

CHEMISTRY PAPER 233 / 1 K.C.S.E 2003

QUESTIONS

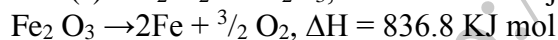
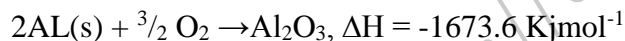
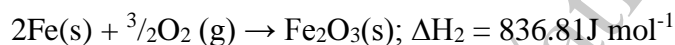
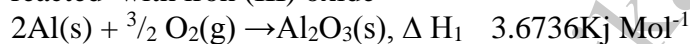
- Some sodium chloride was found to be contaminated with copper (II) oxide. Describe how a sample of sodium chloride can be separated from the mixture
- Study the information in the table and answer the questions that follow

Ion	Electronic arrangement	Ionic radius
Na ⁺	2.8	0.095
K ⁺	2.8.8	0.133
Mg ²⁺	2.8	0.065

Explain why the ionic radius of K⁺ is greater than that of Na⁺ (1mk)

Mg²⁺ is smaller than that of Na⁺

- Use the following equations to determine the heat evolved when aluminum metal is reacted with iron (III) oxide (3 mks)



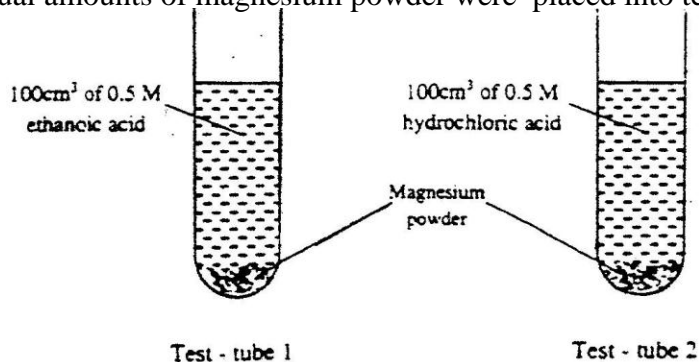
- (a) Sulphur exists in two crystalline forms
(b) Name one crystalline form of sulphur (1mk)

- An atom of hydrogen can form two ions. Write two equations to show how a neutral atom of hydrogen can form two ions. In each case show the sign of the energy change involved.



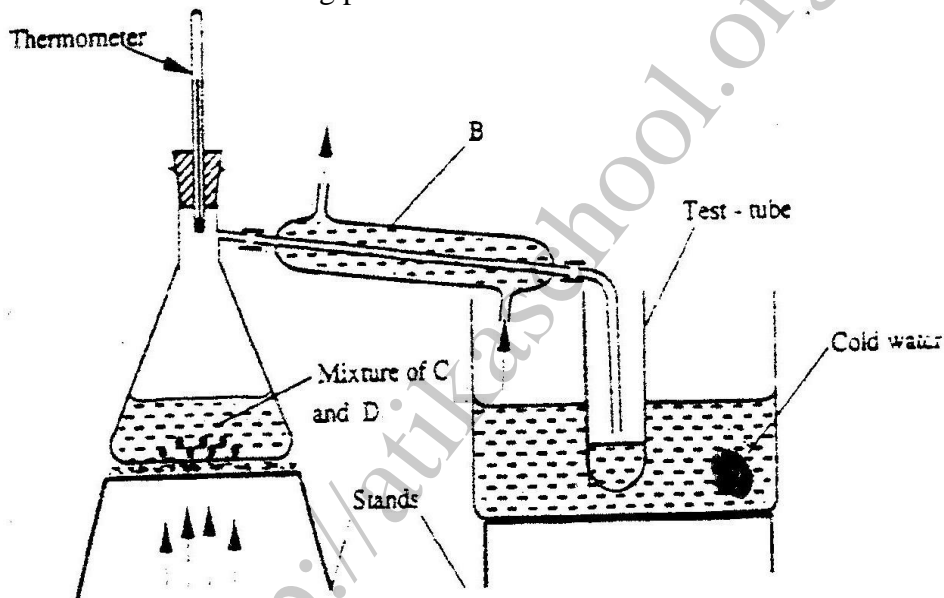
- When excess dilute hydrochloric acid was added to sodium sulphite, 960cm³ of sulphur (IV) oxide gas was produced. Calculate the mass of sodium sulphite that was used. (molar mass of sodium = 126 g and molar gas volume= 24000cm³ (3mks)

