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ICSE YEAR 2013
CHEMISTRY
(SCIENCE - PAPER 2)

- **SOLUTION OF 2013**
- **COMMENTS OF COUNCIL EXAMINERS**
- **SUGGESTIONS FOR TEACHERS**

Dedicated to all my lovely students. May God help you always.

This small booklet contains solution of 2013 ICSE Chemistry (Science Paper 2). The comments from the council examiners under solution of every question makes this a very handy guide for students to understand what the council expects as answer from the students.

I hope that the students will find this to be useful.

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23rd February, 2015

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CHEMISTRY
SCIENCE Paper - 2

Question 1

(a) From the list given below, select the word(s) required to correctly complete blanks (i) to (v) in the following passage. The words from the list are to be used only once. Write the answers as (a) (i), (ii), (iii) and so on. Do not copy the passage.

[ammonia, ammonium, carbonate, carbon dioxide, hydrogen, hydronium, hydroxide, precipitate, salt, water]:

(i) A solution **M** turns blue litmus red, so it must contain (i) _____ions; another solution **O** turns red litmus blue and hence, must contain (ii) _____ ions.

(ii) When solutions **M** and **O** are mixed together, the products will be (iii) _____ and (iv) _____.

(iii) If a piece of magnesium was put into a solution M, (v) _____ gas would be evolved. [5]

(b) Identify the gas evolved in the following reactions when:

(i) sodium propionate is heated with soda lime.

(ii) potassium sulphite is treated with dilute hydrochloric acid.

(iii) Sulphur is treated with concentrated nitric acid.

(iv) a few crystals of KNO_3 are heated in a hard glass test tube.

(v) concentrated hydrochloric acid is made to react with manganese dioxide. [5]

(c) State *one* appropriate observation for each of the following:

(i) Concentrated sulphuric acid is added drop wise to a crystal of hydrated copper sulphate.

(ii) Copper sulphide is treated with dilute hydrochloric acid.

(iii) Excess of chlorine gas is reacted with ammonia gas.

(iv) A few drops of dilute hydrochloric acid are added to silver nitrate solution, followed by addition of ammonium hydroxide solution.

(v) Electricity is passed through molten lead bromide. [5]

(d) Give suitable chemical terms for the following:

(i) A bond formed by a shared pair of electrons with both electrons coming from the same atom.

(ii) A salt formed by incomplete neutralisation of an acid by a base.

(iii) A reaction in which hydrogen of an alkane is replaced by a halogen.

(iv) A definite number of water molecules bound to some salts.

(v) The process in which a substance absorbs moisture from the atmospheric air to become moist, and ultimately dissolves in the absorbed water. [5]

(e) Give a chemical test to distinguish between the following pairs of compounds:

(i) Sodium chloride solution and sodium nitrate solution.

(ii) Hydrogen chloride gas and hydrogen sulphide gas.

(iii) Ethene gas and ethane gas.

(iv) Calcium nitrate solution and zinc nitrate solution.

(v) Carbon dioxide gas and sulphur dioxide gas. [5]

(f) Choose the most appropriate answer from the following options:

(i) Among the period 2 elements, the element which has high electron affinity is

(A) Lithium
(B) Carbon
(C) Chlorine
(D) Fluorine

(ii) Among the following compounds identify the compound that has all three bonds (ionic, covalent and coordinate bond).

(A) Ammonia
(B) Ammonium chloride
(C) Sodium hydroxide
(D) Calcium chloride.

(iii) Identify the statement that is incorrect about alkanes:

(A) They are hydrocarbons.
(B) There is a single covalent bond between carbon and hydrogen
(C) They can undergo both substitution as well as addition reactions
(D) On complete combustion they produce carbon dioxide and water.

(iv) Which of these will act as a non-electrolyte?

(A) Liquid carbon tetrachloride
(B) Acetic acid
(C) Sodium hydroxide aqueous solution acid
(D) Potassium chloride aqueous solution.

