

## FORM 3 TERM 2 NOVEMBER 2021 CHEMISTRY PAPER 2

1. (a) Study the following part of periodic table chart and use it to answer the questions that follow. The letters are not the actual symbols of the elements.

				A		
	S		C		D	E
F	G					
					H	

- (i) Which elements form ions with charge of -2? Explain (2mks)

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- (ii) If the oxides of B and D are separately dissolved in water, what effect will their aqueous solution have on litmus. (2mks)

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- (iii) How would you expect the ionic reactions of C and E to compare? Explain (2mks)

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- (iv) Write the formula of the compounds formed between elements G and H (1mk)

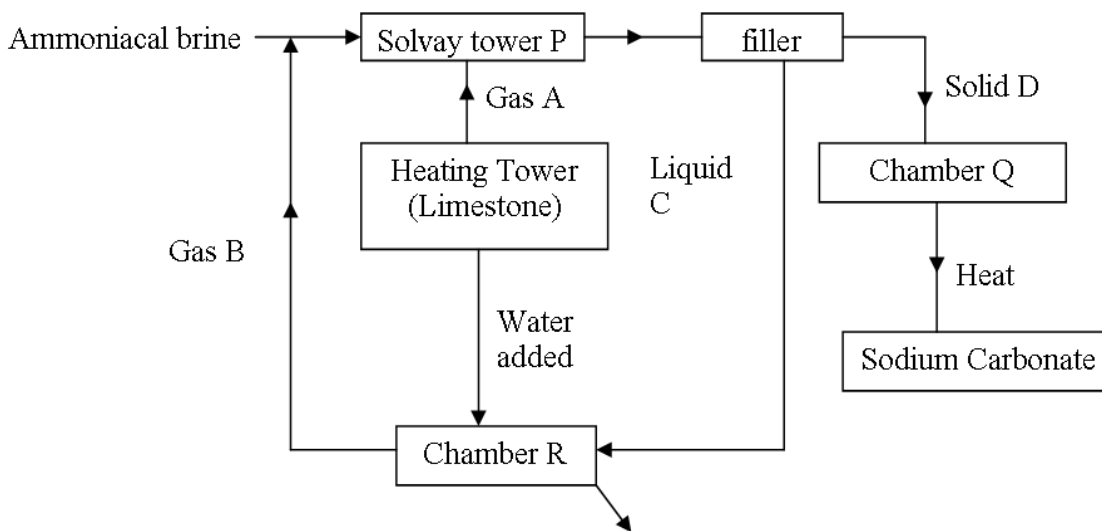
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- (v) In terms of structure and bonding, explain why the oxide of D has a lower melting point than the oxides of B. (2mks)

- (vi) Write an equation to show the action of heat on the carbonates with element G (1mk)

- (b) When 1.5 litres of chlorine gas were completely reacted with element B 5.937g of the product were formed. Determine the relative atomic mass of element B. (Atomic mass of chlorine = 35.5 Molar gas volume = 24litres) (3mks)

2. The scheme below shows the manufacture of sodium carbonate by the Solvay process. Study it and use it to answer the questions that follow.



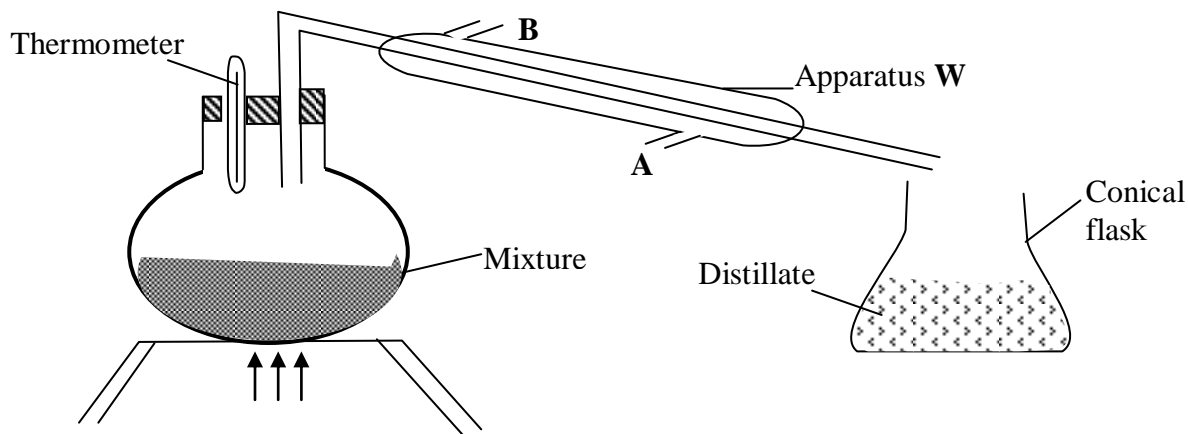
- (a) Name (i) gases A and B (1mark)
- (b) Name liquid C and Solid D (1mark)
- (c) Write equations for the reactions taking place in tower P and chamber R (2marks)

(d) Name the product formed in chamber at chamber R and give one of its uses  
(2marks)

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(c) State two uses of sodium carbonate (1mark)

3. A student left some crushed fruit mixture with water for some days. He found the mixture had fermented. He concluded that the mixture was contaminated with water and ethanol with boiling point of  $100^{\circ}\text{C}$  and  $78^{\circ}\text{C}$  respectively. The set-up of apparatus below are used to separate the mixture.



