SMZ

ZANZIBAR EXAMIATION COUNCIL

FORM THREE ENTRANCE EXAMINATION

043 **CHEMISTRY**

Time: 2:30 Hours **ANSWERS** **TUESDAY 9th NOVEMBER 2021**

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

Choose the correct answer and write its letter in the table below.

i. Combination of hydrogen and chlorine gives:

A. Hydrochloric acid
B. Water
C. Alcohol
D. Oil
Answer: A. Hydrochloric acid
Reason: When hydrogen reacts with chlorine, the result is hydrochloric acid (HCl), a common compound in chemistry.

ii. The positively charged particles of an atom are:

A. Electrons
B. Protons
C. Neutrons
D. Ions
Answer: B. Protons
Reason: Protons carry a positive charge, electrons are negatively charged, and neutrons are neutral.

iii. An ionic bond is formed when:
A. Two metallic elements react together
B. Two non-metallic elements react together
C. Both the combining atoms need to share electrons
D. A metallic element combines with a non-metallic element
Answer: D. A metallic element combines with a non-metallic element
Reason: Ionic bonds are created when metals transfer electrons to non-metals, resulting in positively and negatively charged ions.

iv. The suitable apparatus to measure the mass of sodium hydroxide pallets in a laboratory is:

A. Electronic balance
B. Measuring balance
C. Spring balance
D. Tap balance
Answer: A. Electronic balance
Reason: An electronic balance is the most precise tool for measuring small masses in a laboratory.

v. The windows in the laboratory are kept open during practicals for:

A. Escaping during an emergency
B. Proper ventilation
C. Entering the laboratory
D. Viewing outside
Answer: B. Proper ventilation

Reason: Open windows allow fresh air to circulate, ensuring safe and healthy conditions by removing harmful gases.

vi. A good fuel should have:

A. An average ignition point
B. Highest ignition point
C. Lowest ignition point
D. No ignition point
Answer: C. Lowest ignition point
Reason: A low ignition point ensures that the fuel ignites easily, making it efficient.

vii. It is a universal solvent:

A. Diesel
B. Petrol
C. Kerosene
D. Water
Answer: D. Water
Reason: Water can dissolve more substances than any other liquid due to its polar nature, earning it the title "universal solvent."

viii. Which of the following is a natural source of heat?

A. Kerosene stove
B. Sun
C. Gas stove
D. Bunsen burner
Answer: B. Sun
Reason: The sun is a natural source of heat, while the others are artificial.

ix. The formula for calculating the maximum number of electrons in an energy level is given by $2n^2$. The electrons in the second energy level are:

A. 18
B. 8
C. 2
D. 4
Answer: B. 8
Reason: For the second energy level (n=2), the maximum number of electrons is $2(2^2) = 8$.

x. The process of coating iron or steel with zinc, a metal that does not rust, is:
A. Painting
B. Galvanization

C. Oiling
D. Tin plating
Answer: B. Galvanization
Reason: Galvanization involves coating metals like iron with zinc to prevent rusting.

2. Match the sentence in LIST A with the correct response in LIST B as they are used in the periodic table.

LIST A
i. Have an electronic configuration of 2:8:1
ii. They react with metals to form salts
iii. Ability of an atom to attract electrons
iv. The regular periodic changes of elements due to their atomic number
v. Elements found in the last group of the periodic table
vi. The alkali metals in the periodic table
vii. The properties of elements change according to their atomic number
viii. Alkaline Earth metals in the periodic table
ix. Have both metallic and non-metallic characteristics
x. Act as a catalyst in reactions and also form colored compounds

LIST B
A. Calcium
B. Inert gases
C. Transition elements
D. Potassium
E. Periodic law
F. Halogens
G. Electronegativity
H. Sodium
I. Group II elements
J. Periodicity
K. Metalloid
L. Group I elements

Answers:
i. H (Sodium)
ii. F (Halogens)
iii. G (Electronegativity)
iv. J (Periodicity)
v. B (Inert gases)
vi. L (Group I elements)
vii. E (Periodic law)
viii. I (Group II elements)
ix. K (Metalloid)
x. C (Transition elements)

3. Fill in the Blanks, One word for each space.

i. A fuel gas derived from decomposing biological waste is biogas, while organic matter in living plant material is biomass.
ii. Physical changes affect the physical properties of substances, such as shape and size.
iii. In the process of filtration, the solid remained is the residue, while the liquid collected is the filtrate.
iv. The possible explanation to the question asked is hypothesis, while a summary of the result of an experiment and statement is conclusion.
v. Signs of choking include difficulty in breathing and speaking.

