ICSE Class 10 Chemistry Question Paper Solution 2016

CHEMISTRY

SCIENCE Paper – 2

Question 1

(a) Fill in the blanks with the choices given in brackets. [5]

(i) Metals are good _____ *(oxidizing agents / reducing agents)* because they are electron _____ *(acceptors/ donors).*

(ii) Electrovalent compounds have _____ *(high / low)* melting points.

(iii) Higher the pH value of a solution, the more _____ *(acidic / alkaline)* it is.

(iv) _____ *($AgCl$ / $PbCl_2$)*, a white precipitate is soluble in excess NH_4OH.

(v) Conversion of ethene to ethane is an example of _____ *(hydration / hydrogenation).*

(b) Choose the ***correct answer*** from the options given below: [5]

(i) An element with the atomic number 19 will most likely combine chemically with the element whose atomic number is:

A. 17

B. 11

C. 18

D. 20

(ii) The ratio between the number of molecules in 2g of hydrogen and 32g of oxygen is:

A. 1:2

B. 1:0.01

C. 1:1

D. 0.01:1 [Given that H=1, O=16]

(iii) The two main metals in ***Bronze*** are:

A. Copper and zinc

B. Copper and lead

C. Copper and nickel

D. Copper and tin

(iv) The particles present in ***strong electrolytes*** are:

A. only molecules

B. mainly ions

C. ions and molecules

D. only atoms.

(v) The aim of the ***Fountain Experiment*** is to prove that:

A. HCl turns blue litmus red

B. HCl is denser than air

C. HCl is highly soluble in water

D. HCl fumes in moist air.

(c) Write ***balanced chemical equations*** for each of the following: [5]

(i) Action of warm water on AlN.

(ii) Action of hot and concentrated Nitric acid on copper.

(iii) Action of Hydrochloric acid on sodium bicarbonate.

(iv) Action of dilute Sulphuric acid on Sodium Sulphite.

(v) Preparation of ethanol from Ethyl Chloride.

(d) State your ***observations*** when: [5]

(i) Dilute Hydrochloric acid is added to Lead nitrate solution and the mixture is heated.

(ii) Barium chloride solution is mixed with Sodium Sulphate Solution.

(iii) Concentrated Sulphuric acid is added to Sugar Crystals.

(iv) Dilute Hydrochloric acid is added to Copper carbonate.

(v) Dilute Hydrochloric acid is added to Sodium thiosulphate.

(e) Identify the ***term/substance*** in each of the following: [5]

(i) The tendency of an atom to attract electrons to itself when combined in a compound.

(ii) The method used to separate ore from gangue by preferential wetting.

(iii) The catalyst used in the conversion of ethyne to ethane.

(iv) The type of reactions alkenes undergo.

(v) The electrons present in the outermost shell of an atom.

(f) (i) A gas of mass 32gms has a volume of 20 litres at S.T.P. Calculate the gram molecular weight of the gas. [5]

(ii) How much Calcium oxide is formed when 82g of calcium nitrate is heated? Also find the volume of nitrogendioxide evolved:

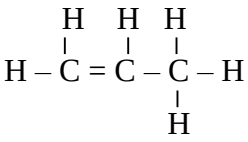
$2Ca(NO_3)_2 \longrightarrow 2CaO + 4NO_2 + O_2$

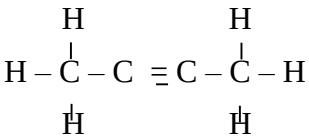
(Ca = 40, N = 14, O = 16)

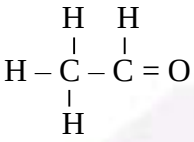
(g) Match the salts given in Column I with their ***method of preparation*** given in Column II: [5]

Column I	Column II
(i) $Pb(NO_3)_2$ from PbO	A) Simple displacement
(ii) $MgCl_2$ from Mg	B) Titration
(iii) $FeCl_3$ from Fe	C) Neutralization
(iv) $NaNO_3$ from NaOH	D) Precipitation
(v) $ZnCO_3$ from $ZnSO_4$	E) Combination

(h) (i) Write the IUPAC names of each of the following: [5]

1. 

2. 

3. 

(ii) ***Rewrite*** the following sentences by using the correct symbol > ***(greater than) or*** < ***(less than)*** in the blanks given:

1. The ionization potential of Potassium is _____ that of Sodium.
2. The electronegativity of Iodine is _____ that of Chlorine.

Comments of Examiners

1 (a)

(i) Candidates made the wrong choice of oxidising agents. They perhaps did not see the association between metals being electron donors and thus their behaviour as reducing agents.

(ii) Low melting point. Properties of electrovalent compounds on the basis of electrostatic force between ions, were not perhaps understood well.

(iii) Candidates chose acidic instead of alkaline solution. Candidates failed to note that a Neutral solution has pH=7, while alkaline solutions have lower H^+ ion concentration and pH goes beyond 7

(iv) Candidates selected $PbCl_2$ instead of AgCl. Practical chemistry not given adequate attention and hence solubilities of salts were not clear to candidates.

(v) Candidates got confused between hydration and hydrogenation and failed to understand that hydrogenation is addition of hydrogen and hydration is addition of water.

