SMZ

ZANZIBAR EXAMIATION COUNCIL

FORM THREE ENTRANCE EXAMINATION

043 **CHEMISTRY**

Time: 2:30 Hours **ANSWERS** **MONDAY 3rd DECEMBER 2018**

Instructions

1. This paper consists of sections A and B and C.
2. Answer **all** questions in Section A and B, and any Two in section C, Question 9 is compulsory
3. All writings must be in **blue** or **black** ink.
4. Communication devices and any unauthorized materials are **not** allowed in the assessment room .
5. Write your **Assessment Number** at the top right hand corner of every page.
6. The following atomic masses may be used:

   N = 14, H = 1. C = 12, O = 16, Cu = 64, S = 32, Mg = 24, Cl = 35.5, C = 12

SECTION A: (30 Marks)

1. Multiple Choice Questions

Choose the letter of the best answer and write it in the table below.

i. Converts mechanical energy into electrical energy
A: Electric iron
B: Speaker
C: Hydroelectric power plant
D: Machine
Answer: C: Hydroelectric power plant
Hydroelectric power plants convert mechanical energy from water flow into electrical energy through turbines and generators.

ii. The force of attraction that holds atoms together to form a molecule
A: Chemical bond
B: Energy
C: Power
D: Valency
Answer: A: Chemical bond
A chemical bond is the interaction that holds atoms together in a molecule, making them stable.

iii. Chemical process that occurs in iron
A: Plating
B: Burning
C: Removal
D: Rusting
Answer: D: Rusting
Rusting is a chemical process where iron reacts with oxygen and moisture, forming iron oxide.

iv. The use of oxygen
A: Used in refrigeration
B: Killing living organisms
C: Sustenance of living organisms
D: Used as a fuel
Answer: C: Sustenance of living organisms
Oxygen is vital for respiration, which sustains living organisms by producing energy.

v. The lightest and most abundant element in the universe
A: Hydrogen
B: Calcium
C: Oxygen
D: Iron
Answer: A: Hydrogen

Hydrogen is the lightest element and the most abundant in the universe, forming stars and other celestial bodies.

vi. The process of removing contaminants from treated water to produce pure water
A: Water treatment
B: Uses of water
C: Boiling
D: Water purification
Answer: D: Water purification
Water purification ensures that treated water is free from contaminants, making it safe for consumption.

vii. Arrangement of electrons in different energy levels
A: Shell
B: Electronic configuration
C: Electronic changing
D: Nuclide notation
Answer: B: Electronic configuration
Electronic configuration describes how electrons are distributed across various energy levels in an atom.

viii. The oxidation number of Cr in $Cr_2O_7^{2-}$
A: -6
B: +6
C: 0
D: -4
Answer: B: +6
The oxidation state of chromium in $Cr_2O_7^{2-}$ is determined by balancing the total charge and individual oxidation states.

ix. The chemical formula of aluminum sulphate
A: $AlSO_4$
B: Al_2SO_4
C: $Al_2(SO4)_3$
D: $Al_2(SO)_4$
Answer: C: $Al_2(SO4)_3$
Aluminum sulfate is formed by combining aluminum ions and sulfate ions in the correct ratio.

x. Which of the following sets of symbols represents isotopes?
A: X_8^{16}, X_8^{17}, X_8^{18}
B: Y_7^{16}, Y_8^{17}, Y_9^{18}
C: X_7^{16}, X_8^{16}, X_9^{16}
D: X_7^{16}, Y_8^{17}, Z_9^{18}

Answer: A: X_8^{16}, X_8^{17}, X_8^{18}
Isotopes have the same atomic number (protons) but different mass numbers (neutrons).

2. Matching Items
Match the items in LIST A with those in LIST B. Write the letter of the correct answer in the table below.

LIST A
i. Are used to improve the quality and quantity of crops grown.
ii. Special room or building that is designed and used for scientific experiments.
iii. Usually used to accurately measure and dispense liquid.
iv. It is among the causes of accidents in the laboratory.
v. The injury that causes a change in the color of the skin.
vi. It produces a black substance known as soot.
vii. Protons and neutrons.
viii. A group of atoms with unpaired electrons.
ix. The ability or capacity of doing work.
x. The regular periodic changes of elements due to their atomic number.

