ICSE Class 10 Chemistry Question Paper Solution 2015

CHEMISTRY

SCIENCE Paper - 2

Question 1

(a) Select from the list ***the gas*** that matches the description given in each case:

[*ammonia, ethane, hydrogen chloride, hydrogen sulphide, ethyne*]

(i) This gas is used as a reducing agent in reducing copper oxide to copper.

(ii) This gas produces dense white fumes with ammonia gas.

(iii) This gas is used for welding purposes.

(iv) This gas is also a saturated hydrocarbon.

(v) This gas has a characteristic rotten egg smell.

(b) Choose the ***most appropriate*** answer for each of the following: [5]

(i) Among the elements given below, the element with the least electronegativity is:

(A) Lithium

(B) Carbon

(C) Boron

(D) Fluorine

(ii) Identify the statement which does **not** describe the property of alkenes:

(A) They are unsaturated hydrocarbons

(B) They decolourise bromine water

(C) They can undergo addition as well as substitution reactions

(D) They undergo combustion with oxygen forming carbon dioxide and water.

(iii) This is **not** an alloy of copper:

(A) Brass

(B) Bronze

(C) Solder

(D) Duralumin.

(iv) Bonding in this molecule can be understood to involve coordinate bonding.

(A) Carbon tetrachloride

(B) Hydrogen

(C) Hydrogen chloride

(D) Ammonium chloride

(v) Which of the following would weigh the least?

(A) 2 gram atoms of Nitrogen.

(B) 1mole of Silver

(C) 22.4 litres of oxygen gas at 1atmospheric pressure and 273K

(D) 6.02×10^{23} atoms of carbon.

[Atomic masses: Ag=108, N=14, O=16, C=12] [5]

(c) Complete the following calculations. Show working for complete credit:

(i) Calculate the mass of Calcium that will contain the same number of atoms as are present in 3.2 gm of Sulphur.

[Atomic masses: S=32, Ca=40] [2]

(ii) If 6 litres of hydrogen and 4 litres of chlorine are mixed and exploded and if water is added to the gases formed, find the volume of the residual gas. [2]

(iii) If the empirical formula of a compound is CH and it has a vapour density of 13, find the molecular formula of the compound. [1]

(d) State ***one relevant observation*** for each of the following:

(i) When crystals of copper nitrate are heated in a test tube.

(ii) When the gaseous product obtained by dehydration of ethyl alcohol is passed through bromine water.

(iii) When hydrogen sulphide gas is passed through lead acetate solution.

(iv) When ammonia gas is burnt in an atmosphere of excess oxygen.

(v) At the Anode when aqueous copper sulphate solution is electrolysed using copper electrodes. [5]

(e) Identify ***the acid*** which matches the following description (i) to (v):

(i) The acid which is used in the preparation of a non-volatile acid.

(ii) The acid which produces sugar charcoal from sugar.

(iii) The acid which is prepared by catalytic oxidation of ammonia.

(iv) The acid on mixing with lead nitrate solution produces a white precipitate which is insoluble even on heating.

(v) The acid on mixing with silver nitrate solution produces a white precipitate which is soluble in excess ammonium hydroxide. [5]

(f) Give ***appropriate scientific reasons*** for the following statements:

(i) Zinc oxide can be reduced to zinc by using carbon monoxide, but aluminium oxide cannot be reduced by a reducing agent.

(ii) Carbon tetrachloride does not conduct electricity.

(iii) During electrolysis of molten lead bromide graphite anode is preferred to other electrodes.

(iv) The electrical conductivity of acetic acid is less in comparison to the electrical conductivity of dilute sulphuric acid at a given concentration.

(v) Electrolysis of molten lead bromide is considered to be a redox reaction. [5]

(g) (i) Give ***balanced chemical equations*** for the following conversions A, B and C:

$$Fe \xrightarrow{A} FeCl_3 \xrightarrow{B} FeCO_3 \xrightarrow{C} Fe(NO_3)_2$$ [3]

(ii) Differentiate between the terms ***strong electrolyte*** *and* ***weak electrolyte***. (stating any two differences) [2]

(h) Answer the following questions:

(i) Explain the bonding in methane molecule using electron dot structure. [2]

(ii) The metals of Group 2 from top to bottom are Be, Mg, Ca, Sr, and Ba.

(i) Which one of these elements will form ions most readily and why?

(ii) State the common feature in the electronic configuration of all these elements. [3]

Examiners' Comments

(a) (i) Candidates made a wrong choice of selecting either hydrogen chloride or hydrogen sulphide or ethyne**.**

(ii) Most candidates answered this part correctly. A few mentioned ammonia, perhaps in haste.