(v) Which one of the following will not produce an acid when made to react with water?

(A) Carbon monoxide
(B) Carbon dioxide
(C) Nitrogen dioxide
(D) Sulphur trioxide.

(vi) Identify the metallic oxide which is amphoteric in nature:

(A) Calcium oxide
(B) Barium oxide
(C) Zinc oxide
(D) Copper(II)oxide. [5]

(vii) In the given equation identify the role played by concentrated sulphuric acid

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

(A) Non-volatile acid
(B) Oxidising agent
(C) Dehydrating agent
(D) None of the above.

(viii) Nitrogen gas can be obtained by heating:

(A) Ammonium nitrate.
(B) Ammonium nitrite.
(C) Magnesium nitride.
(D) Ammonium chloride.

(ix) Which of the following is not a typical property of an ionic compound?

(A) High melting point.
(B) Conducts electricity in the molten and in the aqueous solution state.
(C) They are insoluble in water.
(D) They exist as oppositely charged ions even in the solid state.

(x) The metals zinc and tin are present in the alloy:

(A) Solder.

(B) Brass.

(C) Bronze.

(D) Duralumin. [10]

(g) Solve the following:

(i) What volume of oxygen is required to burn completely 90 dm^3 of butane under similar conditions of temperature and pressure?

$2C_4O_{10} + 13O_2 \longrightarrow 8CO_2 + 10\ H_2O$ [2]

(ii) The vapour density of a gas is 8. What would be the volume occupied by 24.0 g of the gas at STP? [2]

(iii) A vessel contains **X** number of molecules of hydrogen gas at a certain temperature and pressure. How many molecules of nitrogen gas would be present in the same vessel under the same conditions of temperature and pressure? [1]

Examiners' Comments

(a) (i) Most candidates answered this part correctly. However some listed hydrogen instead of hydronium and hence could not use this option for (v) as it could be used only once Errors were also made by interchanging the two words in blanks (i) and (ii).

(ii) The products salt and water were confused with type of ions formed. Hence wrong representation was made with ammonium or carbonate ions by some candidates.

(iii) Most candidates answered this Part correctly. A few mentioned ammonia or CO_2 gas showing guess work.

(b)(i) The following errors were observed :

1. Gas evolved was wrongly listed as methane or sulphur dioxide or carbon dioxide.
2. Candidates mechanically stated the equation and failed to highlight or identify the gas in it.
3. Some wrote the formula of the reactant wrong.
4. Some candidates failed to recollect the name of the gas evolved.

Suggestions for teachers

- Insist on students reading instructions carefully. Confusion about the colour changes with litmus and acid or alkali indicates insufficient lab experience.
- Certain organic equations need to be taught using structural formulae as this helps in understanding how products are formed
- Ensure students are well versed with the IUPAC and trivial nomenclature of organic compounds.
- Stress on the general equations of acids so as to be able to differentiate between similar sounding compounds.
- Ensure students know the variation in products as concentration of HNO_3 differs and also adequate practice needs to be given in writing correctly balanced equations.

(ii) Some candidates had wrongly identified the gas as H_2S instead of SO_2 that indicated there was confusion between Potassium Sulphite and potassium sulphide.

(iii) Keeping in mind the oxidizing nature of HNO_3 candidates suggested the formation of SO_2 instead of NO_2.

(iv) Many candidates wrote NO_2 instead of O_2.

(iv) Some candidates recorded the gas as greenish yellowish gas instead of Chlorine.

(c)(i) Candidates wrote incomplete observations. If the focus was on colour then the change from blue to white (not colourless as it does not apply to solids) was expected to be mentioned. If the focus was placed on state then crystalline state to amorphous or powder form would have made the answer complete.

(ii) Most candidates answered this part correctly. Some identified the gas instead of stating its characteristic smell while others failed to record the smell correctly and called it pungent smelling.

(iii) Most candidates failed to specify the colour or state of the product and named the product instead..

