Candidate's Examination Number ……

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
FORM TWO SECONDARY EDUCATION EXAMINATION, 2012

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 the letter of the correct answer in the box provided for each of the following items.

(i) All domestic utensils made of iron undergo rusting when exposed to:

A. Air and fire

B. Air and oil

C. Air and water

D. Water and oil

Correct Answer: C

Reason: Rusting is a chemical reaction where iron reacts with oxygen (in air) and water to form iron oxide (rust). Oil prevents rust by blocking air and water, and fire is not a factor in rusting.

(ii) When a small amount of common salt is dissolved in a glass of water, the mixture formed is:

A. Heterogeneous

B. Homogeneous

C. Immiscible

D. Suspension

Correct Answer: B

Reason: A homogeneous mixture has a uniform composition throughout, like salt dissolved in water forming a clear solution, unlike heterogeneous mixtures, immiscible liquids, or suspensions.

(iii) A chemist should acquire all of the following skills except:

A. Experimentation

B. Observation

C. Problem identification

D. Surgery

Correct Answer: D

Reason: Surgery is a medical skill, not relevant to chemistry, whereas experimentation, observation, and problem identification are essential for conducting and analyzing chemical experiments.

(iv) An important property of oxygen which distinguishes it from other gases is that it:

A. Burns and supports combustion

B. Burns but does not support combustion

C. Neither burns nor supports combustion

D. Supports combustion but does not burn

Correct Answer: D

Reason: Oxygen supports combustion by enabling other substances to burn but does not burn itself, unlike some gases that may burn or neither burn nor support combustion.

(v) The process of chlorination in water treatment aims at:

A. Forming suspension

B. Killing micro-organisms

C. Making syrup

D. Removing bad odour

Correct Answer: B

Reason: Chlorination involves adding chlorine to water to kill harmful micro-organisms, ensuring it is safe for drinking, not for forming suspensions or removing odours.

(vi) One of the following is not correct about coke being a better fuel than coal as it:

A. Does not produce carbon dioxide gas

B. Does not produce poisonous gas

C. Has a higher heat content

D. Is clean and smokeless

Correct Answer: A

Reason: Coke produces carbon dioxide when burned, but it is preferred over coal for producing less poisonous gas (like carbon monoxide), having higher heat content, and being cleaner and smokeless.

(vii) Class E fire can best be extinguished by using:

A. Carbon dioxide

B. Fire blanket

C. Sand

D. Water

Correct Answer: A

Reason: Class E fires involve electrical equipment, and carbon dioxide extinguishers are ideal as they are non-conductive and displace oxygen, unlike water, which conducts electricity and is dangerous.

(viii) The following is a set of apparatuses which are used for heating:

A. Crucible, test tube, evaporating dish

B. Evaporating dish, tongs, crucible

C. Test tube, evaporating dish, tongs

D. Tongs, crucible, test tube

Correct Answer: A

Reason: Crucible, test tube, and evaporating dish are designed to withstand high temperatures for heating substances, while tongs are for handling, not heating directly.

(ix) Which of the following methods can be used to get oil from cotton seeds?

A. Decantation

B. Distillation

C. Grinding and distillation

D. Grinding followed by squeezing

Correct Answer: D

Reason: Oil is extracted from cotton seeds by grinding them to break the cells and squeezing to release the oil, a process called pressing, unlike decantation or distillation.

(x) Which of the following apparatuses is suitable for measuring volumes of smaller quantities of liquids?

A. Beaker

B. Burette

C. Conical flask

D. Measuring cylinder

Correct Answer: B

Reason: A burette is designed for precise measurement of small liquid volumes, especially in titrations, offering greater accuracy than beakers, conical flasks, or measuring cylinders.

SECTION B

2. Match each item in List A with a correct response in List B by writing its letter below the number of the corresponding item in the table provided.

