SECTION A

*Attempt **all** questions.*

1. Candle wax is a mixture of hydrocarbon molecules that belong to the same homologous series.

(a) Explain what is meant by the term homologous series. *(01marks)*

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(b) An example of one hydrocarbon contained in candle wax is $C_{25}H_{52}$.

i) Name the homologous series to which this hydrocarbon belongs. *(01mark)*

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ii) Write the molecular formula for the molecule, containing 72 hydrogen atoms, that belongs to the same homologous series. *(01mark)*

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(c) State the suitable method that can be used to separate the different hydrocarbons in candle wax and give a reason.

(i) Method *(01mark)*

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(ii) Reason *(01mark)*

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2. A student carried out the following experiment.

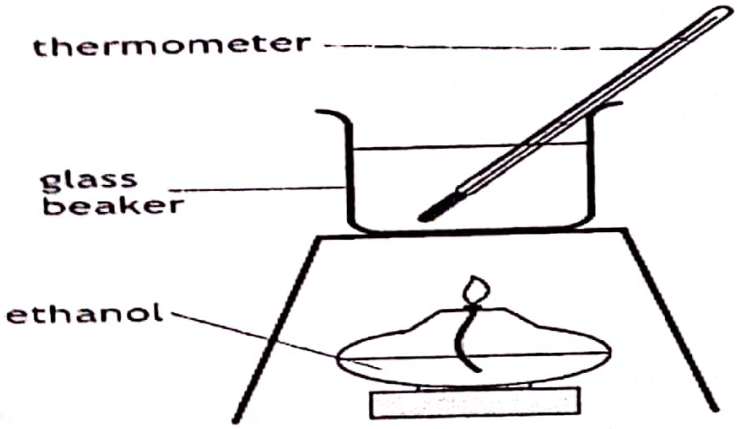

Fig 1.

(a) Write equation for complete combustion of ethanol *(1½ marks)*

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(b) When 0·8 g of ethanol was burned, 8·36 kJ of energy was absorbed by the water. If the temperature of the water increased by 40 °C, calculate the mass, in grammes, of water used by the student in this experiment. (specific heat capacity of water is 4.2 J/g °C) *(1½ marks)*

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(c) The experiment was repeated, replacing the glass beaker with a copper can and using a draught shield. Explain why these changes resulted in more heat energy being absorbed by the water.

(i) Use of copper can *(01mark)*

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(ii) Use of draught shield *(01mark)*

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3. A researcher investigated the conditions for producing ammonia at industrial scale

$$N_{2\,(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3\,(g)}$$

(a) Name the catalyst used in the industrial production of ammonia *(01mark)*

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(b) In her first experiment she measured how the percentage yield of ammonia varied with pressure at a constant temperature of 500 °C.

Pressure(atmospheres)	100	200	300	400	500
Percentage yield of ammonia (%)	10	18	26	34	42

Predict the percentage yield of ammonia at 700 atmospheres *(01mark)*

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(c) In a second experiment the researcher kept the pressure constant, at 200 atmospheres, and changed the temperature as shown.

Temperature (°C)	200	300	400	500
Percentage yield of ammonia (%)	89	67	39	18

Describe how the percentage yield of ammonia varies with temperature. *(01mark)*

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(d) Using the information in both tables, deduce the suitable conditions that would produce the highest percentage yield of ammonia. *(02mark)*

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4. Vitamin C is found in fruits and vegetables. In an experiment, 16.00 cm^3 of 0.005M of iodine solution reacted with exactly 25cm^3 of orange juice according to the equation below

$C_6H_8O_{6\,(aq)} + I_{2(aq)} \longrightarrow C_6H_6O_{6\,(aq)} + 2HI_{\,(aq)}$

(Vitamin C)

Calculate the concentration, in grammes per litre of vitamin C in the orange juice (C=12, H=1 and O=16) *(05marks)*

