Candidate's Examination Number .....

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
FORM TWO SECONDARY EDUCATION EXAMINATION, 2001

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) A hypothesis in chemistry is:
A. A proven fact
B. A tentative explanation
C. A final conclusion
D. An observation
Correct: B
Reason: A hypothesis is a proposed explanation based on observations, not yet proven, unlike a fact or conclusion.

(ii) An isotope of an element has 8 protons and 9 neutrons. How many neutrons are in its nucleus?
A. 8
B. 9
C. 17
D. 1
Correct: B
Reason: The number of neutrons is given as 9, directly stated in the question.

(iii) The region of a Bunsen burner flame with incomplete combustion is:
A. Blue zone
B. Yellow region
C. Inner cone
D. Outer edge
Correct: B
Reason: The yellow region, seen when air holes are closed, indicates incomplete combustion, producing soot.

(iv) A solution with a pH of 10 is:
A. Neutral
B. Weakly acidic
C. Strongly alkaline
D. Weakly alkaline
Correct: D
Reason: A pH of 10 is above 7, indicating an alkaline solution, but not as strong as pH 13 or 14.

(v) When an element from Group I 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: A
Reason: Group I (valency 1) and Group VII (valency 1) combine in a 1:1 ratio, forming MX (e.g., NaCl).

(vi) Group II elements are known as:
A. Alkali metals
B. Halogens
C. Alkaline earth metals
D. Noble gases
Correct: C
Reason: Group II elements, like magnesium and calcium, are called alkaline earth metals.

(vii) The product of neutralization between an acid and a base is:
A. Salt only
B. Water only
C. Salt and water
D. Gas and water
Correct: C
Reason: Neutralization produces a salt and water, as H^+ and OH^- form water, and other ions form a salt.

(viii) Which of the following species are isoelectronic?
A. Li^+, Be^{2+}, B^{3+}, C^{4+}
B. F^-, Ne, Na^+, Mg^{2+}
C. Cl^-, K^+, Ca^{2+}
D. O^{2-}, S^{2-}, Ar
Correct: B
Reason: F^-, Ne, Na^+, and Mg^{2+} all have 10 electrons, making them isoelectronic.

(ix) A measuring cylinder is used for:
A. Heating liquids
B. Measuring approximate volumes of liquids
C. Filtering solids
D. Storing gases
Correct: B
Reason: A measuring cylinder measures approximate liquid volumes, less precise than a pipette.

(x) The purpose of boiling in water treatment is to:
A. Remove dissolved impurities
B. Kill micro-organisms
C. Soften water
D. Improve taste
Correct: B
Reason: Boiling kills harmful micro-organisms, making water 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) Gas used in fire extinguishers	A. Carbon dioxide
(ii) Process of coating iron with zinc	B. Galvanization
(iii) Element with atomic number 17	C. Chlorine
(iv) Apparatus for precise liquid measurement	D. Pipette
(v) Gas that relights a glowing splint	E. Oxygen
(vi) Separates liquids with different density	F. Separating funnel
(vii) Liquid used in antiseptics	G. Ethanol
(viii) Turns anhydrous copper sulphate blue	H. Water
(ix) Method to test for proteins	I. Biuret test
(x) Element in group IV, period 2	J. Carbon

Correct:

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

SECTION B

3. (a) What is a compound?
   A pure substance formed by the chemical combination of two or more elements in a fixed ratio.

   (b) Mention three compounds used in daily life.
   Water, Sodium chloride, Carbon dioxide

   (c) Write the names of the following processes of changing matter from one state to another:
   (i) Solid to liquid: Melting
   (ii) Liquid to solid: Freezing
   (iii) Gas to liquid: Condensation
   These phase changes involve energy transfer, altering molecular arrangements without changing chemical composition.

4. (a) Write the chemical symbols for the following:
   (i) Aluminium: Al
   (ii) Phosphorus: P
   (iii) Copper: Cu
   (iv) Magnesium: Mg
   (v) Fluorine: F

   (b) Write the formulae for the following compounds:
   (i) Calcium chloride: $CaCl_2$
   (ii) Nitrogen monoxide: NO
   (iii) Sodium carbonate: Na_2CO_3

(iv) Hydrogen sulphide: H_2S
(v) Potassium nitrate: KNO_3

(c) Write balanced equations for the following chemical reactions:
(i) Magnesium + Oxygen → Magnesium oxide
$2Mg + O_2 \rightarrow 2MgO$
(ii) Sodium hydroxide + Sulphuric acid → Sodium sulphate + Water
$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
(iii) Decomposition of potassium chlorate
$2KClO_3 \rightarrow 2KCl + 3O_2$
(iv) Iron + Chlorine → Iron(III) chloride
$2Fe + 3Cl_2 \rightarrow 2FeCl_3$
(v) Calcium + Hydrochloric acid → Calcium chloride + Hydrogen
$Ca + 2HCl \rightarrow CaCl_2 + H_2$
Balanced equations ensure conservation of mass, with equal numbers of each atom on both sides.

5. (a) Define the term base.
A substance that releases OH^- ions or accepts H^+ ions in solution, often neutralizing acids.

