

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

032/1

CHEMISTRY 1

(For Both School and Private Candidates)

TIME: 3 Hours

Tuesday afternoon 09/10/2007

Instructions

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. All questions carry equal marks.
4. Electronic calculators are **not** allowed in the examination room.
5. Cellular phones are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. The following constants may be used:

Atomic masses: H = 1, O = 16, C = 12, Cu = 63.5, S = 32, Cl = 35.5, Ca = 40, Na = 23, N = 14,
Fe = 56, Ag = 108, Au = 197.

Atomic numbers: H = 1, Cl = 17.

Avogadro's constant = 6.02×10^{23} .

GMV at s.t.p. = 22.4 dm^3 .

1 Faraday = 96500 coulombs.

Standard pressure = 760 mm Hg.

Standard temperature = 273 K.

1 litre = $1 \text{ dm}^3 = 1000 \text{ cm}^3$.

This paper consists of 8 printed pages.

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SECTION A (20 marks)

Answer **all** questions in this section.

1. For each of the items (i) - (x) choose the correct answer among the given alternatives and write its letter beside the item number.
- (i) A mixture of water and alcohol was carefully distilled. Which property of the first drops of the liquid distillate collected is **not** correct? The first drops
- A have the same boiling point as water
 - B mix easily with water
 - C burn in air
 - D are colourless
 - E will boil at a temperature less than the boiling point of water.
- (ii) Which oxides are gaseous at room temperature?
- A Carbon dioxide and copper oxide.
 - B Sulphur dioxide and copper oxide.
 - C Carbon dioxide and sulphur dioxide.
 - D Copper oxide and iron oxide.
 - E Iron oxide and carbon dioxide.
- (iii) If 0.5 g of hydrogen gas are exploded in air, the mass of water formed is
- A 1.8 g
 - B 4.5 g
 - C 0.75 g
 - D 40 g
 - E 18 g.
- (iv) A and B are atoms of elements in the same period of the periodic table. A is in group II and B is in group III. Which of the following statements is not true?
- A B has one more proton than A in its nucleus.
 - B The atomic number of B is one unit greater than that of A.
 - C A has one electron less than B in its valence shell.
 - D A contains one more electron than B in its valence shell.
 - E A and B have the same number of shells.
- (v) Which of the following statements is true. The Avogadro's constant is the number of
- A electrons in one mole of a solid substance
 - B atoms in one mole of any gas at s.t.p.
 - C atoms in one mole of a metal
 - D electrons needed to liberate one gram of a univalent metal
 - E electrons released when one mole of any element is discharged at the anode.

- (vi) Which, among the given list of metals arranged in order of decreasing reactivity with steam from left to right, is correct?
- A Calcium, magnesium, zinc, copper.
 - B Magnesium, calcium, copper, zinc.
 - C Calcium, zinc, magnesium, copper.
 - D Zinc, magnesium, copper, calcium.
 - E Calcium, magnesium, copper, zinc.
- (vii) Scum tend to be formed when washing clothes with hard water due to the reaction between
- A hard water and soap
 - B calcium ions, magnesium ions and sodium stearate
 - C the dissolved calcium and magnesium salts with detergents
 - D hydrogen carbonate ions and soap
 - E hydrogen carbonate ions and clothes.
- (viii) An organic compound of structural formula $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{C} \begin{array}{l} \text{=} \text{O} \\ \text{---} \text{OH} \end{array}$ belongs to the homologous series of
- A alkenes
 - B esters
 - C alcohols
 - D alkanes
 - E acids.
- (ix) A steady current of 4 amperes was passed through an aqueous solution of copper sulphate for 1800 seconds. The mass of copper deposited is
- A 63.5 g
 - B 31.75 g
 - C 1.185 g
 - D 2.37 g
 - E 11.85 g.
- (x) The particles $^{17}_8\text{M}$ and $^{15}_8\text{M}$ are
- A isomers
 - B allotropes
 - C molecules
 - D radicals
 - E isotopes

