CHRISTIAN SOCIAL SERVICE COMMISION

CHEMISTRY FORM IV

PAPER 1

MARKING GUIDE SAMPLE 2

1.

i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.	x.
D	D	B	C	A	A	C	D	C	B

10 MARKS@ 1 marks

2.

List A	i.	ii.	iii.	iv.	v.	vi.
List B	A	B	F	D	G	E

06 MARKS@01 marks

3.

a)

i. The laboratory should have working fire extinguishers and instructions on how to use them in case of fire accidents.

ii. Laboratory should have first aid kit with all necessary items.

iii. Chemicals that easily reacts with each other should never be stored together.

iv. Doors should open outwards, emergency exits should be present and easy to access.

v. Stored chemicals should be inspected regularly to ensure they are not expired.

vi. People using the laboratory should wear appropriate protective clothing to minimize exposure to hazards.

05 marks@ 1 mark

b) Data given

Isotopic mass of N^{14}= 14

Isotopic mass of N^{15}= 15

R.A.M of N = 14.007

Required

Isotopic abundance of each atom 01 marks

Solution

Let the isotopic abundance of N^{14} be X

Let the isotopic abundance of N^{15} be Y

From

R.AM = Sum of isotopic mass x percentage abundance

14.007 = (14xX + 15x Y)/100

14X + 15Y = 14.007 x 100

14X + 15Y = 1400.7 01 marks

But X%+ Y %= 100%

X= 100-Y

Substitute X = 100-Y in 14X + 15Y = 1400.07

14(100-Y) + 15Y = 1400.7

Y = 0.7% 01 marks

Then from

X=100-Y

X=99.3%

So, X= N^{14}=99.3% and Y = N^{15} =0.7% 01 marks

4.

a) Data given

Mass of Fe_2O_3=300g

Molar mass of Fe_2O_3=(56x2) + (16x3)

=160g/mol

Required, mass of iron=?

- Calculate number of moles of Fe_2O_3 and Fe

Number of mole of Fe_2O_3=$\frac{\text{Mass}}{\text{Molar mass}}$ (0.5 mark)

$=\frac{300g}{160g/mol}$

n=1.875mol of Fe_2O_3 (1 mark)

$$Fe_2O_3(s) + 3CO(g) \xrightarrow{heat} 2Fe(l) + 3CO_2(g)$$

From the balanced equation above,

1mol of Fe_2O_3 = 2mol of Fe (0.5 mark)

1.875mol of Fe_2O_3 = ?

=3.75mol of Fe (1 mark)

- Calculate mass of Fe

Mass = Number of moles x Molar mass

=3.75mol x 56g/mol

=210g

Therefore, mass of iron obtained is 210g (2 marks)

(b) Because production of aluminium by electrolysis is an expensive process. (1 marks)

(c) slags can be used

i. Manufacturing of cements

ii. Making tarmac roads

iii. Liming materials

(1.5@=3marks)

5.

a) When crystals of hydrated copper (ii) sulphate are heated, the colour changes from blue to white due to formation of anhydrous copper (ii) sulphate.

$$\underset{\text{Blue}}{CuSO_4 \cdot 5H_2O(s)} \xrightarrow{\text{heat}} \underset{\text{White}}{CuSO_4(s)} + 5H_2O(g)$$

(2 marks)

b) Concentrated sulphuric acid dehydrates sugar leaving carbon as a black mass. Heat produced evaporates the water from the reaction.

$$\underset{\text{Sugar}}{C_{12}H_{22}O_{11}(s)} \xrightarrow{\text{concentrated } H_2SO_4} 12C(s) + 11H_2O(g)$$

(2 marks)

c) Chlorine gas oxidizes iron (ii) chloride to iron (iii) chloride. The greenish-yellow colour of iron (ii) chloride turns brown which is the colour of iron (iii) chloride.

$$Cl_2(g) + 2FeCl_2(s) \xrightarrow{\text{heat}} 2FeCl_3(s)$$

(2 marks)

d) The reddish brown coat appears due to the formation of iron (iii) oxide (rust)

$$4Fe + xH_2O + 3O_2 \longrightarrow 2Fe_2O_3.xH_2O$$

(1 mark)

e) Lime water reacts with carbon dioxide to form white precipitates of calcium carbonate.
Calcium carbonate + carbon dioxide = Insoluble Calcium carbonate + water
In excess carbon dioxide gas the milkness disappears due to the formation of soluble calcium hydrogen carbonate
Insoluble Calcium carbonate + water + carbon dioxide gas= calcium hydrogen carbonate solution. (2 marks @ 0.5 mark)