Suggestions for teachers

(a)

- ✓ Ensure students first understand the concept of oxidation / reduction on the basis of loss/gain of e^-s clearly. The concept of reducing agent responsible for reduction and the basis for it will then be understood well.
- ✓ Stress on the presence of strong electrostatic force of attraction between the ions present in an electrovalent compound to understand why they have high melting points.
- ✓ Relating pH mathematically to the H^+ ion concentration will help students in understanding why pH increases as H^+ ion concentration decreases, [$pH = -\log_{10}[H^+]$] and therefore the solution becoming alkaline with higher pH [lower H^+ ion conc.]
- ✓ In the laboratories, students need to be shown the formation of white and coloured precipitates as well as their solubilities in water, NaOH and NH_4OH solutions. These ppt must include $PbCl_2$, AgCl as well, besides the hydroxides of the cations (listed in the syllabus)
- ✓ Students' attention must be drawn to the fact that hydrogenation is associated with addition of hydrogen and hydration corresponds to addition of water. Structural formula will assist in achieving clarity of thought. Illustrate with example

(b)

(i) Candidates chose wrong option of 11 or 18 If candidates had written the electronic configuration of the element, then they would have realized that it is a typical metal and hence would combine with a non- metal having an electronic configuration of 5,6 or 7 electrons in the outermost orbit .

(ii) 1:0.01 or 0.01:1 were some of the incorrect answers. Candidates failed to determine that Hydrogen was 1 mole (2g) and oxygen also was 1 mole (2x16 g) and hence the number of molecules would have to be equal in both.

(iii) Choices other than copper and tin. Candidates made random choices as the main metals in the alloys were not known or learnt.

(iv) Candidates either mentioned ions and molecules or only molecules as the choice of particles. Knowledge of basic particles in all the three : weak, strong and non-electrolytes was lacking.

(v) Many candidates chose the incorrect option of HCL turning blue litmus red. Although HCl does turn blue litmus solution red, the formation of fountain due to extreme solubility in water was ignored by many candidates.

Suggestions for teachers

(b) Insist on students writing down the electronic configuration to determine whether element is a metal/ nonmetal and also determine the valency. Advised use of a large no of examples as drill work.

- ✓ Train students to see a relation between mass and number of moles and match the ratio of moles to ratio of molecules.
- ✓ Students need to remember the main metals in the alloys (percentages not required) and their properties. Assist students by tabulating such details and conducting evaluation techniques such as Quizzes
- ✓ Point out to students that strength of electrolytes depends on the proportion of free ions and thus the difference in weak and strong electrolytes is in the proportion of ions and that ions recombine to form molecules in the case of weak electrolytes
- ✓ Ensure students understand the fact that a fountain is created as a result of drop in pressure due to the extreme solubility of the gas in water

c) Candiates made a general error in replacing

$Al(OH)_3$ by Al_2O_3

(i) Although the other products were correctly written, CuO was the wrong product.

(ii) Some candidates misrepresented the reactant as Na_2CO_3 instead of $NaHCO_3$ while some others wrote the product as H_2CO_3 instead of $H_2O + CO_2$, an often repeated error.

(iii) Either the acid chosen was HCl instead of H_2SO_4 or Na_2SO_3 was taken as Na_2S. Candidates failed to see the difference between sodium sulphite and sodium sulphide.

(iv) Reagent required was incorrectly written as alcoholic KOH/ NaOH or simply water. Some candidates wrote the wrong formula for ethyl chloride as well as for ethyl alcohol.

Suggestions for teachers

(c) Indicate the breakup of water as H – OH and then explain the combination of N of nitrides with H and the metal combining with hydroxyl ions to form the corresponding hydroxide and not oxide.

✓ Practical demonstration of such reactions and highlighting the important observations will help students in remembering the products. Using the blue solution of $Cu(NO_3)_2$ and heating it further to get black residue CuO, will bring clarity.

✓ Instruct students to read the questions carefully and draw students' attention to the fact that carbonates/ bicarbonates. react with acids to form $H_2O + CO_2$ (Brisk effervescence) along with the salt and not H_2CO_3.

✓ Ensure that there is no confusion among students between sulphide, sulphite and sulphate [S^{2-} , SO_3^{2-} , SO_4^{2-} respectively]. Also the fact that sulphites behave in manner similar to carbonates by releasing SO_2 on reacting with acids instead of CO_2

✓ Stress on the difference in the products formed when KOH is in the aqueous state and in the alcoholic state. The first is a substitution reaction while the other is an elimination reaction

(d)

(i) Instead of stating the observation, candidates either wrote the equation or named the product. Some candidates gave an incorrect observation of formation of reddish brown gas.

(ii) Candidates identified the compound instead of stating the formation of white precipitate.

(iii) Candidates mentioned formation of sugar charcoal or carbon without stating its appearance. Some of them described the observation as dehydration of sugar which was incorrect.

(iv) Observation of blue ppt. was incorrect as well as the formation of CO_2 as a product. Either the formation of bluish green solution or the evolution of brisk effervescence of gas that turns lime water milky was expected.

(v) SO_2 gas was identified without stating the test for the gas. Formation of Sulphur particles was mentioned without stating the colour. Some candidates gave wrong results for the tests of the gas evolved.

Suggestions for teachers

(d) Theory needs to be supplemented with practical demonstration so that students can recall observations easily.

- ✓ Students focused on the action of heat on $Pb(NO_3)_2$ whereas in reality it was $PbCl_2$ that was formed as a white ppt which dissolved on heating, forming a colourless solution.
- ✓ Draw the attention of students to the fact that identification of products and stating the observations are two different things.
  Acquaint the students to various observations using a number of chemical reactions.
- ✓ The observation of formation of black spongy mass will be retained for a long time if practically seen.
- ✓ Instruct students to state tests for identification of gases which are colourless and associate the term such as brisk effervescence with a gas such as CO_2
- ✓ This particular test of dil HCl with Na_2SO_3 and $Na_2S_2O_3$ must be shown to students.