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

INDICATOR	ACID SOLUTION	ALKALINE SOLUTION
(i) Litmus	Red	Blue
(ii) Phenolphthalein	Colorless	Pink
(iii) Methyl Orange	Red	Yellow
Indicators reflect pH changes by altering color based on H^+ or OH^- concentration.		

(c) Find the oxidation state or number of the following underlined elements:
(i) K: 0 (elemental form, no charge)
(ii) SO_4^{2-} (S underlined): O = -2 (4 × -2 = -8), let S = x. Ion charge = -2: x - 8 = -2, x = +6
(iii) HNO_3 (N underlined): H = +1, O = -2 (3 × -2 = -6), let N = x. Neutral: 1 + x - 6 = 0, x = +5
(iv) $KMnO_4$ (Mn underlined): K = +1, O = -2 (4 × -2 = -8), let Mn = x. Neutral: 1 + x - 8 = 0, x = +7
Oxidation states are calculated by balancing charges, reflecting electron distribution in compounds or ions.

6. (a) Elements P and Q in the Periodic Table have atomic numbers 16 and 17 respectively.
(i) Which element has a higher ionization energy?
Element Q (chlorine)
Higher nuclear charge with similar electron shielding increases ionization energy.
(ii) Of the two elements, which one has smaller atoms?
Element Q (chlorine)

Increased nuclear charge pulls electrons closer, reducing atomic radius.
(iii) Which type of bond forms when element P combines with hydrogen?
Covalent bond
Sulphur (non-metal) shares electrons with hydrogen (non-metal) in H_2S.
(iv) Find the charge of atom P after the reaction in question (iii).
0 (neutral molecule)
In H_2S, sulphur shares electrons, forming a neutral covalent molecule.

(b) Mention four methods of separating mixtures.
Filtration, Evaporation, Sublimation, Distillation

(c) Define the following:
(i) Acid: A substance that releases H^+ ions in aqueous solution.
(ii) Solution: A homogeneous mixture of a solute dissolved in a solvent.
Periodic trends dictate ionization energy and atomic size, while separation methods exploit physical properties.

7. (a) Which method would you use to separate each of the following mixtures?
(i) Sand mixed with water: Filtration
(ii) Iron filings mixed with sulphur powder: Magnetic separation
(iii) Ammonium chloride mixed with sand: Sublimation
(iv) Methanol mixed with water: Fractional distillation

(b) Write three differences between a solution and a suspension.
(i) Solution is clear; suspension is cloudy.
(ii) Solution particles do not settle; suspension particles settle.
(iii) Solution passes through filter paper; suspension is trapped.
Separation methods target differences in physical properties like magnetism, volatility, or boiling points.

8. (a) Classify each of the following chemical equations as displacement, combination, neutralization, decomposition, or precipitation:
(i) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$: Combination
(ii) $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$: Precipitation
(iii) $HCl(aq) + KOH(aq) \rightarrow KCl(aq) + H_2O(l)$: Neutralization
(iv) $Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$: Displacement
(v) $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$: Decomposition
Reaction types reflect processes like ion exchange (precipitation) or bond breaking (decomposition).

(b) What is the use of the following apparatus?
(i) Crucible: Heating solids to high temperatures.
(ii) Tongs: Handling hot or hazardous objects.
(iii) Gas jar: Collecting and storing gases.
(iv) Dropper: Delivering small volumes of liquids.

(v) Filter funnel: Separating solids from liquids during filtration.
Apparatus are designed for specific tasks, enhancing precision and safety in experiments.

9. (a) Draw a well labelled diagram of preparation of carbon dioxide gas.
A conical flask contains calcium carbonate and dilute hydrochloric acid, with a delivery tube leading to a gas jar for collection by upward displacement of air. Labels: Flask, $CaCO_3$, HCl, Delivery tube, Gas jar, Carbon dioxide gas.

(b) What is the test for carbon dioxide gas?
Pass the gas through lime water; it turns cloudy due to calcium carbonate formation.

(c) State any three uses of carbon dioxide.
(i) Fire extinguishers
(ii) Carbonated drinks
(iii) Photosynthesis in plants
Carbon dioxide's preparation and test rely on its reaction with calcium hydroxide, with diverse applications in industry and nature.

10. (a) Define the term laboratory safety.
Practices and measures to prevent accidents and ensure safe handling of chemicals and equipment in a laboratory.

(b) Write down three examples of laboratory accidents.
Chemical spills, Burns, Cuts from broken glass

(c) Explain why a fume cupboard is used in a laboratory.
It removes hazardous fumes, protecting users from inhalation risks during experiments.
Fume cupboards ensure a controlled environment for handling volatile or toxic substances.

(d) What do you understand by the following chemical warning terms?
(i) Flammable: Easily ignites and burns rapidly.
(ii) Corrosive: Causes severe burns to skin or materials.
(iii) Harmful: Causes health issues or irritation upon exposure.
(iv) Explosive: Can cause sudden energy release or explosions.
Warning terms indicate specific risks, guiding safe chemical handling to prevent accidents.