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	LIST B
(i) Double bond	A Soil alkalinity
(ii) Functional group of alkynes	B Double decomposition reaction
(iii) Chlorine	C Isotope
(iv) Empirical formula	D Isomer of hexane
(v) $\text{Pb}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow \text{PbCO}_3(\text{s}) + 2\text{NaNO}_3(\text{aq})$	E Bonding in a molecule of oxygen
(vi) Lead (II) chloride and silver chloride	F Reaction of concentrated HCl acid on sulphur
(vii) Elements in the soil needed by plants in large amount	G Soil acidity
(viii)	H Dehydration of sugar by concentrated H_2SO_4 acid
$ \begin{array}{cccc} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} - \text{H} \\ & & & & \\ & \text{H} & \text{H} & & \text{H} \\ & & & & \\ & & & \text{H} - \text{C} - \text{H} \\ & & & \\ & & & \text{H} \end{array} $	I Simplest formula which expresses the composition of a compound by mass
(ix) Presence of Al^{3+} and H^+ ions in the soil	J Common insoluble chlorides
(x) Hypothesis	K Simplest formula which expresses the actual number of each kind of atoms present in a compound
	L Neutralization reaction
	M A tentative statement for the observed phenomenon
	N One of the products of electrolysis of molten sodium chloride
	O Unsaturated hydrocarbon
	P Macronutrients
	Q Triple bond
	R Basic ions
	S Theory
	T Micronutrients

SECTION B (60 marks)

Answer **all** questions in this section.

3. (a) (i) What is an ionic bond?
(ii) Define a radical
(iii) Draw an electronic diagram to show the covalent bonding between hydrogen and chlorine in a hydrogen chloride gas molecule.
(iv) Explain why covalent compounds do not conduct electricity.
- (b) What is the oxidation state of Fe particle in a FeCl_3 molecule?

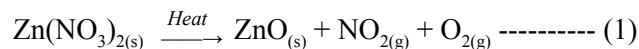
- (c) Study carefully the electronic configuration of elements **Q**, **R** and **S** given below then answer the questions that follow.

Q — 2:7

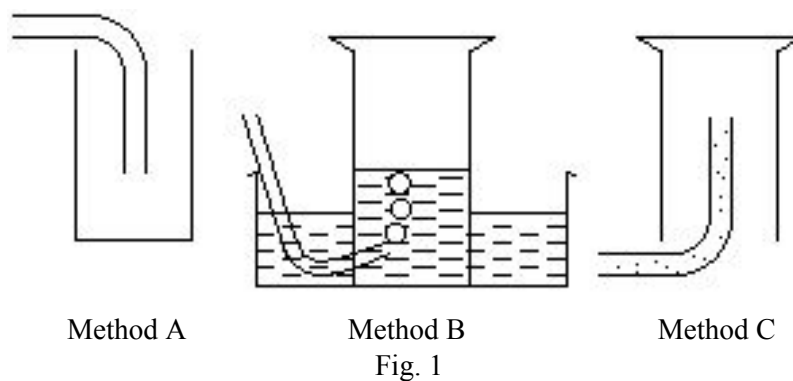
R — 2:8:1

S — 2:6

- (i) What type of bond will exist in a compound formed when **Q** combines with **R**?
- (ii) In what group and period in the periodic table does element **S** occupy?
- (iii) What is the valency of element **Q**?
- (iv) Write a molecular formula of a compound formed when element **R** combines with **S**.
4. (a) Define the term molecular formula.
- (b) An oxide of iron, 4.5 g by mass, was completely reduced by heating it in a certain reducing agent and 3.15 g of iron was produced. Calculate the empirical formula of the compound.
- (c) When a salt of copper nitrate is heated it undergoes a chemical change as shown in equation 1 below.



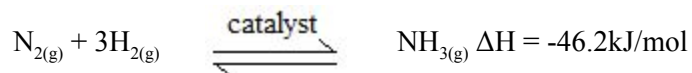
- (i) Balance equation (1).
- (ii) What is the type of chemical reaction represented by equation (1)?
5. The diagrams in figure 1 below represent common methods of collecting gases in the laboratory.



- (a) Identify method A, B and C.

- (b) Which method is used in the laboratory gas preparation of
- ammonia?
 - chlorine?
 - hydrogen?
- Give reasons for your answers.
- (c) What will happen when
- yellow flowers are introduced into a gas jar containing chlorine gas?
 - a burning splint is introduced into a gas jar containing hydrogen gas?
 - a glass rod which was dipped in concentrated hydrochloric acid is introduced into a gas jar containing ammonia gas?
 - sulphur dioxide gas is bubbled through a yellow acidified potassium dichromate solution?
6. (a) Define the term class B fire.
- (b)
- Mention **two (2)** combustible materials in class B fire.
 - Why is water not used to put off oil fires?
 - Your friend's clothes have caught fire. In order to extinguish the fire you have decided to cover her with a damp blanket. What is the function of the damp blanket?
- (c)
- Why is air a mixture and not a compound?
 - Why is rusting of iron a chemical change?
7. (a)
- What is a reversible reaction?
 - List down **three (3)** factors which affect the position of equilibrium in a reversible chemical reaction.