(iii) Some candidates made the error by selecting ethane. Although the name was given some candidates used structural formula to represent ethyne and did not show the triple bond between carbon atoms as HC≡CH and hence list the mark.

(iv) Some candidates ignored the word saturated and chose ethyne.

(v) Most candidates answered this part correctly.

Suggestions for teachers

- Explain how ammonia behaves as a reducing agent.
- Insist on students reading instructions carefully.
- When beginning with organic chemistry bring out the facts of saturation and unsaturation so that students understand how the various types of reactions take place.
- Students need to be well versed with the various terms and the trends across the periodic table.
- Take up a comparative study of properties of alkanes, alkenes and alkynes.

(b) (i) Candidates selected the element fluorine which was contrary to the property stated.
(ii) Error made by selecting the property of alkene.
(iii) Many candidates opted for duralumin.
(iv) Carbon tetrachloride was the most repeated incorrect answer.
(v) Candidate resorted to guess work.

(c) (i) Candidates either made errors in calculation of mole by reversing the ratio or failed to see the connection between mole, molecules and molar mass.
(ii) Balanced equation missed out and the fact that HCl gas is extremely soluble in H_2O was ignored. Final composition stated thus had wrong volumes and incorrect combination of HCl and H_2.
(iii) Candidates either forgot the relation Molecular weight = 2X vapour density or forgot to multiply the empirical formula by 2 to get the molecular formula.

(d) (i) Some candidates referred to blue residue instead of black or a red gas instead of reddish brown or black precipitate instead of black residue or named the product formed without relevant observation.
(ii) Candidates did not comprehend the question and identified the gas instead of the stating the impact of the gas on bromine water.
(iii) Incorrect observation, candidate perhaps got confused with lead sulphate.
(iv) Either wrong colour of flame (yellow/blue) or mention of liberation of N_2 or NO, often the flame was replaced by vapours.
(v) Instead of focusing on the anode candidates stated the effect on the electrolyte.

(e) (i) Candidates failed to mention the concentration of the acid even if the right acid was identified and hence lost mark.
(ii) Most attempted correctly.
(iii) H_2SO_4 incorrectly replaced by hydrochloric acid and failure of candidates to notice the condition of heating.
(iv) Most candidates answered correctly.

- Activities such as quiz or frequent objective tests will help students in remembering the components of alloys and their properties.
- Ensure students are able to differentiate between lone pair and shared pair with relevant examples to understand how a coordinate bond is formed.
- An understanding of the relation between mole and molar mass is essential.
- Establish a link between mole, no of molecules and mass and not solve problems in isolation. Regular practice in stepwise working needs to be given
- Relation of volumes of gases taking part in a chemical equation with the stoichiometry of the equation needs to be stressed on.
- Knowledge of solubility of gases essential.
- Assortment of various types of numericals to be given for practice and repeated brushing up of the topic required. Students need to be trained to follow stepwise working while solving numericals.
- Ensure concepts are clear then solving numerical will not pose a problem.
- Students to be reminded at all times that naming the product is of no use when observations are asked.
- In the course of practical work, students must be asked to write their observations and then discuss them at the end of the practical session.
- Students need to be exposed to adequate variety of questions and instructed to read a particularly difficult question several times for easy comprehension.
- Practical work needs to be given adequate importance.

(f) (i) Some of the statements written by candidates didn't convey the right meaning, such as Alumina—instead of Al having higher affinity for oxygen.

(ii) Candidates failed to mention the absence of free ions and instead, focused in the type of bonding present in CCl_4

(iii) Candidates gave a general reason for use of graphite as an anode without reference to lead bromide electrolysis. Most answered correctly, few however made the mistake of not relating the preference of graphite for the particular electrolyte.

(iv) Vast majority referred to the monobasic nature of acetic acid and dibasic nature of H_2SO_4.

(v) Candidates explained the process of oxidation, reduction without specifying the electrodes or the reactions at the electrodes were reversed.

(g) (i) Errors committed were of the types

$Fe + Cl_2 \rightarrow FeCl_2$

$Fe + 3Cl_2 \rightarrow 2FeCl_3$ i.e. either the products were wrong or the equation was unbalanced. $FeCO_3$ was treated with a salt such as $NaNO_3$ instead of HNO_3.

(ii) Some candidates erred by representing weak electrolytes as bad conductors while some wrote examples to differentiate between the terms instead of doing so on the basis of their properties.