- In an experiment equal amounts of magnesium powder were placed into test – tube 1 and 2 as shown below

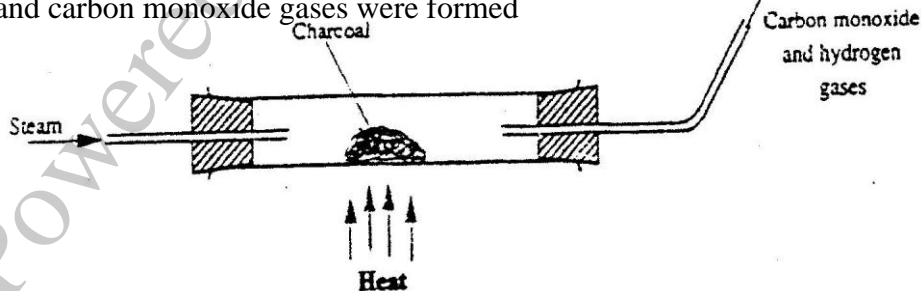


Explain why the amount of hydrogen gas liberated in test – tube 2 is greater than in test-tube 1 before the reaction is complete.

8. (a) what is meant by heat of vaporization (3 mks)
 (b) The boiling points of ethanol, propanol and butanol are 78°C , 97.2° and 117°C . explain this trend (1 mk)
9. The set – up below represents the apparatus that may be used to separate a mixture of two miscible liquids C and D whose boiling points are 80°C and 110°C .

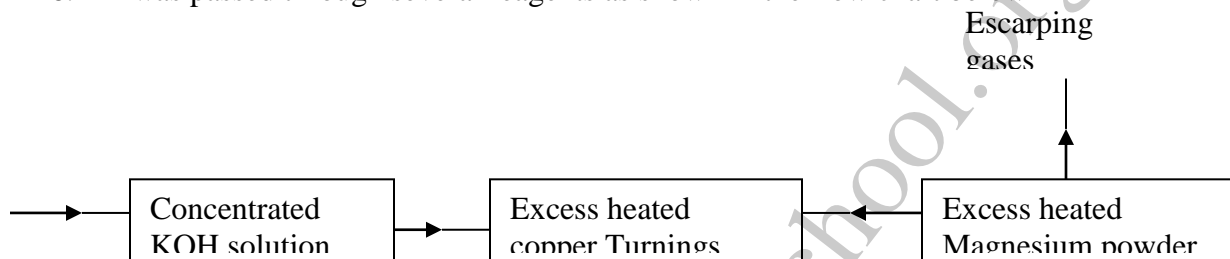


- (a) name B
 (b) What is the purpose of the thermometer (1mk)
 (c) Which liquid was collected in the test tube? (1mk)
10. An oxide of element F has the formula F_2O_5 (1 mk)
 (a) Determine the oxidation state of F
 (b) In which group of the periodic- table is element F (1mk)
11. Yellow phosphorous reacts with chlorine gas to form a yellow liquid. The liquid fumes when exposed to air. Explain these observations (2 mks)
12. When steam was passed over heated charcoal as shown in the diagram below, hydrogen and carbon monoxide gases were formed

