THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

FORM TWO NATIONAL ASSESSMENT

032 **CHEMISTRY**

Time: 2:30 Hours **ANSWERS** **YEAR: 2023**

Instructions

1. This paper consists of sections A and B with a total of **ten (10)** questions.
2. Answer **all** questions in the spaces provided.
3. Section A and C carry **fifteen (15)** marks each and section B carries **seventy (70)** mark s.
4. All writings must be in **blue** or **black** ink.
5. Communication devices and any unauthorized materials are **not** allowed in the assessment room .
6. Write your **Assessment Number** at the top right hand corner of every page.
7. The following atomic masses may be used: H = 1. C = 12, O = 16

SECTION A (15 Marks)
Answer all questions in this section.

1. For each of the items (i) - (x), choose the correct answer and write its letter in the box provided:

(i) Identify the set of chemistry products used for domestic cleanliness.
A. Toothpaste, oils, detergents, and deodorants.
B. Soap, deodorants, toothpaste, and fuel.
C. Detergents, soap, toothpaste, and deodorants.
D. Drugs, toothpaste, soap, and oils.
Answer: C. Detergents, soap, toothpaste, and deodorants.
Reason: These are common cleaning agents used in households for cleanliness and personal hygiene. Oils, drugs, and fuels are not primarily used for cleaning.

(ii) During practical work, a measuring cylinder was used to prepare oxygen by decomposing hydrogen peroxide. What is the function of the cylinder in this experiment?
A. To measure volume.
B. To measure weight.
C. To measure width.
D. To measure volume length.
Answer: A. To measure volume.
Reason: A measuring cylinder is specifically designed to measure the volume of liquids or gases accurately during experiments.

(iii) Your friends were arguing about the scientific procedure that follows after data interpretation. Which stage will you suggest to your friends?
A. Observation.
B. Hypothesis.
C. Conclusion.
D. Experimentation.
Answer: C. Conclusion.
Reason: After interpreting data, scientists draw conclusions to summarize their findings and validate or reject the hypothesis.
(iv) The teacher was demonstrating an experiment by dissolving sodium chloride in water until the solute was not dissolving anymore. What type of solution formed at the end of the experiment?
A. Saturated.
B. Unsaturated.
C. Super saturated.
D. Suspension.

Answer: A. Saturated.
Reason: A saturated solution occurs when no more solute can dissolve in a solvent at a given temperature, indicating the solution has reached its maximum capacity.

(v) A large percent of air is composed of:
A. Nitrogen.
B. Noble gases.
C. Carbon dioxide.
D. Oxygen.
Answer: A. Nitrogen.
Reason: Nitrogen makes up about 78% of the Earth's atmosphere, making it the most abundant gas. Oxygen is only about 21%.

(vi) John and Asha were debating about the processes involved during simple distillation. What processes will you recommend to them?
A. Filtration and decantation.
B. Condensation and decantation.
C. Evaporation and filtration.
D. Evaporation and condensation.
Answer: D. Evaporation and condensation.
Reason: Simple distillation involves evaporating a liquid and then condensing its vapor to separate it from impurities or other substances.

(vii) Form two students discovered that it is impossible to light a fire in a vacuum due to the absence of a certain gas. What comment can you give to the students?
A. Nitrogen is missing.
B. Oxygen is missing.
C. Carbon dioxide is missing.
D. Hydrogen is missing.
Answer: B. Oxygen is missing.
Reason: Oxygen supports combustion. Without it, fire cannot be sustained, which explains why it cannot be lit in a vacuum.

(viii) Atomic structures of all elements consist of electrons, protons, and neutrons except that of:
A. Hydrogen.
B. Nitrogen.
C. Oxygen.
D. Carbon.
Answer: A. Hydrogen.
Reason: Hydrogen is the only element with no neutrons in its most common isotope. It has only one proton and one electron.

(ix) When referring to the modern Periodic Table, the transition elements are found between:
A. Group I and II.
B. Group I and III.
C. Group II and III.
D. Group III and IV.

Answer: C. Group II and III.
Reason: Transition elements are located in the d-block, which lies between Group II (alkaline earth metals) and Group III (boron group).

(x) Given that element "M" with an electronic configuration of 2:8:3 combines with element "G" with an electronic configuration of 2:6 to form a compound, what is the chemical formula of the compound formed?

A. G_3M_2.

B. G_2M_3.

C. G_2M_3.

D. M_3G_2.

Answer: B. G_2M_3.
Reason: Element M (with 3 valence electrons) forms three bonds, while element G (with 6 valence electrons) forms two bonds. The compound is formed in a 2:3 ratio to balance the valencies.

