NAME ..... MARKING SCHEME ..... DATE.....

ADM.NO .....STREAM..... CANDIDATE'S SIGNATURE .....

233/1

CHEMISTRY FORM 3

(THEORY)

TIME: 2 Hours

CASPA AMUKURA PARISH EXAMINATION 2021

Instructions to Candidates

(a) Write your name and admission number in the spaces provided above

(b) Sign and write the date of examination in the spaces provided.

(c) Answer all the questions in the spaces provided

(d) KNEC Mathematical tables and silent electronic calculator may be used.

(e) All the working must be shown clearly where necessary

(f) Candidates should answer questions in English.

For Examiner's Use Only

Questions	Maximum Score	Candidate's Score
1-26	80	

1. An element K has atomic number 20 while element M has atomic number 8.

   a) Write the electronic configuration for K and M

   K 2.8.8.2 ..... (½)

   M

   2.6 ..... (½)

   b) Write the symbol of the most stable ion of K and M

   K

   K^{2+} ..... (½).

   M

   M^{2-} ..... (½)

2. Molten Lead (II) bromide is electrolyzed using carbon electrodes. Write the half equations of the reactions that occur at the anode and the cathode.

a) Anode

$2Br^-_{(aq)} \longrightarrow Br_{2(g)} + 2e^-$ ..... **(1mrk)**

b) Cathode

$Pb^{2+}_{(aq)} + 2e^- \longrightarrow Pb_{(s)}$ ..... **(1mrk)**

4. Three metal oxides XO, YO, and ZO are heated with powdered metal Y. Hot powdered Y will remove oxygen from XO but not from ZO. Arrange the metals in order of reactivity, starting with the most reactive. **1mark**

ZO, YO, XO

↓ most reactive ↘ Least reactive

5. The table below shows the relative atomic masses and the percentage abundance of the isotopes T_1 and T_2 of element T.

	RAM	% abundance
T_1	62.93	69.09
T_2	64.93	30.91

Calculate the relative atomic mass of element T [3 mks]

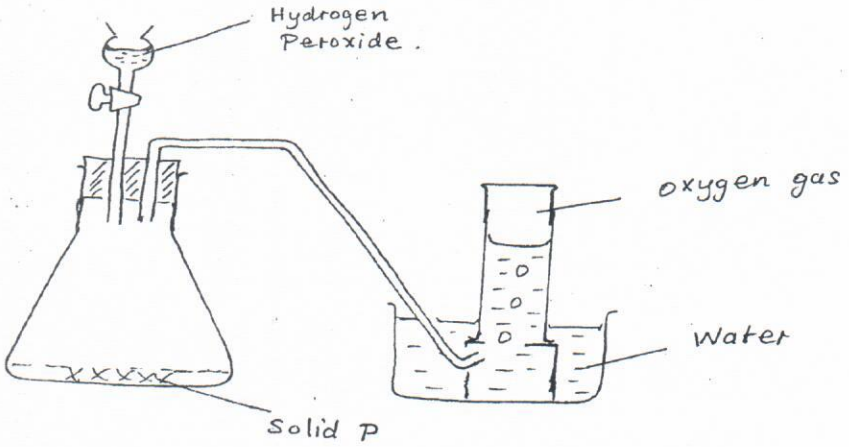
R.A.M = $\frac{(\text{RAM of } T_1 \times \% \text{ abundance}) + (\text{RAM of } T_2 \times \% \text{ abundance})}{100}$

$\frac{(62.93 \times 69.09) + (64.93 \times 30.91)}{100}$

$\frac{(4347.83 + 2006.99)}{100}$

R.A.M = 63.54

6. The diagram below is a set-up for the laboratory preparation of oxygen gas.



a. Name solid

P. Manganese(IV) oxide [1 mk]

b. Write an equation for the reaction that takes place in the conical flask

$H_2O_{2(l)} \xrightarrow{MnO_{(s)}} H_2O_{(l)} + O_{2(g)}$ [1 mk]

