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

032/1

CHEMISTRY 1

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2023**

Instructions

1. This paper consists of sections A, B and C with a total of **eleven (11)** questions.
2. Answer **all** questions in sections A and B and **two (2)** questions from section C.
3. Sections A carries **sixteen (16)** marks, section B **fifty four (54)** marks and section C **thirty (30)** marks.
4. Non-programmable calculators may be used.
5. Cellular phones and any unauthorised materials 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, C = 12, O = 16, S = 32.

SECTION A (16 Marks)

Answer **all** questions in this section.

1. For each of the items (i) – (x), choose the correct answer from the given alternatives and write its letter in the answer booklet provided.

(i) Which is the correct description of nucleons?

A Nucleons are neutrons and protons in the nucleus of an atom.
B Nucleons are neutrons in the nucleus of an atom.
C Nucleons are protons and electrons in the nucleus of an atom.
D Nucleons are neutrons and electrons in the nucleus of an atom.
E Nucleons are neutrons, protons and electrons in the nucleus of an atom.

(ii) Which one of the following characterises ions formation?

A Metal atoms gaining electrons in their outermost shells.
B Non-metal atoms losing electrons from their outermost shells.
C Metal atoms losing electrons from their innermost shells.
D Non-metal atoms gaining electrons in their innermost shells.
E Metal atoms losing electrons from their outermost shells.

(iii) The following are steps of writing ionic equation **except**

A Writing the correct formula for the reaction.
B Writing all soluble ionic substances.
C Writing the reaction in words.
D Writing all insoluble ionic products.
E Writing balanced formula equation for the reaction.

(iv) A Form Two student was given the following staffs for preparation of oxygen gas.

(i) Source of heat
(ii) Manganese dioxide
(iii) Hydrogen peroxide
(iv) Potassium Chlorate

Which combination will fast produce oxygen?

A (ii) and (iv)
B (i) and (iii)
C (iii) and (iv)
D (i), (iii) and (iv)
E (i), (ii) and (iv)

(v) Consider the given trends in physical properties of elements in the Periodic Table:

(i) Electron affinity increases from left to right.
(ii) Densities increases down the group.
(iii) Melting point of metals increases down the group.
(iv) Metallic character increase from left to right.

Which combination demonstrates correct trends?

A (iii) and (iv)
B (i) and (iii)
C (iii) and (ii)
D (i) and (ii)
E (i) and (iv)

(vi) The organic compounds marked A and B reacted together to form compound C as shown in the equation:

$$\underset{\text{A}}{CH_3CH_2CH_2OH(l)} + \underset{\text{B}}{CH_3COOH(l)} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{C}}{CH_3COOCH_2CH_3(l)}$$

What are the names of compounds A, B and C?

A Ester, ethanoic acid and alcohol.
B Alcohol, carboxylic acid and ester.
C Alcohol, ester and carboxylic acid.
D Ethanol, ethanoic acid and ethylethanoate.
E Carboxylic acid, ethanol and ethylethanoate.

(vii) Which of the following **does not** constitute one mole?

A 32 g of oxygen molecules.
B 2 g of hydrogen molecules.
C 19 g of hydroxonium ions.
D 48 g of carbon monoxide molecules.
E 98 g of sulphuric acid.

(viii) When a student mixed a solution of a certain copper (II) salt and sodium hydroxide, blue precipitate is formed. Which substance was produced?

A Copper (II) oxide
B Copper hydroxyde
C Copper salt
D Copper (I) oxide
E Copper metal

(ix) Permanent hardness of water can be removed by using washing soda. Which reaction is the correct ionic equation for the softening process?

A $Ca^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow CaSO_4(aq)$

B $Ca^{2+}(aq) + CO_3^{2-}(aq) \longrightarrow CaCO_3(s)$

C $Mg^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow MgSO_4(aq)$

D $Ca^{2+}(aq) + 2HCO_3\text{-}(aq) \longrightarrow Ca(HCO_3)_2(aq)$

E $Mg^{2+}(aq) + 2HCO_3^{-}(aq) \longrightarrow Mg(HCO_3)_2(aq)$

(x) Why sodium hydroxide pellets should be stored in a closed container?

A Sodium hydroxide is efflorescence.

B Sodium hydroxide is hygroscopic.

C Sodium hydroxide is deliquescent.

D Sodium hydroxide is volatile.

E Sodium hydroxide is flammable.

2. Match the chemical equations in **List A** with the corresponding types of chemical reactions in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A		List B	
(i)	$NH_3(g) + HCl(g) \rightleftharpoons NH_4Cl(s)$	A	Endothermic reaction
(ii)	$C(s) + O_2(g) \rightarrow CO_2(g) + Heat$	B	Ionic reaction
(iii)	$2C(s) + 2H_2(g) + Heat \rightarrow C_2H_4(g)$	C	Exothermic reaction
(iv)	$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	D	Neutralization reaction
(v)	$H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(s) + 2H_2O(l)$	E	Reversible reaction
(vi)	$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$	F	Homogeneous reaction
		G	Displacement reaction
		H	Decomposition reaction

SECTION B (54 Marks)

Answer **all** questions in this section.

3. Using a schematic diagram, illustrate the correct sequence of urban water treatment.

4. (a) Briefly explain the importance of a laboratory coat, safety goggles, gloves and protective masks as safety equipment in the Chemistry laboratory.

