FORM FOUR EXAMINATION

032/1 **CHEMISTRY 1**

MARKING SCHEME

Time: 3 Hours **Year: 2025**

SECTION A (16 Mark)

1.

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
A	C	B	E	B	B	A	C	D	B

1mark @ = 10 mark

2.

LIST A	(i)	(ii)	(iii)	(iv)	(v)	(vi)
LIST B	H	C	G	E	F	D

1mark @ = 06 marks

SECTION B (54 Marks)

3a)
Ions present
$NaNO_3(aq) \rightarrow Na^+(aq) + OH^-(aq)$
$H_2O(l) \leftrightarrow H^+(aq) + OH^-(aq)$ **(01 marks)**

At cathode:
H^+ ions are preferentially discharged due to being lower in the electrochemical series (E.C.S.)
$2H^+(aq) + 2e^- \rightarrow H_2(g)$
Removal of hydrogen ions disturbs the ionic equilibrium of water. Thus water ionizes further to restore the equilibrium. The hydroxyl ions (OH^-) so formed combine with the incoming Na+ ions to form NaOH. Thus the cathodic liquid becomes alkaline.

(02 marks)

At anode:
OH^- ions are preferentially discharged due to their being lower in the E.C.S.
$4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$
Removal of OH^- ions disturbs the ionic equilibrium of water. Thus water ionizes further to restore the
equilibrium. The H^+ ions so formed combine with the incoming NO3- ions to form HNO3. Thus the anodic
liquid becomes acidic. **(02 marks)**

Combining the cathodic half reaction and the anodic half reaction, the overall reaction equation becomes: $4H^+(aq) + 4OH^-(aq) \rightarrow 2H_2O(l) + 2H_2(g) + O_2(g)$ **.(01 marks)**

b)

Discharge equation for oxygen is : $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

Thus $4 \times 96500\ C \rightarrow 22400\ cm^3$

$Q \rightarrow 300\ cm^3$

$Q = (4 \times 96500 \times 300) \div 22400$

$= 5169.6\ C$ **(01 marks)**

Mass of copper liberated is determined as follows,

Discharge equation for copper: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

$2 \times 96500\ C \rightarrow 64\ g$

$5169.6\ C \rightarrow m$

$m = (5169.6 \times 64) \div 2 \times 96500\ C$

$= 1.71\ g$ **(01 marks)**

Therefore, mass of copper deposited was 1.71 g

Mass of silver liberated is obtained as follows,

Discharge equation for silver: $Ag^+(aq) + e^- \rightarrow Ag(s)$

$96500\ C \rightarrow 108\ g$

$5169.6\ C \rightarrow m$

$m = (5169.6 \times 108) \div 96500$

$= 5.7857\ g$

Therefore, mass of silver deposited was 5.7857 g **(01 marks)**

4.a)Differences between primary standard reagents and secondary standard reagents

Primary standard reagent	**Secondary standard reagent** **(01**
1.Should be stable	1.Unstable
2. Have high molecular mass	2. May have low molecular mass
3. High purity	3. Low purity
4.Not hygroscopic or efflorescent	4. May be hygroscopic or efflorescent
5.Less volatile	5. May be volatile
6. Must be highly soluble	6. Normally soluble

Any 4 differences @ 01 mark = 04 marks

4. b) Reaction equation is: $NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$ **(01 marks)**

The amount (mass) of sodium hydrogen carbonate needed to neutralize 2.00 g of HCl produced per day is obtained by: 84 g of $NaHCO_3$ → 36.5 g of HCl

m → 2.00 g of HCl

m = (84 g x 2) ÷ 36.5 g

= 4.6 g **(02marks)**

But 400 mg = 0.4 g

If 1 tablet → 0.4 g

n → 4.6 g

n = (1 x 4.6)÷ 0.4

= 11.5

Therefore 11.5 tablets will be required to serve the intended purpose. **(02 marks)**