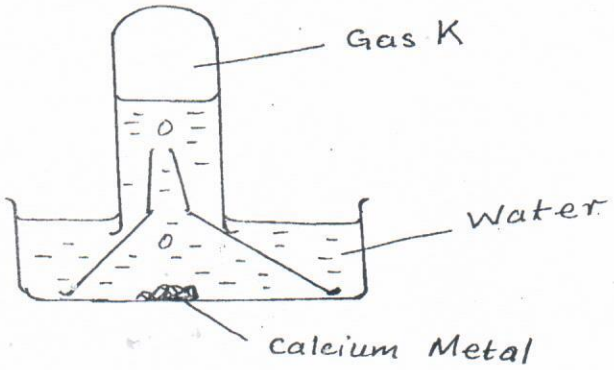
c. Give two commercial uses of oxygen [1 mk]

(i) used in hospitals for patients with breathing difficulties.
(ii) used as one of the reactants in fuel cells.

i. .....

.....

7. The figure shows a set-up by a form three student to prepare a certain gas



a) Write an equation for the formation of gas K [1 mk]

$Ca_{(s)} + 2H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)} + H_{2(g)}$

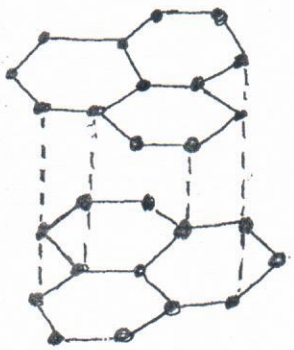
b) Give one use of gas K in the industries [1 mk]

- It is used during Hardening of oils to fats (Hydrogenation).

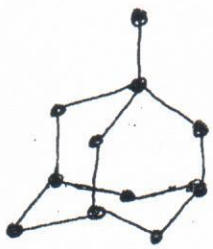
c) Give one use of the resulting solution after the metal has reacted (1 mk)

- used in neutralizing acidic soils.
- lining of chimney in industries that emit acid gases.

8. The diagram shows the structures of two allotropes of carbon. Study them and answer the questions that follow.



A



B

d. Name allotrope A and B [2 mks]

A. Giraphite

B. Diamond

e. Give two uses of allotrope B [2 mks]

i. Used in making jewels.

ii. Used in glass cutters.
Used in drill bits.

f. Which allotrope conducts electricity? Explain. [2 mks]

A. It has delocalised electrons in its structure;
It uses only three of the four valence electrons in bonding leaving one free in the structure.

9. State two differences between permanent and temporary changes (2 marks).

Permanent.	Temporary.
Irreversible	Reversible.
New substance formed	No new substance formed.
Mass change	No mass change.

10. The table below give some properties of substances I, J and K. Study it and answer the questions that follow.

Substance.	Melting point (^{0}c)	Solubility in Water.	Electrical Conductivity in:	
			Solid state.	Molten state.
I	1063	Insoluble	Conducts.	Conducts.
J	113	Insoluble	Doesn't	Doesn't
K	402	Sparingly soluble.	Doesn't	Conducts and it is decomposed.

(a) Suggest the type of structure in:

I Metallic Structure. (1 mark).

K Giant ionic Structure (1 mark).

(b) Explain why molten K is decomposed by current but I is not decomposed. (1 mark).

K has Giant ionic structure made of ions which can be decomposed. I has Giant molecular structure made of molecules. can't be decomposed.

11. Solution R, S and T have pH values shown in the table below.

Solution	pH
R	1.0
S	6.5
T	8.0

(a) What do you deduce about the nature of solution R? (1 mark).

Strong Acidic Solution.

(b) Identify two solutions that will react to form a neutral solution. (1 mark).

R and T

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

							E
A	B	C				D	
	G	I				H	
F							

a) (i) Write down the electronic configuration of element E. (1mk)

2

(ii) Ion formed by element H.

