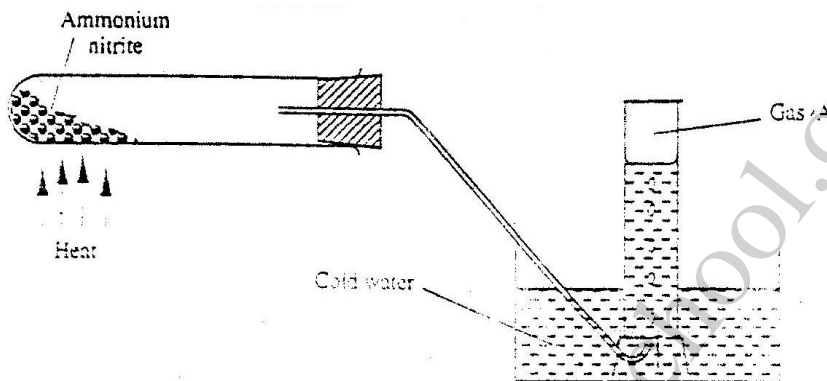


K.C.S.E 2004 CHEMISTRY PAPER 233/1
QUESTIONS

- When a candle was burnt completely. The total mass product was found to be greater than the original mass of the candle. Explain
- Ammonium nitrite was heated as shown in the set-up below (2 marks)

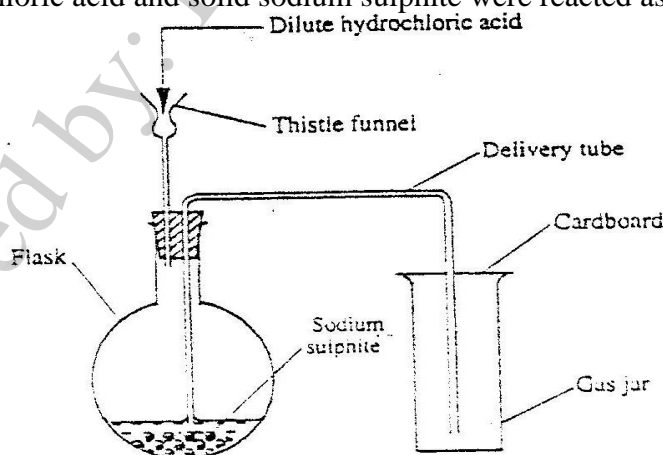


- Identify gas a.
 - State explain precaution that must be taken before heating and dropped.
- The table below the first ionization energies of elements B and C.

Element	Ionisation energy KJ mol ⁻¹
B	494
C	736

What do these values suggest about the reactivity of B compared to that of C? Explain (2mks)

- Dilute hydrochloric acid and solid sodium sulphite were reacted as shown in the set-up below



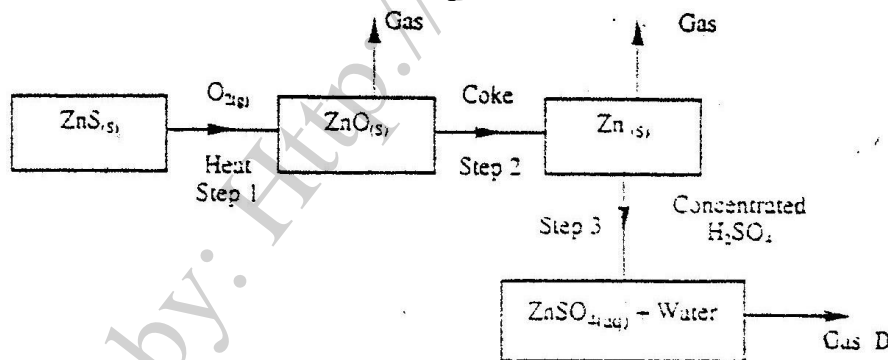
- Name the gas produced in the flask (2mks)
 - Give two reasons why no gas was collected in the gas jar. (2mks)
- Copper(II) sulphate reacts with barium chloride according to the equation below.

$$\text{CuSO}_{4(aq)} + \text{BaCl}_{2(aq)} \longrightarrow \text{CuCl}_{2(aq)} + \text{BaSO}_{4(s)} ; \Delta H = - 17.7\text{kJ mol}^{-1}$$
 Calculate the temperature change when 900cm³ of m copper (II) sulphate were added to 600cm³ of 1M Barium (II) chloride.