LIST A	LIST B
(i) A method used to separate mixtures of two or more liquids that form homogeneous solution by means of fractional column.	A. Biogas
(ii) A substance that absorbs moisture from the atmosphere and dissolves in it.	B. Chromatograph
(iii) Elements with stable structure.	C. Coke
(iv) Molecular mass of calcium carbonate.	D. Corrosive
(v) Poisonous gases prepared in it.	E. Deliquescent
(vi) Produces a "pop" sound.	F. Fractional distillation
(vii) Quiet and unsteady flame.	G. Fume chamber
(viii) Smokeless solid fuel.	H. Hydrogen
(ix) Source of energy derived from animal waste.	I. Luminous flame
(x) Used to prevent direct heat to reach the apparatus.	J. Noble gases
	K. Non-luminous flame
	L. Oxygen
	M. Wire gauze
	N. 80g/mol
	O. 100g/mol

Answers:

LIST A		ii	iii	iv	v	vi	vii	viii	ix	x
LIST B		E	J	O	G	H	I	C	A	M

3. (a) Mariam was preparing food for her family using hot oil in a frying pan. Accidentally the pan tripped over and a huge fire spread over her kitchen floor.

(i) Mention two extinguishers which would be appropriate for putting out the fire.
Carbon dioxide extinguisher, Dry powder extinguisher

(ii) Which fire extinguisher would be dangerous to use when trying to put out the fire in (a) above? Give reason.
Water extinguisher; Reason: Water can spread the oil fire and cause splashing, worsening the fire.

(b) Mention three conditions for a fire to start.
Fuel, Oxygen, Heat

(c) (i) What is combustion?
Combustion is a chemical reaction between a fuel and oxygen, producing heat and often light.

(ii) Give three areas where combustion is applied.
Cooking, Vehicle engines, Power generation

4. (a) In an experiment, two iron nails A and B were used whereby painting was applied on nail A. The two nails were placed in a moist environment and after one month the weight of each nail was determined. Which of the two nails would be heavier? Give reason.
Nail A would be heavier; Reason: Painting prevents rusting on nail A, while nail B rusts, losing iron as iron oxide, reducing its weight.

(b) State the method which will be used to protect each of the following from rusting:
(i) Covering iron sheets with a layer of most reactive metals
Galvanization

(ii) Bicycle chain
Lubrication (applying oil or grease)

(c) Find the oxidation number of the underlined elements in the following:
(i) MnO_4^-
Let Mn = x. Oxygen has -2 (4 × -2 = -8). The ion has a -1 charge. x - 8 = -1, so x = +7.
Oxidation number of Mn is +7.

(ii) $K_2Cr_2O_7$
Answer: Let Cr = x. K = +1 (2 × +1 = +2), O = -2 (7 × -2 = -14). The molecule is neutral. 2 + 2x - 14 = 0, 2x = 12, x = +6. Oxidation number of Cr is +6.

5. Use the details given below about elements P, Q, R, S, and T to answer questions (a) and (b).

Element	Atomic number	Atomic Mass
P	10	20
Q	11	23
R	12	24
S	13	26
T	14	32

6. (a) (i) Write down the electronic configuration of the elements represented by letters from P to T.

   Answer:

   P: 2, 8

   Q: 2, 8, 1

   R: 2, 8, 2

   S: 2, 8, 3

   T: 2, 8, 4

   (ii) How many neutrons are present in element Q?

   Neutrons = Atomic mass - Atomic number = 23 - 11 = 12

   (b) Name the type of bonds that will be formed in the combination between the following elements:

   (i) Q and T

   Ionic bond

   (ii) S and T

   Covalent bond

   (c) Write the chemical symbol for each of the following elements:

   (i) Silver: Ag

   (ii) Lead: Pb

   (iii) Manganese: Mn

7. (a) Explain why petroleum and coal are non-renewable resources of energy.
   Petroleum and coal are formed over millions of years from organic matter, and their reserves are finite, depleting faster than they can be replenished.

   (b) What is fuel?
   A fuel is a substance that releases energy, usually as heat, when burned or reacted, used for power or heating.