2.8.8 (1mk)

(iii) Formula or compound formed when G combines with D.

GD_2 (1mk)

b) Identify the type of bond formed in a (iii) above? Give a reason. (2mks)

- Ionic bond. Formed between a metal and

c) Explain the differences in the melting points of A and B. (2mks)

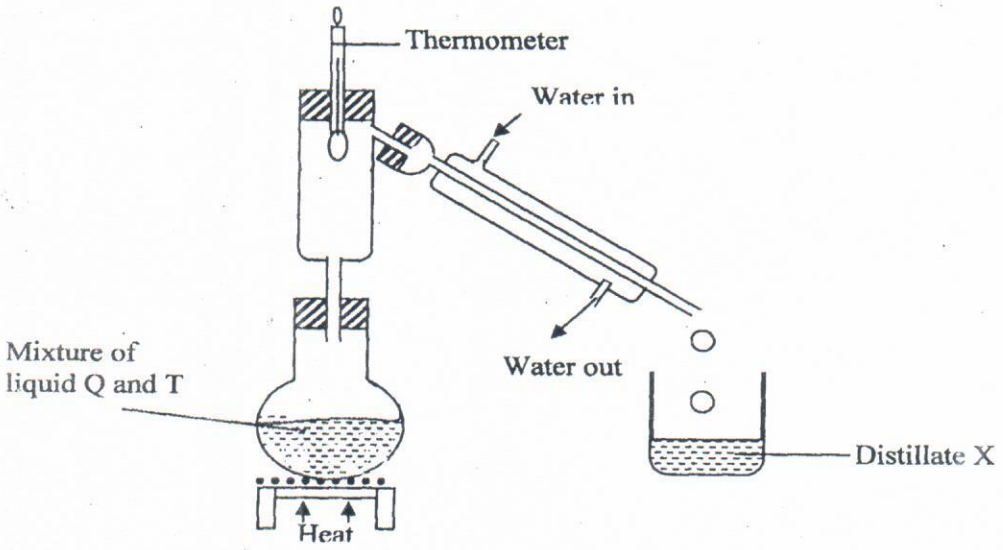
The melting point of B is higher than that of A; B has a smaller radius compared to A hence strong bonds / The Bond in B is made of 2 electrons while in A is made of 1 electro

d) Compare the reactivity of element D and H. (2mks)

D is more reactive than H. Reactivity of Halogens decreases down the group due to increase in electron affinity

13. The setup below was used to separate two miscible liquids Q and T

(Boling points; Q =98° C, T=78°C)



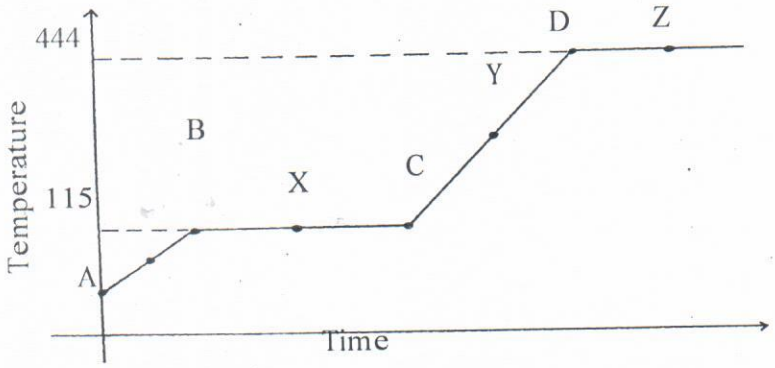
(a) Identify the mistakes in the setup above (2mks)

Interchange of water in and water out Points.

