



## Chemistry 233/2

Form 3

**MARCH EXAMINATION 2021**

**2 hours**

Additional Materials:

- Soft clean eraser
- Soft pencil (type B or HB recommended)

*Read these instructions first*

This paper contains 3 sections. Answer all questions in the spaces provided.

Do **not** use staples, paper clips, and glue or correction fluid.

Any rough working should be done in the rough work booklet provided.

NAME: .....

DATE: .....

SCORE:

TOTAL MARKS:

[Turn over]

**SECTION A: (20 MARKS)**

1. Define the following terms:

(I) Atomic Number. (1mk)

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(II) Mass Number. (1mk)

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(III) The Isotopes. (1mk)

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2. Oxygen is obtained on large scale by the fractional distillation of air as shown on the flow chart below.

(a) Explain why air is considered as a mixture.(1mk)

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(b) Identify the substance that is removed at the filtration stage.(1mk)

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(c) Explain why Carbon (IV) oxide and water are removed before liquefaction of air.(1mk)

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(d) Identify the component that is collected at  $-186^{\circ}\text{C}$ .(1mk)

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3. Study the table below and answer the questions that follow:-

Substance		A	B	C	D	E	F
Melting Point ( $^{\circ}\text{C}$ )		801	113 OR 119	-39	5	-	1356
Boiling point ( $^{\circ}\text{C}$ )						101	
		1410	445	457	54	-36	2860
Electrical Conductivity	Solid	Poor	Poor	Good	Poor	Poor	Poor
	liquid	Good	Poor	Good	Poor	Poor	Poor

**Identify with reasons the substances that:**

(I) Have a metallic structure.(2mks)

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(II) Have a molecular structure.(2mks)

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(III) Substances A and C conduct electric current in the liquid state. State how the two substances differ as conductors of electric current.(2mks)

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

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

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(b) Use dot (·) and cross (x) diagrams to illustrate the atomic structure of  $^{14}_{12}\text{X}$ . (2mks)

5. Give two reasons why most laboratory apparatus are made of glass.(2mks)

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6. Define the following terms:

(I) A saturated solution.(1mk)

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(II) Crystallization.(1mk)

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**SECTION B: (20 MARKS)**

7. Imagine you are travelling on a long journey from Mombasa to Kisumu. Before you start the journey, your tyre pressure is  $3 \times 10^4$  Pa and the temperature is  $16^\circ\text{C}$ . At the end of the journey, the pressure has increased to  $3.2 \times 10^4$  Pa. Calculate the temperature of the air in the tyre at the end of the journey. Assume the volume of the tyre remains constant.(5mks)
8. To what temperature must 2 litres of air at  $17^\circ\text{C}$  be heated at constant pressure in order to double the volume.(3mks)

9. (a) State and explain Charles' law. (2mks)

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(b) Plot a sketch graph of V against T (K) of a gas X at constant pressure.(3mks)

10. A given volume of nitrogen gas,  $N_2$ , requires 68.3 seconds to diffuse through a tiny hole in a chamber. Under the same conditions, another unknown gas requires 85.6 seconds for the same volume to diffuse. What is the molecular mass of this gas?(4mks)

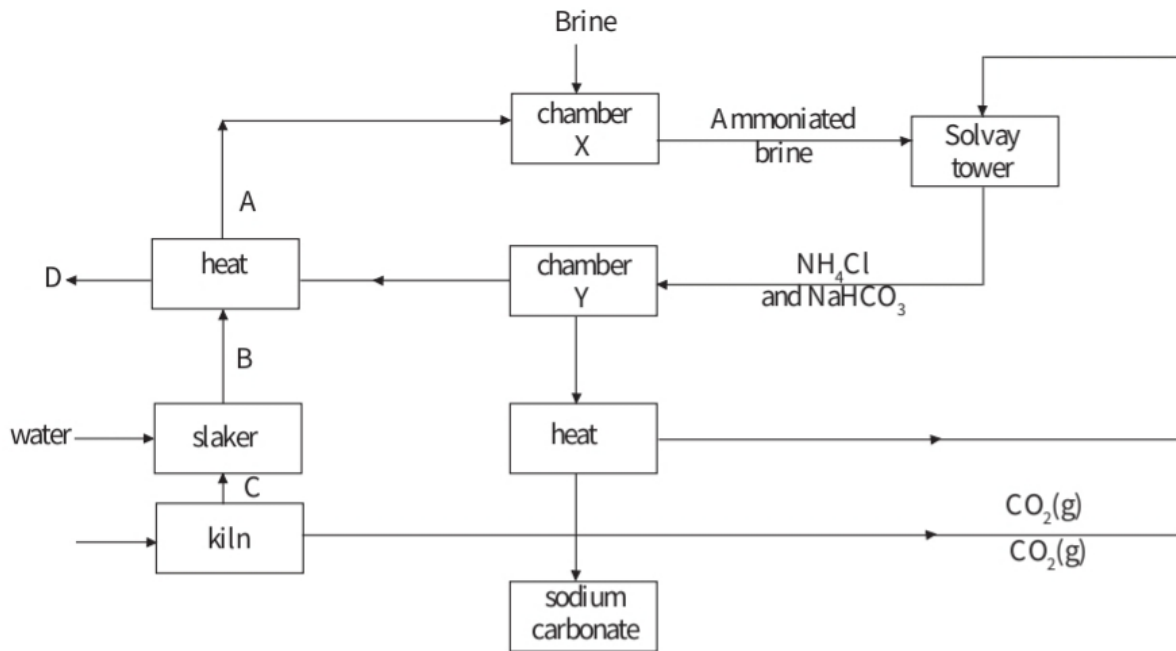
11.  $380 \text{ cm}^3$  of a gas R has a pressure of 85 Kpa. What will be its new volume if the pressure is reduced to 83 Kpa, while the temperature remains constant?(3mks)