6. Both diamond and graphite have giant atomic structures. Explain why diamond is hard while graphite is soft. (3mks)
7. Nitrogen forms many compounds in which its oxidation state varies.
- What is meant by oxidation state? (1mk)
 - What is the oxidation state of nitrogen in Mg_3N_2 (1mk)
8. When wood is burnt, a grey powder called ash remains. The ash is stirred with water and filtered, a colourless solution is obtained.
- What is the main component of the colourless solution?(1mk)
 - Explain your answer in (a) above(2mks)
9. Study the information in the table below and answer the questions that follows.

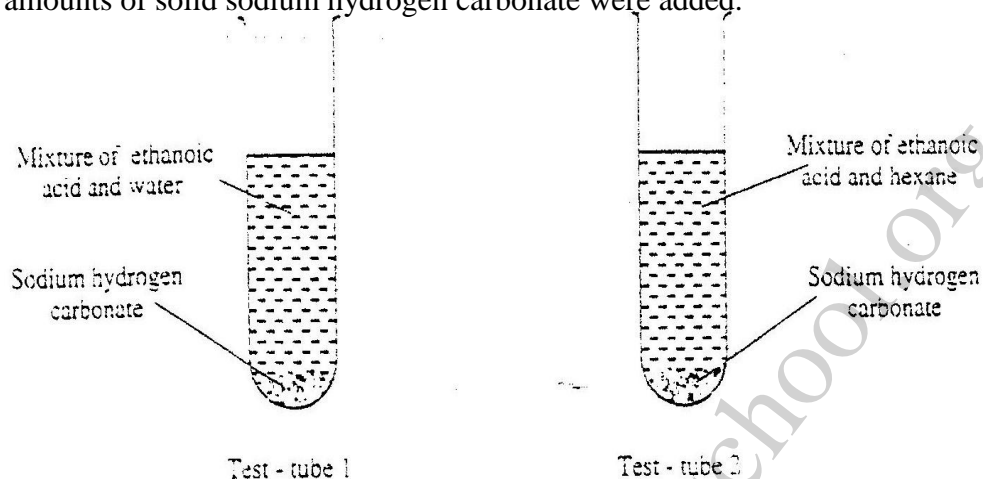
Alcohol	Heat of combustion on KJ mol ⁻¹
Methanol	715
Ethanol	1371
Propanol	2010
Butanol	2673

- Give a reason why the difference in the molar heats of combustion between successive alcohols are close. (3mks)
10. Explain why a high temperature is required for nitrogen of react with oxygen(1mk)
11. Study the flow chart below and answer the questions that follow.



- State the condition necessary for the reaction in step 2 to occur (1mk)
 - Name:
 - Gas D (1mk)
 - One use of zinc (1mk)
12. Starting with aluminium sulphate, describe how a solid sample of aluminium hydroxide could be prepared. (3mks)
13. a) What is the name given to the smallest repeating unit of a polymer.(1mk)
 b) Draw the structure of the smallest repeating unit of a polyvinyl chloride (1mk)
14. When $X \text{ cm}^3$ of a solution of 0.5m magnesium carbonate was 8.4g.
- Write the ionic equation for the reaction that took place(1mk)
 - Calculate the value of X. (C = 12.0, Mg 24.0; 016.0 (2mks)

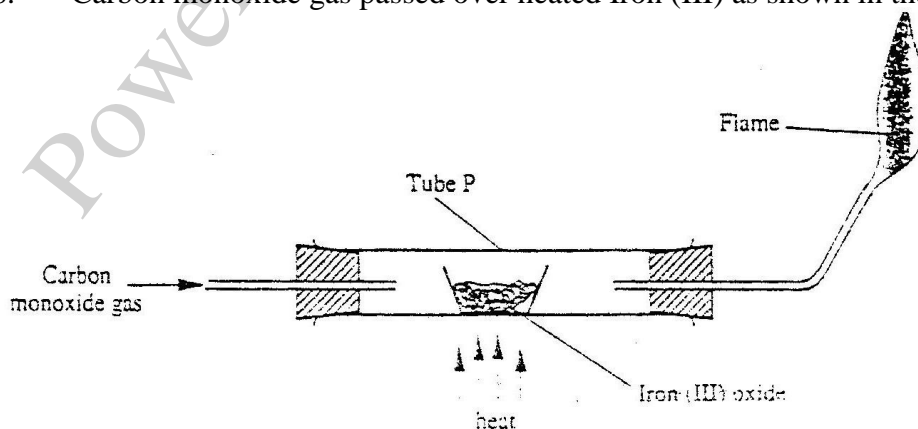
15. In an experiment, a student put equal volumes of mixtures of ethanoic acid in water and ethanoic acid in hexane in two test – tubes as shown below. In each test tube, equal amounts of solid sodium hydrogen carbonate were added.



