Candidate's Examination Number .....

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
FORM TWO SECONDARY EDUCATION EXAMINATION, 2002

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) The study of chemistry involves:
A. Living organisms and their functions
B. Composition and reactions of substances
C. Physical properties of planets
D. Mathematical calculations
Correct: B
Reason: Chemistry focuses on the composition, properties, and reactions of substances, unlike biology (living organisms) or astronomy (planets).

(ii) The number of protons in an atom is known as its:
A. Mass number
B. Atomic number
C. Neutron number
D. Electron number
Correct: B
Reason: The atomic number is the number of protons in an atom's nucleus, distinguishing one element from another.

(iii) In a Bunsen burner, the hottest part of the flame is:
A. The yellow region
B. The blue zone
C. The unburnt gas area
D. The outer edge
Correct: B
Reason: The blue zone, where complete combustion occurs with sufficient oxygen, is the hottest part of the flame.

(iv) A solution with a pH of 2 is:
A. Neutral
B. Weakly acidic
C. Strongly acidic
D. Alkaline
Correct: C
Reason: A pH of 2 indicates a high concentration of H^+ ions, characteristic of a strongly acidic solution.

(v) When an element from Group II combines with an element from Group VII, the formula of the compound formed is:
A. MX
B. M_2X
C. MX_2

D. X_2M
Correct: C
Reason: Group II elements (valency 2) combine with Group VII elements (valency 1) in a 1:2 ratio, forming MX_2 (e.g., $MgCl_2$).

(vi) Group I elements are known as:
A. Halogens
B. Alkali metals
C. Noble gases
D. Transition metals
Correct: B
Reason: Group I elements, like sodium and potassium, are highly reactive alkali metals.

(vii) The ionic equation for the reaction between an acid and a base is:
A. $H^+ + Cl^- \rightarrow HCl$
B. $Na^+ + OH^- \rightarrow NaOH$
C. $H^+ + OH^- \rightarrow H_2O$
D. $H^+ + Na^+ \rightarrow NaH$
Correct: C
Reason: Neutralization involves H^+ from an acid reacting with OH^- from a base to form water (H_2O).

(viii) Which of the following species have the same number of electrons?
A. Na^+, Mg^{2+}, F^-, Ne
B. Cl^-, K^+, Ca^{2+}
C. O^{2-}, S^{2-}, Ar
D. Li^+, Be^{2+}, B^{3+}
Correct: A
Reason: Na^+ (10 electrons), Mg^{2+} (10), F^- (10), and Ne (10) are isoelectronic, all having 10 electrons.

(ix) A burette is used for:
A. Heating substances
B. Measuring precise volumes of liquids
C. Filtering suspensions
D. Storing chemicals
Correct: B
Reason: A burette delivers precise volumes of liquids, typically used in titrations.

(x) The purpose of filtration in water treatment is to:
A. Remove dissolved salts
B. Kill bacteria
C. Remove solid particles
D. Add flavor
Correct: C
Reason: Filtration removes suspended solid particles from water, leaving dissolved substances behind.

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) Gas that supports burning	A. Evaporation
(ii) Process of separating salt from water	B. Oxygen
(iii) Element with atomic number 11	C. Sodium
(iv) Apparatus for heating liquids	D. Beaker
(v) Gas that produces a pop sound	E. Hydrogen
(vi) Prevents rust by coating iron	F. Galvanization
(vii) Liquid at room temperature	G. Mercury
(viii) Separates immiscible liquids	H. Separating funnel
(ix) Turns litmus paper red	I. Acid
(x) Method to test for starch	J. Iodine solution

Correct:

LIST A	i	ii	iii	iv	v	vi	vii	viii	ix	x
LIST B	B	A	C	D	E	F	G	H	I	J

3. (a) What is an element?
A pure substance made of one type of atom, which cannot be broken down into simpler substances by chemical means.
(b) Mention three elements found in everyday life.
Oxygen, Carbon, Hydrogen
(c) Write the names of the following processes of changing matter from one state to another:
(i) Liquid to solid: Freezing
(ii) Solid to gas: Sublimation
(iii) Gas to solid: Deposition

4. (a) Write the chemical symbols for the following:
(i) Iron: Fe
(ii) Sulphur: S
(iii) Silver: Ag
(iv) Calcium: Ca
(v) Nitrogen: N

(b) Write the formulae for the following compounds:
(i) Sodium chloride: NaCl
(ii) Carbon dioxide: CO_2
(iii) Magnesium sulphate: $MgSO_4$
(iv) Water: H_2O
(v) Ammonia: NH_3

(c) Write balanced equations for the following chemical reactions:
(i) Sodium + Water → Sodium hydroxide + Hydrogen
$2Na + 2H_2O \rightarrow 2NaOH + H_2$
(ii) Burning of carbon in oxygen
$C + O_2 \rightarrow CO_2$
(iii) Calcium hydroxide + Nitric acid → Calcium nitrate + Water
$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$
(iv) Zinc + Hydrochloric acid → Zinc chloride + Hydrogen
$Zn + 2HCl \rightarrow ZnCl_2 + H_2$
(v) Decomposition of copper(II) carbonate
$CuCO_3 \rightarrow CuO + CO_2$

5. (a) Define the term acid.
A substance that releases H^+ ions in aqueous solution, often sour-tasting and reactive with bases.
(b) Name the colours of indicators when they are in acidic or alkaline solution.

INDICATOR	ACID SOLUTION	ALKALINE SOLUTION
(i) Litmus	Red	Blue
(ii) Methyl Orange	Red	Yellow
(iii) Phenolphthalein	Colorless	Pink
Indicators change color based on pH, reflecting the presence of H^+ (acidic) or OH^- (alkaline) ions.		