(e)

(i) Most candidates answered this part correctly. Few gave the incorrect term ‘ electron affinity’

(ii) Candidates fared well in this part.

(iii) Candidates selected V_2O_5 or Fe instead of Nickel.

(iv) Errors committed were

(1) Substitution reactions

(2) Hydrogenation reaction

(3) Halogenation reaction

Addition reactions were left out.

(v) Few candidates referred to them as valency shell or valency electrons instead of valence electrons.

Suggestions for teachers

(e)

- ✓ Stress on the differences between the terms electronegativity and electron affinity and ensure clarity among students with suitable examples.
- ✓ Tabulate the various catalyzed reactions in organic chemistry and highlight the catalyst in each case for easy recap. Frequent testing would ensure students learn them correctly
- ✓ Exposure to a variety of questions on confusing terms or reactions will ensure clarity on the subject matter.
- ✓ Important terms in chemistry must be explained with suitable examples and similar sounding words need to be given added attention.
- ✓ Stress on the fact that gram molecular mass of a gas is the weight of 22.4l of that gas at stp.
- ✓ Students must see the association between 1 Mole ------ GMM ------- 22.4l at stp (volume only for a gas)

(f)

(i) Candidates ended up with wrong substitution or did not see the connection between gram molecular mass and molar volume of 22.4l at stp (for any gas)

(ii) Some candidates made errors in calculation of molecular masses. Some others calculated the weight of NO_2 when volume had to be calculated
Many candidates applied Gay Lussac's Law incorrectly referring to volume of calcium nitrate which was incorrect as it was a solid. Some others ignored the stoichiometry of the equation in their calculations.

(g) Many candidates related $Pb(NO_3)_2$ formation to precipitation instead of neutralization and the answer to $ZnCO_3$ formation thus went wrong as it involved precipitation. Some other candidates referred to neutralization in the case of $NaNO_3$ from NaOH instead of titration and hence the choice for formation of $Pb(NO_3)_2$ went wrong.

Suggestions for teachers

(f) Teachers need to spend enough time on the development of this concept and provide sufficient practice with a variety of numericals, that must include:

- ✓ The comparison of masses / volumes of substances that has to be done on the basis of the stoichiometry of the equations.
  Comparisons in terms of
  mass and mass
  or mass and volume
  or volume and volume
- ✓ Preferably establish a relation in terms of moles of substances on the basis of the stoichiometry of the equation, to begin with Students would then be guided to use GMM or molar volume as the case demands
- ✓ Draw the attention of students & emphasize the fact that Gay Lussac's law can be applied to chemical equations involving only gases.
- ✓ Students must see the association between 1 Mole ------ GMM ------- 22.4l at stp (volume only for a gas)

(g) Point out to students that precipitation method is suitable for insoluble salts such as Carbonates, Sulphates etc. and lead salts other than $Pb(NO_3)_2$. Highlight the fact that $Pb(NO_3)_2$ is the only lead salt that is soluble.

- ✓ Also, the fact that titration is the method for reaction between acid and alkali (both are solutions) forming soluble products.
- ✓ Demonstration of titration to students would set their minds clear.

(h) The following errors were made by candidates

(1) 2 propene or prop – 2 – ene

(2) but – 2 eyne or butyne

(3) ethanol or 2 – ethanol or ethanoic acid

(ii) Incorrect symbols used due to lack of understanding of the trends in periodic properties.

Suggestions for teachers

(h) Familiarize the students with the basic rules of IUPAC nomenclature, the selection of the longest chain and the manner of numbering of C atoms. Sufficient practice needs to be given both in naming as well as drawing the structures.

✓ Teachers must explain the basic difference in arrangement of shells and electrons both across a period and down a group.

✓ This will help in understanding how the pull of the nucleus on the valence electrons varies which in turn will give a better understanding of the trends in various periodic properties. Repeated testing using no. of varied examples will help in better understanding & recall.

MARKING SCHEME **Question 1.**	
(a)	(i) Reducing agents, donors (ii) high (iii) alkaline (iv) AgCl (v) hydrogenation
(b)	(i) A or 17 (ii) C or 1:1 (iii) D or Cu & tin (iv) B or mainly ions (v) C or HCl is highly soluble in water.
(c)	(i) $AlN + 3H_2O \rightarrow Al(OH)_3 + NH_3$ (ii) $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$ (iii) $NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$ (iv) $Na_2SO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + SO_2$ (v) $C_2H_5Cl + KOH(aq) \rightarrow C_2H_5OH + KCl$
(d)	(i) A white precipitate soluble on heating. (ii) A white ppt is formed which is insoluble in all the mineral acids (iii) Sugar chars to give black porous mass (iv) A colourless and odourless gas evolves with brisk effervescence which turns lime water milky. (v) Gas evolved which turns potassium dichromate paper from orange to green and yellow particles of Sulphur.
(e)	(i) Electronegativity (ii) Froth floatation (iii) Nickel (iv) Addition Reaction (v) Valence electrons
(f)	(i) 20 l of gas at STP have a mass of 32 g $\therefore$ 22.4 l of gas at STP would have a mass of $\frac{22.4 \times 32}{20}$ $\therefore$ gram molecular weight = 35.84 g. (ii) $2Ca(NO_3)_2 \longrightarrow 2CaO + 4NO_2 + O_2$

