

NAME

ADM

CLASS

CHEMISTRY THEORY 233

TERM EXAM III

TIME 1HR 15Min.

Answer all questions on the space provided.

- Q1. Table below gives information on four elements by letters A, B, C & D. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Elements	Electronic Configuration	Atomic Radius (nm)	Ionic radius (nm)
A	2:8:2	0.136	0.065
B	2:8:7	0.299	0.181
C	2:8:8:1	0.203	0.133
D	2:8:8	0.09	—
E	2:8:8:2	0.174	0.099

- (a) Which two elements have similar chemical properties? Explain (2mk)

A & E, are in same chemical family ✓

- (b) What is the most likely formula of the oxide of B (1mk)



- (c) Which of the element is the most reactive

— Metal

— Non metal.

E ✓

B ✓

(2mk)

- (d) Explain why the ionic radius of B is larger than its atomic radius

in process of forming ion, it gains an electron results in e^-e^- repulsion (2mk) ✓

(e) Give the chemical family to which the following elements belong.

- A & E
- D.

[2mk]

- Alkaline earth metals ✓
- Noble gas ✓

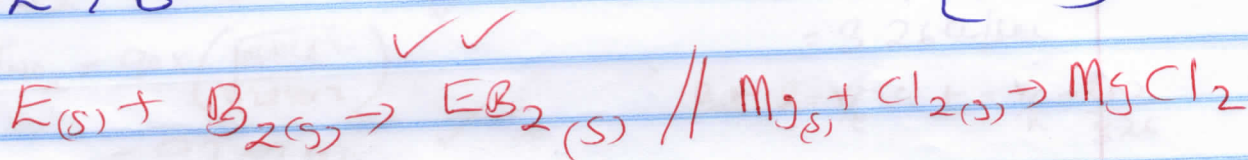
(f) Select a letter which represent a monatomic gas.

[1mk]

D ✓

(g) Write an equation for reaction between E & B.

[2mk]



(P10) Q2. (a) state Charles law.

The volume of a fixed mass of gas is directly proportional to its absolute temperature when pressure is kept constant. [1mk]

(b) Nitrogen gas occupies a volume of 750 cm^3 at 57°C . At what temperature in degrees will it occupy 100 cm^3 .

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$T_1 = 57 + 273 = 330 \text{ K} \quad \checkmark$$

$$T_2 = ?$$

$$T_2 = \frac{V_2 T_1}{V_1} = \frac{100 \times 330}{750} \quad \checkmark$$

[3mk]

(c) State Graham's law. [1mk]

Under similar conditions of Temperature and Pressure the rate of diffusion of fixed mass of gas is inversely proportional to square root of its density. ✓

(d) If it takes 60 seconds for 200cm^3 of Carbon(IV) Oxide to diffuse across a porous plate. How long will it take 300cm^3 of Nitrogen(IV) Oxide to diffuse across the same plate under similar conditions? [3mk]

$$[C=12 \quad O=16 \quad N=14]$$

$$200\text{cc} \Rightarrow 60\text{sec}$$

$$300\text{cc} \Rightarrow ?$$

$$\frac{300 \times 60}{200} = 90\text{sec}$$

$$\frac{r_{\text{NO}_2}}{r_{\text{CO}_2}} = \sqrt{\frac{M_{\text{CO}_2}}{M_{\text{NO}_2}}}$$

$$r_{\text{NO}_2} = 90 \times \left(\sqrt{\frac{14 \times 16 \times 2}{12 \times 16 \times 2}} \right)$$

$$= 92.02\text{sec}$$

$$\text{Or } \frac{r_{\text{NO}_2}}{r_{\text{CO}_2}} = \sqrt{\frac{M_{\text{CO}_2}}{M_{\text{NO}_2}}}$$

$$r_{\text{NO}_2} = (90 \times \sqrt{\frac{12 \times 16 \times 2}{14 \times 16 \times 2}})$$

$$= 3.26\text{cc/sec}$$

$$\text{But } R = \frac{V}{t} \therefore t = \frac{V}{R} = \frac{300}{3.26}$$

$$= 92.02\text{sec}$$

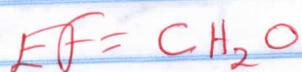
(e) A Compound Weighing 42 grammes was found to contain 12g of Magnesium, 6g of Carbon and the rest Oxygen. Determine the empirical formula of the Compound [C=12 Mg=24 O=16] [3mk]

Elements	Mg	C	O
Mass	12	6	24
Moles	$12/24$	$6/12$	$24/16$
	0.5	0.5	1.5
Simplest Ratio	$\frac{0.5}{0.5}$	$\frac{0.5}{0.5}$	$\frac{1.5}{0.5}$
	1	1	3



(f) An organic compound has a relative formula mass of 90. A 7.5g sample contains 3g of C, 0.5g of H and 4g of O. Determine its molecular formula. [3 marks]