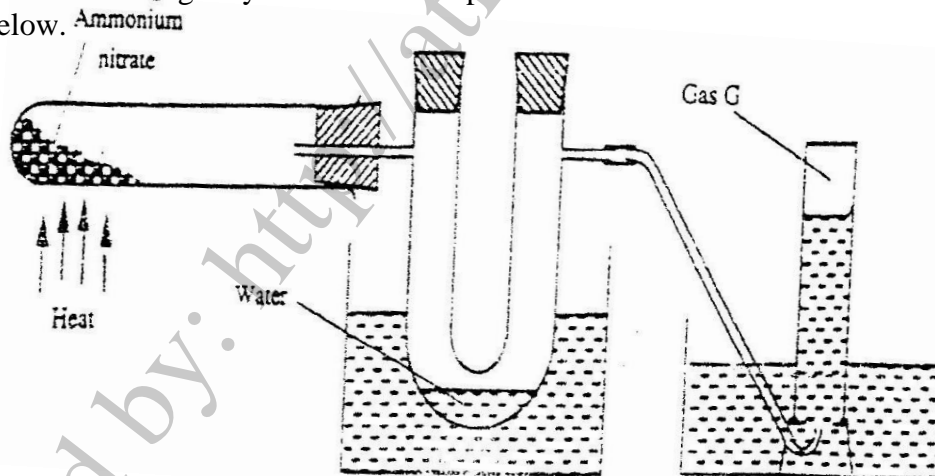


- (a) Write the equation for the reaction which takes place (1 mk)
 (b) Name two uses of carbon monoxide gas, which are also uses of hydrogen gas (2 mks)
13. Nitrogen (II) oxide and nitrogen (IV) oxide are some of the gases released from car exhaust pipes. State how these gases affect the environment

14. A few crystals of potassium permanganate were carefully placed into water in a beaker at one spot. The beaker was left undisturbed for two hours. State and explain the observation that was made. (2mks)
15. Oleum ($H_2S_2O_7$) is an intermediate product in the industrial manufacture of sulphuric acid
- (a) How is oleum converted into sulphuric acid? (1 mk)
- (b) Give one use of sulphuric acid (1mk)
16. Air was passed through several reagents as shown in the flow chart below



- (a) Write an equation for the reaction, which takes place in chamber with magnesium powder
- (b) Name one gas, which escapes from the chamber containing magnesium powder. Give a reason for your answer. (2mks)
17. Ammonium nitrate was gently heated and the products collected as shown in the diagram below.

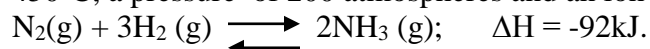


- Describe one chemical and one physical method that can be used to identify gas G.
18. The table below shows the tests carried out on a sample of water and the results obtained.

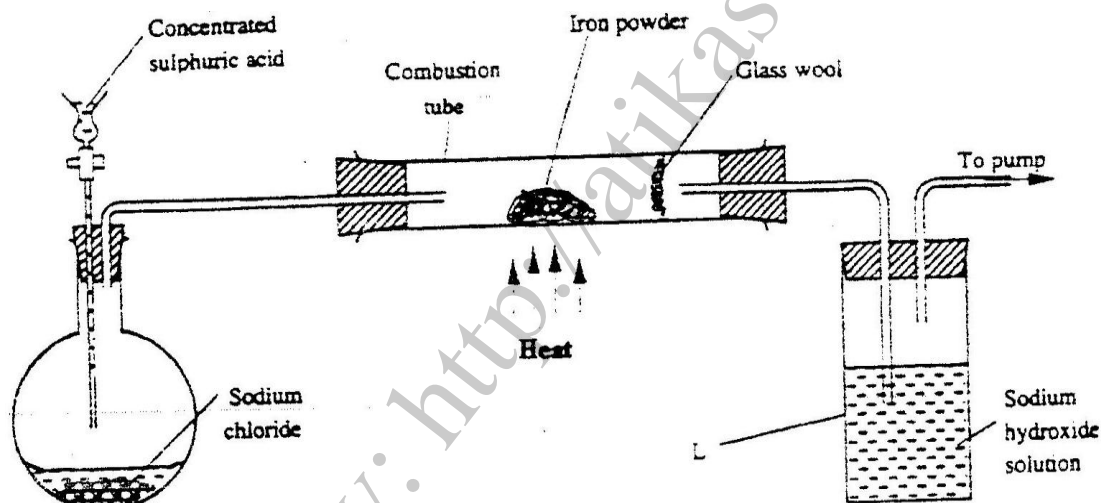
	Tests	Results
I	Addition of sodium hydroxide solution	White precipitate which dissolves in excess
II	Addition of excess aqueous ammonia	Colourless solution obtained
III	Addition of dilute hydrochloric acid and barium chloride	White precipitate

