Candidate's Examination Number .....

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
FORM TWO SECONDARY EDUCATION EXAMINATION, 2003

0032 **CHEMISTRY**

Time: 2½ HOURS **ANSWERS**

INSTRUCTIONS

1. This paper consists of sections A, B and C.
2. Answer **ALL** questions.
3. Write your examination number at the top right corner of every page.
4. **ALL** writing must be in black or blue ink **EXCEPT** diagrams which must be in pencil.
5. Cellphones and calculators are not allowed in the examination room.
6. The following atomic masses may be used: $H = 1$, $O = 16$, $C = 12$, $Na = 23$, $S = 32$, $Ca = 40$

FOR EXAMINER'S USE ONLY		
QUESTION NUMBER	**SCORE**	**INITIALS OF EXAMINER**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
TOTAL		

SECTION A (10 MARKS)

1. Write down the letter of the most correct response for each question:

(i) Chemistry is one of the sciences which deals with:
A. Alkalinity and basicity of substances
B. The study of body cells
C. Composition, properties and behaviour of matter
D. Chemical changes
Correct: C
Reason: Chemistry studies the composition, properties, and behavior of matter, encompassing more than just chemical changes or alkalinity.

(ii) One isotope of an element has atomic number A and mass number M. How many neutrons are contained in the nucleus of its atom?
A. M
B. A
C. A - M
D. M - A
Correct: D
Reason: Neutrons = Mass number (M) - Atomic number (A), as atomic number represents protons, and mass number is protons plus neutrons.

(iii) In the diagram T represents a:
A. Bunsen burner flame
B. Region of unburnt gas
C. Zone of complete combustion
D. Gas burning
Correct: C
Reason: In a Bunsen burner flame diagram, the hottest part (often labeled T) is the zone of complete combustion, where fuel burns fully with oxygen.

(iv) The neutral point in the pH scale is:
A. 0.7
B. 7
C. 6
D. 8.0
Correct: B
Reason: A pH of 7 is neutral, indicating equal concentrations of H^+ and OH^- ions, typically for pure water.

(v) If the element M in group I combines with element X of group VI, the formula of the compound formed is:

A. MX
B. MX_2
C. X_2M
D. M_2X
Correct: D
Reason: Group I element (M, valency 1) combines with Group VI element (X, valency 2) in a 2:1 ratio, forming M_2X (e.g., Na_2O).

(vi) Group seven elements are known as:
A. Alkali metals
B. Transition metals
C. Alkaline earth metals
D. Halogens
Correct: D
Reason: Group VII elements (e.g., fluorine, chlorine) are called halogens, known for their reactivity and tendency to form salts.

(vii) The simplest ionic equation which summarizes the process of neutralization is:
A. $H^+ + NaO^- \rightarrow H_2O + Na^+$
B. $NaOH + Cl^- \rightarrow NaCl$
C. $H^+ + OH^- \rightarrow H_2O$
D. $Na^+ + Cl^- \rightarrow NaCl$
Correct: C
Reason: Neutralization involves H^+ (from acid) reacting with OH^- (from base) to form water (H_2O), the simplest ionic equation.

(viii) Which of the following chemical species have the same number of electrons?
A. K^+, Ca^{2+}, Cl^-, and Ar
B. Cl^-, Be^{2+}, and O^{2-}
C. O^{2-}, Mg^{2+}
D. Na^+, Mg^{2+}, Be^{2+}, and Li^+
Correct: A
Reason: K^+ (18 electrons), Ca^{2+} (18), Cl^- (18), and Ar (18) all have 18 electrons (isoelectronic), unlike the other sets.

(ix) A pipette is used for:
A. Measuring distance or length
B. Measuring specific volume of liquids
C. Measuring volumes
D. Heating liquid
Correct: B
Reason: A pipette measures precise, specific volumes of liquids, typically for titrations, unlike general volume measurement tools.

(x) The process of chlorination in water treatment aims at:
A. Killing micro-organisms
B. Syrup making
C. Forming suspension
D. Removing bad odours
Correct: A
Reason: Chlorination adds chlorine to water to kill harmful micro-organisms, ensuring it is safe for drinking.

2. Match each item in List A with a correct response in List B by writing its letter against the appropriate statement in the space provided.

LIST A	LIST B
(i) ... is a non-metal oxide which combines with water to form an acid	A. Mercuric oxide
(ii) ... determines the arrangement of orbital electrons of an atom	B. Efflorescent
(iii) ... is the addition of hydrogen to removal of oxygen from a substance	C. Air
(iv) ... loses water of crystallization at room temperature	D. Data analysis
(v) ... Is a gas heavier than air, does not support combustion and extinguishes flames	E. Bonding
(vi) ... Shows both acidic and basic properties	F. Valency
(vii) ... is used to test the presence of water in a substance	G. Hydrogen oxide
(viii) ... is the way by which atoms become stable	H. Electronic configuration
(ix) ... Is a mixture of gases	I. Washing soda
(x) ... the modern scientific procedure	J. Carbon dioxide
	K. Zinc oxide
	L. Combustion
	M. Sulfur dioxide
	N. Reduction
	O. Anhydrous copper sulphate

Answer

LIST A	i	ii	iii	iv	v	vi	vii	viii	ix	x
LIST B	M	H	N	I	J	K	O	E	C	D

3. (a) What is matter?
Anything that has mass and occupies space.
(b) Mention three (3) states of matter.
Solid, Liquid, Gas
(c) Write the names of the following process of changing matter from one state to another.
(i) Solid to liquid: Melting
(ii) Liquid to gas: Evaporation
(iii) Gas to liquid: Condensation

