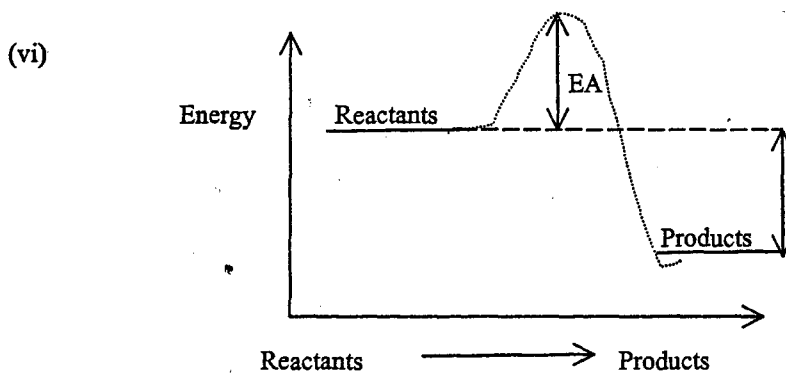


SECTION A (20 marks)

Answer ALL questions in this section.

1. For each of the items (i) – (x) choose the correct answer from among the given alternatives and write its letter beside the item number.
- (i) The following are methods of separating mixtures of liquid substances which are miscible:
- A Chromatography, filtration and fractional distillation
  - B Chromatography, fractional distillation, sorting
  - C Chromatography, fractional distillation, condensation
  - D Chromatography, fractional distillation, fractional crystallization
  - E Chromatography, filtration, condensation.
- (ii) The total number of protons and neutrons in the nucleus of an atom is called
- A valency number
  - B atomic number
  - C molecular number
  - D mass number
  - E hybrid orbital.
- (iii) Which of the following solution will turn pink when phenolphthalein indicator is added to it?
- A Orange juice
  - B Drinking water
  - C Deionised water
  - D Caustic soda
  - E Sulphuric acid
- (iv) A chemist is a person who investigates and collects data on the changes of chemical substances before making any conclusions. Which important qualities must this person have?
- A Mastery of the periodic table of elements
  - B Skills in writing reports in English Language
  - C Keen in the use of most of the sense organs
  - D Interest in the use of computer
  - E Familiar with other science subjects
- (v) An element having atomic number 35 is likely to be a
- A non metal having one electron in the outer shell
  - B metal of valency one
  - C non metal of group VI
  - D non metal having seven electrons in the outer shell
  - E metal of group II.



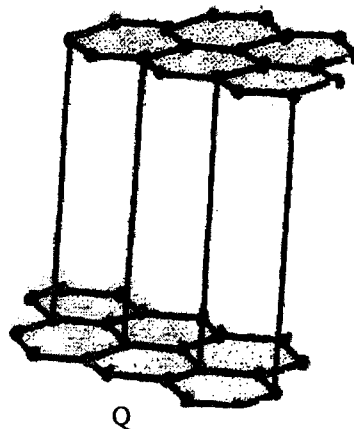
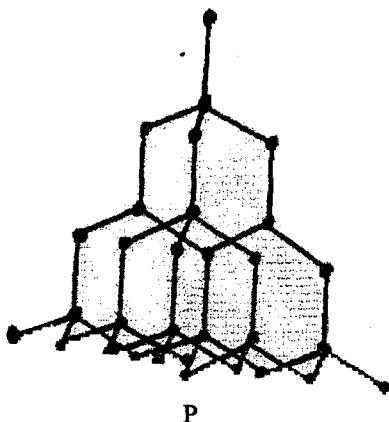
The above illustration presents . . . reaction.