- a) Identify the anion present in the water
- b) Write an ionic equation for the reaction in III
- c) Write the formula of the complex ion formed in II

19. In the Haber process, the optimum yield of ammonia is obtained when a temperature of 450°C, a pressure of 200 atmospheres and an iron catalyst are used

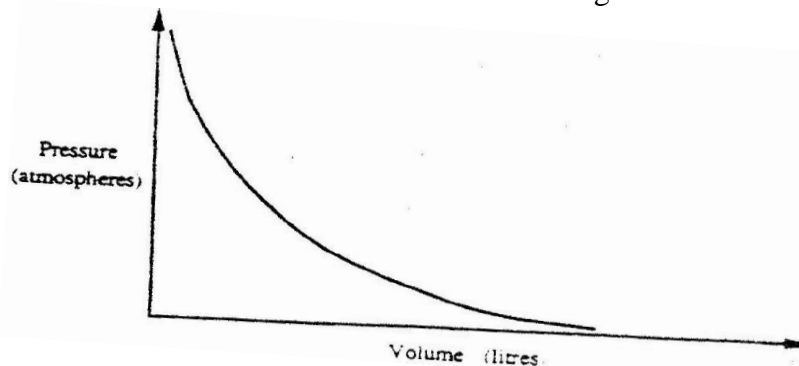


- (a) How would the yield of ammonia be affected if the temperature was raised to 600°C? (2mks)
- (b) Give one use of ammonia (1mk)
20. Brass is an alloy of zinc and copper. Give one use of brass (1mk)
21. An organic compound with the formula $\text{C}_4\text{H}_{10}\text{O}$ reacts with potassium metal to give hydrogen gas and white solid
- (a) Write the structural formula of the compound
- (b) To which homologous series does the compound belong?
- (c) Write the equation for the reaction between the compound and potassium metal (1mk)
22. The set-up below was used to prepare hydrogen chloride gas and react it with iron powder. Study it and answer the questions that follow.



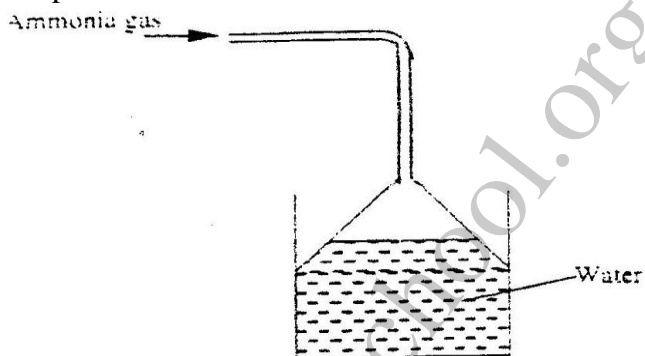
At the end of the reaction, the iron powder turned into a light green solid.

- a) Identify the light green solid. (1mk)
- b) At the beginning of the experiment, the pH of the solution in container L was about 14. At the end, the pH was found to be 2. Explain. (2mks)
23. a) State the observation made when excess pentane is reacted with bromine gas
- b) Name the compound formed in (a) above. (1mk)
24. Explain why the reactivity of group (vii) elements decreases down the group
25. The graph below shows the behaviour of a fixed mass of a gas at constant temperature.