6.

a) Hoffman voltammeter 02 marks

b)

i. Sample of copper (ii) oxide will encounter the chemical change 02 marks
Equation
Copper (ii) oxide + hydrogen gas = Solid copper + water 02 marks

ii. From the equation above
1 mole of hydrogen gas = 1 mole of copper
Volume of hydrogen gas = 10 g of copper
Volume of hydrogen gas = 10g x 22.4 dm^3/63.5
= 3.528 dm^3 at s.t.p
The volume of hydrogen gas at s.t.p is 3.528 dm^3 03 marks

7.

a) Substance C because it is soluble in water but not in kerosene 02 mark

b)

i. By filtration sample C can be obtained after being dissolved in water 01.5marks

ii. Solvent extraction can be used to extract sample A from B because kerosene will dissolve A but not B **01.5marks**

c)

i. Dissolving
ii. Decantating
iii. Filtrating

iv. Evaporating **04 marks @ 1 mark**

8. **Data given**

Volume of acid (V_a) = 15.8cm^3

Volume of base (V_b) = 23cm^3

Molarity of acid (M_a) = 0.3 M

Mass of hydrated sodium carbonate = 12.772g

Required

The value of X 01 marks

Solution

$Na_2CO_{3(aq)} + 2HCl \xrightarrow{yields} 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$ 02 marks

$na = 2, nb = 1$

From

$\frac{MaVa}{MbVb} = \frac{na}{nb}$ 01 marks

$Mb \quad \frac{MaVanb}{Vbna} = \frac{0.3\ x\ 15.8\ x\ 1}{23\ x\ 2} = 0.103$ M 01 marks

Then

From

Molarity = $\frac{concentration(\frac{g}{dm3})}{Molar\ mass\ (\frac{g}{mol})}$

Molar mass = $\frac{concentration\ (\frac{g}{dm3})}{Molarity\ (\frac{mol}{dm3})}$

Concentration = $\frac{mass(g)}{volume(dm3)} = \frac{12.772g}{1dm3}$ = 12.772g/dm^3 01 marks

So molar mass = $\frac{12.772(\frac{g}{dm3})}{0.103(\frac{mol}{dm3})}$ = 124 g/mol 01 marks

To find the value of x in $Na_2CO_3.XH_2O$ = 124 01 marks

(2X 23) +12 + (16X3) + X((1X2) + 16) = 124

106 + 18X = 124

18X = 18

X = $\frac{18}{18}$

= 1

The value of X in $Na_2CO_3.XH_2O$ is 1 01 marks

SECTION C (30 Marks)

Any two questions from this section

9.

a)

i.

a) Reactant is Calcium nitrate

b) Products are Calcium oxide and Nitrogen dioxide gas and oxygen gas

02 marks

ii. The balanced chemical equation

$Ca(NO_3)_{2(s)} \xrightarrow{\Delta} CaO_{(s)} + 2NO_{2(g)} + O_{2(g)}$

01marks

b)

i. Chemical names of all compounds in the scheme are as follows

A= Iron (ii) sulphate
B= Iron (ii) Chloride
C= Iron (ii) hydroxide
D= Iron (iii) hydroxide
E= Iron

05@01 marks

ii.

a) Conditions needed from 1 to 5 are;

1. Dilute Sulphuric acid
2. Hydrochloric acid
3. Air
4. Air
5. Precipitation

05@01 marks

b) The equation for any six

Iron fillings + sulphuric acid $\xrightarrow{yields}$ $Iron\ (ii) sulphate + hydrogen\ gas$

