SMZ

ZANZIBAR EXAMIATION COUNCIL

FORM THREE ENTRANCE EXAMINATION

043 **CHEMISTRY**

Time: 2:30 Hours **ANSWERS** **THURSDAY 3th DECEMBER 2019**

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:

   H = 1. C = 12, O = 16, , Ca = 40, Na = 23

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

i. Chemistry deals with
A. Composition and structure of matter
B. Structure and properties of matter
C. Composition and properties of matter
D. Composition, structure, and properties of matter
Answer: D. Composition, structure, and properties of matter
Chemistry focuses on understanding the composition, structure, and properties of matter and their interactions.

ii. The blockage of the upper part of the airway by food or other objects
A. Bruises
B. Choking
C. Shock
D. Suffocation
Answer: B. Choking
Choking refers to the obstruction of the airway, preventing proper breathing.

iii. A summary of the results of the experiment and a statement of how the results relate to the hypothesis
A. Data interpretation
B. Problem identification
C. Drawing conclusion
D. Data collection
Answer: C. Drawing conclusion
A conclusion summarizes experimental results and connects them to the hypothesis.

iv. One of the following is a physical change
A. Milk left on the counter turns sour
B. Common salt dissolves completely in water
C. A forest fire burns all the trees
D. Fruits are fermented to produce wine
Answer: B. Common salt dissolves completely in water
Dissolving salt is a physical change as it involves no change in chemical composition.

v. The process of separating a heterogeneous mixture of a solid and liquid
A. Layer separation
B. Decantation
C. Evaporation
D. Filtration
Answer: D. Filtration
Filtration separates solids from liquids using a barrier like filter paper.

vi. The process of coating iron or steel with zinc
A. Tin plating
B. Painting
C. Galvanization
D. Oiling
Answer: C. Galvanization
Galvanization protects iron or steel by coating it with zinc to prevent rust.

vii. Hydrogen can be collected by upward displacement of water because
A. It is slightly soluble in water
B. It is highly soluble in water
C. It is highly colorized in water
D. It is highly reactive in water
Answer: A. It is slightly soluble in water
Hydrogen is collected via water displacement due to its low solubility.

viii. In an atom, protons are
A. Positively charged in the shells
B. Negatively charged in the shells
C. Positively charged in the nucleus
D. Negatively charged in the nucleus
Answer: C. Positively charged in the nucleus
Protons are located in the nucleus and carry a positive charge.

ix. The correct formula for the combination of Mg^{2+} and PO_4^{3-} ions
A. Mg_2PO_4
B. $Mg_3(PO_4)_2$
C. $Mg_2(PO_4)_3$
D. $MgPO_4$
Answer: B. $Mg_3(PO_4)_2$
The charges balance when three magnesium ions combine with two phosphate ions.

x. The highest temperature that can be reached by burning fuel
A. Pyrometric burning effect
B. Velocity of combustion
C. Ignition point
D. Energy value
Answer: C. Ignition point
The ignition point refers to the temperature at which fuel burns efficiently.

2. Match the items in LIST A with those in LIST B.

LIST A
i. Measure and indicate temperature
ii. Soothing chapped skin
iii. Reducing muscle pain
iv. Add reagents into flasks during an experiment
v. Crushing or grinding substances
vi. Cleaning wounds to kill germs
vii. Treating mild bacterial infections on the skin
viii. Measure the specific volume of a liquid
ix. Covering small wounds
x. Measure the mass of chemicals

LIST B
A. Electronic balance
B. Mortar and pestle
C. Thermometer
D. Antibiotic
E. Petroleum jelly
F. Liniment
G. Pipette
H. Soap
I. Plaster
J. Antiseptic
K. Thistle funnel
L. Spatula

Answers:

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

| LIST B | C | E | F | G | B | J | D | G | I | A

3. Fill in the blank spaces. Use one word for each space.

i. Weed killers are chemical substances that are used to destroy unwanted plants which are harmful to crops.
ii. Stored chemicals in a laboratory should be checked regularly to ensure they have not expired.
iii. The two types of hardness of water are temporary hardness and permanent hardness.
iv. A radical is a group of atoms with unpaired electrons.
v. The process of separating a solid from a liquid is called filtration.