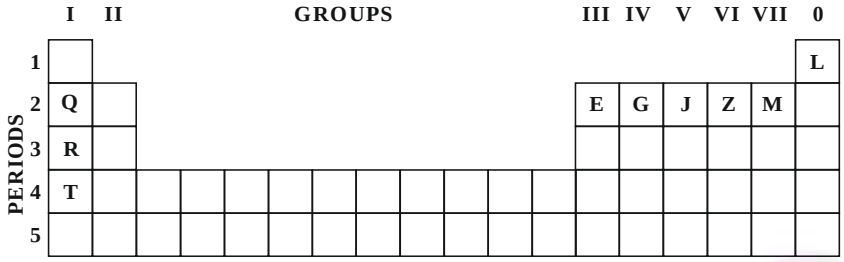
	1 mole of $Ca(NO_3)_2 \longrightarrow$ 1 mole of CaO i.e. (40+28+96)g $\longrightarrow$ (40+16)g $\therefore$ 82 g $\longrightarrow \frac{82\times56}{164}$ i.e. 28 g of CaO. 2 moles of $Ca(NO_3)_2 \longrightarrow$ 4 moles of NO_2 i.e. 2 x 164 g $\longrightarrow$ 4 x 22.4 l g NO_2 $\therefore$ 82 g $\longrightarrow \frac{82\times4\times22.4}{2\times164}$ i.e. 22.4 l g NO_2 at STP
(g)	(i) C or Neutralization (ii) A or Simple displacement (iii) E or synthesis (iv) B or Titration (v) D or Precipitation
(h)	(i) 1. Propene 2. but-2-yne 3. ethanal (ii) 1. < or less than 2. < or less than

SECTION II (40 Marks)

*Attempt **any four** questions from this Section*

Question 2

(a) Use the ***letters*** only written in the Periodic Table given below to answer the questions that follow: [4]



(i) State the number of ***valence electrons*** in atom **J**.

(ii) Which element shown forms ***ions*** with a single negative charge?

(iii) Which ***metallic element*** is more reactive than **R**?

(iv) Which element has its electrons arranged in ***four shells***?

(b) Fill in the blanks by selecting the correct word from the brackets: [2]

(i) If an element has a low ionization energy then it is likely to be _____ *(metallic / non metallic).*

(ii) If an element has seven electrons in its outermost shell then it is likely to have the _____ *(largest / smallest)* atomic size among all the elements in the same period.

(c) The following table shows the electronic configuration of the elements W, X, Y, Z:

Element	W	X	Y	Z
Electronic configurations	2,8,1	2,8,7	2,5	1

[2]

Answer the following questions based on the table above:

(i) What type of Bond is formed between: [2]

1. W and X
2. Y and Z

(ii) What is the formula of the compound formed between :

1. X and Z
2. W and X

Comments of Examiners

2 (a)

(i) Valence electrons were confused with valency
(ii) Some candidates identified the element and did not choose the letter mentioned in the table in spite of clear instructions given Few candidates picked up an element from group I instead of Group VII .
(iii) Most candidates fared well in this part few wrote 'Q' instead of 'T'
(iv) Most answered correctly.

(b)

(i) The term Non-metallic was the incorrect answer of some candidates
(ii) Some candidates wrote largest instead of smallest

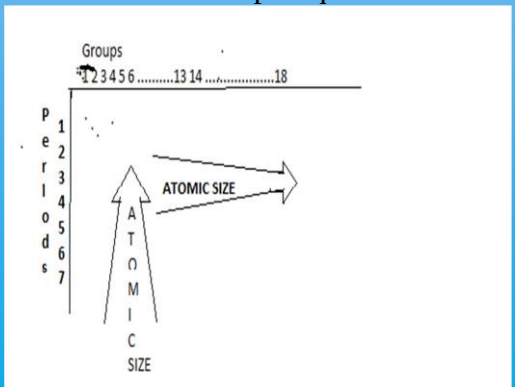
Suggestions for teachers

(a)

- ✓ Emphasize on the fact that valence electrons need not be equal to valency and that valency is the number of electrons needed to be gained or lost to attain stability.
- ✓ Valence electrons correspond to number of electrons in the outermost shell.
- ✓ Ensure students relate the valence electrons to the group to which the element belongs. Then identifying the charge on the ion will not be difficult.
- ✓ Regular exercises in the application of the knowledge of trends in periodic properties in the periodic table, must be carried out.
- ✓ Period number = outer most shell number must be impressed upon the students.

(b)

- ✓ Emphasize the fact that metals have tendency to loose electrons as they have 1,2 or 3 electrons in the outermost shell and hence require less energy to do so. Thus their ionisation energy is less than that of non-metals.
- ✓ Charts with pictorial representation of the trends, such as the one shown below would help in quick recall.



(c) (i) Most candidates answered this part correctly, some interchanged the type of bond in 1 and 2.
(ii) Candidates gave the incorrect answers in the following:
1. XZ or identified the compound or wrote HCl
2. XW or NaCl

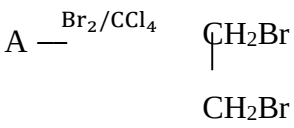
Suggestions for teachers

(c) Stress on the fact that metals are characterized by 1,2,or 3 electrons in the outermost shell whereas non-metals have 4,5,6 or 7 in the outermost shell
- ✓ Essentially bond between metal and non-metal is electrovalent/ ionic and that between 2 non-metals is covalent in nature.+
- ✓ Insist on writing the metal atom or positive ion first in the formula.
- ✓ Train students to use the letters given in the question and avoid identifying them unless asked to do so.

MARKING SCHEME

Question 2.

