

THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

NOVEMBER 1997

032/1

CHEMISTRY PAPER 1

(For both School and Private Candidates)

TIME: 3.0 Hours.

INSTRUCTIONS TO CANDIDATES

1. This paper consists of sections A, B and C.
2. Answer ALL questions in sections A and B and THREE (3) questions including question 6 from section C in the answer book provided.
3. Read the instructions given under each section very carefully.
4. The marks allocated to each section and/or question are indicated in brackets.
5. Where calculations are involved you are expected to show clearly all the steps of your work in a systematic manner.
6. The following constants may be useful.

Atomic masses:

H = 1, C = 12, O = 16, Na = 23, Al = 27, S = 32, Mn = 55,

Fe = 56, I = 127.

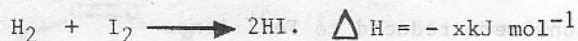
This paper consists of 8 printed pages.

SECTION A [15 Marks]

Answer ALL questions in this section. You are advised to spend not more than 45 minutes in this section. Choose the correct answer from the given alternatives and write its letter in the answer book provided.

1. (i) When substance A and substance B react to produce a new substance, C, the reactants A and B are said to:
 - A. undergo a chemical change
 - B. form a solution C
 - C. undergo a physical change
 - D. form a mixture.
- (ii) According to the Dalton's atomic theory, the smallest particle which can undergo a chemical change is:
 - A. an electron
 - B. a molecule
 - C. an atom
 - D. a proton.
- (iii) If two jars labelled W and Z contain 22.4dm^3 of oxygen gas and 22.4dm^3 of nitrogen gas at STP respectively, then it is true that:
 - A. There were 6.02×10^{23} oxygen molecules in jar W and 6.02×10^{23} nitrogen molecules in jar Z.
 - B. 6.02×10^{23} oxygen atoms were in jar W and 6.02×10^{23} atoms of nitrogen were in jar Z.
 - C. there were 12.04×10^{23} molecules of oxygen and nitrogen in the gas jars W and Z.
 - D. 6.02×10^{13} molecules of oxygen and nitrogen were in the two gas jars W and Z.
- (iv) Element Q of atomic number 12 is found in
 - A. group I and period 2
 - B. group II and period 2
 - C. group II and period 3
 - D. group IV and period 4.
- (v) When hydrogen chloride molecule is formed covalently, how many electrons are shared between hydrogen and chlorine atoms?
 - A. 1 electron
 - B. 2 electrons
 - C. 3 electrons
 - D. 4 electrons.

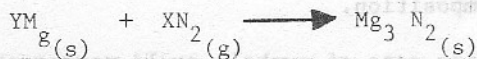
- (vi) When an alcohol reacts with a carboxylic acid, which of the following organic compounds is formed?
- an ester
 - an ether
 - a haloalkane
 - an alkene.
- (vii) Which of the following equations represent a neutralization reaction?
- $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \longrightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$
 - $\text{HCl}(\text{aq}) + \text{NaOH}(\text{aq}) \longrightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 - $\text{NO}_2(\text{g}) + \text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{H}_2\text{SO}_4(\text{l}) + \text{NO}(\text{g})$
 - $\text{H}_2\text{SO}_4(\text{aq}) + \text{Zn}(\text{s}) \longrightarrow \text{H}_2(\text{g}) + \text{ZnSO}_4(\text{aq})$
- (viii) When 0.125 Faradays of electricity are passed through a copper (II) sulphate solution, the mass of copper deposited will be:
- 4 g
 - 8 g
 - 64 g
 - 32 g
- (ix) The reaction between iodine and hydrogen can be represented by the equation below:



This shows that the reaction is:

- endothermic
 - exothermic
 - a thermal combination
 - a thermal decomposition.
- (x) Which of the following sets of symbols could represent isotopes of a single element?
- $^{16}_8\text{X}$, $^{17}_8\text{X}$, $^{18}_8\text{X}$
 - $^{16}_8\text{Z}$, $^{17}_8\text{Z}$, $^{16}_9\text{Z}$
 - $^{16}_7\text{W}$, $^{16}_8\text{W}$, $^{16}_9\text{W}$
 - $^{16}_7\text{W}$, $^{17}_8\text{W}$, $^{18}_9\text{Z}$

- (xi) When methane (CH_4) is completely burnt in oxygen the products will be:
- carbon, carbon dioxide and water vapour
 - hydrogen, carbon dioxide and water vapour
 - carbon dioxide and water vapour
 - carbon monoxide and water vapour.
- (xii) The method of separating a mixture of two liquids by using their differences in boiling points is known as:
- distillation
 - filtration
 - evaporation
 - fractional distillation.
- (viii) The volume of $0.2\text{M H}_2\text{SO}_4$ required to neutralize completely 25.0cm^3 of 0.05M KOH is:
- 0.626cm^3
 - 6.125cm^3
 - 6.315cm^3
 - 3.125cm^3
- (xiv) When a green solution of iron (II) salt was exposed to air for 10 minutes, its colour changed to yellowish-brown because:
- Fe^{2+} ions were reduced to Fe^{3+} ions
 - Fe^{3+} ions were reduced to Fe^{2+} ions
 - Fe^{2+} ions were oxidized to Fe^{3+} ions
 - Fe^{3+} ions were oxidized to Fe^{2+} ions.
- (xv) What numbers do the letters Y and X represent in the following balanced equation?

