Candidate's Examination Number ……

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
FORM TWO SECONDARY EDUCATION EXAMINATION, 2000

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 branch of science that studies matter and its changes is:
A. Physics
B. Biology
C. Chemistry
D. Geography
Correct: C
Reason: Chemistry studies the composition, properties, and transformations of matter, unlike physics (energy and forces), biology (living organisms), or geography (earth systems).

(ii) An atom with 7 protons and 8 neutrons has a mass number of:
A. 7
B. 8
C. 15
D. 1
Correct: C
Reason: Mass number = protons + neutrons = 7 + 8 = 15.

(iii) The part of a Bunsen burner that controls air intake is:
A. Collar
B. Barrel
C. Base
D. Jet
Correct: A
Reason: The collar adjusts the air holes, controlling oxygen supply for combustion, affecting flame type.

(iv) A solution with a pH of 7 is:
A. Acidic
B. Alkaline
C. Neutral
D. Weakly acidic
Correct: C
Reason: A pH of 7 indicates equal H^+ and OH^- concentrations, typical of neutral solutions like pure water.

(v) When an element from Group IV combines with an element from Group VI, the formula of the compound formed is:
A. MX_2
B. M_2X
C. MX
D. M_2X_2
Correct: A

Reason: Group IV elements (valency 4) and Group VI elements (valency 2) combine in a 1:2 ratio, forming MX_2 (e.g., CO_2).

(vi) Group VIII elements are known as:
A. Alkali metals
B. Halogens
C. Noble gases
D. Alkaline earth metals
Correct: C
Reason: Group VIII elements, like helium and neon, are noble gases, known for their chemical inertness.

(vii) The result of a neutralization reaction is:
A. Gas only
B. Water and salt
C. Acid and base
D. Salt only
Correct: B
Reason: Neutralization between an acid and base produces a salt and water (e.g., $HCl + NaOH \rightarrow NaCl + H_2O$).

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

(ix) A spatula is used for:
A. Measuring liquids
B. Transferring small amounts of solids
C. Heating substances
D. Filtering mixtures
Correct: B
Reason: A spatula is used to scoop and transfer small quantities of solid chemicals.

(x) The purpose of distillation in water treatment is to:
A. Remove solid particles
B. Kill micro-organisms
C. Remove dissolved impurities
D. Add minerals
Correct: C
Reason: Distillation evaporates and condenses water, leaving behind dissolved impurities like salts.

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 balloons	A. Helium
(ii) Process of preventing rust with oil	B. Lubrication
(iii) Element with atomic number 14	C. Silicon
(iv) Apparatus for gas collection	D. Gas jar
(v) Gas that turns lime water cloudy	E. Carbon dioxide
(vi) Separates dyes in a mixture	F. Chromatography
(vii) Liquid used in thermometers	G. Mercury
(viii) Turns litmus paper blue	H. Base
(ix) Method to obtain pure sugar	I. Crystallization
(x) Element in group VI, period 3	J. Sulphur

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 mixture?
A combination of two or more substances that retain their individual properties and can be separated by physical means.

(b) Mention three mixtures found in daily life.
Air, Seawater, Soil

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

4. (a) Write the chemical symbols for the following:
(i) Sodium: Na
(ii) Oxygen: O
(iii) Iron: Fe
(iv) Chlorine: Cl
(v) Potassium: K

(b) Write the formulae for the following compounds:
(i) Magnesium chloride: $MgCl_2$
(ii) Sulphur dioxide: SO_2
(iii) Calcium carbonate: $CaCO_3$
(iv) Ammonia: NH_3
(v) Sodium hydroxide: NaOH

(c) Write balanced equations for the following chemical reactions:
(i) Aluminium + Oxygen → Aluminium oxide
$4Al + 3O_2 \rightarrow 2Al_2O_3$
(ii) Sodium carbonate + Hydrochloric acid → Sodium chloride + Water + Carbon dioxide
$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$
(iii) Decomposition of ammonium chloride
$NH_4Cl \rightarrow NH_3 + HCl$
(iv) Copper + Sulphuric acid → Copper(II) sulphate + Hydrogen
$Cu + H_2SO_4 \rightarrow CuSO_4 + H_2$
(v) Potassium hydroxide + Nitric acid → Potassium nitrate + Water
$KOH + HNO_3 \rightarrow KNO_3 + H_2O$
Balanced equations ensure equal atoms on both sides, reflecting conservation of mass in reactions like combination, neutralization, or decomposition.