- a) What is the relationship between the volume and the pressure of the gas?
b) 3 litres of oxygen gas at one atmosphere pressure were compressed to two atmospheres at constant temperature. Calculate the volume occupied by the oxygen gas (2mks)

26. Ammonia gas was passed into water as shown below

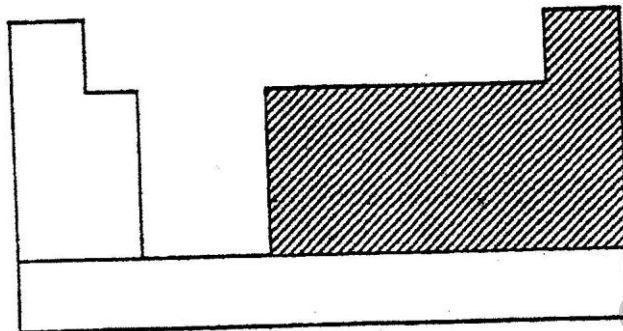


- a) What is the relationship between the volume and the pressure of the gas?(1mk)
b) 3 litres of oxygen gas at one atmosphere pressure were compressed to two atmospheres at constant temperature. Calculate the volume occupied by the oxygen gas. (2mks)
27. During purification of copper by electrolysis, 1.48g of copper were deposited when current was passed through aqueous copper(II) sulphate for $2\frac{1}{2}$ hours. Calculate (CU = 63.5, 1 Faraday = 96,500C).

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1. a) The chart below is an outline of part of the periodic table.

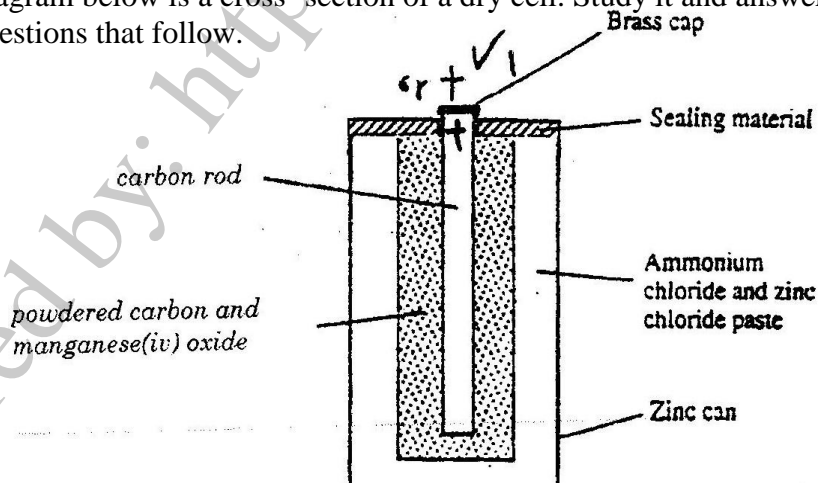


With the help of vertical and horizontal lines, indicate the direction of increasing metallic nature of the elements. (2mks)

Which types of elements are represented in the shaded area? (1mk)

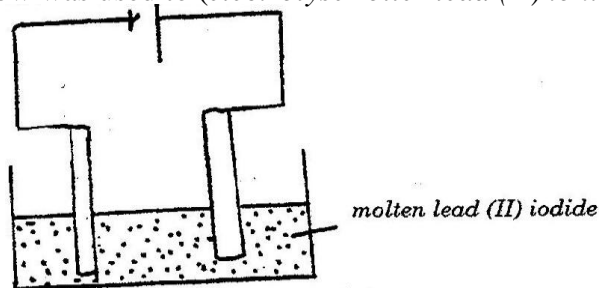
- b) i) Element A is the same group of the periodic table as chlorine.
Write the formula of the compound formed when A reacts with potassium metal. (1mk)
- ii) What type of bonding exists in the compound formed in (b) (i) above?
Give a reason for your answers. (3mks)
- c) Starting with aqueous magnesium sulphate, describe how you would obtain a sample of magnesium oxide. (3mks)
- d) Write two ionic equations to show that aluminium hydroxide is amphoteric (2mk)

2. a) The diagram below is a cross-section of a dry cell. Study it and answer the questions that follow.