(i) Name the piece of apparatus labelled **W** (1mk)

(ii) What is the purpose of the thermometer in the set-up? (1mk)

iii) At which end of the apparatus **W** should tap water be connected?(1mk)

(iv) Which liquid was collected as the first distillate? Explain (2mk)

(v) What is the name given to the above method of separating mixture?(1mk)

vi) State **two** applications of the above method of separating mixtures (1mk)

(vi) What properties of the mixture make it possible for the component to be separated by the above methods?(2mk)

4. I. In an experiment, a piece of magnesium ribbon was cleaned with steel wool. 2.4g of the clean magnesium ribbon was placed in a crucible and completely burnt in oxygen. After cooling the product weighed 4.0g

a) Explain why it is necessary to clean magnesium ribbon (1mks)

b) What observation was made in the crucible after burning magnesium ribbon?(1mk)

c) Why was there an increase in mass?(1mk)

d) Write an equation for the major chemical reaction which took place in the crucible(1mk)

e) The product in the crucible was shaken with water and filtered. State and explain the Observation which was made when red and blue litmus paper were dropped into the filtrate (3mks)

II. Below is a list of oxides.

MgO, N<sub>2</sub>O, K<sub>2</sub>O, CaO and Al<sub>2</sub>O<sub>3</sub>

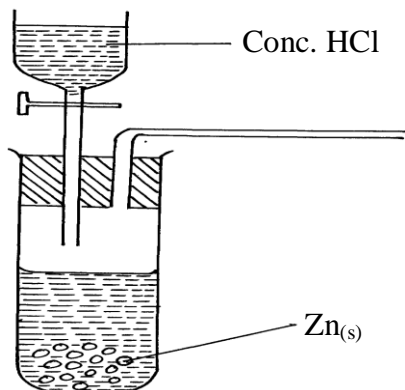
Select:-

a) A neutral oxide. (1mk)

b) A highly water soluble basic oxide. (1mk)

c) An oxide which can react with both sodium hydroxide solution and dilute hydrochloric acid. (1mk)

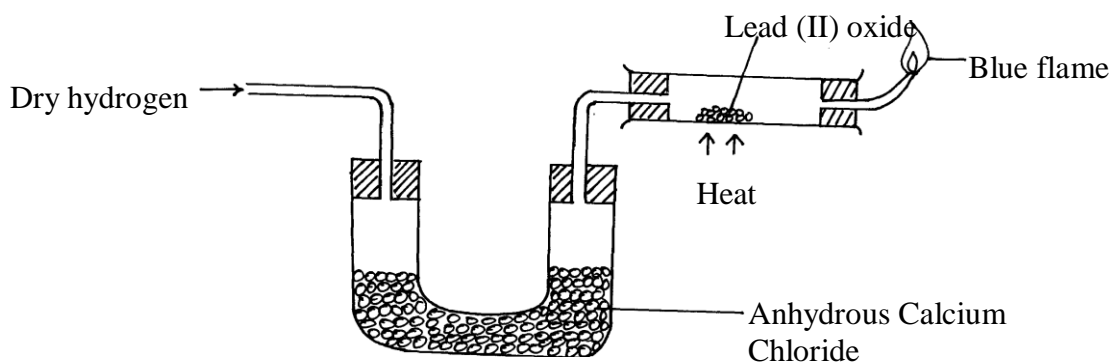
5. a) The set-up below was used by a form three student to prepare a dry sample of gas **M**. Study it and use it to answer the questions that follow:-



- (i) Complete the diagram to show how a dry sample of gas **M** can be collected (3mks)
- (ii) State the identity of gas **M** (1mk)
- iii) state two industrial uses of gas **M**.(2mks)

b) What property of concentrated sulphuric acid is being employed in the above preparation?

(1mk) The set-up below was used to investigate the properties of hydrogen



- (i) State the observations that were made in the combustion tube as the reaction progressed to completion (2mks)
- (ii) Write equations for the reactions ;
  - I) In the combustion tube (1mk)
  - II) At the jet of the delivery tube (1mk)

Naturally occurring boron exists as two isotopes, boron-10  $^{10}\text{B}$  with a relative abundance of 20% and boron-11  $^{11}\text{B}$  with a relative abundance of 80%.