(b)Identify Distillate X (1mk)

Liquid T

14. The diagram below shows the heating curve of a substance. Study it and answer the questions that follow:



(a) What is the melting and boiling point of the substance? (1mk)

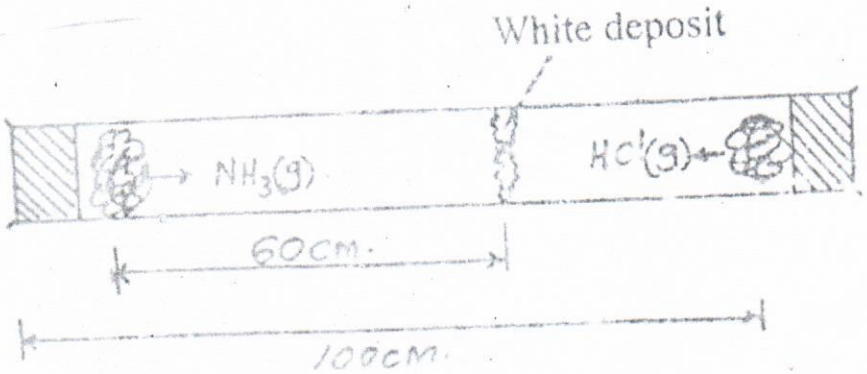
Melting Point → 115°C

Boiling Point → 444°C

(b)Explain what happens to the melting point when sodium chloride is added to this substance. (2mks)

The melting point reduces. Impurities reduces (Lowers) the melting Point of a substance.

15. Two pieces of cotton wool were separately soaked in concentrated Ammonia and Hydrochloric acid solution respectively. Then, were simultaneously placed at the end of an open-ended tube.



a) Name the white deposit. (1 mark).

Ammonium chloride

b) Workout the relative rates at which Ammonia (NH_3) and Hydrogen chloride (HCl) gas diffuse.

(N=14, H=1 ,Cl=35.5) (2mark).

$\frac{R_{NH_3}}{R_{HCl}} = \sqrt{\frac{M_{HCl}}{M_{NH_3}}}$

$\frac{R_{NH_3}}{R_{HCl}} = \sqrt{\frac{36.5}{17}}$

$\frac{R_{NH_3}}{R_{HCl}} = 1.465$

$R_{NH_3} = 1.5\ R_{HCl}$

This implies that Ammonia diffuses 1.5 times faster than HCl.

c) Name the gas law that explains the difference in the rate of diffusion. (1 mark)

Graham's law of diffusion.

16. a)What is allotropy? (1mk)

Existence of an element in more than one form in the same physical state.

b)A burning magnesium continues to burn inside a gas jar full of carbon (IV) oxide. Explain.. (2mks)

Heat produced by burning Magnesium decomposes Carbon(iv) oxide into carbon and Oxygen. Oxygen produced supports burning of magnesium.

17. Calculate the number of moles present in:

a) 12g of sulphur (S=32) (2mks)

moles = $\frac{\text{mass}}{\text{Molar mass}}$ $\frac{12}{32}$

= 0.375 moles

b) 9.8g of sulphuric acid (S=32,O=16,H=1) (2mks)

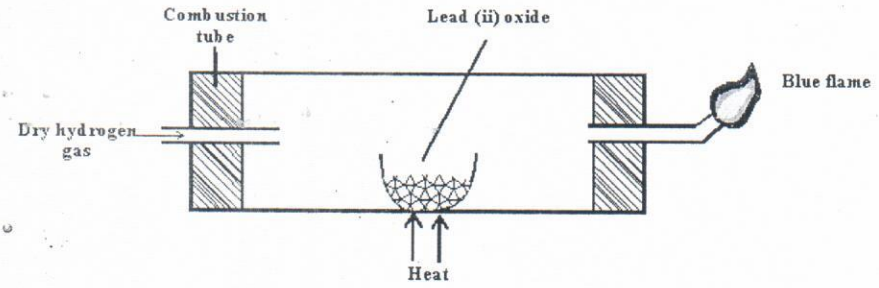
moles = $\frac{\text{mass}}{\text{Molar mass}}$

$H_2SO_4 = 2+32+64$

$\frac{9.8}{98}$

$= 0.1$ moles.