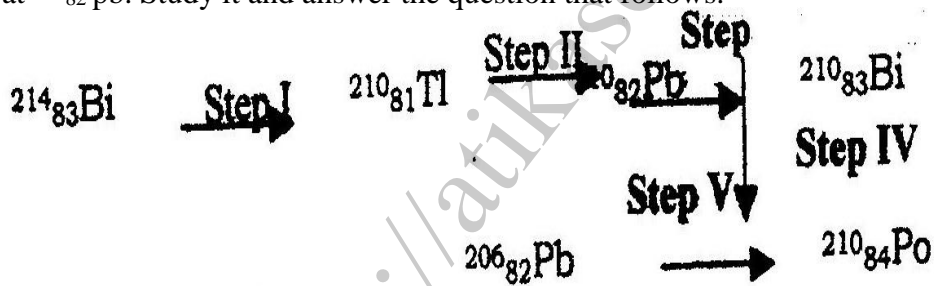


- i) On the diagram, show with a (+) sign the positive terminal
- ii) Write the equation for the reaction in which electrons are produced
- iii) The zinc can is lined with ammonium chloride and zinc chloride paste.
- iv) Give one advantage and one disadvantage of dry cells.

- b) The set – up below was used to (*electrolyse roller lead (II) ionide.*)



- i) State the observation that was made at the anode during the electrolysis. Give a reason for your answer.(2mk)
 - ii) A current of 0.5 A was passed for two hours. Calculate the mass of lead that was deposited (pb = 1F = 9,500C) (3mks)
3. a) State two differences between chemical and nuclear reactions(2mks)
- b) Below is a radioactive decay series starting from $^{214}_{83}\text{Bi}$ and ending at $^{206}_{82}\text{Pb}$. Study it and answer the question that follows.



- i) Identify the particles emitted in steps I and III (2mks)
 - I
 - II
- ii) Write the nuclear equation for the reaction which takes place in step V(1mk)

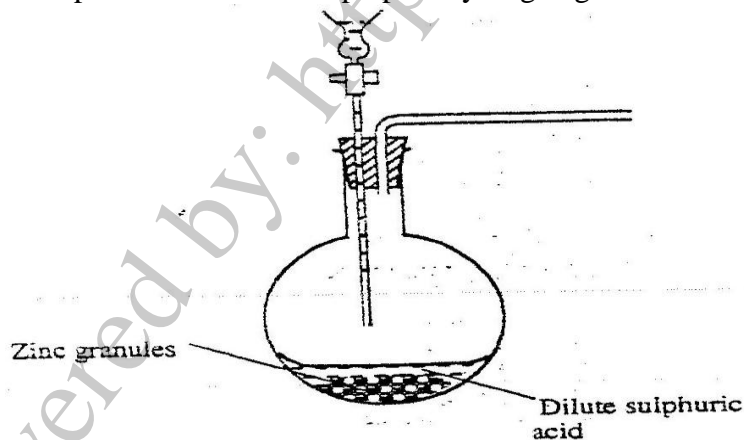
The table below give the percentages of a radioactive isotope of Bismuth that remains after decaying at different times.

Time (min)	0	6	12	22	38	62	100
Percentage of Bismuth	100	81	65	46	29	12	3

- i) On the grid provided, plot a graph of the percentage of Bismuth remaining (Vertical axis) against time.
 - ii) Using the graph, determine the:
 - I. Half – life of the Bismuth isotope
 - II. Original mass of the Bismuth isotope given that the mass that remained after 70 minutes was 0.16g (2mks)
 - d) Give one use of radioactive isotopes in medicine (1mk)
4. Excess marble chips (calcium carbonate) was put in a beaker containing 100cm³ of dilute hydrochloric acid. The beaker was then placed on a balance and the total loss in mass recorded after every two minutes as shown in the table below.