(h) (i) Candidates made errors while showing the shared pairs while some mistook methane to be ammonia.

(ii) (1) though reason given was correct, candidates chose the wrong element.

(2) Candidates referred to the general property of elements down any group, ignoring the fact that the question pertained to Group 2.

- Stress on observation like colour of flame and the fact that observation does not mean identifying the gas.
- Students must be aware of possible observations at the electrodes and also any change in the electrolyte. Students to be advised to focus on the questions asked.
- Point out the various properties of acids incorporating the various conditions required.
- Knowledge of solubility of salts essential and regular objective tests will help in remembering factual data.
- Reference of metal activity series is a must when discussing the reactivity of metals.
- Highlight the basic difference between electrolytes and non-electrolytes on the basis of ionization.
- Guide students to pay attention to all aspects of a question so that certain key facts are not missed out. Expose students to a variety of questions on particular topic so that they apply their knowledge correctly.
- Associate the degree of ionization with the weak and strong electrolytes.
- Students must be trained to analyze the question and ensure all aspects are explained.
- Besides acquainting students with different methods of salt preparations, they must understand the variation in reactions taking place especially with metals exhibiting variable valencies.
- Ensure students are able to distinguish between strong and weak electrolytes on the basis of ionization, kind of particles and on conductivity.
- Develop the understanding of bonding with a number of relevant examples with repetitive practice to be given in drawing dot diagrams.
- After familiarizing students with trends in the periodic table, train them to apply this knowledge to varied situations.

MARKING SCHEME

Question 1

a) (i) ammonia

(ii) hydrogen chloride

(iii) ethyne

(iv) ethane

(v) hydrogen sulphide

b) (i) A

(ii) C

(iii) C

(iv) D

(v) D

c) (i) 3.2÷32 = no. of moles of sulphur

= 0.1 moles

= 0.1 moles of calcium

No. of moles are equal then number of atoms also will be equal

Mass of calcium= 0.1 x 40= 4gm

(ii) $H_2 + Cl_2 \rightarrow 2HCl$

4 litres of chlorine will react with 4 litres of hydrogen, HCl gas is highly soluble in water. Therefore residual gas will be un reacted chlorine = (6-4) =2litres

(iii) Molecular weight = 2 x VD

= 2x13

= 26

Empirical weight = 13, n= 26÷13 = 2

Molecular formula= n x empirical formula=2x CH= C_2H_2

d) Each relevant observation carries 1 mark

(i) Reddish brown gas of nitrogen dioxide gas is evolved and black residue of CuO is formed.

(ii) Brown colour of Bromine solution decolourises.

(iii) Black precipitate of lead sulphide is formed.

(iv) Burns with a greenish yellow flame.

(v) Anode is consumed.

e) Each correct answer carries 1 mark

(i) Concentrated nitric acid

(ii) Concentrated sulphuric acid

(iii) Concentrated nitric acid

(iv) Dilute sulphuric acid

(v) Dilute hydrochloric acid

f) Each appropriate reason carries 1 mark

(i) Aluminium is more reactive than zinc and has a high affinity for oxygen, it cannot be reduced by reducing agent.

(ii) Carbon tetrachloride consists of only molecules hence it is a non-electrolyte, it cannot conduct electricity.

(iii) Graphite is inert by nature it would not react with bromine vapours which evolve at the anode.

(iv) Acetic acid is a weak acid it consists of less number ions at a given concentration in comparison to sulphuric acid of the same concentration which is a strong acid.

(v) The metallic ion of the electrolyte moves towards the cathode there it gains electrons and gets deposited as neutral metal atom and hence gets reduced. The anion or Br^- ion loses its electron at the anode and gets oxidised.