4. a) Define an atom.
An atom is the smallest unit of matter that retains the properties of an element and consists of protons, neutrons, and electrons.

b) i) List down any three points of Dalton's atomic theory.
- Matter is made up of indivisible particles called atoms.
- Atoms of a given element are identical in mass and properties.
- Atoms of different elements combine in simple whole-number ratios to form compounds.

ii) What is electronic configuration?
Electronic configuration is the arrangement of electrons in an atom's orbitals or energy levels around the nucleus.

c) Below are elements. Draw their electronic configuration and suggest if they are either metals or non-metals.

i) 3X
Electronic configuration: 2:1
It is a metal.

ii) 9Y
Electronic configuration: 2:7
It is a non-metal.

iii) 19K
Electronic configuration: 2:8:8:1
It is a metal.

iv) 17CF
Electronic configuration: 2:8:7
It is a non-metal.

5. a) What is a Bunsen burner?
A Bunsen burner is a laboratory apparatus that produces a single open flame, used for heating, sterilization, and combustion.

b) Why is the Bunsen burner most widely used as a source of heat in the laboratory?
- It provides a controlled flame.
- It produces a high-temperature flame.
- It is simple to operate and adjust.

c) Briefly explain the following:

i) Why is a non-luminous flame suitable for cooking?
A non-luminous flame produces more heat, is stable, and burns cleanly without soot.

ii) Why is a luminous flame used for lighting?
A luminous flame emits a bright light due to incomplete combustion of carbon particles, making it suitable for illumination.

iii) Why are some chemicals and mixtures needed to be heated up?
Heating speeds up reactions, dissolves substances, and facilitates the evaporation of solvents in experiments.

6. a) Define the following:
i) Nomenclature
Nomenclature is the systematic method of naming chemical compounds based on their structure and composition.

ii) Ionic compound
An ionic compound is a chemical compound composed of positively and negatively charged ions held together by electrostatic forces.

b) Write the chemical formulae of the following compounds:
i) Sodium chloride: $NaCl$
ii) Magnesium sulphate: $MgSO_4$
iii) Calcium chloride: $CaCl_2$

c) Calculate and write the molecular formula of the following compounds:

i) $C_3H_6O_3$ if its molecular mass is 180
Step 1: Empirical formula mass = $(3 \times 12) + (6 \times 1) + (3 \times 16) = 90$
Step 2: Molecular formula = $(180 \div 90) \times C_3H_6O_3 = C6H12O6$

ii) CH_2O if its molecular mass is 360
Step 1: Empirical formula mass = $(1 \times 12) + (2 \times 1) + (1 \times 16) = 30$
Step 2: **Molecular formula = $(360 \div 30) \times CH_2O = C_{12}H_{24}O_{12}$**

7. a) i) What is firefighting?
Firefighting is the act of extinguishing or controlling fire to prevent damage to property and life.

ii) List down components needed to start a fire.
- Fuel
- Oxygen
- Heat

iii) List down any two domestic applications of combustion.
- Cooking food using stoves or ovens.
- Heating homes using fireplaces or heaters.

b) i) What is a portable fire extinguisher?
A portable fire extinguisher is a handheld device used to suppress or extinguish small fires.

ii) List down any three precautions that should be taken when using fire extinguishers.
- Ensure the extinguisher is suitable for the type of fire.
- Check the expiration date before use.
- Aim at the base of the fire while operating.

8. a) Define the following:

i) Noble gases
Noble gases are a group of elements in group 18 of the periodic table, characterized by their inertness and complete outer electron shells.

ii) Halogens
Halogens are elements in group 17 of the periodic table, known for their high reactivity and ability to form salts.

b) Write any four properties of transition metals.
- They have high melting and boiling points.
- They form colored compounds.
- They have variable oxidation states.
- They are good conductors of heat and electricity.

c) i) What are metalloids? Give any two examples.
Metalloids are elements with properties intermediate between metals and non-metals.
Examples: Silicon and Boron.

ii) In the periodic table, elements are classified into group numbers. What does this signify?
Group numbers indicate the number of valence electrons in an element, which determines its chemical properties.

