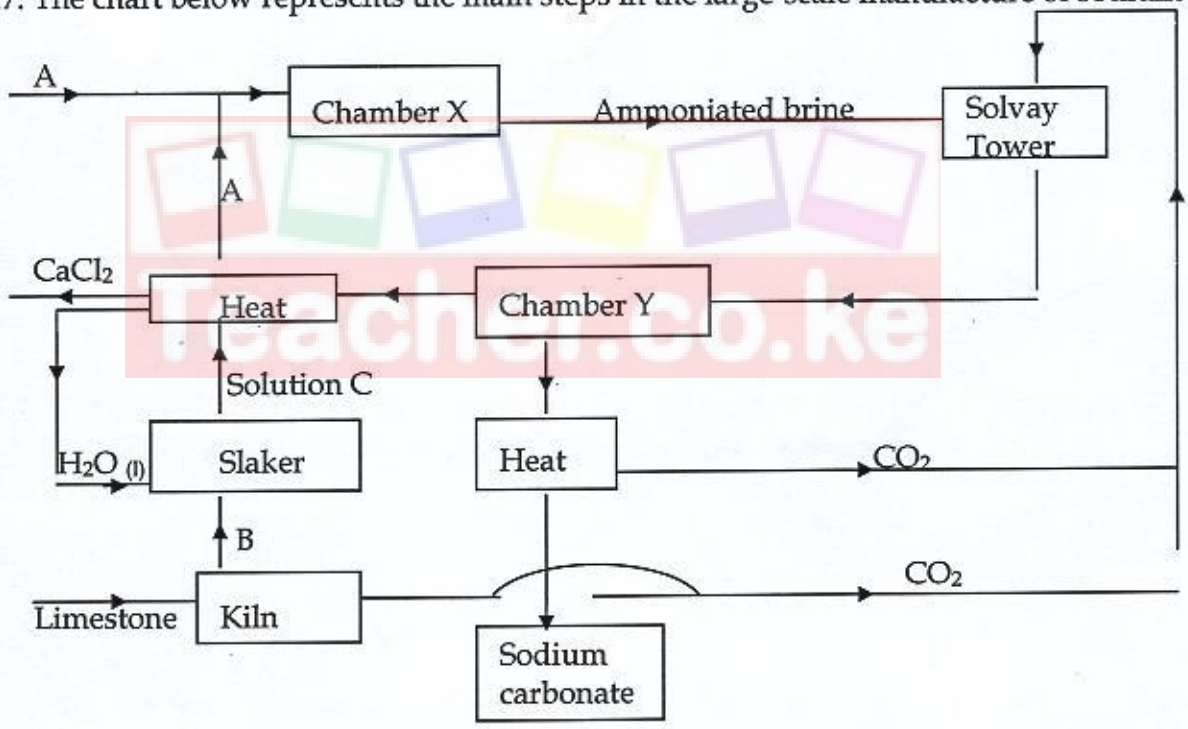
19. The scheme below shows the preparation of a certain salt. Study it and answer the questions that follow

$T^{3+} + Y^{-}$

h) Draw (a) dot (.) and cross (x) diagram to represent the bonding in compound formed between T and Y **(2 marks)**



17. The chart below represents the main steps in the large-scale manufacture of sodium carbonate.



(a) Name substances A and B.

A ...Ammonia ✓..... **(1 mark)**

B ...Calcium Oxide ✓..... **(1 mark)**

(b) Write down the chemical equation leading to formation of C. **(1 mark)**

$CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)}$ ✓

.....

(c) A stream of cold water is made to circulate around chamber X. What does this suggest about the reaction taking place. **(1 mark)**

It is exothermic ✓.....

16. The grid below forms part of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements

P				T	V	W	Y	M
	Q		S	U	N	X		
	R						Z	

a) Write the general name given to the element P belong. **(1mark)**

Alkali metals ✓

b) An element N has an atomic number of 15. Write down its electronic arrangement and hence fix it in its right position on the grid above. **(2marks)**

Electronic arrangement 2 : 8 : 5 ✓

c) Compare the size of the atom of R and that of its ion. Explain your answer. **(2marks)**

$R > R^{2+}$ ✓

It loses electrons when forming ion hence energy level ✓ results to decrease in size.

d) Give the formula of the compound formed between **(1mark)**

i. P and W $P^{+} + W^{2-} \rightarrow P_2W$ ✓

ii. T and Y $T^{4+} + Y^{-1} \rightarrow TY_4$ ✓

e) Compare the melting points of element Q and S. Explain **(2marks)**

S > Q ✓

Q has more Valence e⁻ hence stronger Metallic bond ✓

Q smaller than S hence stronger metallic bond.