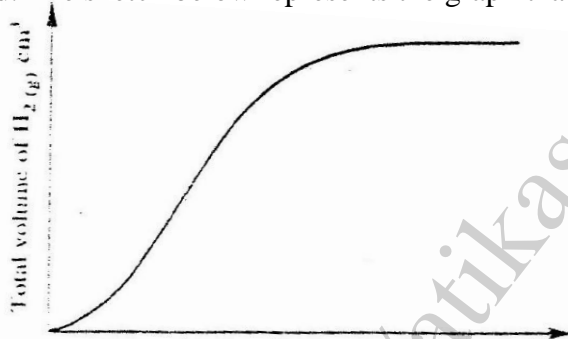
- a) State the observation which was made in each test – tube(1mk)
 Test tube 1
 Test tube 2
- b) Explain the observation in (a) above (2mks)
16. Four metal F,G,H and J were each separately added to cold water, and steam. The table below is a summary of the observations made and the formulae of the hydroxides formed.

Metal	Cold water	Hot water	Steam	Formula of Hydroxide
F	Reacts slowly	Reacts fast	Reacts very fast	F(OH) ₂
G	No reaction	No reaction	No reaction	-
H	Fast	Reacts very fast	Reacts explosively	HOH
J	No reaction	Reacts slowly	Reacts fast	J(OH) ₂

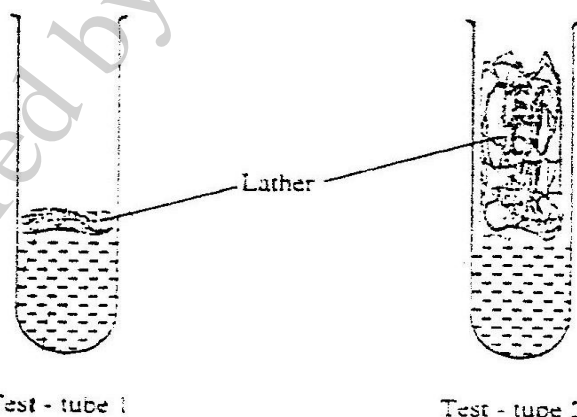
- a) Which two elements are likely to be in the same group of the periodic table?
- b) Arrange the metals in the order of their reactivity starting with the most reactive (2mks)
17. Name the organic compound formed when $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ is reacted with concentrate sulphuric acid at 170°C (1mk)
18. Carbon monoxide gas passed over heated Iron (III) as shown in the diagram below.



- a) Give the observation made in tube P. (1mk)
 b) Write the equation for the reaction which takes place in tube P. (1mk)
19. A strip of metal Q was dipped into a solution of copper (II) sulphate and allowed to stand overnight. Give that:
 $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu(s)} ; E^\ominus = + 0.34\text{v}$
 $\text{Q}^{2+}(\text{aq}) + 2\text{e} \rightarrow \text{Q(s)} ; E^\ominus = - 0.13\text{v}$
 a) State the observations which were made (2mks)
 b) Give a reason for your answer in 19 (a) above. (1mk)
20. State two factors which determine the stability of an isotope. (2mks)
21. The react between a piece of magnesium ribbon with excess 2m hydrochloric acid was investigated at 25°C by measuring the volume of hydrogen gas produced as the reaction progressed. The sketch below represents the graph that was obtained.