9. a) Khatibu of a certain Secondary School wants to prepare hydrogen and oxygen.

i) List down chemicals that he could use in the preparation of oxygen and hydrogen.
Oxygen: Potassium permanganate ($KMnO_4$), hydrogen peroxide (H_2O_2)
Hydrogen: Zinc (Zn), hydrochloric acid (HCl)

ii) Differentiate between chemical tests of oxygen and hydrogen.

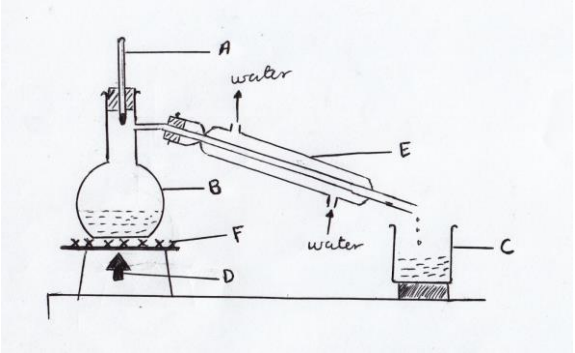
Chemical test of oxygen	Chemical test of hydrogen
Glowing splint relights.	Produces a popping sound when ignited.

iii) List two industrial uses of oxygen.
- Oxygen is used in welding and cutting metals.
- Oxygen is used in the production of steel and other chemicals.

iv) List down any two laboratory methods of preparation of hydrogen.
- Reaction of zinc with hydrochloric acid.
- Electrolysis of water.

v) List down two common laboratory methods of preparation of oxygen.
- Heating potassium permanganate.
- Decomposition of hydrogen peroxide using manganese(IV) oxide as a catalyst.

9. b) Below is an experimental apparatus arrangement done by a certain student at XYZ Secondary School.



i) Label the parts marked from A to F.
ANS:
- A: Boiling tube
- B: Delivery tube
- C: Water trough
- D: Gas jar
- E: Clamp stand
- F: Bunsen burner

ii) What is the role of the apparatus marked E?
It holds the apparatus in place securely during the experiment.

iii) Suggest the aim of this experiment.
To collect and test a gas produced during a chemical reaction.
iv) Suggest the name of this process.
Gas collection by downward displacement of water.

v) Define the process.
This process involves collecting gases that are insoluble or slightly soluble in water by allowing them to displace water from a gas jar.

10. a) What is a covalent bond?
A covalent bond is a chemical bond formed by the sharing of electrons between two atoms to achieve a full outer shell.

b) List down any three properties of covalent compounds.
- They have low melting and boiling points.
- They are poor conductors of electricity.
- They are usually soluble in non-polar solvents.

c) What is oxidation number?
The oxidation number is the charge that an atom would have if the compound was composed of ions. It indicates the number of electrons lost or gained by an atom in a compound.

d) Find the oxidation state of underlined elements.

i) $K\underline{Cl}O3$
Let the oxidation number of Cl = x.
K = +1, O = -2 (3 oxygen atoms = -6).
+1 + x - 6 = 0
x = +5
Oxidation number of Cl = +5

ii) $\underline{Cr_2}O_7^{2-}$
Let the oxidation number of Cr = x.
O = -2 (7 oxygen atoms = -14).
2x - 14 = -2
2x = +12
x = +6
Oxidation number of Cr = +6

11. a) i) What is biogas?
Biogas is a renewable energy source produced from the anaerobic digestion of organic materials like animal waste and plant residues.

ii) How can biogas be produced?
Biogas is produced by collecting organic waste in an airtight digester, where bacteria break down the material anaerobically, releasing a mixture of methane and carbon dioxide.

b) i) What is global warming?
Global warming is the long-term rise in Earth's average temperature due to increased concentrations of greenhouse gases like carbon dioxide and methane.

ii) Write a short essay on any three environmental effects of using firewood as a source of fuel.

ANS:

Using firewood as a fuel source has several environmental effects:

- **Deforestation**: Cutting down trees for firewood leads to the destruction of forests, which disrupts ecosystems and reduces biodiversity.
- **Air pollution:** Burning firewood releases smoke and harmful gases like carbon monoxide, contributing to air pollution and respiratory issues.
- **Soil erosion**: Removing trees weakens soil structure, leading to erosion and reduced fertility.