* f) State the least reactive element in the grid. Give a reason for your answer **(2marks)**

Select: unreactive.

M ✓

show negligible tendancies of gaining or losing electrons. ✓

g) Give two advantages that element S has over element Q in making electric cables **(2mks)**

S has more Valence e⁻ hence better Conductor ✓

S forms thin oxide layer making it unreactive ✓

SECTION B

15. (a) Name two apparatuses that can be used for determining accurate volume in a laboratory **(2marks)**

Volumetric flask ✓
pipette ✓
Burette, measuring cylinder.

(b) One of the flames produced by Bunsen burner is the luminous flame

i) Explain why this flame is very bright **(1mark)**

It has unburnt carbon which is luminous. ✓

ii) State two disadvantages of the luminous flame **(2marks)**

- Its sooty ✓
- Its less hot ✓

(c) Air is usually one of the substances that is considered as a mixture

(i) Identify the two most abundant component of air **(2marks)**

- Nitrogen gas ✓
- Oxygen ✓

(ii) Give two reasons why the air is considered as a mixture **(2marks)**

- The components of air can be separated by physical means. ✓
- Components are not chemically combined ✓

(iii) One of the components of air is carbon (iv) oxide. Describe an experiment that can be used to prove the presence of carbon (iv) oxide in the air **(2marks)**

Bubble the air into an aqueous solution of calcium hydroxide. ✓ a white precipitate is formed ✓

10. (a) Calculate the number of sodium atomsa present in 40g of sodium metal

["L" = 6.02×10^{23} Na = 23] (3mks)

Moles of Na $\Rightarrow 40/23 = 1.739$ moles. ✓

But moles = No of particles / Avagadros NO ✓

No. of particles $= 1.739 \times 6.02 \times 10^{23}$

$= 1.0469 \times 10^{24}$ ✓

(b) Calculate the molarity of sodium hydroxide if 40g of sodium hydroxide was dissolved water to make 500ml of solution. (3mks)

Moles of NaOH $\Rightarrow \frac{40}{(23+16+1)}$

$= 1$ mole ✓

Molarity $= \frac{1000 \times 1}{1000} = 1M$ ✓

Na = 23 - 1 = 1 0 = 1

11. Describe an experiment to show that group one element reacts with cold water forming an alkaline solution. (3mks)

Take a small grain size portion of Sodium/Potassium/Lithium ✓

Place it in a beaker containing a bit of water ✓

Test the resulting solution using red litmus paper ✓ it turn blue.

12. Name three methods of gas collection. (3mks)

Over Water Method ✓

downward delivery ✓

upward delivery ✓

13. (i) Candle wax is mainly compound consisting of the elements. Name the two elements (2mks)

Hydrogen ✓

Carbon ✓

(ii) State one industrial use of hydrogen gas (1mk)

Hardening of oil to fat ✓ // in manufacture of HCl with Cl_2. // in Oxy-hydrogen flame do cut metals

14. (a)Write the chemical formula of rust (1mk)

$Fe_2O_3 \cdot 3H_2O$ ✓

(b) List 3 methods of prevent rusting (3mks)

- greasing/oiling ✓
- painting ✓

b. Describe how a solid sample of copper (ii) nitrate can be prepared in the lab starting with copper metal (3mk)

Heat copper in Crucible to obtain CuO. ✓
Add excess CuO to warm dilute Nitric(v) acid and stir ✓. Filter ✓ Heat the filtrate until it is saturated allow saturated solution ✓ to cool, dry the crystals ✓ formed in between filter paper.