g) (i) Each conversion reaction carries 1 mark

A $\longrightarrow$ $2Fe + 3Cl_2 \longrightarrow 2FeCl_3$

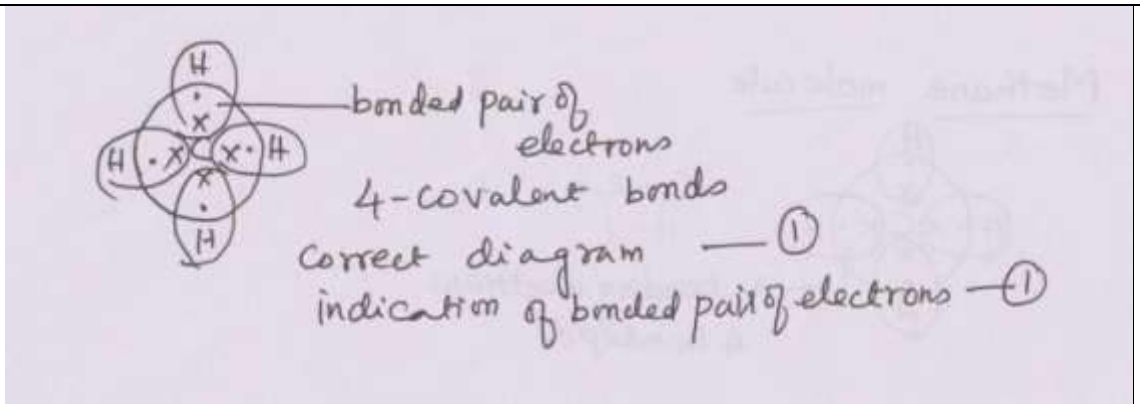
B $\longrightarrow$ $2FeCl_3 + 3Na_2CO_3 \longrightarrow Fe_2(CO)_3 + 6NaCl$

C $\longrightarrow$ $FeCO_3 + 2HNO_3 \longrightarrow Fe(NO_3)_2 + H_2O + CO_2$

(ii) Each appropriate difference carries [1] mark.

Strong Electrolyte	Weak Electrolyte
(i) Electrolyte undergoes almost complete ionisation.	(i) Electrolyte undergoes partial ionisation.
(ii) Allows large current to pass through.	(ii) Allows only a weak current to pass through.

h) (i)



(ii) (1) Ba will form ions most easily. The ionisation energy is the least and hence it loses electrons most readily to form +ve ions.

(2) They all have 2 electrons in the valence shell.

Question 2

(a) Arrange the following as per the ***instructions*** given in the brackets:

(i) Cs, Na, Li, K, Rb (increasing order of metallic character).

(ii) Mg, Cl, Na, S, Si (decreasing order of atomic size).

(iii) Na, K, Cl, S, Si (increasing order of ionization energy)

(iv) Cl, F, Br, I (increasing order of electron affinity) [4]

(b) Choose the most appropriate answer from the following list of oxides which fit the ***description***. Each answer may be used only once:

[SO_2, SiO_2, Al_2O_3, MgO, CO, Na_2O]

(i) A basic oxide.

(ii) An oxide which dissolves in water forming an acid.

(iii) An amphoteric oxide.

(iv) A covalent oxide of a metalloid. [4]

(c) Element X is a metal with a valency 2, Y is a non-metal with a valency 3.

(i) Write an equation to show how Y forms an ion.

(ii) If Y is a diatomic gas, write an equation for the direct combination of X and Y to form a compound. [2]

Examiners' Comments

(a) (i) Though the order in which the elements were written was correct however some candidates incorporated the wrong sign (>, <).
(ii) Most candidates answered this part correctly but some made errors by exchanging elements.
(iii) Answered correctly by most candidates.
(iv) Most answered this part correctly.

(b) (i) Alumina was used which was amphoteric and hence could not be repeated in part (iii).
(ii) Few candidates selected the incorrect answer.
(iii) Those who repeated the answer lost marks.
(iv) Candidates got confused between SO_2 and SiO_2.

(c) (i) Most candidates seemed unsure while showing the ionization of Y.
(ii) Most candidates either wrote only the formula of the product or an unbalanced equation or showed the atomicity of Y to be 3 lost marks.

Suggestions for teachers

- Familiarize students with alkali metals and halogens and train them to apply the knowledge of trends in properties to them.
- Train students to answering application based questions on a regular basis.
- Encourage thinking among students.
- Familiarize students with the properties of oxides with relevant examples.
- Repeated testing or quizzing will ensure students manage to retain factual data.
- Students need to be given adequate explanation and practice in writing ionic explanation to ensure clarity of thought.

MARKING SCHEME

Question-2

(a) (i) Li, Na, K, Rb, Cs (increasing order of metallic character)

(ii) Na, Mg, Si, S, Cl (decreasing order of atomic size)

(iii) K, Na, Si, S, Cl (increasing order of ionization energy)

(iv) I, Br, F, Cl (increasing order of electron affinity)

(b) (i) A basic oxide----MgO

(ii) SO_2

(iii) Al_2O_3

(iv) SiO_2

(c) (i) $Y + 3e^- \rightarrow Y^{3-}$

(ii) $3X + Y_2 \rightarrow X_3Y_2$

Question 3

(a) Give balanced ***chemical equations*** for the following ***conversions***:

(i) Ethanoic acid to ethyl ethanoate.