(a)	(i) five (ii) M (iii) T (iv) T
(b)	(i) metallic (ii) smallest
(c)	(i) 1. electrovalent bond or Ionic Bond 2. Covalent Bond (ii) 1. ZX 2. WX

Question 3		
(a)	Write a ***balanced chemical equation*** for each of the following: (i) Burning of ethane in plentiful supply of air. (ii) Action of water on Calcium carbide. (iii) Heating of Ethanol at 170°C in the presence of conc. Sulphuric acid.	[3]
(b)	Give the structural formulae of each of the following (i) 2-methyl propane (ii) Ethanoic acid (iii) Butan – 2 – ol	[3]
(c)	Equation for the reaction when **compound A** is bubbled through *bromine* dissolved in *carbon tetrachloride* is as follows:  (i) Draw the structure of A. (ii) State your observation during this reaction.	[2]
(d)	Fill in the blanks using the appropriate words given below**:** *(Sulphur dioxide, Nitrogen dioxide, Nitric oxide, Sulphuric acid)* (i) Cold, dilute nitric acid reacts with copper to give _____. (ii) Hot, concentrated nitric acid reacts with sulphur to form _____.	[2]

Comments of Examiners

3 (a)

(i) Candidates either wrote the incorrect formula for ethane or did not balance the equation correctly
(ii) The triple bond was not correctly placed between the C atoms
Or the product $Ca(OH)_2$ was replaced by CaO

(iii) The product stated was $C_2H_5HSO_4$ instead of C_2H_4

(b)(i) Some of the errors made by candidates was giving the condensed formula for methyl (CH_3) group or all the valences of C not were satisfied as only the skeletal chain with the substituent was drawn.

(ii) Either the functional group was confused with the aldehydic group

OR The condensed form - COOH was written, which was not acceptable.

(iii) Errors made were either
(1) 3 carbon atoms instead of 4
Or (2) – OH group attached to C numbered 1
Or (3) Double bond between C and H
of – OH groups.

(c) (i) The moleculer formula was given instead of structural formula, ie C_2H_4
Or incorrect formula ie $CH_2 = CH_2$ instead of $H_2C = CH_2$ or occasionally ethane was the incorrect answer.

(ii) Most candidates answered this part well.
(d) (i) Many candidates selected NO_2 instead of NO.

(ii) Many wrote SO_2 as the product instead of NO_2 / H_2SO_4

Suggestions for teachers

(a) Burning of hydrocarbons in plentiful supply of air produces CO_2 and H_2O Insist on balancing of equations at all times.
✓ Insist on double / triple bond shown between adjacent C atoms and make the students aware of the common errors of students while writing this particular equation.
✓ Besides learning all the equations with the conditions, students must also understand the role of the substances added / used other than the reactants especially the role of conc. H_2SO_4 as a dehydrating agent.
(b) Train students to draw structural formula, avoiding condensed formula and also ensure all the valencies of all the C atoms are satisfied.
✓ Familiarize students with the various functional groups along with the associated names and reinforce this knowledge with a number of examples, for practice / drill work.
✓ Teachers must draw the attention of students to the possible errors that they could make while drawing the structural formulae.
(c) Frequent testing will assist students in avoiding often repeated errors.
✓ Teachers need to point out to students, the variation in the products formed as the conditions vary.
(d) Prepare a chart of reactions wherein the products differ with the same reactants, but when conditions change.
✓ Explain the process of oxidation by HNO_3 using stepwise reactions.

MARKING SCHEME

Question 3.

(a)

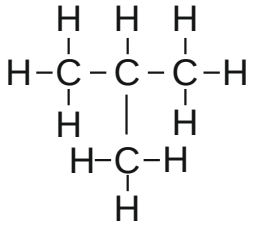
(i) $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

(ii) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$ or H-C = C-H

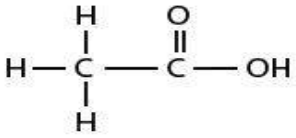
(iii) $C_2H_5OH \xrightarrow[170^o]{Conc.H_2SO_4} C_2H_4 + H_2O$

(b)

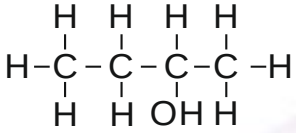
(i)



(ii)

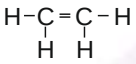


(iii)



(c)

(i)



(ii) Bromine solution is decolourised.

(d)

(i) Nitric oxide

(iii) Sulphuric acid

Question 4

(a) Identify the ***gas evolved*** and give the ***chemical test*** in each of the following cases: [2]

(i) Dilute hydrochloric acid reacts with sodium sulphite.

(ii) Dilute hydrochloric acid reacts with iron (II) sulphide.

(b) State your observations when *ammonium hydroxide solution is added drop by drop and then in excess* to each of the following solutions: [2]

(i) copper sulphate solution

(ii) zinc sulphate solution.

(c) Write equations for the ***reactions taking place at the two electrodes*** (mentioning clearly the name of the electrode) during the electrolysis of: [4]

(i) Acidified copper sulphate solution with copper electrodes.

(ii) Molten lead bromide with inert electrodes.

(d) (i) Name the ***product formed*** at the ***anode*** during the electrolysis of acidified water using platinum electrodes. [2]

(ii) Name the ***metallic ions*** that should be present in the electrolyte when an article made of copper is to be electroplated with silver.

Comments of Examiners

Q.4
a.(i) Errors such as :
H_2S incorrectly identified or
Equation written without highlighting the gas. Or
Physical test such as smell instead of chemical test or the word paper / solution not specified when $K_2Cr_2O_7$ / $KMnO_4$ was used for testing.