5. a) The statement signify that the types of mixture are **suspension** mixture which is heterogeneous mixture of liquid and fine particles of a solid. The solid does not dissolve but remain suspended in the liquid, the suspended particles are slightly visible and settles over time if left undisturbed, therefore shaking make the syrup to mix well. **(02 Marks)**
The suitable method for separation is **Filtration (01 Marks)**

b) i) Mass of oxygen =4.5-3.15=1.35

=1.35g **(01 Marks)**

Element	Fe	O
% Composition by mass	3.15	1.35
Divide by R.A.M	3.15/56=0.056	1.35/16=0.084
Divide by small value	0.056/0.056=1	0.084/0.056=2
Ratio	1	1.5

: Empirical formula= FeO **(04 Marks)**

ii) The name is Iron (ii)Oxide **(01 Marks)**

6.a) (i) The IUPAC name of the compound is ethyl ethanoate
(ii) It is an ester
(iii) It can be identified by its sweet smell
(iv) Concentrated sulphuric acid acts a drying agent and as catalyst

(@01 mark = 04 marks)

(v) The reaction is CH3CH2OH(l) +
CH3COOH(l)→CH3COOCH2CH3 + H2O

(02 mark)

(b) b) (i) It forms sweet-smelling compounds called esters which are used as food flavorings, cosmetics,
perfumes, medicines, etc. **(01 mark)**
(ii) Two (2) examples of products bought containing esters include sweets and soft drinks, soaps,
powders, detergents, glues.

(02 mark)

7.(a)

Extracted metal	**Material added**	**functions**
SODIUM	Calcium chloride	Lowering melting point
IRON	i) Limestone ii)Carbon coke	-Formation of slag -Used as reducing agent

@ 0.5 Mark= 03mks

(b) i) $2AgNO_{3(aq)} + CaCl_{2(aq)} \rightarrow 2AgCl_{(s)} + Ca(NO_3)_{2(aq)}$

Total ionic equation; $2Ag^{+} + 2NO_3^{+}{}_{(aq)} + Ca^{2+} + 2Cl^{-}{}_{(aq)} \rightarrow 2AgCl_{(s)} + Ca^{2+} + 2(NO_3)^{-}{}_{(aq)}$

Net ionic equation; $2Ag^{+} + 2Cl^{-} \rightarrow 2AgCl_{(s)}$

@01 Mark=03 Mrks

ii) – It shows state phase of reactants and product during chemical reaction. Eg solid, liquid or gas.

- It shows the number of molecules present in each atom in chemical reaction
- It shows the composition (mass/moles) of substance in chemical reaction

@01 Mark=03 Mrks

8(a) i) Nitrogen gas **(01marks)**
ii) - The gas passed through sodium hydroxide to remove carbon dioxide gas
$NaOH_{(aq)} + CO_{2\ (g)} \rightarrow NaHCO_{3(aq)}$ **(02marks)**
- The gas passed through a heated copper metal to remove oxygen gas
$2Cu_{\ (s)} + O_{2(g)} \rightarrow 2CuO_{(s)}$ **(02 marks)**

iii) Uses of the gas
- Manufacture of fertilizer

- Used in refrigeration
- Manufacture of ammonia
- Used in food preservation
- Manufacture of medicine and drugs
- Light bulb production. **Any four points @0.5 mark= 02 marks**

(b) i) The reaction is **endothermic** because the bond energy in product is greater than bond energy in the reactant, means the energy were absorbed during the reaction **(01 marks)**

ii) The equilibrium will shift more right or forward reaction will be favored and product will increase since the reaction is endothermic. **(01 Marks)**

SECTION C (30 Marks)