(b) Identify the uses of the given apparatuses:

(i) Reagent bottle

(ii) Filter funnel

(iii) Pipette

(iv) Mortar and pestle

(v) Bunsen burner

5. Explain six scientific procedures used by scientists to investigate scientific problems.

6. (a) Justify each of the following statements.

(i) It is advisable to use an evaporating dish instead of conical flask to evaporate a solution.

(ii) In filtration process, the filtrate passes through the filter paper while the residue does not.

(iii) Melting of ice is regarded as a physical change.

(iv) Rusting of iron is regarded as a chemical change.

(v) Carbon is a non-metal.

(b) A solution of sugar is said to be a mixture. Justify the statement using four points.

7. (a) (i) Why is it not advisable to examine a car battery using a burning candle light.

(ii) Why is the blue colour disappears during electrolysis of copper (II) sulphate solutions using carbon electrode?

(iii) Why is a concentrated sulphuric acid not an electrolyte?

(b) With the aid of ionic equations at the anode and cathode, explain the difference between the electrolysis of dilute NaCl using carbon electrode and molten NaCl.

8. (a) With examples, explain the given terms as used in chemistry:

(i) Fire extinguisher

(ii) Combustible material

(b) Identify four stages of extinguishing fire using a carbon dioxide extinguisher.

(c) Suggest the three components needed to start fire.

SECTION C (30 Marks)

Answer **two (2)** questions in this section.

9. You paid a visit to a certain village which has a scarcity of cooking fuel but plenty of raw materials for generating biogas. How would you advise the villagers with regard to the given aspects?

   (a) Nature of the gas.

   (b) Raw material for generating the gas.

   (c) The process involved in generating the gas.

   (d) Three advantages of using biogas over charcoal.

10. Illustrate five environmental destructions caused by the process of extraction of metals and suggest five intervention measures to control the problem.

11. Using five points, explain the harmful effects of Terrestrial pollution.

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032/2A

CHEMISTRY 2A
ACTUAL PRACTICAL A
(For Both School and Private Candidates)

Time: 2:30 Hours **Year: 2023**

Instructions

1. This paper consists of **two (2)** questions. Answer **all** the questions.
2. Each question carries **twenty five (25)** marks.
3. All writings should be in **blue** or **black** ink, except for diagrams which must be in pencil.
4. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. You may use the following atomic masses:

   H=1, O = 16, Na =23, Cl = 35.5.

1. You are asked to determine the concentration of sodium hydroxide contaminating drinking water source in a certain village. In order to investigate the problem, a sample from the village water source (containing NaOH) has been brought in the chemistry laboratory for you to carry out a volumetric analysis. You are also given a standard solution of 1.825 g hydrochloric acid dissolved in 0.5 dm^3 of the solution. Use methyl orange (MO) and litmus papers as indicators.

Procedure

(i) Pour about 2 cm^3 of solution **V1** into a test tube, use litmus papers to test if it is an acidic or a basic solution.

(ii) Discard the content and wash the test tube.

(iii) Repeat the procedure (i) and (ii) using solution **V2**.

(iv) Titrate the acid (in the burette) against the sample solution (sodium hydroxide) using **MO** up to the end point. Repeat the procedure to obtain three more readings and record your results in a tabular form.

Questions

(a) What was the volume of the pipette used?

(b) Calculate the average volume of the acid used.

(c) What were the changes on the litmus papers?

(d) Indicating all the state symbols, write a balanced chemical equation for the neutralization reaction between **V1** and **V2**.

(e) Write an ionic equation for the reaction.

(f) Showing your procedures clearly, calculate the concentration in g/dm^3 of the claimed component (sodium hydroxide).

2. You are provided with the following:

RR: a solution containing 0.2 M sodium thiosulphate ($Na_2S_2O_3$);
SS: a solution containing 1.0 M hydrochloric acid (HCl);
Distilled water;
Plain paper marked **M**;
Stopwatch.

Procedure

(i) Measure 4 cm^3 of **RR** and put it into the 50 cm^3 beaker. Add 6 cm^3 of distilled water.

(ii) Measure 10 cm^3 of **SS** and put it into the 50 cm^3 beaker containing **RR** and distilled water, and immediately start the stopwatch.

(iii) Swirl the contents and place the beaker on top of the letter **M** marked on the plain paper provided. Watch from above and observe the changes.

(iv) Switch off the stop watch when the mark **M** disappears.

(v) Record the time taken for the letter **M** to disappear.

(vi) Repeat the experiment using different data as shown in the following table.

Table: Experimental Data

Experiment	1	2	3	4
Volume of RR (cm^3)	10	8	6	4
Volume of Distilled Water (cm^3)	0	2	4	6
Volume of SS (cm^3)	10	10	10	10
Time (s)				

Questions

(a) What is the aim of this experiment?

(b) Complete filling the table.

(c) Giving reason(s), identify the experiment in which the reaction was:
   (i) slow
   (ii) fast.

(d) (i) Indicating the state symbols of the reactants and products, write a balanced chemical equation for the reaction between **RR** and **SS**.
   (ii) Write the ionic equation for the reaction.

(e) How does the concentration of **RR** affect the time for the mark **M** to disappear?

(f) (i) Plot a graph of volume of **RR** against time.
   (ii) What can you conclude from the graph?