4.(a). List four negative effects of global warming:

- Rising sea levels due to melting polar ice.
- Increased frequency of extreme weather events.
- Loss of biodiversity as species struggle to adapt.
- Decreased agricultural productivity due to changing climate patterns.

(b).
i. Define non-renewable sources of energy:
Non-renewable energy sources are those that cannot be replenished naturally within a short period and are depleted over time, such as coal, oil, and natural gas.
ii. List two classes of fuel according to their occurrence:

- Fossil fuels
- Biofuels

c. Why fossil fuels are not preferred to be used as a source of fuel:
They release greenhouse gases, such as carbon dioxide, contributing to global warming.
Burning them causes air pollution, leading to health issues.
They are non-renewable and deplete over time, making them unsustainable.
Extraction and usage can harm ecosystems and biodiversity.

5.(a). What is atomic number?
The atomic number is the number of protons present in the nucleus of an atom. It uniquely identifies an element and determines its position in the periodic table.
(b). State the number of atoms present in each of the following formulas:
i. $7HNO_3$

- Hydrogen (H): 7
- Nitrogen (N): 7
- Oxygen (O): 21

ii. $20PbSO_4$

- Lead (Pb): 20
- Sulfur (S): 20
- Oxygen (O): 80

c. Element X has an atomic number of 11 and a mass number of 23. Write:
i. Electronic configuration of element X: 2:8:1
ii. Number of periods of element X in the periodic table: 3 periods
iii. State whether element X is a metal or non-metal: Metal
Reason: It belongs to Group 1 (alkali metals) and has one electron in its outermost shell, making it highly reactive.

6. (a). Why can a radical not exist on its own?
Radicals cannot exist independently because they contain unpaired electrons, making them highly reactive and unstable until they form bonds with other atoms.

(b). Complete the table of radicals:

number	Name of radical	formula	valency
i	dichromate	Cr_2O_7	-2
ii	ammonium	NH_4	+1
iii	nitrate	NO_3	-1

(c). Complete the table of common names and chemical names:

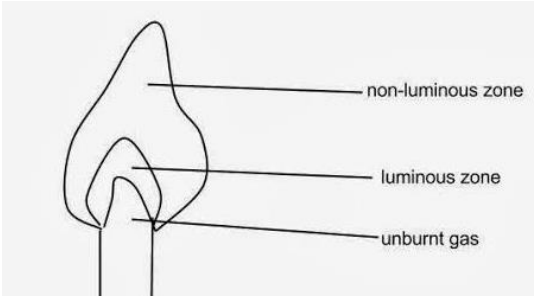
number	Common name	Chemical name	formula
i	Soda ash	Sodium carbonate	Na_2CO_3
ii	Common salt	Sodium chloride	NaCl
iii	marble	Calcium carbonate	$CaCO_3$

7. (a). Define the following terms:
i. Heat:
Heat is a form of energy that is transferred between objects or systems due to a temperature difference.
ii. Flame:
A flame is the visible, gaseous part of a fire, produced by the combustion of a substance.
iii. Luminous flame:
A luminous flame is a bright, yellow-orange flame that produces soot and occurs when there is incomplete combustion due to insufficient oxygen.

(b). Why is a non-luminous flame suitable for cooking?

It burns more efficiently and completely, producing a higher temperature.
It does not produce soot, keeping cooking utensils clean.
It provides a steady and consistent source of heat.