   (c) The problem facing Tanzanian society is misuse of charcoal and firewood as a source of fuel. Give two points of advice to the society on how to use less charcoal and firewood efficiently.
   Use energy-efficient stoves, Plant trees to replenish forests.

   (d) Mention three categories of fuel and give two examples in each category.

   Solid: Coal, Wood
   Liquid: Petrol, Kerosene
   Gas: Natural gas, Biogas

8. (a) List down four careers that are a result of studying Chemistry.
   Chemist, Pharmacist, Chemical engineer, Forensic scientist

   (b) The following are possible causes of accidents which can occur in the Chemistry laboratory. State how you can avoid them.
   (i) Poisonous chemicals left in an unlocked cupboard
   Store chemicals in locked cupboards accessible only to authorized personnel.
   (ii) A student picking up a bottle containing concentrated H_2SO_4 acid by the neck
   Train students to hold bottles by the base and use protective gloves.
   (iii) Concentrated acids stored in the uppermost shelf of cupboard
   Store concentrated acids on lower shelves to prevent spills from falling.

9. (a) An experiment showed that 13.88g of calcium chloride were obtained from the combination of 5g of calcium with unknown relative mass of chlorine.

    (i) What is the simplest formula of calcium chloride?
    Moles of Ca = 5/40 = 0.125. Mass of Cl = 13.88 - 5 = 8.88g. Moles of Cl = 8.88/35.5 = 0.25. Ratio Ca:Cl = 0.125:0.25 = 1:2. Simplest formula: $CaCl_2$

    (ii) What kind of bond exists between calcium and chlorine?
    Ionic bond

    (iii) Give two properties of the bond you have mentioned in (ii) above.

    High melting point, Conducts electricity when molten or dissolved

    (b) Define the following terms as applied in Chemistry:

    (i) Decantation: Pouring off a liquid to separate it from a settled solid.

    (ii) Filtration: Separating a solid from a liquid using a porous material like filter paper.

    (iii) Picking: Manually removing large, visible impurities from a mixture.

    (iv) Funnel Separation: Using a separating funnel to separate immiscible liquids based on density.

    (c) (i) Which is the most abundant element on the earth's outer crust?

    Oxygen

    (ii) The term used for acidic chemicals which can burn your skin is

    Corrosive

    (iii) Give the name of a flame which forms soot

    Luminous flame

10. (a) Explain why:

    (i) A magnesium ion has a charge of 2+

    Magnesium (Mg) has 12 electrons (2, 8, 2). It loses 2 electrons from its outer shell to achieve a stable octet, forming Mg^{2+}.

    (ii) A magnesium oxide has no overall charge

    Magnesium oxide (MgO) is neutral because Mg^{2+} and O^{2-} ions combine, balancing their charges (2+ and 2- cancel out).

    (b) Give the name of a bond which can be formed between two oxygen atoms

    Covalent bond

(c) (i) State the modern periodic law

The properties of elements are a periodic function of their atomic numbers.

(ii) Give the special name for each of the following groups of elements in the periodic table:

Group I: Alkali metals

Group VII: Halogens

(iii) Why is the atomic number a better way of identifying an element than the mass number?

Atomic number determines the number of protons, unique to each element, while mass number varies due to isotopes, making it less specific.

11. Mention four physical properties of water.
Colourless, Odourless, Boiling point 100°C, Freezing point 0°C

(b) What will happen when:
(i) A burning splint of wood is introduced into a gas jar containing oxygen gas
The splint burns more brightly due to increased oxygen supporting combustion.
(ii) Oxygen gas reacts with metals
Forms metal oxides, often as solids (e.g., iron forms iron oxide).
(iii) Hydrogen gas reacts with oxygen gas
Produces water, often explosively, releasing energy.

(c) List four uses of hydrogen in our daily life.
Fuel in rockets

Hydrogenation of oils

Ammonia production

Welding