- (b) The industrial preparation of ammonia in the Haber process is represented by the following equation:



Study the equation carefully then answer the questions that follow. What will happen to the position of equilibrium if

- the temperature of the equilibrium mixture is increased?
 - more nitrogen gas is added to the equilibrium mixture?
 - the formed ammonia gas is removed from the equilibrium mixture?
- (c)
- Why are catalysts used in chemical reactions?
 - What is the meaning of the negative sign against the value of heat change, -46.2 kJ/mol in the chemical equation given in 7.(b) above?
 - Sketch an energy level diagram of energy against reaction path for the reaction in 7.(b) above.

8. (a) Classify the following compounds as alkanes, alkenes and alkynes:
 C_7H_{12} , C_4H_{10} , C_5H_{10} , C_3H_4 , C_2H_4 and C_6H_{12} .
- (b) Complete and balance the following chemical equations:
 (i) $CH \equiv CH + O_2 \rightarrow ?$
 (ii) $CH_3CH_2OH + Na \rightarrow ?$
 (iii) $CH_3COOH + KOH \rightarrow ?$
 (iv) $CH_2 = CH_2 + Cl_2 \rightarrow ?$
- (c) Write down the condensed structural isomers of alcohols of molecular formula C_4H_9OH .

SECTION C (20 marks)

Answer **two** questions from this section.

9. (a) (i) Define the term fertilizer.
 (ii) What are the **three (3)** effects of excessive nitrogen to plants?
- (b) (i) State **four (4)** methods of application of fertilizers.
 (ii) What are the **four (4)** advantages of using manures in the farms?
 (iii) Calculate the percentage composition of nitrogen in ammonium sulphate fertilizer, $(NH_4)_2SO_4$.
10. (a) Name the ore commonly used in the extraction of copper metal.
- (b) Steps (i) to (iv) below are used during the extraction of copper metal from its ore. Write a balanced chemical equation for each step.
 (i) Roasting of the concentrated ore ($CuFeS_2$) in air.
 (ii) Heating the roasted ore with silica in the absence of air.
 (iii) Burning copper sulphide ore (CuS) in regulated supply of air.
 (iv) Purification of copper by electrolysis using copper sulphate solution electrolyte, pure copper cathode and impure copper obtained from the extraction anode.
- (c) With the help of chemical equations explain what will happen to
 (i) an iron earring dropped into a container of copper sulphate solution?
 (ii) copper knife dipped into zinc nitrate solution?
 (iii) copper turnings dropped into a container of dilute hydrochloric acid?
11. (a) (i) What does the term terrestrial pollution mean?
 (ii) Mention **three (3)** causes of terrestrial pollution.
 (iii) Explain **four (4)** methods of preventing terrestrial pollution.
- (b) What is the effect of ultraviolet radiations on living organisms?
- (c) (i) What is the function of ozone layer in the atmosphere?
 (ii) What control measures should be taken to prevent the destruction of ozone layer?

12. (a) (i) What are the factors affecting the selective discharge of ions at the electrodes?
 (ii) Define the term electrochemical equivalent.
- (b) The apparatus shown in figure 2 below was used in an experiment of electroplating an iron knife with silver.

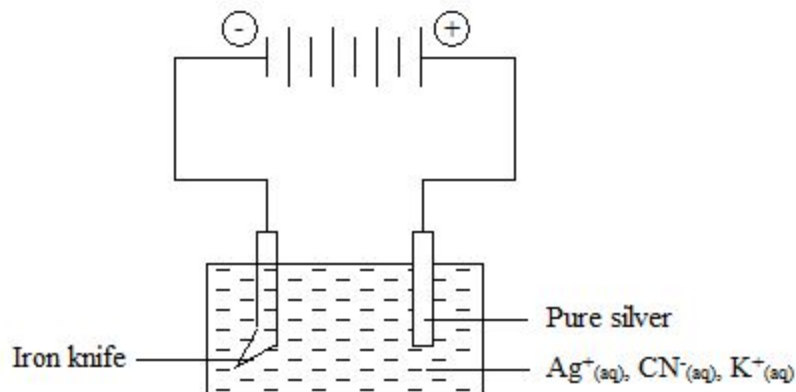


Fig. 2

- (i) Which electrode is the cathode?
 (ii) Write ionic equations to represent the reactions taking place at the electrodes.
 (iii) At which electrode was reduction taking place?
- (c) A sample of impure silver of mass 3.45 g was used as the anode in an electrolysis purifying process. The cathode was made up of pure gold of mass 6.45 g. After the electrolysis the cathode was found to weight 9.66 g.
- (i) Calculate the number of coulombs of electricity passed.
 (ii) What is the percentage purity of the impure silver?