(c). Draw and label parts of a non-luminous flame:



8.(a) .i. Define water cycle:
The water cycle is the continuous movement of water within the Earth and atmosphere through processes such as evaporation, condensation, precipitation, and collection.

ii. Water has high surface tension. What does this mean?
High surface tension means that water molecules are strongly attracted to each other, creating a "skin-like" surface that can resist external force.

iii. Why is treated water best for use in laboratories and medical facilities?
It is free from impurities and contaminants that may interfere with experiments.
It prevents the introduction of harmful bacteria or chemicals into sensitive environments.

iv. List two chemical properties of water:
- It reacts with metals to form metal hydroxides.
- It decomposes into hydrogen and oxygen when subjected to electrolysis.

(b). Explain briefly the following terms in the water cycle:
i. Condensation:
The process by which water vapor in the air cools and changes back into liquid droplets, forming clouds.
ii. Precipitation:
The process by which condensed water in clouds falls to the Earth's surface as rain, snow, sleet, or hail.

iii. Collection:
The accumulation of water on the Earth's surface in bodies such as lakes, rivers, and oceans after precipitation.

9. Study the figure below carefully and then answer the following questions.

i. What is the aim of this experiment?
The aim is to demonstrate the sublimation process, where a solid changes directly into a gas without passing through the liquid phase.

ii. Label apparatus A, B, and substances C and D.
Apparatus A: Funnel
Apparatus B: Beaker
Substance C: Ammonium chloride
Substance D: Water

iii. Write the function of substance C in apparatus B.
Substance C (ammonium chloride) demonstrates the sublimation process, where it transitions from a solid to a gaseous state and then back to a solid upon cooling.

iv. Write the substance that can be used in this experiment instead of ammonium chloride.
Answer: Iodine crystals or naphthalene.

v. Why is this experiment carried out in a fume chamber?
To prevent the inhalation of toxic fumes produced during sublimation, ensuring safety for the experimenter.

(b). Air is a mixture of different gases. Below are materials used to test different gases in air.

i. Which component of air causes anhydrous copper (II) sulfate to turn blue?
Answer: Water vapor (moisture in the air).

ii. What would you observe when carbon dioxide is passed through lime water?
Answer: Lime water turns milky due to the formation of calcium carbonate.

iii. Which gas causes copper turnings to turn black when heated in the presence of air?
Answer: Oxygen, as it forms copper(II) oxide.

iv. Write the balanced chemical equation when carbon dioxide reacts with lime water.
Answer:

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

v. List four noble gases.
Answer:

- Helium (He)
- Neon (Ne)
- Argon (Ar)
- Krypton (Kr)

10.(a). Explain briefly the Thomson plum pudding model of the atom.

- The Thomson plum pudding model suggests that the atom is a positively charged sphere with negatively charged electrons embedded within it, similar to raisins in a pudding.

(b). Write three properties of neutrons.

- Neutrons have no electrical charge (neutral).
- Neutrons are found in the nucleus of an atom.
- Neutrons have a mass nearly equal to that of a proton.

(c). Give a brief explanation of the electron arrangement according to Neils Bohr.

- Neils Bohr proposed that electrons revolve around the nucleus in specific energy levels or shells. Electrons occupy the lowest available energy level first and move to higher levels as they gain energy. The arrangement follows the $2n^2$ rule, where n is the energy level number.

11.(a). With the aid of equations, explain what happens when:
i. Magnesium ribbon burns in air:
When magnesium burns in air, it reacts with oxygen to form magnesium oxide.
Equation:

$$2Mg + O_2 \longrightarrow 2MgO$$

ii. Zinc granules dissolve in dilute sulfuric acid:
When zinc reacts with dilute sulfuric acid, it produces hydrogen gas and zinc sulfate.
Equation:

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

(b). Water is neither acidic nor basic; it is neutral. What does this mean?
Neutrality means that water has a pH of 7 and contains an equal concentration of hydrogen ions (H^+) and hydroxide ions (OH^-).

(c). Explain briefly painting as a method of preventing rust.
Painting forms a protective barrier on metal surfaces, preventing exposure to moisture and oxygen, which are necessary for the rusting process.

(d). Why is carbon dioxide used in fire extinguishers?
Carbon dioxide is non-flammable and heavier than air, allowing it to displace oxygen around the fire, suffocating it and preventing combustion.