2. Match the mixtures in List A with the corresponding methods of separation in List B by writing the letter of the correct answer below the item number in the table provided.

List A
(i) Chlorophyll from leaves
(ii) Sulphur and iron fillings
(iii) Sand and ammonium chloride
(iv) Pure water from muddy water
(v) Salt from the sea water

List B
A. Simple distillation
B. Magnetization
C. Chromatography
D. Solvent extraction
E. Evaporation
F. Sublimation
G. Filtration

Answers:
(i) Chlorophyll from leaves - C. Chromatography
(ii) Sulphur and iron fillings - B. Magnetization
(iii) Sand and ammonium chloride - F. Sublimation
(iv) Pure water from muddy water - A. Simple distillation
(v) Salt from the sea water - E. Evaporation

3. (a) A chemist heated a mixture of ammonium chloride and sand in a test tube. After 5 minutes, only sand remained in the test tube. Explain the observation that made by a chemist.

Observation made by the chemist:
When the mixture of ammonium chloride and sand was heated, ammonium chloride sublimed, leaving only sand in the test tube.
Explanation:
Ammonium chloride undergoes sublimation when heated, converting directly from solid to gas without passing through the liquid phase. Sand does not sublime and remains in the test tube.

(b) A gardener became sick and decided to rush to hospital. After checkup, the doctor prescribed medicines and instructed the gardener to shake the medicines well before use. What does the instruction imply basing on the type of the mixture? Give reason to support your answer .

Doctor's instruction: **Shake the medicines well before use**.
Implication based on the type of mixture:
The medicine prescribed is likely a suspension.
Reason:
- A suspension consists of solid particles dispersed in a liquid, which settle at the bottom when left undisturbed.
- Shaking the mixture ensures even distribution of the particles before consumption, allowing the patient to receive the correct dosage.

(c) Differences between mixtures and compounds:

Mixtures	Compounds
Components retain their original properties.	Components lose their individual properties.
Components can be separated by physical means.	Separation requires chemical methods.
Components are not chemically combined.	Components are chemically combined.
Composition can vary.	Composition is fixed and defined by a formula.
No energy changes during the formation of mixtures.	Energy changes occur during the formation of compounds.

4. (a) Give reasons to support each of the following statements.
(i) Helium is used in filling balloons instead of hydrogen gas despite the fact that hydrogen is lighter.
Reason:
Helium is inert and non-flammable, making it safer than hydrogen, which is highly flammable.

(ii) When air bubbles pass through lime water, lime water turns milky.
Reason:
Lime water reacts with carbon dioxide in the air bubbles to form calcium carbonate, which is insoluble and appears milky.

(iii) Iron and steel of bridges, ships, and pipelines are protected from rusting by joining to a reactive metal such as magnesium.

Reason:

Magnesium acts as a sacrificial anode, corroding in place of iron due to its higher reactivity.

(b)

Two processes that add carbon dioxide to the air:

- Respiration: Animals and plants release carbon dioxide during cellular respiration.
- Combustion: Burning fossil fuels or organic materials releases carbon dioxide into the atmosphere.

5. (a)

Differences between empirical formula and molecular formula:

	Empirical Formula	Molecular Formula
i.	Shows the simplest whole-number ratio of atoms.	Shows the actual number of atoms in a molecule
ii.	May not represent the actual molecule.	Represents the actual molecule.
iii.	Derived from experimental data.	Derived from empirical formula and molecular weight.
iv.	Example: CH (for benzene).	Example: C6H6 (for benzene).

6. (a) explain the followings

(i)

(ii) Rusting will not occur when anhydrous copper(II) sulphate is placed on top of a dry cotton wool in the test tube containing nails and left for 4 days .

ANS:

Rusting will not occur when anhydrous copper sulfate is placed on dry cotton wool.

Reason:

Rusting requires the presence of both water and oxygen. Anhydrous copper sulfate and dry cotton wool ensure there is no moisture.

(iii) Carbon dioxide is used as fire extinguisher.

ANS: Carbon dioxide is used as a fire extinguisher.

Reason:

Carbon dioxide displaces oxygen, cutting off the supply of oxygen to the fire and preventing combustion.

(b) A Form Two student dipped a clean iron rod into a cold distilled water in a test tube and left it for 2 days .

(i) State what will happen to the iron rod after 2 days

ANS: Observations for the iron rod experiment:
Iron rod in cold distilled water for 2 days: The rod will develop rust.
Reason: Rust forms in the presence of water and oxygen.

(ii) Explain the observation if the iron rod is replaced by a painted nail in the same test tube and left there for 2 days.
ANS: Iron rod replaced by a painted nail: No rust will form.
Reason: The paint acts as a barrier, preventing water and oxygen from reaching the metal.