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

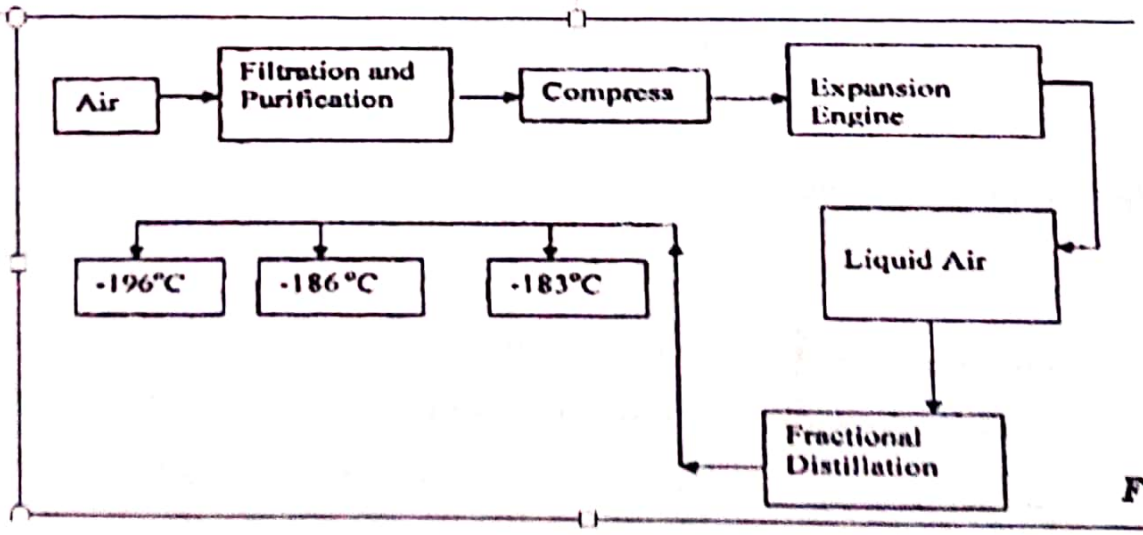

Fig 2.

(a) Name four components of air in the atmosphere. *(02marks)*

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(b) Identify the substance that is removed at the filtration stage. *(01mark)*

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(c) Explain why Carbon(IV) oxide and water are removed before liquefaction of air. *(01mark)*

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(d) Identify the component that is collected at -186°C. *(01mark)*

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6. The set-up below is used to investigate the properties of hydrogen.

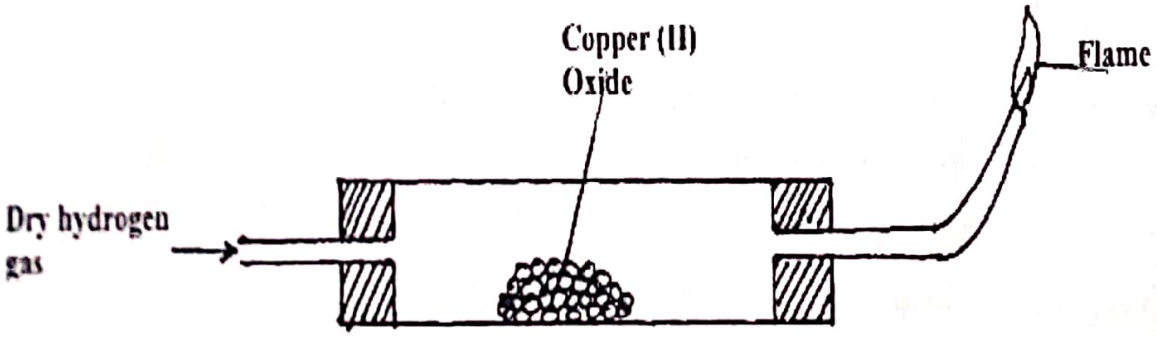

Fig. 3

(a) On the diagram, indicate what should be done for the reaction to occur. *(0½ marks)*

(b) Hydrogen gas is allowed to pass through the tube for some time before it is lit. Explain why. *(01mark)*

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(c) Write an equation for the reaction that occurs in the combustion tube *(1½ marks)*

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(d) When the reaction is complete, hydrogen gas is passed through the apparatus until they cool down. Explain why. *(01mark)*

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(e) What property of hydrogen is being investigated? *(0½ mark)*

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(f) What observation confirms the property stated in (e) above? *(0½ mark)*