9. Explanation of six (6) methods of fertilizer application. Introduction

Main body : **(1.5 marks)**

- **Broadcasting method** involves the random scattering of fertilisers on the farm. This is done either manually or by the use of fertilizer spreaders. This method is used to spread nitrogenous and potassic fertlisers when the soil is moist.
- **Placement method** in which the fertilizer is put in the planting holes or drills. The fertilizer is then mixed thoroughly with the soil before placement of seeds. This method is mainly used when applying phosphatic fertilisers.
- **Side dressing application** which is the placement of nitrogenous fertilisers at the side of the crop or around the growing crop. It is mainly used on perennial crops like coffee.
- **Foliar spraying** which is the application of fertilisers in solution form on the leaves of crops. The fertilsers are directly absorbed by the leaves. This method is used when conditions do not allow the use of soil-applied fertilisers.
- **Drip application** in which the fertilizer is allowed in water and applied to individual plants through pipe or bottles.
- **Banding method** in which the fertilizer is placed either below or on the side of the seed or plant, at a distance of 6 to 9 cm from the seed or plant.

(@02 marks = 12 marks)

Conclusion

(1.5 Marks)

10. (a) i)- Solid X is copper (ii) nitrate
- Gas Y is Nitrogen dioxide gas
- Gas Z is oxygen gas

@01 mark= 03 marks

(ii) $CuCO_{3(aq)} + 2HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + CO_{2\,(g)} + H_2O_{(g)}$ **(02 marks)**

(iii) $2Cu(NO_3)_{2(aq)} \rightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$ **(02 marks)**

(iv)- react with hydrogen to form water (Strong oxidizing agent)
-It support combustion, eg react with metal to form metal oxide. **@02 mark= 02 marks**
(v) Copper (ii) oxide. **(01 marks)**

(b) i) The presence of nitrate is tested by **Brown ring test**, it is performed when adding fresh prepared iron ii sulphate to the nitrate solution followed by drop wise of concentrated sulphiric acid, the added sulphric acid is move down and settle at the bottom of the test tube due to high denser than a mixture of solution, if nitrate present in the mixture solution a **brown ring** forms between the layer of sulphiric acid and the mixture of the solution. **(2.5 marks)**

ii) The presence of chlorides in the solution is tested by addition of concentrated sulphiric acid to the metal chloride, the hydrogen chloride gas is given off.
The hydrogen chloride gas if passed through concentrated ammonia gas white denser fumes of ammonium chloride were formed. Hydrogen chloride gas also form white precipitates with silver nitrate due to formation of silver chloride. **(2.5 marks)**

11. Given ; moles of SO_2=3 moles
Moles of O_2=4 moles
Required;
(a) Reactant present in small amount
$2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$
From the equation
For SO_2 from the equation…….
2moles of SO_2 = 2moles of SO_3
3moles of SO_2 = ? **(03 marks)**
=(3 x 2)÷ 2 = 3 moles of SO_3
Therefore, sulphur dioxide produce **3 moles** of sulphur trioxide.

For O_2 from the equation……
1mole of O_2 = 2moles of SO_3
4 moles of O_2 = ?
= 8 moles of O_{2tytrt}
Therefore, oxygen gas produces **8 moles** of Sulphur trioxide. **(02marks)**

> Hence the reactant present in small amount was Sulphur dioxide because the amount given (3moles) is smaller than the amount required to react (8 moles)

(b) Gram of reactant left in the container;
Reactant left is oxygen.
Amount of oxygen given = 4 moles and amount of oxygen gas reacted =1.5 moles
Amount remained/ left =4 moles -1.5 moles =2.5 moles
Amount of oxygen gas remained =2.5 moles.

But amount of substance (n) = mass/molar mass
Mass= 2.5 moles x 32 =80g.
Therefore, grams of reactant left in the container=80g. (04marks)

(c) Moles of Sulphur trioxide produced
From the equation

2moles of SO_2 = 2moles of SO_3

3moles of SO_2 = ?

= (3x2)÷ 2 = 3 moles of Sulphur trioxide. **(03marks)**

Therefore, moles of Sulphur trioxide produced = 3 moles.

(d) Litre of suphur trioxide produced

Amount of substance (n) = volume of a gas÷molar volume of a gas

Volume= 3molesx 22.4 dm^3/ mol 67.2 litres.

Therefore, 67.2 of Sulphur trioxide were produced at s.t.p (03marks)