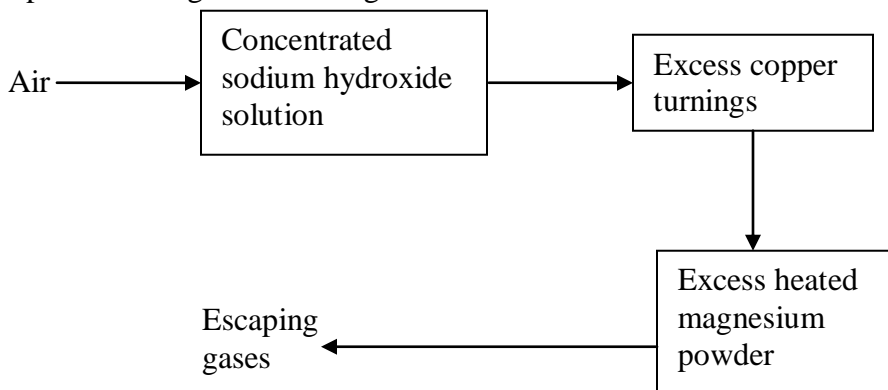
(a) How many electrons does each atom of boron contain? (1mk)

(b) How many neutrons does each atom of the most abundant isotope contain? (1mk)

(c) Calculate the relative atomic mass of boron. (2mks)

(d) Make a diagrammatic representation of an atom of the least abundant isotope of boron showing the distribution of electrons and composition of the nucleus. (2mks)

II. Air was passed through several reagents as shown below:



- (a) Write an equation for the reaction which takes place in the chamber containing Magnesium powder (1mk)
- (b) Name **one** gas which escapes from the chamber containing magnesium powder. Give a reason for your answer (1mk)
- (c) State two industrial uses of hydrogen gas (1mk)

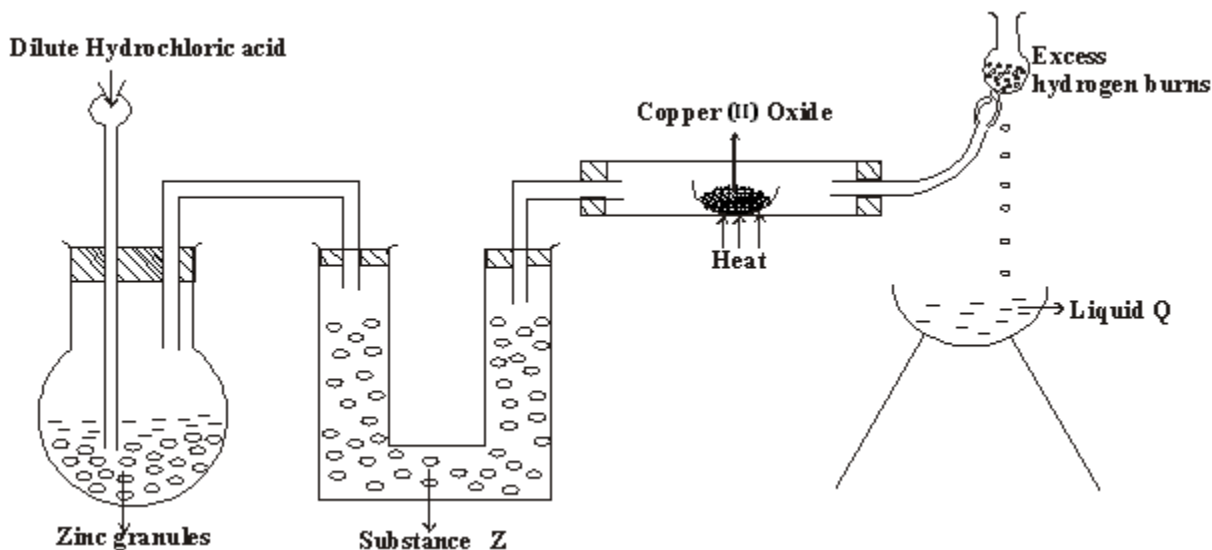
6. In the preparation of magnesium carbonate, magnesium was burnt in air and the product collected. Dilute sulphuric acid was then added and the mixture filtered and cooled. Sodium carbonate was added to the filtrate and the contents filtered. The residue was then washed and dried to give a white powder.

- (a) Give the name of the product (1mk)
- (b) Write the chemical equation for the formation of the product (1mk)
- (c) (i) Name the filtrate collected after sodium carbonate was added. (1mk)
- (ii) Write down the chemical formula of the white powder (1mk)
- (d) Write a chemical equation for the reaction between product in (a) and the acid (1mk)
- (e) Write an ionic equation to show the formation of the white powder (1mk).
- (f) Write an equation to show what happens when the white powder is strongly heated. (1mk)

(g) Identify the ions present in the filtrate after addition of sodium carbonate. (1mk)

(h) What is the name given to the reaction that takes place when sodium carbonate was added to the filtrate? (1mk)

7.(a) In an experiment to investigate the properties of hydrogen, a student set up as follows.



(i) Name substances  
(2 marks)

Z

Q

(ii) State two properties of hydrogen that were being investigated.  
(2marks)

(iii) Give two precautions that should be taken towards the end of the experiment.  
(2marks)



(iv) State two reasons why it is not suitable to use dilute nitric (V) acid in the preparation of hydrogen with zinc. (2marks)

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b) Water molecule ( $\text{H}_2\text{O}$ ) combines with  $\text{H}^+$  to form hydroxonium ion. ( $\text{H}_3\text{O}^+$ ) explain. (2marks)

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c) Give TWO reason why hydrogen is used to fill meteorological balloons. (2mark)

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