Element	C	H	O
Mass	3	0.5	4
moles	$\frac{3}{12}$	$\frac{0.5}{1}$	$\frac{4}{16}$
	0.25	0.5	0.25
Simplest ratio	$\frac{0.25}{0.25}$	$\frac{0.5}{0.25}$	$\frac{0.25}{0.25}$
	1	2	1

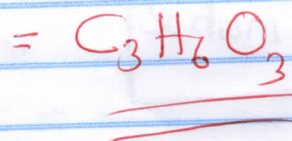
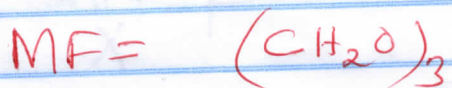


$$\text{But } (EF)_n = MF.$$

$$= (12 + 1 \times 2 + 16)n = 90$$

$$30n = 90$$

$$n = 3$$



(12 marks) Q3. (a) When dilute Sulphuric acid is added to marble chips, reaction starts then stops immediately. Explain this observation.

Formation of insoluble layer of $CaSO_4$ which ✓ [2 marks]
 further reaction.

(b) In Kenya, Sodium Carbonate is extracted from
trons at Lake Magadi.

(i) Give the formula of trons.



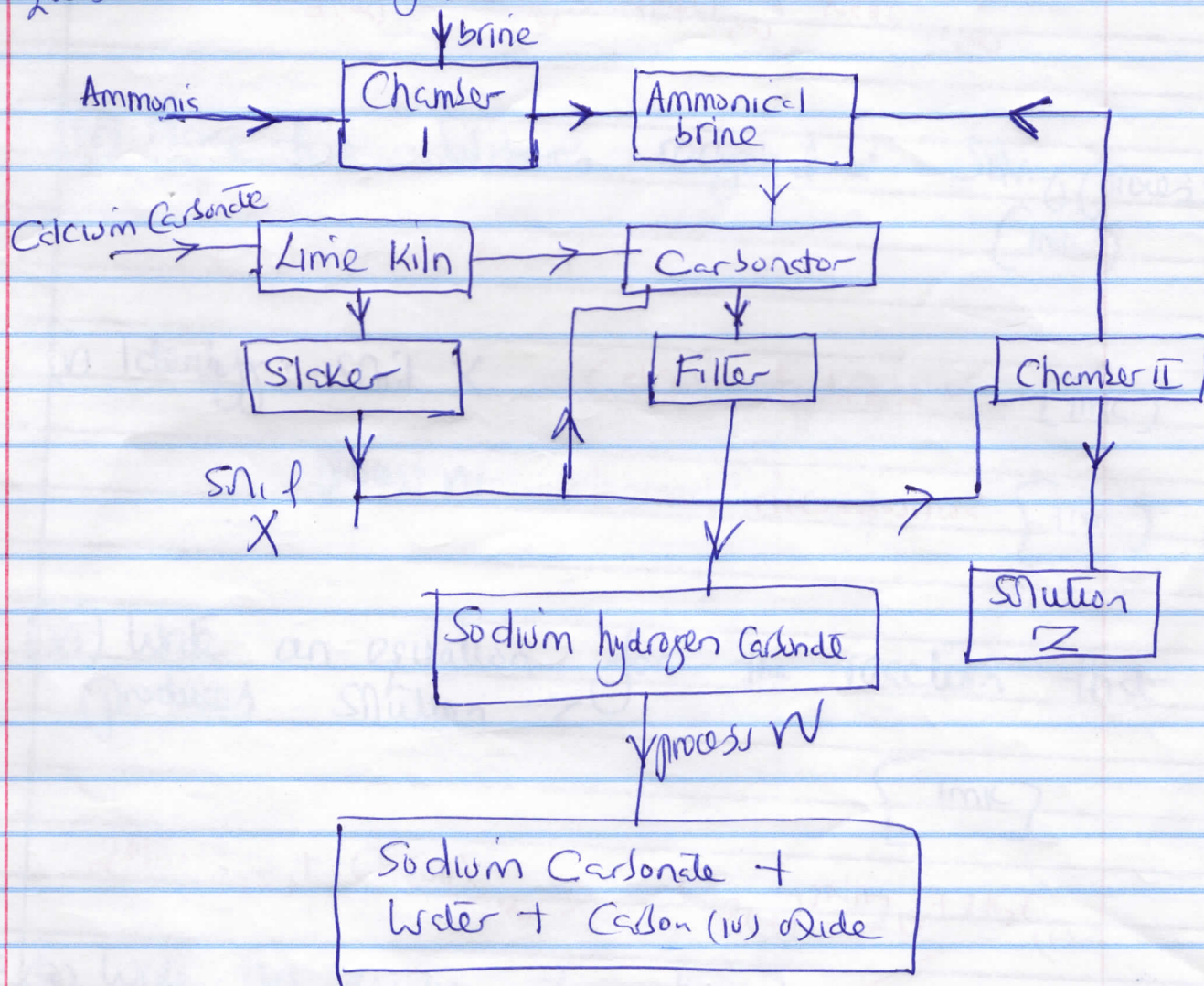
{1mk}

(ii) Name the process of extracting Sodium Carbonate
from trons.