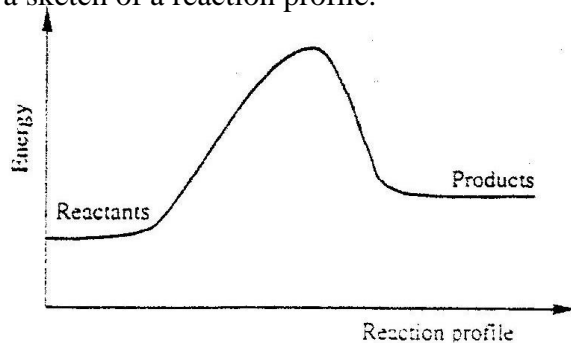


- a) Name one piece of apparatus that may be used to measure the volume of hydrogen gas produced.
- b) On the same diagram, sketch the curve that would be obtained if the experiment when excess chlorine gas was bubbled into hot concentrated sodium hydroxide, the following reaction occurred.
- $$3\text{Cl}_{2(\text{g})} + 6\text{NaOH}_{(\text{aq})} \longrightarrow \text{NaCO}_{3(\text{aq})} + 5\text{NaCl}_{(\text{aq})} + 3\text{H}_2\text{O}_{(\text{l})}$$
- In which product did chlorine undergo oxidation? Explain (3mks)
23. 1cm³ of soap was added to two test – tubes each containing water obtained from different sources. The lather produced in each test tube is represented as shown in the diagram below.

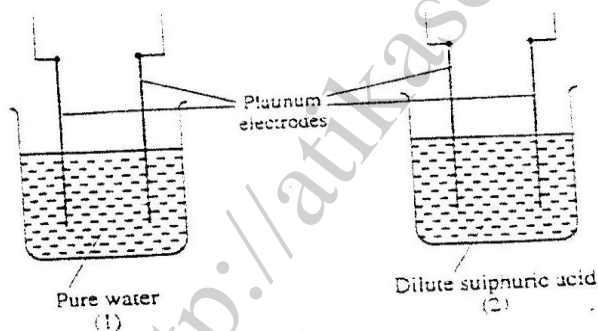


- Explain why there is more lather in test – tube 2 than in test – tube 1. (3mks)
24. Carbon dioxide can be dissolved in water under pressure to make an acidic solution.
- a) What is meant by an acidic solution? (1mk)
 b) aqueous lead (II) nitrate reacts with the acidic solution to form a precipitate.

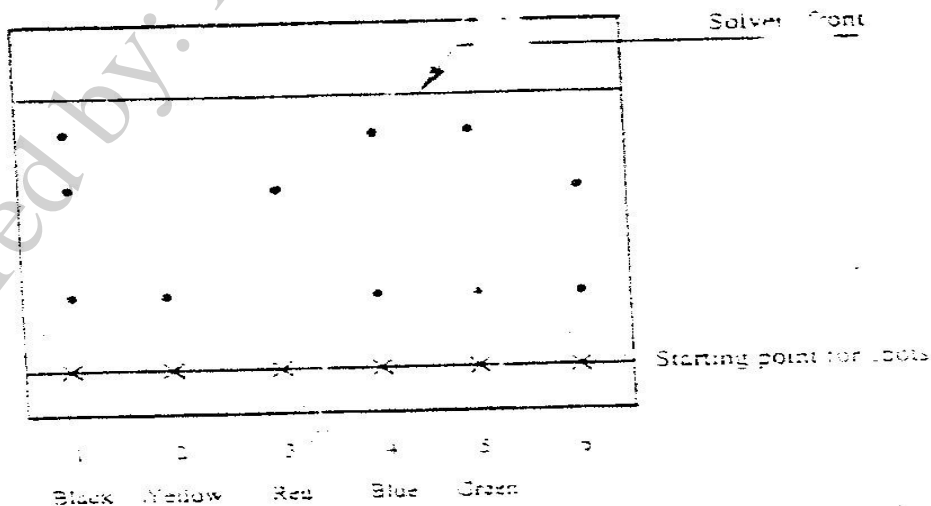
- Write anionic equation for the reaction.(1mk)
25. Below is a sketch of a reaction profile.



- a) On the diagram, show the heat of reaction, ΔH .(1mk)
- b) State and explain the type of reaction represented by the profile(2mks)
26. The diagram below represents the set – up that was used to study the effect of an electric current on pure water and dilute sulphuric acid.



27. State and explain the observation made when each experiment was started.(3mks)
27. A piece of chromatography paper was spotted with coloured inks obtained from pens labeled 1 to 6. The diagram below shows the spots after the chromatogram was developed.



- a) Which two pens contained in the same pigment?(1mks)
- b) Which pens contained only one pigment(1mk)
- c) According to the chromatogram, which pigments are present in the ink of pen number 6.(1mk)

CHEMISTRY PAPER 233/2.

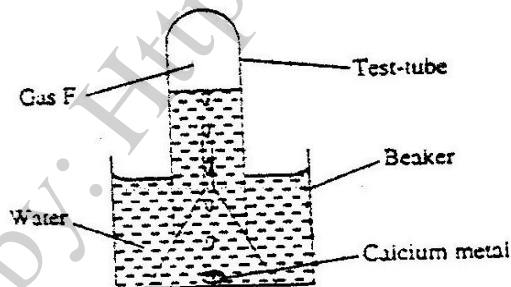
K.C.S.E 2004

1. a) The table below shows properties of chlorine, bromine and iodine.