- A an activation
- B an endothermic
- C an exothermic
- D a heat
- E a neutralisation

(vii) Substance L has a percentage composition of 54.6 % carbon, 9.1 % hydrogen and the rest is oxygen. The empirical formula of substance L is

- A  $C_2H_4O$     B  $CH_4$     C  $CH_2O$     D  $C_2H_6O$     E  $C_2H_3O_2$

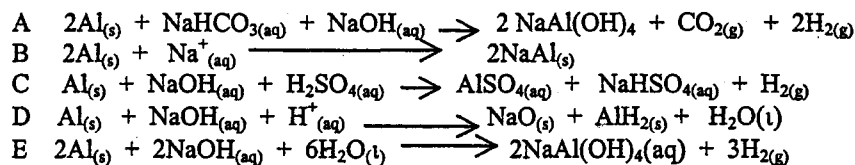
(viii) Substances P and Q exist in different structural forms yet they belong to one element.



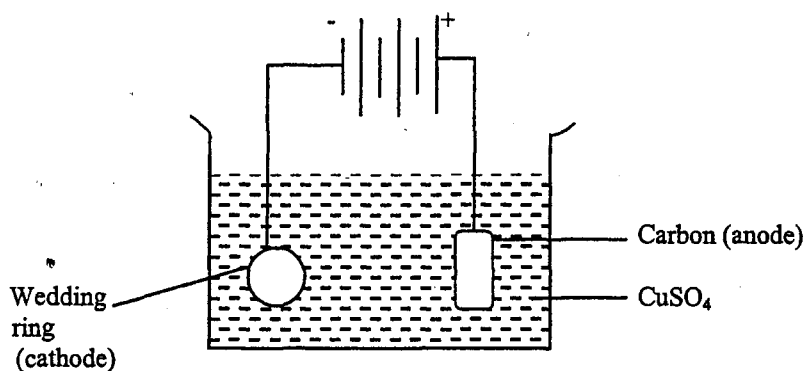
The existence of these substances in different forms is known as

- A isotopy    B anisotropy    C allotropy    D isomerism    E radioactivity.

(ix) The effect of surface area of reactants on the rate of chemical reaction can be studied in the laboratory using dilute sodium hydroxide solution and aluminium foil or powdered aluminium. The chemical equation for this reaction will be



(x) Electroplating of wedding ring was carried out in the laboratory using copper sulphate solution as shown in the diagram below:



What reaction took place at the carbon electrode?

- A Oxidation reaction with discharge of  $\text{OH}^-$  ions
- B Oxidation reaction with discharge of  $\text{H}_2(\text{g})$
- C Reduction reaction with discharge of  $\text{OH}^-$  ions
- D Oxidation reaction with discharge of  $\text{Cu}^{2+}$  ions
- E Redox reaction with discharge of  $\text{Cu}^{2+}$  and  $\text{H}^+$  ions

2. Match the items in list A with the responses in list B by writing the letter of the correct response beside the item number.

LIST A

- |  |   |
|--|---|
| (i) Flocculation                       | (vii) Mass number   |
| (ii) Bonding in a molecule of nitrogen | (viii) Used to remove colouring matter in brown sugar                     |
| (iii) Ammonia in water                 | (ix) Empirical formula  |
| (iv) Chemical equations                | (x) Existence of element in more than one form without changing its state |
| (v) Identification of hydrogen         |   |
| (vi) Acid-base reaction                |   |

LIST B

- A Graphite
- B Isomer
- C Tripple bonds
- D Binding together of soil particles
- E Catenation
- F pH greater than 7
- G Pop sound
- H Lime water change to milky colour
- I Representation of reactants and products in a chemical reaction
- J Neutralisation reaction
- K Allotropy
- L Total number of protons and neutrons in the nucleus
- M Animal charcoal
- N Bleaching
- O Simplest formular that express its composition by mass
- P Kipp's apparatus
- Q To precipitate soil materials
- R One which expresses the actual number of each kind of atom present in its molecule
- S Method of separating solid mixtures
- T Chromatographic techniques

**SECTION B (60 Marks)**

Answer ALL questions in this section.

