THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

FORM TWO NATIONAL ASSESSMENT

032 **CHEMISTRY**

Time: 2:30 Hours **ANSWERS** **YEAR: 2024**

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: Multiple-Choice Questions

(i). How can contaminants be removed from water?
A. Through electrolysis
B. Through sedimentation
C. Through decantation
D. Through purification
Answer: D. Through purification
Reason: Purification is the general process of removing contaminants, which may include filtration, boiling, and other methods.

(ii). How many protons are there in a molecule of oxygen gas?
A. 8
B. 16
C. 32
D. 24
Answer: B. 16
Reason: Oxygen gas (O_2) consists of two oxygen atoms. Each oxygen atom has 8 protons, so the total is 16.

(iii). What is the total number of electrons in the hypothetical ion Q^{2+} whose atomic number is 12?
A. 14
B. 12
C. 10
D. 24
Answer: C. 10
Reason: The neutral atom of Q (atomic number 12) has 12 electrons. Since it loses 2 electrons to become Q^{2+}, it has 10 electrons remaining.

(iv). How are the different atoms which occupy the same group and period called?
A. Isomers
B. Isotopes
C. Isobars
D. Isotones
Answer: C. Isobars
Reason: Isobars are atoms of different elements with the same mass number but different atomic numbers.

(vi). Which source of flame produces a non-luminous flame?
A. Candle
B. Kerosene stove
C. Tin lamp
D. Bunsen burner
Answer: D. Bunsen burner
Reason: A properly adjusted Bunsen burner produces a non-luminous flame due to complete combustion.

(vi). How can water be changed from vapor to liquid state?
A. By sublimation
B. By melting
C. By evaporation
D. By condensation
Answer: D. By condensation
Reason: Condensation is the process where water vapor cools and changes into a liquid state.

(vii). Which one of the following is not a part of the Bunsen burner?
A. Gas tap
B. Barrel
C. Air hole
D. Deflagrating spoon
Answer: D. Deflagrating spoon
Reason: A deflagrating spoon is a laboratory tool used for heating substances, not a part of the Bunsen burner.

(viii). Which apparatus serves the function of stirring substances?
A. Spatula
B. Deflagrating spoon
C. Glass rod
D. Desiccator
Answer: C. Glass rod
Reason: A glass rod is specifically designed for stirring liquids in the laboratory.

(ix). Why is water regarded as the universal solvent?
A. Because it is found all over the world.
B. Because it contains hydrogen and oxygen elements.
C. Because most substances dissolve in it.
D. Because it contains a variety of minerals.
Answer: C. Because most substances dissolve in it.
Reason: Water's polarity allows it to dissolve many substances, earning it the title of a universal solvent.

(x). When one of the following is not a suitable means of separating the components of air?
A. Freezing method
B. Physical means
C. Chemical means
D. Precipitation method
Answer: C. Chemical means
Reason: Air components can be separated by physical methods like fractional distillation, not by chemical methods.

2. Match the elements in list A with the number of protons in list B by writing the correct response beside the corresponding item number.

LIST A	LIST B
(i) Hydrogen	A. Six
(ii) Helium	B. Five
(iii) Carbon	C. Four
(iv) Fluorine	D. Ten
(v) beryllium	E. Nine
	F. Zero
	G. two

Answers:

LIST A	**i**	**ii**	**iii**	**iv**	**v**
LIST B	**ONE**	**G**	**A**	**E**	**C**

3. With the aid of a diagram, briefly describe the zones on a luminous flame.
Answer:
A luminous flame has three main zones:
-**The innermost zone:** The innermost zone is the zone which is formed just around the wick of the candle flame as the candle burns. It is also known as dark zone of the flame. It consists of hot, unburnt vapours of the combustible material. There is no air present here. It is the least hot of all the zones.
-. **Middle zone:** The middle zone also known as luminous zone is the zone which is moderately hot with limited oxygen supply. Hence, the fuel vapours burn partially and produce carbon particles. These particles then leave the flame as smoke and soot. This zone is the major part of the flame. The colour of this zone is yellow.
-. **The outermost zone**: The outermost zone also known as non-luminous zone is the zone of complete combustion. The ample presence of oxygen (or air) aids in complete combustion. It is the hottest zone of the candle flame and does not produce much light. It is blue in colour.

https://images.topperlearning.com/topper/tinymce/imagemanager/files/chemistry/cbse_chem_8/237557_ZonesofFlame.png

4. (a) (i). Give three assumptions of Dalton's Atomic Theory.
Answer:
All matter is made up of small indivisible particles called atoms.
Atoms of the same element are identical in mass and properties.
Atoms combine in simple whole-number ratios to form compounds.

(ii). Write the nuclide notation of an arbitrary element X having atomic number Z and neutron number A.
Answer: Nuclide notation is written as: $^{A+Z}_{Z}X$

(b). A sample of chlorine gas was found to contain 75% of the ^{35}Cl isotope and 25% of ^{37}Cl isotope . Calculate the relative atomic mass of chlorine.
Answer:
RAM = % abundance of ^{35}Cl and % abundance of ^{37}Cl
= (0.75 x 35) + (0.25 x 37)
= 35.5
The relative atomic mass of chlorine is 35.5.