5. (a) Define the term neutralization.
A chemical reaction between an acid and a base to produce a salt and water.

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

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

(c) Find the oxidation state or number of the following underlined elements:
(i) Ca: 0 (elemental form, no charge)
(ii) NO_2 (N underlined): O = -2 (2 × -2 = -4), let N = x. Neutral: x - 4 = 0, x = +4
(iii) H_2S (S underlined): H = +1 (2 × +1 = +2), let S = x. Neutral: 2 + x = 0, x = -2
(iv) Na_2CO_3 (C underlined): Na = +1 (2 × +1 = +2), O = -2 (3 × -2 = -6), let C = x. Neutral: 2 + x - 6 = 0, x = +4
Oxidation states reflect electron distribution, calculated by balancing charges in compounds.

6. (a) Elements R and S in the Periodic Table have atomic numbers 6 and 7 respectively.
(i) Which element has a higher ionization energy?
Element S (nitrogen)
Higher nuclear charge with similar electron shielding increases ionization energy.
(ii) Of the two elements, which one has larger atoms?
Element R (carbon)
Lower nuclear charge reduces electron attraction, increasing atomic radius.
(iii) Which type of bond forms when element R combines with chlorine?
Covalent bond
Carbon (non-metal) shares electrons with chlorine (non-metal) in CCl_4.
(iv) Find the charge of atom R after the reaction in question (iii).
0 (neutral molecule)
In CCl_4, carbon shares electrons, forming a neutral covalent molecule.

(b) Mention four uses of water in daily life.
Drinking, Cooking, Cleaning, Irrigation

(c) Define the following:
(i) Compound: A pure substance formed by the chemical combination of elements in a fixed ratio.
(ii) Suspension: A heterogeneous mixture with solid particles dispersed in a liquid that settle over time.
Periodic trends explain ionization energy and atomic size, while water's versatility supports daily activities.

7. (a) Which method would you use to separate each of the following mixtures?
(i) Mud mixed with water: Filtration
(ii) Copper sulphate crystals mixed with sand: Dissolving and filtration
(iii) Sulphur mixed with iron filings: Magnetic separation
(iv) Kerosene mixed with water: Separating funnel

(b) Write three differences between an element and a compound.
(i) Element is a single type of atom; compound is two or more elements chemically combined.
(ii) Element cannot be broken down chemically; compound can be decomposed.
(iii) Element has its own properties; compound has new properties.
Separation methods exploit physical properties like solubility, magnetism, or density, while elements and compounds differ in composition and behavior.

8. (a) Classify each of the following chemical equations as displacement, combination, neutralization, decomposition, or precipitation:
(i) $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$: Combination
(ii) $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$: Precipitation
(iii) $H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$: Neutralization
(iv) $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$: Displacement
(v) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$: Decomposition
Reaction types reflect processes like ion recombination (precipitation) or atom exchange (displacement).

(b) What is the use of the following apparatus?
(i) Test tube: Holding small amounts of substances for reactions or tests.
(ii) Delivery tube: Transferring gases from one container to another.
(iii) Mortar and pestle: Grinding solids into fine powders.
(iv) Burette: Measuring precise volumes of liquids for titrations.
(v) Retort stand: Supporting apparatus during experiments.
Apparatus functions ensure precision and safety in chemical procedures.

9. (a) Draw a well labelled diagram of preparation of hydrogen gas.
A conical flask contains zinc granules and dilute hydrochloric acid, with 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
Hydrogen’s preparation and test exploit its flammability, with applications in industry and energy.

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

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

(c) Explain why water is not used to extinguish oil fires.
Water spreads oil, worsening the fire, as oil is less dense and floats on water.
Oil fires require foam or CO_2 extinguishers to smother flames.

(d) What do you understand by the following chemical warning terms?
(i) Toxic: Harmful or fatal if ingested, inhaled, or absorbed.
(ii) Flammable: Easily ignites and burns rapidly.
(iii) Corrosive: Causes severe burns to skin or materials.
(iv) Harmful: Causes health issues or irritation, less severe than toxic.
Warning terms guide safe handling, indicating risks like poisoning (toxic) or fire (flammable).