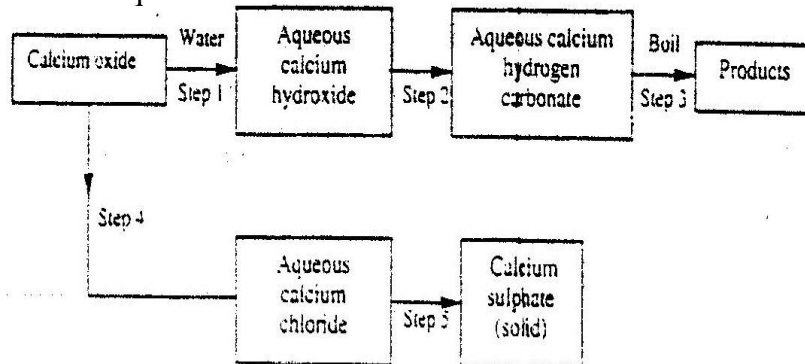
Ele	Formula	Colour and state room temperature	Solubility
Chlorine	Cl ₂	i).....	Soluble
Bromine	Br ₂	Brown liquid	ii).....
Iodine	I ₂	iii)	Slight soluble

Complete the table by giving the missing information in (i),(ii) and (iii) (3mks)

- b) Chlorine gas is prepared by reacting concentrated hydrochloric acids with manganese (iv) oxide.
- i) Write the equation for reaction between concentrated hydrochloric acid and manganese (iv) oxide. (1mk)
 - ii) What is the role of manganese (Iv) oxide in this reaction (1mks)
- c) i) Iron (II) chloride reacts with chlorine gas to form substance E.(1mk)
Identify substance E
- ii) During the reaction in c(i) above,6.30g of iron chloride were converted to 8.06 of substance E. Calculate the volume of chlorine used.
(Cl = 35.5, Molar gas volume at room temperature = 24000cm³, Fe =56 (mks)
- d) Draw and name the structure of the compound formed when excess chlorine gas is reacted with ethane gas. (2marks)
- e) Give the industrial use of chlorine (1 mk)
2. a) The set-up below was used to collect gas F, produced by the reaction between water and calcium metal.

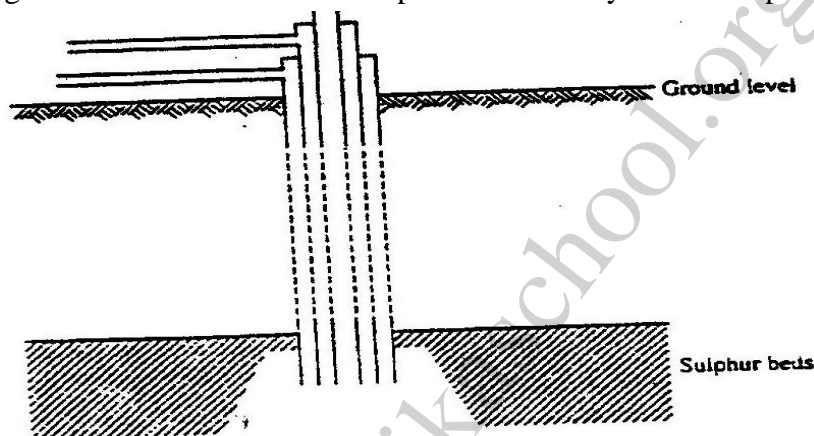


- (i) Name gas f
 - (ii) At the end of the experiment, the solution in the beaker was found to be a weak base. Explain why the solution is a weak base. (2 marks)
 - (iii) Give one laboratory use of the solution formed in a beaker. (1 mark)
- (b) The scheme below shows some reactions starting with calcium oxide. Study it and answer the questions that follow.



- (i) Name the reagents used in steps 2 and 4 (2marks)
 Step 2
 Step 4
- (ii) write an equation for the reaction in step 3. (1 mk)
- (iii) Describe how a solid sample of anhydrous calcium sulphate is obtained in Step 5

3. a) The diagram below illustrates how sulphur is extracted by the Frisch process.