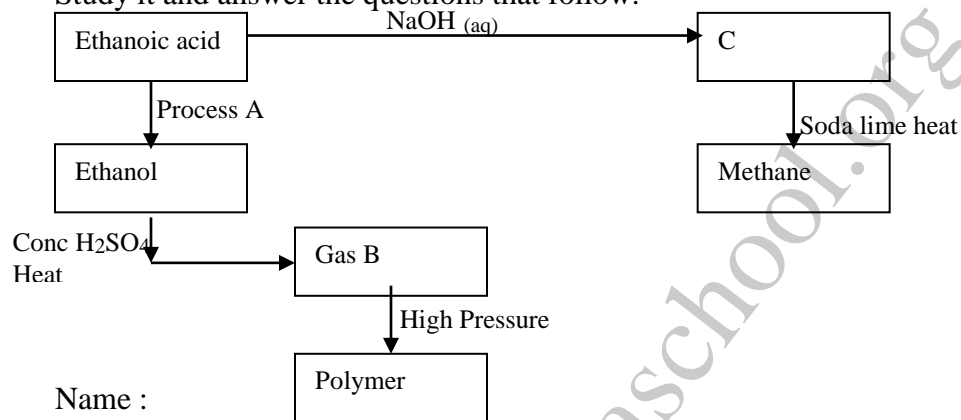
Time(min)	0	2	4	6	8	10
Total loss in mass (g)	0	1.8	2.45	2.95	3.2	3.3

- a) Why was there a loss in mass? (1mk)
- b) Calculate the average rate of loss in mass between:
- 0 and 2 minutes (1mk)
 - 6 and 8 minutes (1mk)
 - Explain the difference in the average rates of reaction in (b) (i) and (ii) above (2mks)
- c) Write the equation for the reaction which takes place in the beaker
- d) State three ways in which the rate of the reaction above could be increased(3mk)
- e) The solution in the beaker was evaporated to dryness what would happen if the open beaker and its contents were left in the laboratory overnight.(2mks)
- f) Finally some water was added to the contents of the beaker. When aqueous sodium sulphate was added to the contents of the beaker, a white precipitate was formed. (1mk)
- Identify the white precipitate
 - State one use of the substance identified in (f) (i) above (1mk)
5. The basic raw material for extraction of aluminium is bauxite
- Name the method that is used to extract aluminium from bauxite
 - Write the chemical formula of the major component of bauxite
 - Name two major impurities in bauxite (2mks)
 - Explain how the impurities in bauxite are removed (3mks)
 - Cryolite is used in the extraction of aluminium from bauxite. State its function (1mk)
 - Aluminium is a reactive metal yet utensils made of aluminium do not corrode easily. Explain this observation (2mks)
6. The set – up below was used to prepare hydrogen gas



- Complete the diagram to show how a dry sample of hydrogen gas can be collected(3mks)
- Write an equation for the reaction, which takes place when hydrogen gas burns in air.(1mk)
- 1.2 litres of hydrogen gas produced at room temperature and pressure when 3.27g of zinc was used. Determine the relative atomic mass of zinc.(Molar gas volume is 24 litres) 4mks
- State two industrial uses of hydrogen gas.

7. a) State how burning can be used to distinguish between ethane and ethyne. Explain your answer.(3mks)
- b) Draw the structural formula of the third member of the homologous series of ethyne.
- c) The flow chart below shows a series of reactions starting with ethanol. Study it and answer the questions that follow.



- i) Name :
- I. Process A
 - II. Substances B and C
- B
- C
- ii) Write the equation for the combustion of ethanol (1mks)
- iii) Explain why it is necessary to use high pressure to change gas B into the polymer (1mk)
- iv) State one use of methane (1mk)