5. Study the following part of the Periodic Table and then answer the questions that follow

I							VIII
A	II	III	IV	V	VI	VII	
							B
			C				
	D						

(b). Identify the element which:
i. Has the highest electronegativity.
Answer: Fluorine (F).

ii. Has a valency of four.
Answer: Carbon (C).

iii. Is among the inert gases.
Answer: Neon (Ne).

iv. Belongs to alkaline earth metals' block.
Answer: Magnesium (Mg).

v. Burns in oxygen to form water.
Answer: Hydrogen (H).

6.(a) Give reasons for the following safety measures towards fire accidents in the laboratory:

i. It is advised to close all windows before leaving the laboratory after work.
Answer: To prevent air drafts, which may lead to spreading of fire or explosion risks.

ii. If a person is surrounded by smoke to the extent of not being able to access the exits, it is advised to lie flat on the floor while searching for the exit points.
Answer: Smoke is less dense at ground level, making it easier to breathe and locate exits.

(b). Briefly explain three classes of fire by focusing on the nature of the burning materials and the recommended extinguishers.
Answer:
Class A: Fires involving ordinary combustibles like wood and paper. Extinguishers: Water or foam.
Class B: Fires involving flammable liquids like oil. Extinguishers: CO_2 or foam.
Class C: Fires involving electrical equipment. Extinguishers: Dry powder or CO_2.

(c). What will be observed in the following simple experiments?
i. A piece of white plain paper is placed above a luminous flame.
Answer: The paper will turn black due to soot deposition caused by incomplete combustion in the luminous flame.

ii. Red litmus paper is dipped into a flask containing dilute hydrochloric acid.
Answer: The red litmus paper will remain red because the solution is already acidic.

iii. A burning splint is lowered into a jar containing a mixture of hydrogen and oxygen gas.
Answer: A loud pop sound will be heard due to the explosive reaction of hydrogen and oxygen forming water.

7. Describe the fractional distillation process of a mixture of water and ethanol.

Answer:

- Fractional distillation separates a mixture based on differences in boiling points.
- The mixture is heated, and ethanol, with a lower boiling point (78°C), evaporates first.
- The ethanol vapor rises into the fractionating column, condenses in the condenser, and is collected as a liquid.
- Water, with a higher boiling point (100°C), remains behind.

8.(a). Give three laboratory rules.
i. Do not eat, drink, or chew gum in the laboratory.
ii. Always wear protective equipment such as goggles and gloves.
iii. Label all chemicals and never mix unknown substances.

(b). Identify three fields in which Chemistry is applied.
i. Medicine (e.g., drug formulation).
ii. Agriculture (e.g., fertilizer production).
iii. Industry (e.g., polymer and plastic manufacturing).

9.(a) Give two differences between covalent compounds and electrovalent compounds.
Answer:
Covalent Compounds:

- Formed by the sharing of electrons.
- Usually occur between nonmetals.

Electrovalent Compounds:

- Formed by the transfer of electrons.
- Usually occur between metals and nonmetals.

(b) A compound is composed of 52.2% carbon, 13% hydrogen, and the rest being oxygen. Calculate the molecular formula of the compound if its molecular mass is 138.
Answer:
Step 1: Determine the empirical formula.
Assume 100 g of the compound:
Carbon (C): 52.2 g
Hydrogen (H): 13 g
Oxygen (O): 100 - (52.2 + 13) = 34.8 g
Divide each percentage by the atomic mass of the each element:
Moles of C = 52.2 ÷ 12 = 4.35
Moles of H = 13 ÷ 1 = 13
Moles of O = 34.8 ÷ 16 = 2.175
Simplify the ratios by dividing all values by the smallest(2.175):
C: 4.35 ÷ 2.175 ≈ 2
H: 13 ÷ 2.175 ≈ 6
O: 2.175 ÷ 2.175 ≈1
So, The empirical formula is C_2H_6O.

Step 2: Determine the molecular formula.
Calculate the empirical formula mass:
(2 × 12) + (6 × 1) + (1 × 16) = 46
Find the molecular formula ratio by dividing the molecular mass by the empirical formula mass:
Molecular mass ÷ Empirical formula mass = 138 ÷ 46 = 3.
Multiply the subscripts in the empirical formula by 3:
Molecular formula = $(C_2H_6O) \times 3 = C_6H_{18}O_3$.
Thus, the molecular formula of the compound is $C_6H_{18}O_3$.

10. (a). Give four chemical properties of hydrogen gas.

Answer:
i. Hydrogen burns in oxygen to form water, producing a blue flame.
ii. It reduces metal oxides to their corresponding metals.
iii. Hydrogen reacts with halogens to form hydrogen halides (e.g., HCl).
iv. It reacts with nitrogen under specific conditions to form ammonia (Haber process).

(b). Draw a well-labeled diagram of the apparatus setup for the laboratory preparation of hydrogen gas. Include all chemicals involved.
Answer:
The setup includes a conical flask containing dilute hydrochloric acid and granulated zinc.
A delivery tube connects the flask to an inverted test tube or gas jar filled with water to collect hydrogen by displacement.
Hydrogen gas bubbles through the water and is collected in the test tube.