(ii) Few candidates wrote H_2 or SO_2 instead of H_2S. Most answered this part correctly.
(b)(i)Candidates either forgot to state the colour of the ppt. or gave the result as ink blue ppt. formation or did not state the final result of formation of ink blue solution.
(ii) Some students had doubts about the solubility of the precipitate.

Suggestions for teachers

- ✓ Ensure students do not get confused between sulphide and sulphite.
- ✓ The result of various tests conducted during practical work must be enumerated by the students independently.
- ✓ Make students aware that the smell of H_2S or any gas can be used as a test if chemical test is not mentioned in the question.
- ✓ Lead acetate solution / paper turning black was the correct test.
- ✓ Students must be trained during practical work to use the right terms and present their observations in a tabulated form with the reagent used drop by drop and then in excess.

(c) (1) Most students failed to name the electrodes before the reactions.

2) Anode reaction wrongly written as
$4OH^- \longrightarrow 2H_2O+O_2+4e^-$ instead of $Cu \longrightarrow Cu^{2+} + 2e^-$

3) Cathode reaction wrongly written as
$Cu+2e^- \longrightarrow Cu^{2+}$

(iii)Most candidates answered correctly some got confused between the electrode and the reaction. Some left the product Bromine in the atomic state.

(d) (i) Instead of naming the product O_2, the equation was given ending in OH formation or the product incorrectly identified as H_2 or water.

(ii) Several other ions, other than Ag^+ or wrong symbol Ag^{2+}

Suggestions for teachers

(c) Teachers need to impress upon students that cations are attracted to be cathode and gain e's to form neutral atoms

- ✓ Anions go to the anode and lose e's to form neutral atoms.
- ✓ Name of electrode must precede reaction.
- ✓ Regular practice in writing electrode reactions is a must.
- ✓ Teachers must ensure that students learn the requirements of electroplating in terms of electrolyte, ions, electrodes and the corresponding reactions.
- ✓ Use of audiovisuals recommended.

MARKING SCHEME **Question 4.**	
(a)	(i) The gas evolved turns orange potassium dichromate paper green. (ii) The gas evolved turns moist lead acetate paper silvery black.
(b)	On adding NH_4OH solution, the $CuSO_4$ solution first forms a pale blue ppt dissolving in excess to form an ink blue solution. With zinc sulphate solution, NH_4OH solution first forms a gelatinous white ppt which dissolves in excess to form a colourless solution.
(c)	(i) At cathode $Cu^{+2}+2e \rightarrow Cu$ Reduction At anode $Cu-2e \rightarrow Cu^{+2}$ oxidation (ii) At cathode $Pb^{+2}+2e \rightarrow Pb$ Reduction At anode $2Br^- - 2e \rightarrow Br_2$
(d)	(i) H_2 or Hydrogen (ii) Ag^+ or silver ions.

Question 5

(a) A gas cylinder contains 12 x 10^{24} molecules of oxygen gas. [2]

If Avogadro's number is 6x10^{23}; Calculate:

(i) the mass of oxygen present in the cylinder.

(ii) the volume of oxygen at S.T.P. present in the cylinder. [O=16]

(b) A gaseous hydrocarbon contains 82.76% of carbon. Given that its vapour density is 29, find its ***molecular formula***. [C=12, H=1] [3]

(c) The equation $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$, represents the catalytic oxidation of ammonia. If 100 cm^3 of ammonia is used calculate the ***volume of oxygen required*** to oxidise the ammonia completely. [3]

(d) By drawing an *electron dot diagram* show the formation of ***Ammonium Ion*** [Atomic No.: N = 7 and H = 1] [2]

Comments of Examiners

Q.No.5

(a)

(i) Gram molecular mass (GMM) wrongly substituted as 16 instead of 32.

(ii) Candidates failed to take into consideration the actual number of molecules or moles and gave the answer as 22.4 l

(b) Simplest ratio worked out to 1:2.5 and candidates rounded off this ratio to 1:2 or 1:3, instead of multiplying the ratio by 2 to make it 2:5

(c) Most fared well in this part.

(d) Some of the errors made by the candidates were as follows:

The two particles ie NH_3 and H^+, used in the formation of NH_4^+ were not shown.

Co-ordinate bond was not shown or the charge on the ammonium ion was missing

Suggestions for teachers

- ✓ Emphasize that GMM corresponds to the MOLAR MASS OR TO Avogadro's number of molecules.
- ✓ Such numericals can be solved using simple unitary method
- ✓ Emphasize the point that in calculating the simplest ratio, rounding off to the nearest whole no. is essential but when one of quantities ends in 0.5 multiplying throughout by 2 takes care of rounding off.
- ✓ Draw the attention of students to the following:
  - (1) Presence of Ammonia molecule and H^+ ion as reactants using electron dot diagram
  - (2) Electron dot diagram of ammonium ion with the co-ordinate bond and the overall + charge on the particle.

MARKING SCHEME

Question 5.

(a)

(i) $6x10^{23}$ molecules of O_2 have a mass of 32g

$\therefore$ $12x10^{24}$ molecules of O_2 have a mass of $32x12x10^{24}/ 6x10^{23}$

= 640g.

(ii) No. of moles of O_2 = $12 \times 10^{24} / 6 \times 10^{23} = 20$

$\therefore$ Volume of O_2 at S.T.P. = $20 \times 22.4 = 448$ l

Hence volume of 640g at s.t.p. = 22.4x640/32= 448l.