3. (a) Differentiate between
- |                             |                            |           |
|-----------------------------|----------------------------|-----------|
| (i) isotopes and allotropes | (ii) protons and neutrons. | (4 marks) |
|-----------------------------|----------------------------|-----------|
- (b) Dalton's atomic theory contains assumptions concerning the manner in which elements combine with one another. State these assumptions. (3 marks)
- (c) A mass of 4.133 g of sodium carbonate crystal ( $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ ), was heated gently and 3.533 g of the anhydrous compound remained. Calculate the value of x. (3 marks)

4. (a) What do you understand by the following terms?

- (i) A base      (ii) An alkali      (iii) A salt      (iv) A weak acid      (2 marks)

(b) When zinc granules and dilute sulphuric acid are reacted together, a gas M is produced. The gas produced is collected by downward displacement of water. Use this information to answer the questions below:

- (i) Name the gas M produced.  
 (ii) How is the gas tested?  
 (iii) Why is the gas collected by downward displacement of water?  
 (iv) List all the apparatuses used in the preparation of gas M.  
 (v) Write one use of gas M. (5 marks)

(c) Give reasons for the following chemical phenomena:

- (i) Hydrochloric acid is added in a test-tube containing a carbonate.  
 (ii) Ammonium sulphate crystals are warmed together with sodium hydroxide solution.  
 (iii) Lead nitrate is heated in a test-tube. (3 marks)

5. (a) Identify the substances revealed by the following information:

- (i) a pale green solution which becomes yellowish-brown on exposure to air  
 (ii) a colourless liquid, immiscible with water, which dissolves sulphur  
 (iii) a heavy liquid metal. (3 marks)

(b) The atomic number of potassium is 19. Give three deductions which can be made from this statement. (4 marks)

(c) The following elements represent atoms of elements showing their mass numbers and atomic numbers:  ${}_{18}^{40}\text{Ar}$  and  ${}_{19}^{39}\text{K}$ .

- (i) What is the electronic structure of argon atom?  
 (ii) How many neutrons are there in the nucleus of the argon atom?  
 (iii) Explain why argon has a lower atomic number but greater atomic mass than that of potassium. (3 marks)

6. (a) Study the following elements:  ${}_{16}^{32}\text{S}$ ,  ${}_{17}^{35}\text{Cl}$ ,  ${}_{18}^{40}\text{Ar}$ ,  ${}_{20}^{40}\text{Ca}$  and  ${}_{19}^{39}\text{K}$ .

Atoms and ions which have the same number of electrons are said to be iso-electronic. From the elements given above, write the formula of three ions which are iso-electronic and draw their electronic structures. (3 marks)

(b) Calcium oxide (quicklime) is manufactured by heating limestone in a stream of air.

- (i) Write the equation for the reaction and explain why it is necessary to heat the limestone in a stream of air.  
 (ii) State how calcium oxide is converted to calcium hydroxide and indicate one point of interest concerning the reaction that takes place. (2 marks)

(c) (i) Explain one laboratory use and one large scale use of calcium hydroxide. (2 marks)

(ii) Give the reaction that takes place when a mixture of coke and calcium oxide is heated in an electric furnace. (3 marks)

7. The diagram below represents the laboratory preparation of oxygen. Study the diagram and then Answer the questions which follow:

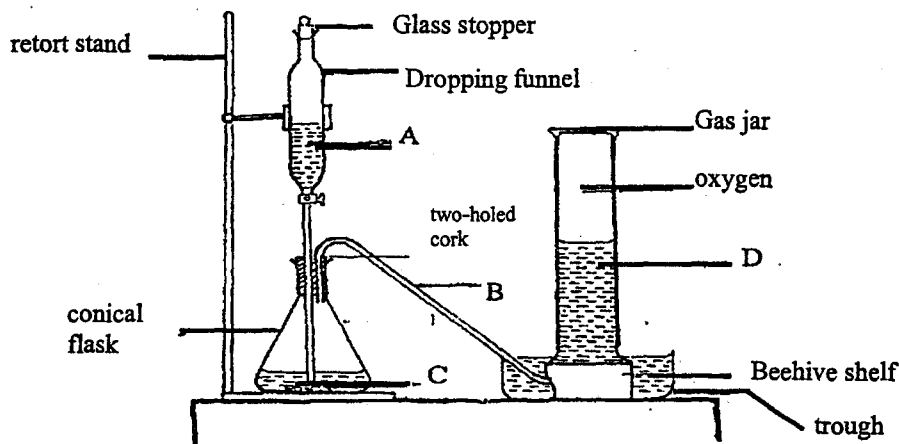


Fig. 3.1 Preparation of oxygen

(a) (i) Label the parts indicated with letters A, B, C, D in the diagram. (4 marks)

(ii) Does oxygen burn? Why? (1 mark)

(b) The formula of manganese (IV) oxide is  $MnO_2$  and that of hydrogen peroxide is  $H_2O_2$ . Which compound produces oxygen? (1 mark)

(c) (i) What is the name of the method of collecting the gas? (1 mark)

(ii) Explain the meaning of a catalyst. (2 marks)

(iii) How can you test for oxygen? (1 mark)

8. (a) (i) Define the term mole. (1 mark)

(ii) How many hydrogen atoms are there in  $2.57 \times 10^{-6}$  g of hydrogen? (1 mark)

(b) Suggest the suitable indicators for the following titrations:

(i) Strong acid against strong base (iii) Weak base against strong acid

(ii) Strong base against weak acid (iv) Weak acid against weak base (4 marks)

(c) (i) Ammonium sulphate combines with sodium hydroxide solution to produce sodium sulphate. With the aid of a balanced chemical equation calculate the mass of sodium hydroxide that would combine with 52 g of ammonium sulphate. (2 marks)

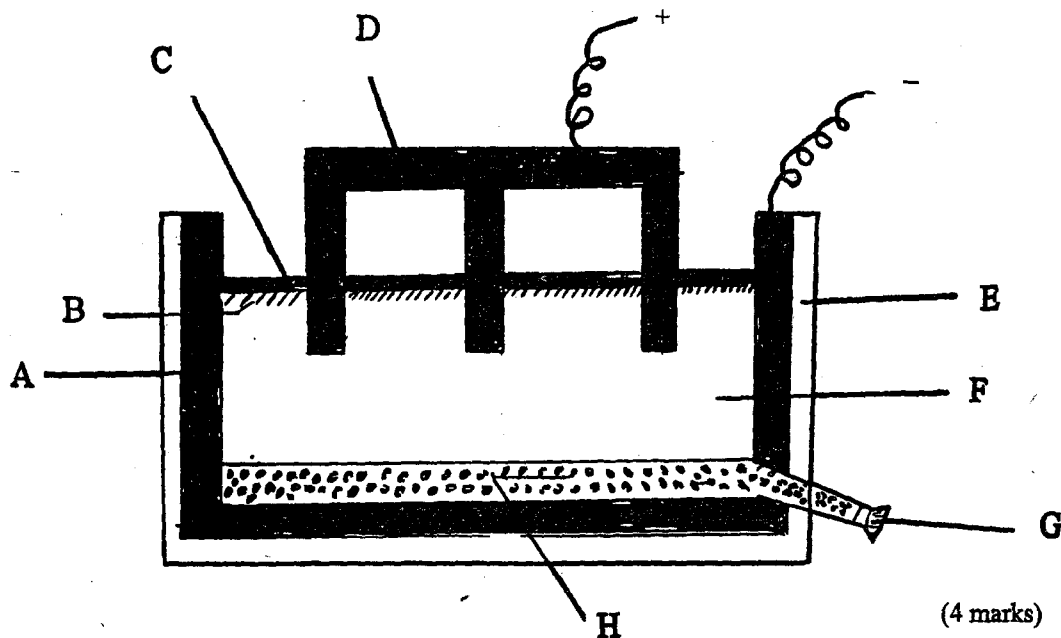
- (ii)  $25 \text{ cm}^3$  of a solution containing  $0.196 \text{ g}$  of a metal hydroxide,  $\text{XOH}$  were neutralized by  $35 \text{ cm}^3$  of  $0.1 \text{ M}$  hydrochloric acid solution.