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7. The table below gives information about the ions T^+ and X^{2-}

Ions	T^+	X^{2-}
Electronic configuration	2:8:8	2:8:8
Number of neutrons	20	16

(a) How many protons are there in the nucleus of;

(i) Element T? *(01mark)*

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(ii) Element X? *(01mark)*

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(b) Determine the molar mass of the compound formed between T and X
(02marks)

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(c) State two conditions under which the compound would conduct electricity
(01mark)

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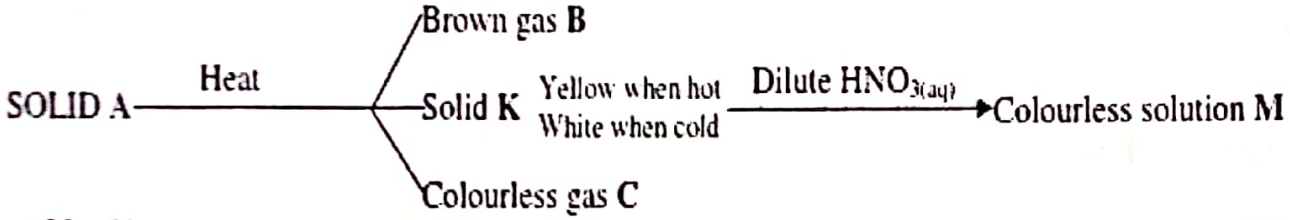
8. Study the flow chart below and answer the questions that follow



(a) Identify; *(01mark)*

(i) gases C..... and B.....

(ii) Ions likely to be presented in solid A. *(01mark)*

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(b) Write chemical equation for reaction that

(i) led to formation of solid K *(1½ marks)*

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(ii) occurred between solid K and dilute nitric acid. *(1½ marks)*

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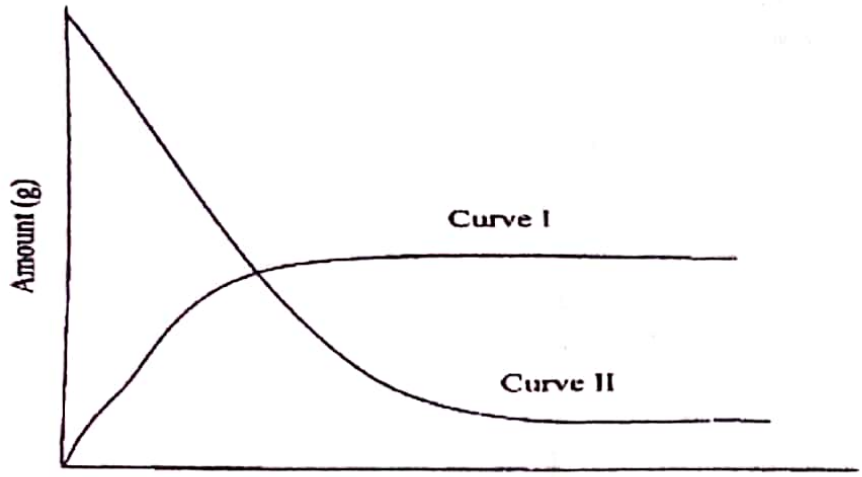
9. The graph below shows the amount of calcium carbonate and calcium chloride varying with time in the reactions:



(a) What is meant by the term 'rate of reaction' *(01mark)*

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(b) Write an equation for reaction between calcium carbonate and dilute hydrochloric acid. *(1½ marks)*

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(i) Which curve shows the amount of calcium chloride varying with time? *(1½ marks)*

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(ii) Explain why the two curves become horizontal after a given period of time. *(01mark)*

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(iii) Sketch on the graph how curve II would appear if the experiment was repeated using a more dilute hydrochloric acid solution

(01mark)