7. (a) State Charles law (1mk)

Volume of fixed mass of gas is directly proportional to its absolute temperature provided pressure is kept constant. ✓

(b) A gas occupies 300ml at a pressure of 570 mmHg and temperature of -136 degrees Celsius. What would be its volume at stp. (3mks)

$P_1 = 570mmHg$ $P_2 = 760mmHg$
$V_1 = 300ml$ $V_2 =$ ✓
$T_1 = -136+273 = 137K$ $T_2 = 273K$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$V_2 = \frac{P_1V_1T_2}{T_1P_2}$ ✓

$V_2 = \frac{570 \times 300 \times 273}{137 \times 760}$

$= 448.36cm^3$ ✓

8. (a) State Gay Lusacs law. (1mk)

When gases combine, they do so in volumes that bear simple ratios to one another and to product if gaseous.

(b) Under certain condition methane react with steam forming carbon (ii) Oxide and Hydrogen. Calculate the total volume of the of gas that would be form when a 100ml of steam react completely with methane (2mks)

$CH_{4(g)} + \underset{100ml}{H_2O_{(g)}} \rightarrow CO_{(g)} + 3H_{2(g)}$ ✓

$CO = 100ml$ ✓

$H_2 = 100 \times 3 = 300ml$ ✓

9. Ammonia and nitric (v) acid are used to manufacture ammonium nitrate. Calculate the amount of nitric (v) acid required to manufacture 1000kg of ammonium nitrate using excess ammonia gas. [N = 14, H = 1, O = 16] (3mks)

$NH_{3(g)} + HNO_{3(aq)} \rightarrow NH_4NO_{3(aq)}$ ✓

Moles of $NH_4NO_3 \Rightarrow \frac{1000}{(14\times2+1\times4+16\times3)} = 12.5 moles$ ✓

Moles of $HNO_3 \Rightarrow 12.5$ moles (mole ratio 1:1)

Mass of $HNO_3 \Rightarrow 12.5 \times (1+14+16\times3)$

$\Rightarrow 787.5kg$ ✓

$\frac{1000 \times 1000}{(14\times2+1\times4+16\times3)} = 12,$ mo

Moles of $HNO_3 \Rightarrow 12,500$

Mass of $HNO_3 = 12500 \times$

$= 787,5$

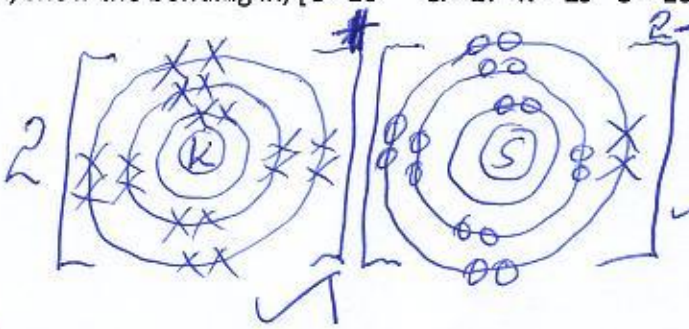
4. Using dots (.) and cross(X) diagram, show the bonding in; [C =16 Cl= 17 K = 19 S = 16]

(i) Potassium Sulphide ($1\frac{1}{2}$ mks)

K = 2 8 8 1 S = 2 : 8 : 6

K^+ S^{2-}

$K^+ + S^{2-} \rightarrow K_2S$ ✓1



✓1

(ii) Carbon tetrachloride ($1\frac{1}{2}$ mks)

C = 2 : 4 (X)

Cl = 2 : 8 : 7 (o) ✓

✓ ✓1

5. During laboratory preparatioin of Oxygen, Manganese (iv) Oxide is added to reagent H.

(i) Name reagent H. (1mk)

Hydrogen peroxide ✓

(ii) State the role of Manganese (iv) Oxide in this experiment (1mk)

Catalyst ✓ // speed up rate of reaction

(iii) Write the chemical equation for the reaction that took place (1mk)

$2H_2O_{2(l)} \xrightarrow{MnO_2} O_{2(g)} + 2H_2O_{(l)}$ ✓

6. Salt may be classified as soluble or insoluble salt.

a. Select from the following list a pair of compounds that can be used to prepare soluble and insoluble salts.

Nitric acid, lead nitrate, Potassium Nitrate, Barium Oxide, Sodium Chloride

(i) Soluble salt (1mk)

BaO & HNO_3 ✓

(ii) Insoluble salt (1mk)

NaCl & $Pb(NO_3)_2$ ✓

e) Distinguish between anhydrous salt and dry salt (1mk)

Anhydrous salt is salt that doesn't contain wder of crystallisation while dry salt is a salt which doesn't have any moisture or wder in it.