4. (a) Write the chemical symbols for the following:
(i) Lead: Pb
(ii) Potassium: K
(iii) Gold: Au
(iv) Sodium: Na
(v) Chlorine: Cl

(b) Write the formulae for the following compounds:
(i) Carbon tetrachloride: CCl_4
(ii) Magnesium oxide: MgO
(iii) Aluminum sulphate: $Al_2(SO_4)_3$
(iv) Ammonia: NH_3
(v) Nitrogen dioxide: NO_2

(c) Write balanced equations for the following chemical reactions:
(i) Iron + Sulphate → Iron sulphate
$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$
(ii) Decomposition of calcium carbonate
$CaCO_3 \rightarrow CaO + CO_2$
(iii) Magnesium hydroxide + hydrochloric acid → Magnesium chloride + H_2O
$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$
(iv) Silver nitrate + Sodium chloride → Silver chloride + Sodium nitrate
$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$
(v) Potassium + Sulphuric acid → Potassium sulphate + hydrogen gas
$2K + H_2SO_4 \rightarrow K_2SO_4 + H_2$

5. (a) Define the term indicator.
A substance that changes color to show the acidity or alkalinity of a solution.

(b) Name the colours of indicators when they are in acidic or alkaline solution.

INDICATOR	ACID SOLUTION	ALKALINE SOLUTION
(i) Methyl Orange (MO)	Red	Yellow
(ii) Litmus	Red	Blue
(iii) Phenolphthalein (POP)	Colorless	Pink

(c) Find the oxidation state or number of the following underlined elements:
(i) Mg: 0 (elemental form, no charge)
(ii) NO_3^- (N underlined): O = -2 (3 × -2 = -6), let N = x. Ion charge = -1: x - 6 = -1, x = +5
(iii) SO_2 (S underlined): O = -2 (2 × -2 = -4), let S = x. Neutral: x - 4 = 0, x = +4
(iv) Na_3PO_4 (P underlined): Na = +1 (3 × +1 = +3), O = -2 (4 × -2 = -8), let P = x. Neutral: 3 + x - 8 = 0, x = +5

6. (a) Element A and B in the Periodic Table have atomic numbers 12 and 13 respectively.
(i) Which element has a higher ionization energy?
Element B (atomic number 13, aluminium)
Reason: Higher nuclear charge with similar electron shielding increases ionization energy.
(ii) Of the two elements which one has smaller atoms?
Element B (aluminium)
Reason: Increased nuclear charge pulls electrons closer, reducing atomic radius.
(iii) Which type of bond forms when element A combines with chlorine?
Ionic bond
Reason: Element A (magnesium, metal) transfers electrons to chlorine (non-metal).
(iv) Find the charge of atom A after the reaction in question (iii).
+2 (Mg^{2+})
Reason: Magnesium loses 2 electrons to form a stable ion.

(b) Mention four methods of preventing rusting.
(i) Painting
(ii) Galvanization
(iii) Oiling
(iv) Sacrificial protection

(c) Define the following:
(i) Acid: A substance that releases H^+ ions in solution.
(ii) Base: A substance that releases OH^- ions or accepts H^+ ions in solution.

7. (a) Which method would you use to separate each of the following mixtures?
(i) Water mixed with kerosene: Separating funnel
(ii) Iron powder mixed with sand: Magnetic separation
(iii) Ammonium chloride crystals mixed with sodium chloride crystals: Sublimation
(iv) Water mixed with alcohol: Fractional distillation

(b) Write three differences between a mixture and a compound.
(i) Mixture has variable composition; compound has fixed composition.
(ii) Mixture retains properties of its components; compound has new properties.
(iii) Mixture can be separated by physical means; compound requires chemical means.

8. (a) Classify each of the following chemical equations as displacement, combination, neutralization, deposition, or decomposition.

(i) $BaCl_2(aq) + ZnSO_4(s) \rightarrow BaSO_4(s) + ZnCl_2(aq)$: Precipitation (not deposition, likely a typo)
(ii) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$: Combination
(iii) $2Na(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2(g)$: Displacement
(iv) $CaO(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l)$: Neutralization
(v) $CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$: Decomposition

(b) What is the use of the following apparatus?
(i) Sandbath: Provides uniform heating for glassware.
(ii) Dropper: Delivers small, precise volumes of liquid.
(iii) Tripod stand: Supports apparatus over a heat source.
(iv) Pipette: Measures specific volumes of liquids accurately.
(v) Desiccator: Stores substances in a dry environment to prevent moisture absorption.

9. (a) Draw a well labelled diagram of preparation of hydrogen gas.
[Text-based description]: A conical flask contains zinc granules and dilute hydrochloric acid, connected to a delivery tube leading to a gas jar for collection by upward delivery. Labels: Flask, Zinc, HCl, Delivery tube, Gas jar, Hydrogen gas.

(b) What is the test for hydrogen gas?
Introduce a lit splint; hydrogen produces a “pop” sound due to rapid combustion.

(c) State any three uses of hydrogen.
(i) Ammonia production
(ii) Hydrogenation of oils
(iii) Fuel in rockets

10. (a) Define the term combustion.
A chemical reaction between a substance and oxygen, producing heat and often light.

(b) Write down three (3) examples of combustible substances.
Wood, Petrol, Paper

(c) Explain why luminous flame is not used for heating.
It produces soot and less heat due to incomplete combustion, making it inefficient for heating.

(d) What do you understand by the following chemical warning terms?
(i) Explosive: Can cause sudden release of energy or gas, leading to explosions.
(ii) Toxic: Harmful or fatal if ingested, inhaled, or absorbed.
(iii) Flammable: Easily ignites and burns rapidly.
(iv) Harmful: Causes health issues or irritation upon exposure, less severe than toxic.