18. When dry hydrogen gas passed over heated Lead (II) oxide in combustion tube, a grey solid was formed.



a) Identify the grey solid. (1mk)

Lead metal.

b) Write the equation of the reaction taking place in the combustion tube. (1mk)

$PbO_{(s)} + H_{2(g)} \longrightarrow Pb_{(s)} + H_2O_{(l)}$

c) Write the equation involving the blue flame. (2mks)

$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$

19. a) State Charles' law (1mk)

It states that the volume of a fixed mass of a gas is directly proportional to its absolute temperature at constant pressure.

b) The volume of a sample of nitrogen gas at temperature of 298k and 600mmHg pressure was $0.048m^3$, calculate the temperature at which the volume of the gas would be $0.032m^3$ if pressure remains the same. (2mks)

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\quad \frac{298 \times 600 \times 0.032}{600 \times 0.048} = T_2$

$\frac{600 \times 0.048}{298} = \frac{600 \times 0.032}{T_2}$ $\quad T_2 = 198.67K$

20. Some sodium chloride was found to be contaminated with copper (II) oxide. Describe how a sample of sodium chloride can be separated from the mixture. **(2marks**

- Add water to the mixture to dissolve sodium chloride
- filter to obtain copper(II) oxide residue and sodium chlorid
- Transfer Sodium chloride ~~and~~ into an evaporating dis
- Evaporate to saturation and allow to cool.

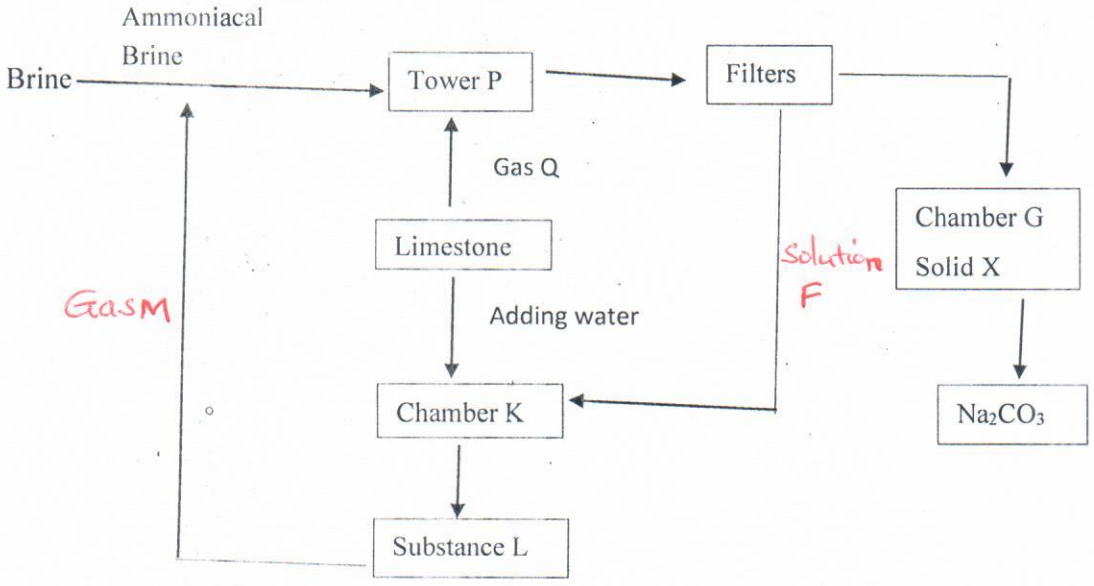
21. Laboratory results showed the composition of a compound to be 58.81% barium, 13.72%, sulphur and 27.47% Oxygen. Calculate the empirical formula of the compound. Ba=137, S = 32, O = 16. (2mks)

Reacting elements	~~Oxygen~~ Barium	Sulphur	Oxygen
% ~~mass~~	58.81	13.72	27.47
Molar mass	137	32	16
Moles	0.429	0.429	1.717
Mole ratio	$\frac{0.429}{0.429} = 1$	$\frac{0.429}{0.429} = 1$	$\frac{1.717}{0.429} = 4$