(c) Find the oxidation state or number of the following underlined elements:
(i) Na: 0 (elemental form, no charge)
(ii) CO_3^{2-} (C underlined): O = -2 (3 × -2 = -6), let C = x. Ion charge = -2: x - 6 = -2, x = +4
(iii) H_2SO_4 (S underlined): H = +1 (2 × +1 = +2), O = -2 (4 × -2 = -8), let S = x. Neutral: 2 + x - 8 = 0, x = +6
(iv) K_2CrO_4 (Cr underlined): K = +1 (2 × +1 = +2), O = -2 (4 × -2 = -8), let Cr = x. Neutral: 2 + x - 8 = 0, x = +6
Oxidation states indicate electron distribution, calculated by balancing charges in neutral compounds or ions.

6. (a) Elements X and Y in the Periodic Table have atomic numbers 9 and 10 respectively.
(i) Which element has a higher ionization energy?
Element X (fluorine)
Higher nuclear charge with similar electron shielding increases ionization energy.
(ii) Of the two elements, which one has larger atoms?
Element Y (neon)
Lower nuclear charge results in less electron attraction, increasing atomic radius.
(iii) Which type of bond forms when element X combines with hydrogen?
Covalent bond

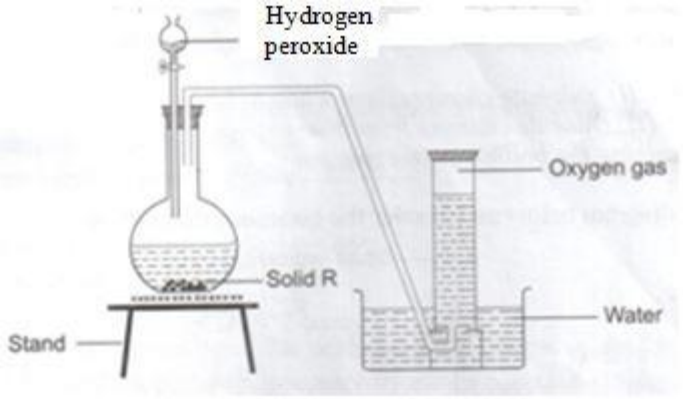
Fluorine (non-metal) shares electrons with hydrogen (non-metal) in HF.
(iv) Find the charge of atom X after the reaction in question (iii).
0 (neutral molecule)
In HF, fluorine shares electrons, forming a neutral covalent molecule, not an ion.

(b) Mention four laboratory safety rules.
(i) Wear protective gear (goggles, gloves)
(ii) Handle chemicals in a fume cupboard
(iii) No eating or drinking in the lab
(iv) Follow proper disposal procedures
(c) Define the following:
(i) Base: A substance that releases OH^- ions or accepts H^+ ions in solution.
(ii) Mixture: A combination of substances that retain their individual properties.
Periodic trends explain ionization energy and atomic size, while safety rules prevent lab accidents.

7. (a) Which method would you use to separate each of the following mixtures?
(i) Oil mixed with water: Separating funnel
(ii) Sugar mixed with sand: Dissolving and filtration
(iii) Iodine mixed with sodium chloride: Sublimation
(iv) Ethanol mixed with water: Fractional distillation
(b) Write three differences between a homogeneous and a heterogeneous mixture.
(i) Homogeneous has uniform composition; heterogeneous has non-uniform composition.
(ii) Homogeneous appears as one phase; heterogeneous has visible separate phases.
(iii) Homogeneous cannot be separated by filtration; heterogeneous can.
Separation methods exploit physical properties like solubility (dissolving), volatility (sublimation), or density (separating funnel).

8. (a) Classify each of the following chemical equations as displacement, combination, neutralization, decomposition, or precipitation:
(i) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$: Displacement
(ii) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$: Combination
(iii) $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$: Neutralization
(iv) $Pb(NO_3)_2(aq) + 2NaCl(aq) \rightarrow PbCl_2(s) + 2NaNO_3(aq)$: Precipitation
(v) $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$: Decomposition
Each reaction type reflects specific chemical processes, like atom exchange (displacement) or ion recombination (precipitation).
(b) What is the use of the following apparatus?
(i) Evaporating dish: Evaporating liquids to obtain dissolved solids.
(ii) Spatula: Transferring small amounts of solids.
(iii) Bunsen burner: Providing heat for experiments.
(iv) Measuring cylinder: Measuring approximate volumes of liquids.
(v) Fume cupboard: Safely handling hazardous fumes.
Apparatus functions support experimental precision and safety in chemical processes.

9. (a) Draw a well labelled diagram of preparation of oxygen gas.



(c) State any three uses of oxygen.
(i) Respiration in medical treatment
(ii) Welding and cutting metals
(iii) Combustion in industries
Oxygen's preparation and test rely on its chemical properties, with uses spanning health and industry.

10. (a) Define the term fuel.

A substance that releases energy, usually as heat, when burned or reacted.

(b) Write down three examples of fuels used in Tanzania.

Charcoal, Firewood, Kerosene

(c) Explain why a non-luminous flame is preferred for heating.

It burns completely, producing more heat and no soot, making it efficient for heating.

Non-luminous flames result from sufficient oxygen, ensuring clean, intense heat.

(d) What do you understand by the following chemical warning terms?

(i) Corrosive: Causes severe burns to skin or materials.

(ii) Toxic: Harmful or fatal if ingested or inhaled.

(iii) Irritant: Causes mild discomfort or irritation.

(iv) Oxidizing: Promotes combustion by providing oxygen.

Warning terms guide safe handling, indicating specific hazards like burns (corrosive) or fire risk (oxidizing).