LIST B
A: Bruises
B: Luminous flame
C: Radicals
D: Periodicity
E: Burette
F: Energy
G: Nucleons
H: Laboratory
I: Fertilizers
J: Beaker
K: Power
L: Wrong use of equipment
M: Choking
N: Non-luminous flame

Answers

| LIST A | i | ii | iii | iv | v | vi | vii | viii | ix | x |

| LIST B | I | H | E | L | A | B | G | C | F | D

3. Fill in the blanks, one word for each space.

i. Heat is the energy of being transferred.
ii. Weed killers are chemical substances that are used to destroy unwanted plants which are harmful to crops.
iii. Chemical warning signs are hazard symbols found on chemical containers, especially those used in the laboratory.
iv. In immiscible liquids, the dense liquid settles at the bottom while the least dense remains at the top of the separating funnel.
v. Fire is the state or process of combustion in which ignited material combines with oxygen and gives off light, heat, and flame.

SECTION B (50 Marks)

4. a) What is a chemical formula?
A chemical formula is a representation of a substance using symbols for its constituent elements and numerical subscripts to indicate the ratio of atoms.

b) Differentiate between molecular formula and empirical formula.
- A molecular formula shows the actual number of atoms of each element in a molecule (e.g., H2O2).
- An empirical formula shows the simplest whole-number ratio of the atoms in a compound (e.g., HO).

c) A certain compound contains 1.59% hydrogen, 22.22% nitrogen, and 76.19% oxygen.

i. Calculate the empirical formula
Step 1: Determine the moles of each element.
H: 1.59 ÷ 1 = 1.59 moles
N: 22.22 ÷ 14 = 1.59 moles
O: 76.19 ÷ 16 = 4.76 moles

Step 2: Find the simplest ratio.
Divide by the smallest value (1.59):
H = 1, N = 1, O = 3

Empirical formula: HNO3

ii. Calculate the molecular formula if the relative molecular mass is 63.
Empirical mass = 1 (H) + 14 (N) + 48 (O) = 63.
Since the empirical mass equals the molecular mass, the **molecular formula is HNO_3.**

iii. Name the compound
Nitric acid.

5. a) i) What is biogas?
Biogas is a renewable fuel produced by the anaerobic digestion of organic matter, such as animal dung, plant waste, or food scraps, by microorganisms.

ii) List down any two materials that can produce biogas in our local environment.
- Animal dung
- Crop residues

iii) Why is biogas mostly encouraged to use as fuel compared to other types of fuel?
- It is environmentally friendly as it reduces greenhouse gas emissions.
- It is a renewable energy source, unlike fossil fuels.
- It can be produced locally, reducing dependency on external energy sources.

b) i) What is renewable energy?
Renewable energy is energy obtained from natural resources that are replenished naturally and continuously, such as sunlight, wind, and water.

ii) Mention any two examples of renewable energy.
- Solar energy
- Wind energy

iii) Write two areas where renewable energy can be used.
- Power generation for homes and industries
- Agricultural irrigation systems

6. a) i) What is a scientific procedure?
A scientific procedure is a systematic approach used in experiments to investigate questions, solve problems, and validate results.

ii) List down all steps of a scientific procedure.
- Identifying the problem
- Formulating a hypothesis
- Designing and conducting an experiment
- Collecting data
- Analyzing data
- Drawing conclusions
- Reporting findings

iii) Mention any two areas of application of scientific procedures.
- Medicine (developing drugs)
- Engineering (designing new products)

7. a) Define the following terms:

i) Unsaturated solution
An unsaturated solution is a solution that can dissolve more solute at a given temperature and pressure.

ii) Solute
A solute is a substance that is dissolved in a solvent to form a solution.

iii) Emulsion
An emulsion is a mixture of two immiscible liquids, where one liquid is dispersed in the other in the form of tiny droplets.

b) Give any two differences between a mixture and a compound.