$Fe_{(s)} + H_2SO_{4(aq)} \xrightarrow{yields} FeSO_{4(s)} + H_{2(g)}$

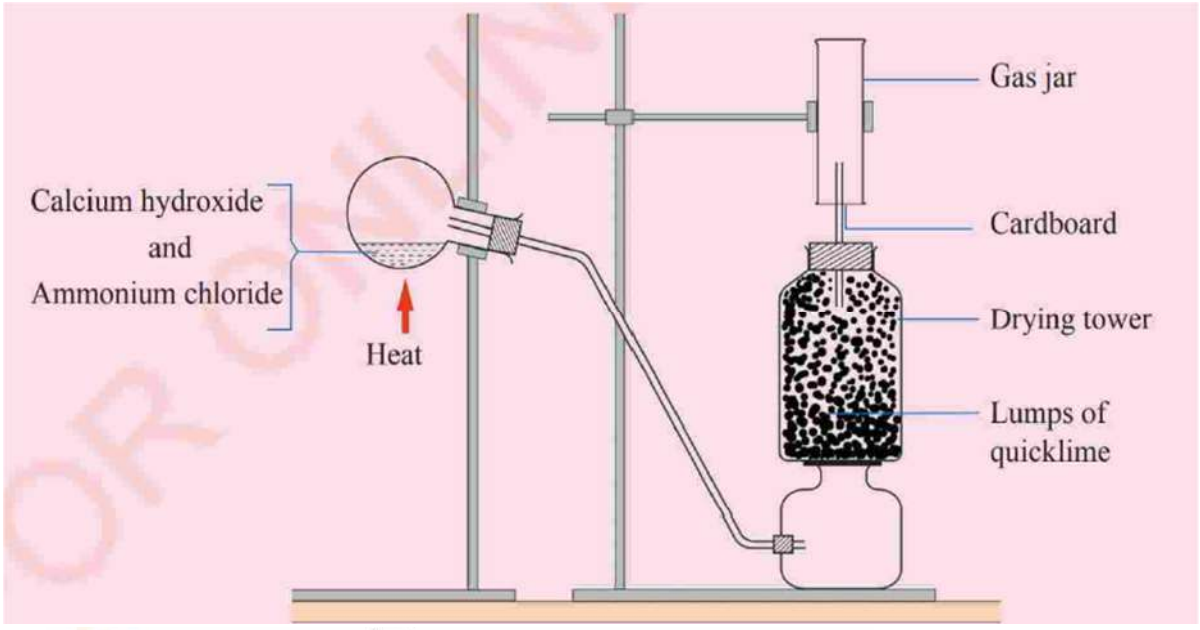
02 marks

10.

a) Ammonia gas (1mark)

b) The diagram for the laboratory set-up for the preparation of ammonia gas.

(Diagram 2 marks, labels 0.5@=3 marks)



(c) $2NH_4Cl(s) + Ca(OH)_2(s) \xrightarrow{heat} CaCl_2(aq) + 2H_2O(l) + 2NH_3(g)$ (2 marks)

(d) Calcium oxide-Is used for drying ammonia gas.
Gas jar-Used for collecting gases. (1@=2 marks)

(e) It forms white dense fumes with hydrogen chloride gas.

$NH_3(g) + HCl(g) \longrightarrow NH_4Cl(s)$ (2 marks)

(f) It is collected by upward delivery method because the gas is less dense than air. (1 mark)

(g) Ammonia gas would react with Sulphuric acid to produce ammonium sulphate.

$$2NH_3(g) + H_2SO_4(l) \rightleftharpoons (NH_4)_2SO_4(l)$$

(2 marks)

11. Causes and control measures of water pollution

Introduction (Meaning and sources of water pollution) (1.5 marks)

Causes of water pollution

i. Pesticides that are applied to animals and plants.
ii. Leakage of petroleum onto the surfaces of water.
iii. Wastes from mining activities.
iv. Poor farming methods causes soil erosion which contribute to deposition of sediments in water bodies.
v. Discharging industrial effluents into water bodies.
vi. Directing untreated sewage directly into water bodies. (Any four explained points 1.5@ 6marks)

Measures to be taken in order to control water pollution

i. Reducing the use of fertilisers and pesticides in agricultural activities.
ii. Treating raw sewage and industrial wastes before releasing it into water bodies.
iii. Stopping deforestation to minimise soil erosion.
iv. New mines should not be established in areas where they are likely to cause water pollution.

(Any four explained point's 1.5@6 marks)

Conclusion (1.5 marks)