Fractional Crystallisation. ✓

{1mk}

(c) Flow chart below summarises steps involved
in production of Sodium Carbonate. Use it to answer
questions that follows.



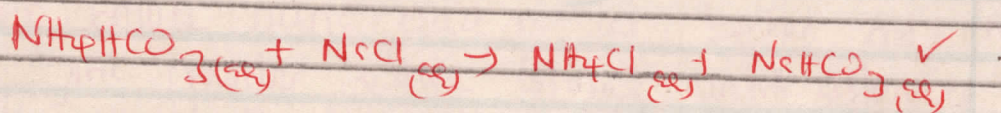
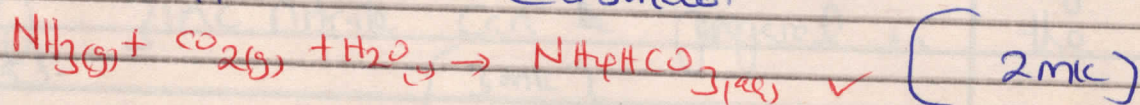
(i) Name the process illustrated above

Solvay process ✓

{1mk}

g) Sodium Carbonate [2mc]
 brine ✓
 Coke/coal/limestone ✓
 Ammonia ✓

(ii) Write equations for the two reactions that occur in the Carbonator



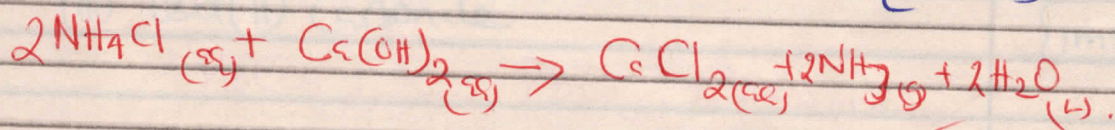
(iv) Name two substances recycled in Solvay process [1mc]
 Ammonia ✓
 Carbon (iv) oxide ✓

(v) Identify; solid X Calcium hydroxide ✓ [1mc]

Process W Thermal decomposition [1mc]

(vi) Write an equation for the reaction that produces solution Z.

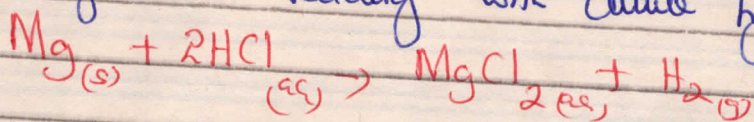
[1mc]



Q4 (a) Write an equation for the following reactions

(i) Solution of lead (II) nitrate reacting with ammonium sulphate.

Q. (ii) Magnesium reacting with dilute hydrochloric acid. [2mk]



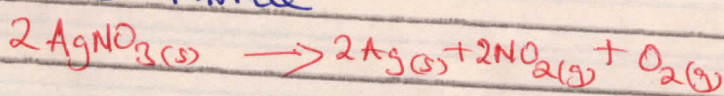
5✓
6✓

(b) You are provided with zinc powder and dilute nitric acid. Describe how a solid sample of zinc nitrate can be prepared in the lab. [3mk]

Put dilute nitric acid in a beaker, add little by little zinc powder while stirring until effervescence stops/no more zinc can dissolve. ✓
Filter to obtain filtrate. ✓ Heat filtrate until it is saturated then allow saturated solution to cool, dry the crystals formed in between 2 filter paper. ✓

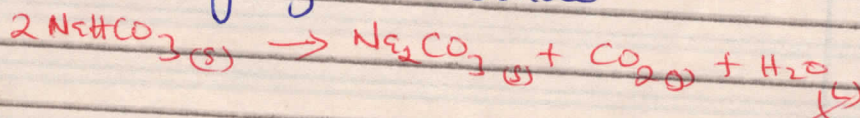
(c) Write a chemical equation for the action of heat on the following salts;

(i) Silver Nitrate



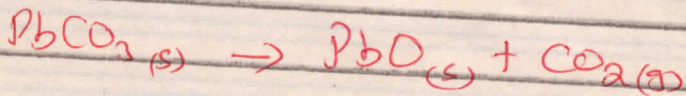
[1mk]

(ii) Sodium hydrogen Carbonate.



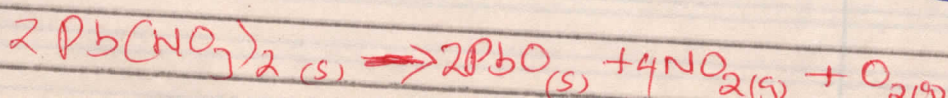
[1mk]

(iii) Lead(II) Carbonate.



[1mk]

(iv) Lead(II) Nitrate



[1mk]