**SECTION C: (40 MARKS)**

12. Calculate the percentage of each element in calcium phosphate. (Ca=40, P=31, O=16)

(3mks)

13. The flow chart below represents the main steps in the preparation of sodium carbonate.



(a) Name the substances labelled A,B, C,D.(3mks)

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(b) Cold water is made to circulate around X. What does this suggest about the reaction between A and brine.(1mk)

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(c) What process is represented by Y.(1mk)

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(d) Name two by-products that are recycled in this process.(2mks)

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(e) Why is recycling important?(1mk)

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(f) Write the equation for the reaction that takes place in the upper part of Solvay tower.(2mks)

(g) Assuming that there was no recycling in this process, two moles of ammonia would be required for producing one mole of anhydrous sodium carbonate. Calculate the volume of ammonia at s.t.p that would be used to produce 10.6kg of sodium carbonate by a factory operating at 80% efficiency.(C = 12, O = 16, H = 1, Na = 23, N = 14 and 1 mole of gas occupies  $22.4 \text{ dm}^3$  at s.t.p.(3mks)



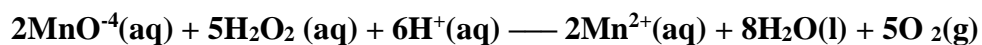
(h) Give two industrial uses of sodium carbonate.(2mks)

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14. An unknown mass of anhydrous sodium carbonate was dissolved in water and the solution made up to  $250\text{ cm}^3$ ,  $25.0\text{ cm}^3$  of this solution neutralized  $20.0\text{ cm}^3$  of  $0.25\text{ M}$  nitric acid. Calculate the unknown mass of sodium carbonate. (5mks)

15. An organic compound has a relative formula mass of 90 grams. A 7.5 grams sample contains 3 grams Carbon, 0.5 grams hydrogen and 4.0 grams Oxygen. Determine its molecular formula.( C=12,H=1,O=16) [5mks]

16. During a titration experiment 25.0 cm<sup>3</sup> of a solution of hydrogen peroxide, H<sub>2</sub>O<sub>2</sub>, required 44.2 cm<sup>3</sup> of 0.02 mol dm<sup>-3</sup> of acidified potassium manganate (VII), KMnO<sub>4</sub>, solution for complete reaction. Calculate the concentration (molarity) of hydrogen peroxide solution. The overall ionic reaction is given below.



(5mk)

17. You are provided with;

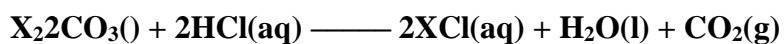
- (I) Solution M, which is 0.5 M hydrochloric acid
- (II) Solution N, containing 5.3 g of a metal carbonate, X<sub>2</sub>CO<sub>3</sub> dissolved in 250 cm<sup>3</sup> distilled water in a volumetric flask.
- (III) Indicator-methyl orange.

(IV) Titration apparatus. (Na = 23; C = 12; O = 16)

You solve this question by titration. Pipette 25 cm<sup>3</sup> of solution N and transfer into a conical flask. Add 2-3 drops of the indicator, get 3 values that are close to each other. Suppose you obtained values as in the following table;

Burette readings	1	2	3
Final burette reading	22.0	43.9	21.8
Initial burette reading	0.0	22.0	0.0
Volume of acid reading (cm <sup>3</sup> )	22.0	21.9	21.8

The equation for reaction that occurred is;



You are required to determine the;

(a) Calculate the average volume of solution B used. Show how you get your average. (1mk)

(b) concentration (molarity) of solution N in

(I) moles per dm<sup>3</sup> (1mk)

(II)  $\text{gdm}^{-3}$  (1mk)

(c) Relative Atomic Mass (R.A.M) of X (4mks)