(b)

Element	% comp.	Atomic Wt.	R.N.A.	S.R	
C	82.76	12	6.89	1	2
H	17.24	1	17.24	2.5	5

E.F. = C_2H_5.

$$n = \frac{M.wt}{EF\ wt} = \frac{2 \times 29}{(24+5)} = 2$$

$\therefore$ Molecular Formula = C_4H_{10}.

(c)

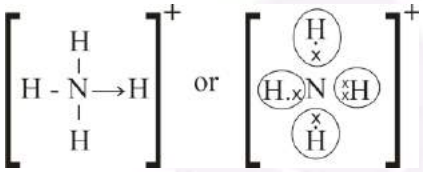
$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

4 vol + 5 vol $\rightarrow$ 4 vol

$\therefore$ 100 cm3 of ammonia requires $\frac{100 \times 5}{4} = 125$ cm3

(d)

$NH_3 + H^+ \rightarrow NH_4^+$



Question 6

(a) ***Name the gas*** evolved when the following mixtures are heated: [2]

(i) Calcium hydroxide and Ammonium Chloride

(ii) Sodium Nitrite and Ammonium Chloride

(b) Write ***balanced chemical equations*** for each of the following: [2]

(i) When excess of ammonia is treated with chlorine.

(ii) An equation to illustrate the reducing nature of ammonia.

(c) A, B, C and D summarize the properties of ***sulphuric acid*** depending on whether it is **dilute** or **concentrated**. [3]

A = Typical acid property

B = Non volatile acid

C = Oxidizing agent

D = Dehydrating agent

Choose the property (A, B, C or D) depending on which is relevant to each of the following:

(i) Preparation of Hydrogen chloride gas.

(ii) Preparation of Copper sulphate from copper oxide.

(iii) Action of conc. Sulphuric acid on Sulphur.

(d) Give ***reasons*** why: [3]

(i) Sodium Chloride will *conduct electricity* only in fused or aqueous solution state.

(ii) In the electroplating of an article with silver, the electrolyte sodium argento cyanide solution is preferred over silver nitrate solution.

(iii) Although copper is a good conductor of electricity, it is a non-electrolyte.

Comments of Examiners

Q.6

(a)

(i) Correctly answered by most candidates.

(ii) Very few candidates attempted this question correctly. Many candidates identified the gas as ammonia instead of nitrogen gas.

(b)

(i) Students ignored the word excess NH_3 and wrote

$2NH_3 + 3Cl_2 \rightarrow N_2 + 6HCl$

Hence products were incorrect or Cl_2 was represented in the atomic state as 6Cl

(ii) Instead of illustrating the reducing nature of NH_3, candidates indicated either basic nature of NH3 with the equation $NH_3 + HCl \rightarrow NH_4Cl$ or

Alkali formation with ammonia as

$NH_3 + H_2O \rightarrow NH_4OH$

Some candidates wrote the correct equation but failed to balance it

(c)

(i) H_2SO_4 chosen as a typical acid or as an oxidising agent instead of its behaviour as a non – volatile acid.

(ii) Candidates suggested the property of H_2SO_4 as a dehydrating agent / oxidising agent instead of its acidic nature.

(iii) Many candidates erred by stating Dehydrating property / typical acid property instead of its oxidising property.

(d)

(i) Absence of ions in solid NaCl was the single most incorrect answer

(ii) Sodium argentocyanide being cheaper and easily available was the incorrect answer in some cases.

(iii) The common error committed by candidates was that coper cannot conduct electricity in molten or aqueous state due to absence of ions.

Suggestions for teacher

(a) Explain the reaction in stages. $NaNO_2$ reacts with NH_4Cl to from NH_4NO_2 which decomposes forming N_2 gas

(b) Point out to students that if ammonia has to show reducing nature, it must get oxidized to N_2 (removal of H) and this is possible with CuO. Cuo is reduced to Cu

(c) HCl is a volatile acid and hence to avoid contamination with substances such as moisture Conc. H_2SO_4 is used as a non- volatile acid

✓ The reaction is essentially neutralization of a basic oxide with H_2SO_4 and hence its typical acid property

✓ S being an element cannot undergo dehydration. S is neither acidic nor basic and hence cannot undergo neutralization. But S can get oxidized to SO_2 and this happens due to oxidizing nature of H_2SO_4.

(d) Stress on the fact that presence of charge carriers (free ions) necessary for conduction of electricity through liquids.

✓ Melting or dissolving NaCl in water sets the already existing ions in the solid state free.

✓ Students need to understand the importance of sodium argentocyanide solution undergoing a slow process of electrolysis thereby producing an even and smooth deposit of silver which does not happen in the case of $AgNO_3$ solution.

✓ Students need to know that ions do exist in copper but are not free to move and it conducts electricity due to the presence of free electrons, being a metal, but to be termed as an electrolyte it must conduct electricity by movement of ions.

MARKING SCHEME **Question 6.**	
(a)	(i) Ammonia (ii) Nitrogen
(b)	(i) $8NH_3 + 3Cl_2 \rightarrow 6NH_4Cl + N_2$ (ii) $2NH_3 + 3CuO \rightarrow 3Cu + 3H_2O + N_2$
(c)	(i) B or non-volatile acid. (ii) A or typical acid property. (iii) C or oxidizing property / agent.
(d)	(i) Na^+ and Cl^- ions become mobile only on melting or dissolving it in water and only then can NaCl conduct electricity. (ii) Addition of sodium argento cyanide helps in getting a uniform and smooth deposit of silver. With silver nitrate alone, the process is rapid and the deposit is uneven. (iii) An electrolyte must have free ions which act as charge carriers whereas in copper the free electrons act as charge carriers.