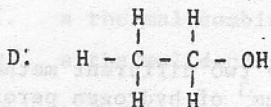
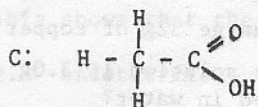
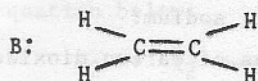
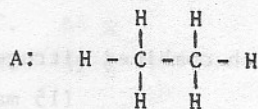


- Y is 2 while X is 3
- Y is 3 while X is 1
- Y is 3 while X is 2
- Y is 1 while X is 3

SECTION B [40 Marks]

Answer ALL questions in this section. You are advised to spend not more than 1 hour in this section.

2. (a) Define the following terms
 - (i) anode
 - (ii) electrode
- (b) What will the product be at the cathode if a solution of copper (II) sulphate is electrolysed using platinum electrodes? (10 marks)
3. (a) Give the meaning of
 - (i) empirical formula
 - (ii) molecular formula
- (b) A compound of relative molecular mass of 106 was found to be composed of 43.4% sodium, 11.3% carbon and 45.3% oxygen. Determine its:
 - (i) empirical formula
 - (ii) molecular formula if its molar mass is 106.
4. (a) You are provided with compounds which have the following structural formulae



- (i) Give the name of the functional groups in each of the compounds, B, C and D.
- (ii) Give the systematic (IUPAC) names of the compounds, A, B and D.
- (b) By using potassium permanganate, how can you distinguish between compound A from compound B? (10 marks)

5. (a) Why are metals used as
- (i) reducing agents?
 - (ii) conductors of electricity?
- (b) Give the name of the metals which fits the following descriptions:
- (i) It must be kept under kerosene to protect it from water or air.
 - (ii) The metallic element in limestone.
 - (iii) Its green coloured carbonate decomposes when heated to give a black oxide.
 - (iv) Its oxide is yellow when hot and white when cold.

(10 marks)

SECTION C [45 Marks]

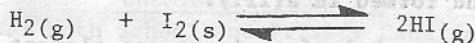
Answer question six (6) and any other TWO questions from this section.
You are advised to spend not more than $1\frac{1}{4}$ hours in this section.

6. (a) Define nitrogen fixation.
- (b) Explain why the naturally occurring nitrogen gas is not available to plants directly.
- (c) Which are the THREE major processes by which atmospheric nitrogen is transformed into usable forms?
- (d) Which are the two major ionic forms in which combined nitrogen is absorbed by plants?
- (15 marks)
7. (a) How many atoms are there in 46g of metallic sodium?
- (b) How many molecules are there in 11.2 litres of carbon dioxide at STP?
- (c) How many electrons will be needed to discharge 32g of copper?
- (d) How many aluminium ions will be present in solution if 3.0g of aluminium sulphate are completely dissolved in water?
- (15 marks)

8. (a) (i) What is a catalyst?
- (ii) Mathias set out to prepare oxygen by two different methods. In the first experiment, he mixed 5cm^3 of hydrogen peroxide with 30cm^3 of water and added in the mixture some 0.5g of solid manganese dioxide, MnO_2 . He managed to collect 20cm^3 of oxygen within the first 20 seconds at room temperature.
- In his second experiment, 5cm^3 of the same hydrogen peroxide with 30cm^3 of water also at room temperature, but it took 360 seconds to collect 20cm^3 of oxygen.
- Explain why the time he needed for collecting 20cm^3 of oxygen was different in the two experiments.

8. Cont.

- (b) What are the three factors which affect the equilibrium position of a balanced reversible chemical reaction?
- (c) Solid iodine and gaseous hydrogen were kept in a closed system and heated until the following equilibrium was established.



If water was introduced in the system and the hydrogen iodide dissolved in it,

- (i) in which direction would the equilibrium position be shifted?
- (ii) What would happen to the production of hydrogen iodide upon the introduction of water into the reaction system? (15 marks)

9. (a) (i) State the Charles' Law.
- (ii) Write an expression of the combined Charles' and Boyle's Laws.
- (b) What will happen to the volume of a given mass of gas if its pressure is doubled at constant temperature?
- (c) Calculate the volume of a gas at 273K and 760mmHg if its volume is 198cm³ at 297K and 740mmHg pressure. (15 marks)

10. The figure below is part of the Periodic table where the transition metals are not included. The numbers in the table are the atomic numbers of some of the elements.

→ Groups

↓ Periods

1							2
	4		6		8		
11	12					17	

- (a) (i) For each number, write the symbol of the corresponding element.
- (ii) Considering the elements with atomic number 12 and 17, which is a metal and which is a non-metal?
- (iii) Write one equation which represents a reaction between the element with atomic number 1 and the element with atomic number 17.

10. Cont.

- (b) (i) What are the types of oxides formed by elements with atomic numbers 11 and 12?
- (ii) Write a balanced chemical equation between the oxide of the element with atomic number 11 and aqueous solution of the compound formed in a(iii).
- (iii) Write the symbol of an inert gas element represented by the given atomic numbers. (15 marks)

(1) In which direction would the equilibrium position be shifted?

(2) The introduction of water into the reaction system. (15 marks)

(3) State the Charles' law. (1) Write an expression of the combined Charles' and Boyle's laws.

(4) What will happen to the volume of a given mass of gas if its pressure is doubled at constant temperature?

(5) Calculate the volume of a gas at 27°C and 760 mmHg if its volume is 100 cm³ at 27°C and 140 mmHg pressure. (15 marks)

10: The figure below is part of the periodic table where the transition metals are not included. The numbers in the table are the atomic numbers of some of the elements.

Groups									
↓ Periods									
1	2								
3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22

(a) (i) For each number, write the symbol of the corresponding element.

(ii) Considering the elements with atomic numbers 11 and 12, which is a metal and which is a non-metal?

(iii) Write one equation which represents a reaction between the element with atomic number 1 and the element with atomic number 17.