Empirical

BaS

22. The flow chart below shows industrial manufacture of sodium carbonate by Solvay process. Study it and answer the questions that follow.



i) Name

I. Gas Q ..... Carbon (iv) oxide (CO_2) ..... (½mark)

II. Gas M ..... Ammonia (NH_3) ..... (½mark)

III. Solution F ..... Ammonium chloride (NH_4Cl) ..... (½mark)

IV. Substance L ..... Calcium chloride ($CaCl_2$) ..... (½mark)

ii) Write equations for the reactions that occurred; (1mark)

I. Chamber K

$Ca(OH)_{2(aq)} + 2NH_4Cl_{(aq)} \longrightarrow CaCl_{2(aq)} + 2H_2O_{(l)} + 2NH_{3(g)}$

II. Heating solid X (1mark)

$2NaHCO_{3(s)} \xrightarrow{heat} Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$

iii) Give one use of sodium carbonate. (1mk)

- water softening.
- making of sodium silicate.
- glass making.
- paper industry

23. 20cm^3 of Hydrochloric acid requires 25cm^3 of 0.2M Sodium hydroxide.

(i) Calculate the moles of Sodium hydroxide solution in the reaction. (1mk)

$$\text{Moles} = \frac{M \times V}{1000}$$

$$\frac{25 \times 0.2}{1000} = 0.005 \text{ Moles}$$

(ii) Calculate the Molarity of Hydrochloric acid. (2mks)

$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

Mole ratio NaOH : HCl

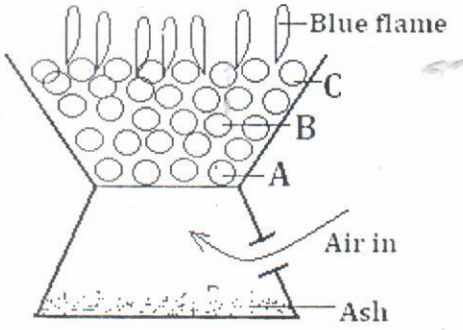
1 : 1

Therefore moles of HCl = 0.005

$$\text{Molarity} = \frac{\text{moles} \times 1000}{\text{volume}} = \frac{0.005 \times 1000}{20}$$

$\Rightarrow 0.25M$

24. The diagram below represents a burning jiko.



a) Write down the equation for the reactions taking place at; (2marks)

B

$CO_{2(g)} + C_{(s)} \longrightarrow 2CO_{(g)}$

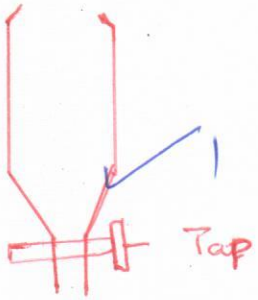
C

$2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)}$

b) Why is it dangerous to use a jiko in a closed room? (1mark)

Burning jiko produces CO which is poisonous. It combines with haemoglobin in the blood to form carboxy-haemoglobin which prevents formation of oxyhaemoglobin leading to suffocation.

25. Draw and name the apparatus that can be used to separate a mixture of water and kerosene. (2mks)



Name: Separating funnel. ✓

26. Describe how you can prepare a dry sample of lead (II) sulphate using the following reagents. (2mks)

- Dilute nitric(v)acid
- Solid lead(II)oxide
- Solid sodium sulphate

- Measure about 20cm³ of ~~lead~~ nitric(V) acid in a beaker. ✓½
- Add lead (II) oxide in small amounts will stirring until in excess. ✓
- filter to remove excess lead (II) oxide.
- Add water solid sodium sulphate. ✓½
- Add aqueous sodium sulphate the solution of Lead (II) nitrate until all lead sulphate precipitates ✓½
- Filter to obtain lead (II) sulphate residue and dry between