Question 7

(a) (i) Name the ***solution*** used to react with **Bauxite** as a first step in obtaining pure aluminum oxide, in the Baeyer's process. [5]

(ii) ***Write the equation*** for the reaction where the aluminum oxide for the electrolytic extraction of aluminum is obtained by heating aluminum hydroxide.

(iii) Name the ***compound*** added to pure alumina to lower the fusion temperature during the electrolytic reduction of alumina.

(iv) ***Write the equation*** for the reaction that occurs at the cathode during the extraction of aluminum by electrolysis.

(v) Explain why it is preferable to use a number of graphite electrodes as anode instead of a single electrode, during the above electrolysis.

(b) ***State*** what would you ***observe*** when: [2]

(i) Washing Soda Crystals are exposed to the atmosphere.

(ii) The salt ferric chloride is exposed to the atmosphere.

(c) Identify the ***cations*** in each of the following case: [3]

(i) NaOH solution when added to the Solution (A) gives a reddish brown precipitate.

(ii) NH_4OH Solution when added to the Solution (B) gives white ppt which does not dissolve in excess.

(iii) NaOH Solution when added to Solution (C) gives white ppt which is insoluble in excess.

Comments of Examiners

7 (a)

(i) Most candidates wrote the correct answer few of them suggested molten cryolite.

(ii) Equation though correct, not balanced correctly by many candidates.

(iii) Fluorspar instead of cryolite was the incorrect answer written by many candidates.

(iv) Candidates gave incorrect equations such as

$2Al^{3+} + 6e \longrightarrow Al$

Or

$Al^{3+} - 3e \longrightarrow Al$

(v) To get more aluminium by increasing the surface area of the anode was the occasional wong answer.

(b)

(i) Candidates erred by stating loss of water of crystallisation. Some suggested it acsorbs water molecules from the atmosphere and turns into a solution.

Some others referred to it as a deliquescent substance.

(ii) Some stated the observation to be its absorption of water molecules from the atmosphere when exposed or lossing its water of crystallisation.

The change in state of the solid was not mentioned

(c)

(i) Name of the salt instead of the cation

Or

Cation with an incorrect charge were the errors made by candidates.

(ii) Ca^{2+} or Zn^{2+} or Pb or $PbCl_2$ were some of the comman errors.

(iii) Calcium sulphate or Ca or Pb^{2+} were some of the incorrect answers

Suggestions for teachers

(a) Explain to students that $Al_2O_3.2H_2O$ (Bauxite) is amphoteric in nature and so can react with NaOH to form $NaAlO_2$, leaving behind the basic impurities which can be removed.

✓ Regular testing and written practice required.

✓ Role of each component of the electrolyte in the extraction of aluminum, must be discussed in detail.

✓ When writing ionic equations, besides ensuring number of atoms of each kind are the same, the total charge on both sides of equation must be the same.

✓ Explain the fact that although C electrodes are inert, the temperature at which [O] is formed, it reacts with the carbon anode forming CO_2. Thereby consuming it. To ensure continuity of process, a number of rods of Carbon are used.

(b) Expose the students to such experiments and they can see it turning into a white amorphous substance / powder from its crystalline state

✓ Put some ferric chloride in a watch glass and leave it for children to observe. They will realise at once that visible factor / observation is its turning into a solution.

(c) Theory to be supplemented by practical work and results presented in a tabulated form by students.

✓ Ca^{2+} ion which forms $Ca(OH)_2$ with NaOH does not dissolve as it is basic but $2n(OH)_2$ and $Pb(OH)_2$ which form white form white ppt. dissolve in NaOH as they are amphoteric in nature.

MARKING SCHEME **Question 7.**	
(a)	(i) NaOH or sodium hydroxide solution (ii) $2Al(OH)_3 \xrightarrow[1100℃]{\Delta} Al_2O_3 + 3H_2O$ (iii) Cryolite (iv) $Al^{3+} + 3e' \rightarrow Al$ (v) The anode is consumed as the oxygen formed at it reacts with the anode and hence large no. of electrodes ensures continuity of process.
(b)	(i) Washing soda crystals when exposed to atmosphere lose their water of crystalisation partially and crumble to form a powder. (ii) Ferric chloride absorbs moisture when exposed to atmosphere and forms a solution dissolving in the absorbed moisture.
(c)	(i) Fe^{+3} (ii) Pb^{2+} (iii) Ca^{2+}

Topics / Concepts found Difficult:

- Numericals based on mole concept and Gay Lussac's Law.
- Observations for different reactions.
- IUPAC names and structures of organic compounds.
- Specific terms in Periodic table and organic chemistry.
- Balancing of equations.
- Oxidising and reducing agents.
- Hydration and hydrogenation.
- Solubility of precipitates in excess NaOH and excess NH_4OH.
- Neutralisation and titration.
- Relation between Gram molecular mass and molar volume
- Deliquescence and efflorescence.
- Ionic Reactions at electrodes.
- Formulae of compounds when electronic configurations were given.
- Observations when reactants are same but conditions vary.
- Trends in the properties of elements across a period and down a group.

Suggestions for students:

- Key words to be highlighted.
- Bonds should be drawn correctly in structural formulae.
- While learning the equations conditions must be kept in mind too.
- Understand ionic equations and place the electrons on the correct side so that total charge on both sides of equations tally.
- While learning important reactions of sulphuric acid, correctly associate the role of the acid.
- In metallurgy understand the role of the various substances and electrode materials used.
- Confusing terms must be given additional time to avoid errors.
- Solve the earlier Board papers to understand the pattern of questions.