Mixture	Compound
i. Components can be separated physically.	Components can only be separated chemically.
ii. The composition varies.	The composition is fixed.

c) i) Outline any two significances of chemical symbols.
- They simplify the representation of elements and compounds.
- They make it easier to write chemical equations and communicate scientific concepts.

ii) Write the symbols of Sodium, Potassium, and Beryllium.
- Sodium: Na
- Potassium: K
- Beryllium: Be

8. a) i) How is an ion formed?
An ion is formed when an atom gains or loses electrons to attain a stable electronic configuration.

ii) By using and x, show how potassium chloride is formed.

$K \rightarrow K^+ + e^-$
$Cl + e^- \rightarrow Cl^-$
$K^+ + Cl^- \rightarrow KCl$

b) List down three properties of electrovalent compounds.
- They have high melting and boiling points.
- They conduct electricity in molten or aqueous states.
- They are usually soluble in water.

c) Calculate the oxidation number (state) of the underlined elements:

i) K<u>Cl</u>O3
Let the oxidation number of Cl = x.
K = +1, O = -2 (3 atoms of oxygen = -6)
+1 + x - 6 = 0
x = +5
Oxidation number of Cl = +5

ii) <u>C</u>O_3^{2-}
Let the oxidation number of C = x.
O = -2 (3 atoms of oxygen = -6)
x - 6 = -2
x = +4
Oxidation number of C = +4

SECTION C (20 Marks)

Answer any two questions. Question 9 is compulsory.

9. a) i) Study the table which shows the reaction of some metals with oxygen, then fill the blanks.

Metal	How it burns	Colour of flame	Name of product formed
Potassium	Reacts vigorously	Lilac flame	Potassium oxide
Calcium	Reacts quickly	Orange-red flame	Calcium oxide
Zinc	Slowly with a dull red flame	None	Zinc oxide

ii) Outline two physical properties of oxygen.
- Oxygen is a colorless, odorless, and tasteless gas.
- It is slightly soluble in water and supports combustion.

iii) List down any two industrial uses of oxygen.
- Used in welding and cutting metals.
- Used in the manufacture of steel and other chemicals.

9. b) i) Explain briefly the three states of matter.
- Solid: Matter with a fixed shape and volume due to closely packed particles with strong intermolecular forces.
- Liquid: Matter with a definite volume but no fixed shape, allowing it to flow.
- Gas: Matter with neither a fixed shape nor volume; its particles are widely spaced and move freely.

ii) Study the summary diagram of the change of matter from one state to another and answer the questions.

Letter	**Name of Change**
A	Sublimation
B	Condensation
C	Evaporation
D	Freezing
E	Melting

iii) Define the change represented by letter A.
Sublimation is the process by which a solid changes directly into a gas without passing through the liquid state.

iv) Mention one example of a substance that can undergo the change represented by letter A.
Ammonium chloride or dry ice (solid carbon dioxide).

10. a) i) Define the periodic table.
The periodic table is a tabular arrangement of elements based on their atomic number, electronic configuration, and recurring chemical properties.

ii) State modern periodic law.
Modern periodic law states that the properties of elements are a periodic function of their atomic numbers.

iii) Below are groups of elements. Arrange them in their respective positions in the periodic table as shown below:

Group I: Li
Group II: Mg
Group III: Al
Group IV: Si
Group V: P
Group VI: O
Group VII: F
Group O: Ne

11. a) Draw the warning signs representing the following:

i) Harmful substance

ii) Irritant substance

iii) Oxidant

b) i) Why is it important to put safety measures in place in a laboratory?
To prevent accidents, injuries, or exposure to hazardous chemicals, ensuring the safety of laboratory users.

ii) Why are all persons working in a laboratory required to wear appropriate protective clothing?
To protect themselves from chemical spills, burns, or harmful exposure to substances.

c) What is the aim of using a fume chamber in the laboratory?
A fume chamber is used to prevent the inhalation of toxic gases, vapors, or dust by providing proper ventilation during experiments.