(ii) Calcium carbide to ethyne.

(iii) Sodium ethanoate to methane. [3]

(b) Using their structural formulae identify the functional group by circling them:

(i) Dimethyl ether.

(ii) Propanone. [2]

(c) Name the following:

(i) Process by which ethane is obtained from ethene.

(ii) A hydrocarbon which contributes towards the ***greenhouse*** effect.

(iii) Distinctive reaction that takes place when ethanol is treated with acetic acid.

(iv) The property of elements by virtue of which atoms of the element can link to each other in the form of a long chain or ring structure.

(v) Reaction when an alkyl halide is treated with alcoholic potassium hydroxide. [5]

Examiners' Comments

(a) (i) Ethanoic acid was incorrectly replaced by propanoic acid and the concentration of H_2SO_4 was not stated by many candidates hence, lost mark.

(ii) Few candidates replaced the product Ca $(OH)_2$ by CaO. Resulting in an incorrect answer.

(iii) Either the reactant was wrong or the product was wrong while some missed the mention of sodalime.

(b) (i) Dimethyl ether was incorrectly represented by acetaldehyde. Many candidates made the error of writing the condensed formula instead of structural formula.

(ii) Candidates wrote the condensed formula or mistook the ketonic group to be aldehydic group

(c) (i) Some candidates were confused between the terms – hydrogenation halogenations, dehydrogenation and dehydration.

(ii) The hydrocarbon selected was incorrect in many cases.

(iii) Most candidates answered correctly.

(iv) Occasional incorrect answers was on self-linking property.

(v) Few candidates mentioned halogenations instead of dehydrohalogenation.

Suggestions for teachers

- IUPAC nomenclature is a very important part of organic chemistry and its importance cannot be undermined.
- Students tend to make mistakes when the functional group is – CHO or COOH so pay special attention here. Insist on conditions being written with the equation.
- Draw out differences between structural formula and condensed formula clearly.
- Ensure students have clarity on the various functional groups.
- Terms such as these must be explained with relevant examples.
- Impact of various chemicals affecting our daily lives need to be discussed.
- Besides ensuring that students learn to write balanced chemical equations the various terms in organic chemistry must be given due importance.

MARKING SCHEME

Question - 3

a) i) Catalyst Ni(1/2), temperature 300°C (1/2)

ii) Alcoholic KOH or NaOH

iii) catalyst Pt (1/2), temperature(700-800)°C (1/2)

iv) catalyst V2O5, temperature(450-500)°C, pressure (1-2)atms. (any 2)

b) i) copper, zinc

ii) aluminium, copper

iii) copper, tin

c) i) $KNO_3 + H_2SO_4(conc) \rightarrow KHSO_4 + HNO_3$ or with $NaNO_3$

ii) $C_2H_5Cl + NaOH \rightarrow C_2H_5OH + NaCl$

Question 4

(a) Identify the ***anion*** present in each of the following compounds:

(i) A salt **M** on treatment with concentrated sulphuric acid produces a gas which fumes in moist air and gives dense fumes with ammonia.

(ii) A salt **D** on treatment with dilute sulphuric acid produces a gas which turns lime water milky but has no effect on acidified potassium dichromate solution.

(iii) When barium chloride solution is added to salt solution **E** a white precipitate insoluble in dilute hydrochloric acid is obtained. [3]

(b) The following table shows the tests a student performed on four different aqueous solutions which are **X**, **Y**, **Z** and **W**. Based on the observations provided, identify the cation present:

Chemical test	Observation	Conclusion
To solution **X,** ammonium hydroxide is added in minimum quantity first and then in excess.	A dirty white precipitate is formed which dissolves in excess to form a clear solution.	(i)
To solution **Y** ammonium hydroxide is added in minimum quantity first and then in excess.	A pale blue precipitate is formed which dissolves in excess to form a clear inky blue solution.	(ii)

To solution **W** a small quantity of sodium hydroxide solution is added and then in excess.	A white precipitate is formed which remains insoluble.	(iii)
To a salt **Z** calcium hydroxide solution is added and then heated.	A pungent smelling gas turning moist red litmus paper blue is obtained.	(iv)

[4]

(c) Give balanced chemical equations for each of the following:

(i) Lab preparation of ammonia using an ammonium salt.

(ii) Reaction of ammonia with excess chlorine.