Write down the balanced chemical equation for the reaction. (2 marks)

**SECTION C (20 Marks)**

Answer TWO (2) questions from this section.

9. (a) The diagram below represents the process of extraction of aluminium metal from bauxite. Label parts A, B, C, D, E, F, G and H.



(4 marks)

- (b) (i) Explain briefly how aluminium is obtained from its oxide. (1 mark)  
 (ii) Explain how aluminium chloride is formed. (1 mark)  
 (iii) What will happen if aluminium chloride reacts with water? (1 mark)
- (c) With the help of a balanced chemical equation, explain why aluminium containers can be used to store concentrated nitric acid and not concentrated sulphuric acid. (3 marks)

10. (a) What do you understand by the following terms?  
 (i) Isomerism (ii) Homologous series (iii) Substitution reaction (3 marks)
- (b) Explain how the following conversions take place. Give the necessary conditions.  
 (i) Methane is converted to tetrachloromethane  
 (ii) Ethanol is converted to acetaldehyde  
 (iii) Alcohol is converted to ethene (3 marks)

(c) Natural gas consists of one important constituent of hydrocarbons.

(i) Name the compound

(ii) Give the general formulae for the homologous series to which it belongs. (4 marks)

11. (a) Explain briefly the following terms:

(i) Soil formation (ii) Denitrification (iii) Symbiotic bacteria

(iv) Mulching.

(4 marks)

(b) (i) What is manure?

(ii) Name five types of organic manures.

(iii) Give three advantages and three disadvantages of manures.

(4 marks)

(c) (i) Give four (4) reasons why a fertile soil is not necessarily productive.

(ii) Asha's school shamba soil requires 80 kg of nitrogen per hectare so as to fulfil plant requirements of nitrogen. Calculate the quantity (in kg) of ammonium sulphate  $[(\text{NH}_4)_2 \text{SO}_4]$  fertilizer required to meet this demand. (2 marks)

12. (a) Define the following terms:

(i) Electrolyte (ii) Electrochemical equivalent

(iii) What is the mass of copper deposited when a current of 2 amperes flows in an electrolyte for one hour? (3 marks)

(b) (i) State first Faraday's law of electrolysis.

(ii) How many faradays of electricity are required to liberate one mole of zinc by electrolysis?

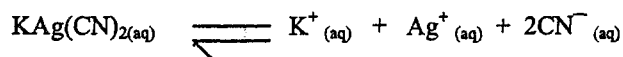
(iii) Explain three factors which affect electrolysis.

(3marks)

(c) (i) What is meant by electroplating?

(ii) What does the amount of element liberated in electrolysis depend upon?

(iii) Given the following solution



What happens when direct current passes through this solution using pure silver anode?

(4 marks)

**THE UNITED REPUBLIC OF TANZANIA  
NATIONAL EXAMINATIONS COUNCIL  
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

032A

**CHEMISTRY I**

(For Both School and Private Candidates)

Time: 3 Hours

November, 2001

1. This paper consists of sections A, B and C.

2. Answer all questions in sections A and B and TWO (2) questions from section C.

3. Write your Examination Number on every page of your answer booklet(s).

4. The following constants may be used

Atomic masses: H = 1, C = 12, N = 14, O = 16, Na = 23, Ca = 40, Cu = 63.5, Pb = 207

Avogadro's Number =  $6.02 \times 10^{23}$

GMV at sea level = 760 mmHg

Faraday constant = 96,500 C

Standard pressure = 760 mmHg

Standard temperature = 273 K

This paper consists of 8 printed pages.