(iii) Explain the observation if cold distilled water will be replaced by a mixture of hot water and oil.
ANS: Cold distilled water replaced by hot water and oil: No rust will form.
Reason: The oil layer prevents oxygen from dissolving in the water, halting rusting.

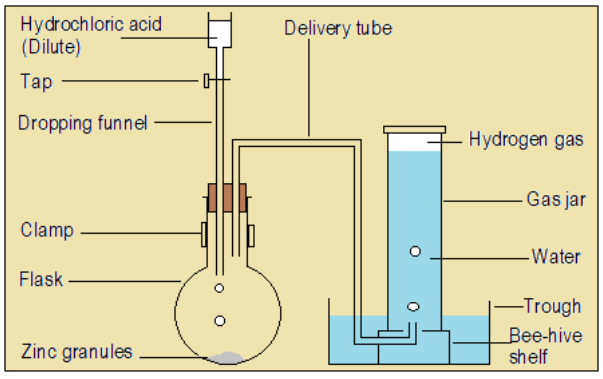
7. The laboratory technician planned to conduct an experiment for the preparation of gas Y. The following set of apparatus was used: Flat-bottomed flask, thistle funnel, delivery tube, beehe shelf and gas jar. Also piece of zinc metal and dilute hydrochloric acid were used.

(a) Identify Gas Y.
ANS: Gas Y: Hydrogen gas.

(b) What apparatus is missing in the set provided?
ANS: Missing apparatus: Water trough (for collecting the gas over water).

(c) Draw a well labelled diagram for the preparation of gas **Y** in the laboratory.

ANS: Well-labeled diagram:



(d) Word equation:

Zinc + Hydrochloric acid ⟶ Zinc chloride + Hydrogen gas.

8. Presentation on Classification of Fuels Based on Efficiency
(a) Pyrometric effect of burning:
The amount of heat released during combustion determines the fuel's efficiency.
(b) Heat value:
Fuels with a high calorific value release more energy and are more efficient.
(c) Ignition point:
The temperature at which a fuel starts burning. Lower ignition points improve efficiency.
(d) Velocity of burning:
Efficient fuels burn steadily and evenly, maximizing energy output.
(e) Affordability:
Economic factors determine the feasibility of using a particular fuel.

9. (a) (i) Dalton's atomic theory explains calcium sulfate from Tanzania and Kenya having the same composition because **atoms of calcium, sulfur, and oxygen are identical regardless of location**.

(ii) Isotopes of the same element have the same chemical properties because:

- They have the same number of electrons in the outer shell.
- Their electronic configuration is identical.
- Chemical properties depend on electrons, not neutrons.

(iii) Support the statement: "Matter is made up of tiny indivisible particles called atoms."
Reason: Atoms are the basic building blocks of matter, as shown by atomic theory and modern experiments.

(b) An isotope of strontium (Sr) has mass number 87 and atomic number 38.
(i) write its Nuclide notation

- Nuclide notation: $_{38}Sr^{87}$.

(ii) how many neutrons does it have?

- Neutrons: 49 (87 - 38).

(iii) how many protons does it have?

- Protons: 38.

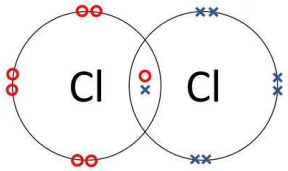
(iv) how many electrons does it have?

- Electrons: 38.

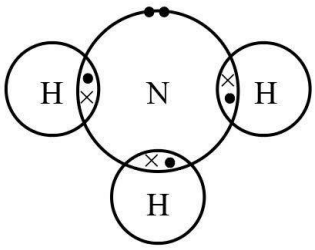
10. Molecular Electron Arrangement

(a) Diagrams:

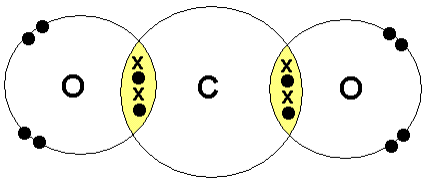
(i) Chlorine (Cl_2): Two chlorine atoms sharing one pair of electrons (single covalent bond).



(ii) Ammonia (NH_3): Nitrogen bonded to three hydrogen atoms, with one lone pair of electrons on nitrogen.



(iii) Carbon dioxide (CO_2): Carbon double-bonded to two oxygen atoms.



(b) What type of bond exists in the molecules in part (a)?

- Covalent bonds in all molecules.

(c) identify four properties of the molecules in part (a)

- Poor conductors of electricity.
- Low melting and boiling points.
- Soluble in non-polar solvents.
- Exist as gases or liquids at room temperature.

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