(iii) Reaction of ammonia with sulphuric acid. [3]

Examiners' Comments

(a) (i) Chloride ion was incorrectly listed as Cl or chlorine.
(ii) Name of the salt was given instead of the anion
(iii) The charge was missing on the SO_4^{-2} ion.
(iv) Incorrect answers such as Cl^{2-} / chlorine/ CO^{3-} /SO_4^- / SO_3^- were given.

(b) (i) Even if the cation identified was correct the charge was missing.
(ii) Some candidates named a salt instead of the cation present.
(iii) Instead of the cation present a few candidates named the salt.
(iv) Ammonium radical was incorrectly spelt as ammonia radical or the conclusion made was that the salt was ammonium chloride.

(c) (i) Incorrect choice of ammonium salt or alkali in the lab preparation of ammonia.
(ii) Some candidates wrote the reaction of excess ammonia with chlorine that was not part of the question.
(iii) Most candidates answered correctly. Few candidates included H_2O as a product.

Suggestions for teachers

- Instructions to be read carefully while identifying anions or cations.
- Relate tests and observations to relevant inferences.
- Tabulated display of these results in the lab would assist students in recalling the correct symbols during examinations.
- Point out the common errors to students during practicals.
- Insist on students writing down the observation themselves during practicals followed by inferences and then the results may be discussed by the teachers.
- Stress on the choice of appropriate reactants for lab preparation.
- Certain reactions have varied products depending on the conditions.
- Enumerate such reactions in tabulated form.
- Highlight the difference between the reactions of acid with ammonia and ammonium hydroxide.

MARKING SCHEME

Question-4

(a) (i) M … chloride ion or Cl^- ion

(ii) D … carbonate ion or CO_3^{2-} ion or bicarbonate or hydrogen carbonate or HCO_3^- ion

(iii) E … sulphate ion or SO_4^{2-} ion.

(b) (i) The salt solution X contains Zn^{2+} ions

(ii) The salt solution Y contains Cu^{2+} ions

(iii) The salt solution W contains Ca^{2+} ions or Mg^{2+} ion

(iv) Salt Z contains NH_4^+ ions or Ammonium ions

(c) (i) $2NH_4Cl + Ca(OH)_2 \longrightarrow CaCl_2 + 2H_2O + 2NH_3$

(ii) $NH_3 + 3Cl_2 \longrightarrow 3HCl + NCl_3$

(iii) $2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

Question 5

(a) Consider the following reaction and based on the reaction answer the questions that follow:

$$(NH_4)_2Cr_2O_7 \xrightarrow{heat} N_2(g) + 4\,H_2O(g) + Cr_2O_3$$

Calculate:

(i) the quantity in moles of $(NH_4)_2Cr_2O_7$ if 63gm of $(NH_4)_2Cr_2O_7$ is heated. [1]

(ii) the quantity in moles of nitrogen formed. [1]

(iii) the volume in litres or dm^3 of N_2 evolved at S.T.P. [1]

(iv) the mass in grams of Cr_2O_3 formed at the same time. [2]

[Atomic masses: H=1, Cr= 52, N=14]

(b) (i) For each of the substance listed below, describe the role played in the extraction of aluminium.

(1) Cryolite

(2) Sodium hydroxide

(3) Graphite. [3]

(ii) Explain why:

(1) In the electrolysis of alumina using the Hall Heroult's Process the electrolyte is covered with powdered coke.

(2) Iron sheets are coated with zinc during galvanization. [2]

Examiners' Comments

(a) (i) Some candidates made errors in molecular weight calculation or reversed the calculation.
(ii) Instead of deducing the number of moles of N_2 from the equation, candidates erred by calculating the molecular mass of N_2 .Where candidates made errors in step (1), the same error continued.
(iii) Volume stated was the molar volume instead of determining the volume from step (ii).
(iv) Candidates erred in calculation of molar mass or ignored the equation for the calculation of moles.

(b) (i) 1. Errors such as solvent for bauxite.
2. Incorrect answer of dissolving alumina instead of bauxite.
3. Most candidates answered correctly.
(ii) 1. Most candidates answered this part correctly.
2. Few made an error of stating Zn lies below Fe in the activity series.

Suggestions for teachers

- Students to be taught to establish molar relationships from the stoichiometry of the equation.
- Highlight that Gay Lussac's law applies only to gases.
- Regular stepwise working to be insisted upon.
- Exposure to variety of numericals necessary.
- Students to be reminded to learn specifics and focus on the choice of correct chemicals when there are similar ones to choose from. For eg alumina and bauxite.
- Knowledge of the correct order of metals in the activity series essential.