Label the pipe through which superheated water is pumped in (1mk)

- b. The equation below shows the oxidation of sulphur dioxide to sulphur trioxide in the contact process.



- (i) Name one catalyst for this reaction (1 mark)
- (ii) State and explain the effect on the yield of sulphur trioxide when:
 I The temperature increased (2mks)
 II The amount of oxygen is increased (2mks)
- (iii) Describe how sulphur trioxide is converted to sulphuric acid in the contact process. (2 marks)
- (c) State two disadvantages of having sulphur dioxide in the environment (2mks)
- (d) Ammonia sulphate is a fertilizer produced by passing ammonia gas into concentrated sulphuric acid.

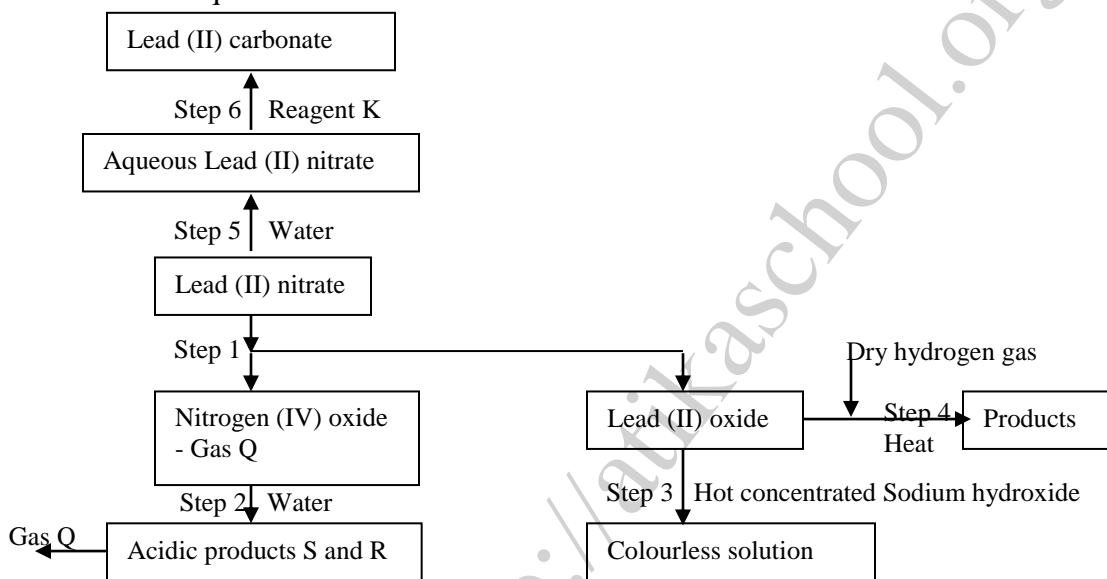
- (i) Write the equation for the reaction (1mk)
- (ii) Calculate the mass in Kg of sulphuric acid required to produce 25kg of the fertilizer (S= 32.0; O= 16.0; N = 1.0)

4. a) at 25°C, 50g of potassium were added to 100g of water to make a saturated solution. What is meant by a saturated solution? (1 mk)
- b) The table below gives the solubilities of potassium nitrate at different temperatures.

Temperature °C	12	20	28	36	44	52
Solubility g/100g C water	22	31	42	55	70	90

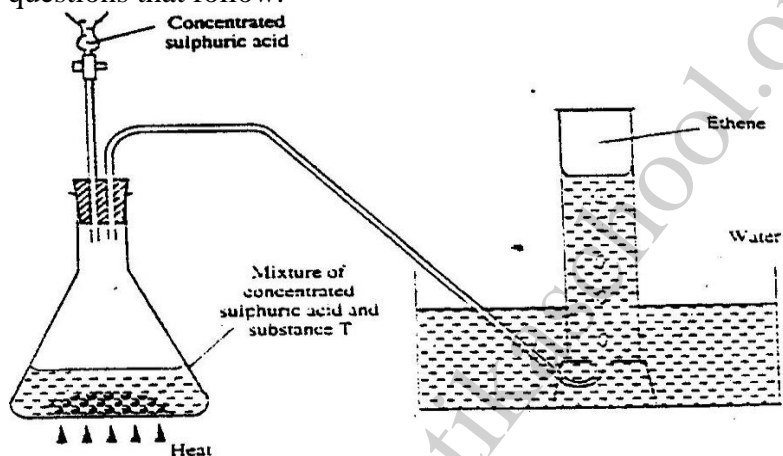
- (i) Plot graph of the solubility of potassium nitrate (vertical axis) against temperature (3 marks)
- (ii) Using the graph:
 I Determine the solubility of potassium nitrate at 15°C

- II Determine the mass of potassium nitrate that remained undissolved given that 80g of potassium nitrate were added to 100cm³ of water and warmed to 40°C.
- c) Determine the molar concentration of potassium nitrate at 15°C (3mks)
(Assume there is no change in density of water at this temperature)
(K = 39.0; N= 14.0; O = 16.0)
5. The flow chart below shows some reactions starting with lead (II) nitrate. Study it and answer the questions that follow.