10. The setup below was used in the electrolysis of dilute copper (II) nitrate solution.

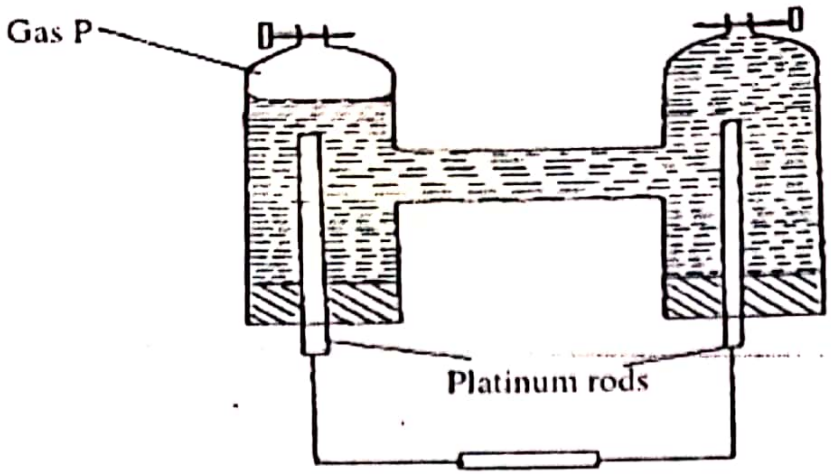

Fig . 5

(a) What is meant by the term electrolysis? *(01mark)*

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(b) Show the anode and cathode on the diagram above. *(01mark)*

(c) Explain how you would confirm gas P *(01mark)*

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(d) Write the equation for the reaction occurring at

i) Anode *(01mark)*

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ii) Cathode *(01mark)*

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SECTION B

*Attempt any **two** questions.*

11. (a) Sodium metal is extracted by the electrolysis of molten sodium chloride to which calcium chloride is added before heating is done.

i) Give a reason for the addition of calcium chloride. *(01mark)*

ii) Name a material that can be used as the cathode and another that can be used as the anode. *(01mark)*

iii) Write equations for the reactions that take place at each electrode. *(02marks)*

iv) Describe how the product at the cathode is collected. *(01mark)*

v) Name one other metal that can be extracted by a similar method *(01mark)*

(b) Name a place in Uganda where a plant for the extraction of sodium could be constructed. Give a reason for your answer. *(02marks)*

(c) State what would be observed and write equation(s) for reaction(s), if a small piece of sodium metal is;

i) heated and quickly plunged into a gas jar of oxygen. *(03marks)*

ii) dropped in trough which is half filled with water *(04marks)*

12. (a) Chlorine can be prepared in the laboratory from an acid and an oxide.

i) Name the acid and the oxide used in the preparation of chlorine. *(01mark)*

ii) State the conditions for the reaction. *(01mark)*

iii) Write an equation for the reaction which takes place between the acid and the oxide you have named in (i). *(1½ marks)*

(b) (i) Draw a labelled diagram to show the preparation of anhydrous iron(III) chloride using chlorine. *(04 marks)*

(ii) State what would be observed during the preparation. *(1½ marks)*

(iii) Write an equation for reaction leading to the formation of iron(III) chloride. *(1½ marks)*

(c) (i) State what would be observed if aqueous ammonia was added to a solution of iron(III) chloride. *(01mark)*

(ii) Write an ionic equation for the reaction in (c)(i). *(1½ marks)*

(d) State two industrial uses of chlorine gas (2mks)

13. (a) Describe the structure of graphite (diagram required). *(5 ½ marks)*

(b) State two properties in which graphite differs from diamond. *(02 marks)*

(c) Graphite was heated in excess air and the gas given off passed through aqueous calcium hydroxide for a long time.

(i) State what was observed. *(01 mark)*

(ii) Write equation(s) for the reaction(s) *(03 marks)*

(iii) Carbon monoxide reacts with iron(III) oxide according the following equation: $Fe_2O_3(s) + 3CO\ (g) \rightarrow 2\ Fe(s) + 3CO_2\ (g)$

If excess carbon monoxide was passed over 3.5 g of hot iron(III) oxide, calculate the volume of carbon dioxide evolved at s.t.p. *(3½ marks)*

14. (a) Explain how sulphuric acid is manufactured at industrial scale. *(07marks)*

(b) Describe the reaction of sulphuric acid with;

i) Carbon *(03marks)*

ii) Magnesium oxide *(03marks)*

(c) Describe the confirmatory test for the anion in dilute sulphuric acid. *(02marks)*

END