MARKING SCHEME

Question - 5

i. 252 ÷ 63 or 0.25 moles

ii. 0.25 moles of N_2

iii. 0.25 x 22.4 l or 5.6 l

iv. Mass of salt = 0.25 x 152 = 38 g

(b) (i) 1. Cryolite is used to reduce the temperature to melt the (purified ore) / to increase the conductivity / it acts as a solvent.

2. Sodium hydroxide or NaOH is used to dissolve bauxite / to concentrate the ore / insoluble impurities get precipitated or removed/ NaOH is used to dissolve aluminium oxide or Al_2O_3 / to convert bauxite to sodium aluminate / to purify bauxite.

3. Graphite lining of the electrolytic tank is used as cathode / graphite rods are used as anode.

(ii) 1. Coke powder does not allow the radiation of heat from the electrolyte/ prevents oxidation or burning of the anode / prevents loss of heat.

2. Zinc is more reactive than iron / zinc is more electropositive than iron / Zinc is higher in the activity series / to prevent rusting / corrosion.

Question 6

(a) (i) Give balanced chemical equations for the action of sulphuric acid on each of the following:

(1) Potassium hydrogen carbonate.

(2) Sulphur. [2]

(ii) In the contact process for the manufacture of sulphuric acid give the equations for the conversion of sulphur trioxide to sulphuric acid. [2]

(b) (i) Copy and complete the following table:

	Anode	Electrolyte
Purification of copper		

[2]

(ii) Write the equation taking place at the anode. [1]

(c) Explain the following:

(i) Dilute nitric acid is generally considered a typical acid but not so in its reaction with metals.

(ii) Concentrated nitric acid appears yellow when it is left standing in a glass bottle.

(iii) An all glass apparatus is used in the laboratory preparation of nitric acid. [3]

Examiners' Comments

(a) (i) 1. Few candidates made the error by giving the product $KHSO_4$ or H_2CO_3.
2. Incorrect balancing of equation.

(ii) Although the first step of obtaining oleum was correctly written, some candidates went wrong in balancing the second step.

(b) (i) A few candidates missed out on impure copper but most got the electrolyte right.

(ii) Most candidates answered correctly. Some wrote the reaction at the cathode instead of at the anode.

(c) (i) Candidates faced difficulty in explaining the reason.

(ii) Some candidates failed to mention the dissolution of NO_2 in the acid being responsible for the yellow colour of acid.

(iii) Majority of candidates answered correctly.

Suggestions for teachers

- Common error among students in the action of acid on carbonate is to enlist H2CO3 instead of H2O+CO2.Ensure students make a note of this.
- Enumerate the industrial process as in a tabulated form so that a comparative study of acid manufacture is possible and differences in the steps are noted.
- Draw out the differences between simple electrolysis and application of electrolysis such as electroplating or electro refining in terms of electrodes and electrolyte. This will ensure clarity of thought.
- Mere rote memorization of reaction is of no use, students need to understand how the reaction differs at electrodes.
- Besides learning to write balanced chemical equations, students need to focus on the role played by the acid in different reactions.

MARKING SCHEME

Question-6

(a) (i) 1. $2KHCO_3 + H_2SO_4 \longrightarrow K_2SO_4 + 2\ H_2O + 2CO_2$

2. $S + 2H_2SO_4 \longrightarrow 3SO_2 + 2\ H_2O$

(ii) 1. $SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

2. $H_2S_2O_7 + H_2O \longrightarrow 2\ H_2SO_4$

(b) (i)

	Anode	Electrolyte
Purification of copper	Impure copper metal	Copper sulphate $CuSO_4$ any soluble salt of copper

(ii) $Cu \longrightarrow Cu^{2+} + 2e^-$ or

$Cu - 2e^- \longrightarrow Cu^{2+}$

(c) (i) Dilute nitric acid also has oxidizing properties does not form H_2 with all metals except Mg & Mn / produces oxides of nitrogen

(ii) Conc. HNO_3 decomposes to form nitrogen dioxide which dissolves in it.

Or

Conc. HNO_3 produces reddish brown gas which dissolves in it.

(iii) HNO_3 vapours are very corrosive in nature / they react with rubber or cork / they attack or damage or corrode or destroy any other material.

Question 7

(a) The following questions are pertaining to the laboratory preparation of hydrogen chloride gas:

(i) Write the equation for its preparation mentioning the condition required. [1]

(ii) Name the drying agent used and justify your choice. [2]

(iii) State a safety precaution you would take during the preparation of hydrochloric acid. [1]

(b) An element **L** consists of molecules.

(i) What type of bonding is present in the particles that make up **L**?