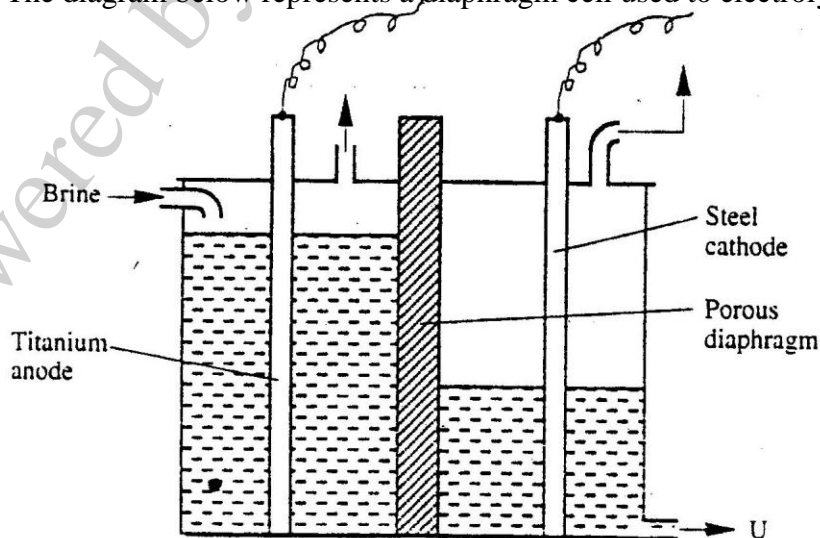


- (i) State the condition necessary in step 1.
- (ii) Identify:
I Reagent K
II Gas q
III Acidic products S and R
- (iii) Write:
I The formula of the complex ion formed instep 3. (1mk)
II The equation of the reaction in step 4 (1 mk)
- b) The use of materials made of lead in roofing and in water pipes is being discouraged
State:
(i) Two reasons why these materials have been used in the past. (2mks)
(ii) One reason why their use is being discouraged
- c) (i) The reaction between lead (II) nitrate and concentrated sulphuric acid starts but stops immediately. Explain (2mks)
6. a) Crude oil is a source of many compounds that contain carbon and hydrogen only.
(i) Name the processes used to separate the components of crude oil (1mk)
(ii) On what two physical properties of the above components does the separation depend? (2mks)
- b) Under certain conditions, hexane can be converted to two products.
The formula of one of the products is C₃H₆
(i) Write the formula of the other product (1mk)

- (ii) Describe a simple chemical reaction to show the difference between the two products formed in (b) above. (2mks)
- c) Ethane, C_2H_2 is another compound found in crude oil. One mole of ethane was reacted with one mole of hydrogen chloride gas and a product p_1 and was formed. P_1 was then reacted with excess hydrogen gas to form p_2 . Draw the structures p_1 and p_2 .
- d) The set-up below was used to prepare and collect ethane gas. Study it and answer the questions that follow.



- (i) Name the substance T
- (ii) Give the property of ethane that allows it to be collected as shown in the set up.
- e) One of the reactions undergone by ethane is addition polymerization. Give the name of the polymer and one disadvantage of the polymer it forms. (2 marks)
Name the polymer.
Disadvantage of the polymer
7. (a) Brine usually contains soluble calcium and magnesium salts. Explain how sodium carbonate is used to purify brine. (2mks)
- b) The diagram below represents a diaphragm cell used to electrolyse pure brine



- i) Write the equations for the reactions that take place at
- I Cathode (1mk)
 - II Anode (1mk)
- ii) Name:
- I Product at U (1mk)
 - II Another material that can be used instead of titanium (1mk)
 - III The impurity present in the product at U
- iii) State two functions of the diagram (2mks)
- c) Give one industrial use of the product at U. (1 mk)

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