(ii) When **L** is heated with iron metal, it forms a compound **FeL**. What chemical term would you use to describe the change undergone by **L**? [2]

(c) From the list of the following salts choose the salt that most appropriately fits the description given in the following:

[$AgCl$, $MgCl_2$, $NaHSO_4$, $PbCO_3$, $ZnCO_3$, KNO_3, $Ca(NO_3)_2$]

(i) A deliquescent salt.

(ii) An insoluble chloride.

(iii) On heating, this salt gives a yellow residue when hot and white when cold.

(iv) On heating this salt, a brown coloured gas is evolved. [4]

Examiners' Comments

(a) (i) Most candidates knew the correct equation however some candidates wrote the reaction at a higher temperature which ought to have been avoided.

(ii) The occasional incorrect answer was CaO. Most however answered correctly. However, some candidates failed to refer to the concentration of the acid with the reason not clearly mentioned by many.

(iii) Irrelevant answers written by many as they were not sure of the safety precaution.

(b) (i) Most candidates answered correctly.

(ii) Incorrect answers such as oxidation, ionization and double decomposition.

(c) (i) Wrong choice of salt.

(ii) Most candidates answered this part correctly.

(iii) Most candidates wrote $PbCO_3$ instead of $ZnCO_3$ as they failed to remember that PbO is yellow both when hot and cold.

(iv) Most candidates selected the correct salt, some erred by selecting KNO_3 as they perhaps did not know that KNO_3 and $NaNO_3$ are the only 2 metal salts that do not give NO_2 gas on heating.

Suggestions for teachers

- Emphasis must be laid on the dependence of products on the condition employed.
- Frequent testing of factual data required.
- Students must be trained to analyse the data and reason out.
- Acquaint students with the different properties of salts and relevant examples.
- Visible changes need to be shown to students in the lab so as to help in retaining the colour of various compounds.
- When students are explained general equations of action of heat on substances, the exceptional cases must be highlighted and brought to the notice of students.

MARKING SCHEME

Question-7

(a) (i) $KCl / NaCl + H_2SO_4 \xrightarrow{< 200^\circ C} KHSO_4 / NaHSO_4 + HCl$

P_2O_5 and CaO react with HCl vapours, H_2SO_4 does not

(ii) Concentrated sulphuric acid or H_2SO_4 is used as the drying agent.

(iii) Funnel arrangement as HCl is highly soluble in water and to avoid back suction

(c) (i) Covalent bonding / covalent bond

(ii) L is getting reduced

(c) (i) $MgCl_2$

(ii) AgCl

(iii) $ZnCO_3$

(iv) $Ca(NO_3)_2$

Topics/Concepts that candidates found difficult and/or confusing:

- Practical based questions where observation had to be enumerated.
- Application of trends in periodic Table.
- Concept of g atom and g molecule and the relation with mass and volume.
- Enumeration of results of electrolysis.
- Reactions at anode and cathode.
- Inferences based on Practical observations.
- Calculations based on chemical equations.
- IUPAC Nomenclature and structural formulae of organic compounds.
- Ionic equations involving oxidation / reduction.
- Various functional groups and their symbolic representation.
- Specific terms in organic chemistry.

Teachers to note:-

Extensive use of audio / visual aids and innovative techniques of testing of testing would help students in better understanding and retention of subject matter.

Suggestions for candidates:

- Read instructions carefully and avoid haste.
- Stating observation does not mean identifying the substance.
- Learn all equations with the relevant conditions. If acids are used, remember to state the concentration.
- Pay attention to details during practical work and focus on both observations and inferences.
- Learn the various terms, get to know IUPAC Nomenclature well and ensure structural formulae are represented correctly.
- Exposure to variety of numericals is essential and habit of step wise working will fetch rich dividends.
- Focus on the colours of precipitates and their solubilities in reagents such as N_aOH, NH_4OH.
- Solubilities of salts and properties of salts require special attention to understand the methods of preparation of salts.
- Knowledge of various types of oxides essential with relevant examples.
- Learn the laws, principles and definitions verbatim.
- Learn the tests for identifying the cations and anions and the related observations.
- Tabulate Industrial preparations and make a comparative study of the details.
- Study alloys in tabulated form highlighting the main component and the other metals and their special properties.
- Remember the rules for selective discharge of ions and learn to apply them.
- Various roles of different substances used must be understood in metallurgy.
- Ensure all aspects of the syllabus are covered and avoid selective study.
- Practice solving previous year's Question Papers to get an insight into the pattern of the papers.