(iv) White precipitate was incorrectly replaced by gelatinous by some, others failed to record the solubility of the white ppt in NH_4OH.

(v) Some candidates mentioned the ions formed at the electrode instead of naming the products Lead and Bromine. Some did not match the observation with the electrode correctly or the colour stated of Bromine or Lead was incorrect.

(d) (i) Most candidates answered correctly but some mentioned covalent bond and others stated electrovalent bond.

(ii) Most candidates answered this part correctly but few made an error of calling it a basic salt.

(iii) Majority of candidates answered this part correctly, however a few addressed it as a replacement reaction or addition reaction while others referred to it as dehydrohalogenation.

(iv) The term water of crystallization was incorrectly referred to as hydrated crystals.

(v) Some candidates incorrectly answered as

Suggestions for teachers

- Attention needs to be focused on the grouping of nitrates into those of very reactive metals, the reactive ones and the least reactive ones and how the products vary on heating them. Theory needs to be supplemented with practical work so that the essential differences can be noted by students.
- Avoid rote memorizing by students, by explaining how the oxidation of HCl by the oxidizing agents takes place.
- Students must be instructed to specify the change that can be observed from initial stage to final and not just the end result.
- Adequate practical work if carried out, will surely go a long way in helping students recall observations.
- Instructions, guiding students while making observations during practical work, need to be repeated.
- During practical work emphasize on the colour of the precipitates formed and their solubility or non solubility in specific reagents.
- Stress on the fact that ions are an essential component of an electrolyte and on passing electricity these get discharged at the respective electrodes forming different products. While explaining this also highlight on the colour or form of the products formed.
- Illustrate the difference between covalent and coordinate bond by explaining the lone pair effect.
- Students could maintain a glossary of chemical terms and their meanings along with a list of examples for each.
- Highlight the difference in the behavior of saturated and unsaturated organic compounds clearly so that the concept of substitution and addition reactions is well understood.

efflorescent or Hygroscopic.

(e) (i) Common errors that was repeated among all the sub parts was that even if the reagent was correctly chosen the result with both the substances under consideration was not specified.
The reagent, conc. H_2SO_4, was incorrectly chosen by many candidates.

(ii) Most candidates differentiated on the basis of smell and did not fulfil the requirement of chemical test. Some suggested blue litmus turning red for HCl and the other way round for H_2S. A few candidates did not use the same reagent for both gases.

(iii) Most candidates brought out the difference on the basis of bonds present i.e double bond and single bonds and did not give a chemical test to distinguish. Some other candidates specified the kind of reactions shown by both i.e addition and substitution reactions respectively or the type of compounds as being unsaturated and saturated.

(iv) Candidates used NaOH as the distinguishing reagent and stated the colour of the ppt with each solution but failed to specify the solubilities of the ppt in the reagent.
Most candidates were unaware that $Ca(NO_3)_2$ solution does not form ppt with NH_4OH.

(v) Most candidates did not associate the word solution / paper / acidified with $K_2Cr_2O_7$ or $KMnO_4$.
Some used lime water test which was answered by both gases

(f) (i) Chlorine and lithium were the occasional wrong answers.

(ii) Most candidates answered correctly. A few candidates chose Ammonia as the correct options.

(iii) Most candidates answered correctly.

(iv) Some candidates wrote acetic acid.

(v) Most candidates answered correctly.

(vi) Oxide chosen at random.

(vii) Some candidates incorrectly answered

Suggestions for teachers

- Ensure students have clarity regarding the different terms by supplying variety of compounds and asking to classify them into those that show the properties and those that do not.
- Train students to state the result of the test, with both substances, besides mentioning the choice of reagent. Students need to be given adequate practice in distinguishing substances and teachers could assist students by enumerating the results in a tabular form.
- Written practice in differentiating substances must be given from time to time. Students should be trained to respond correctly to the instructions given.
- Adequate practical work would take care of these type of questions.
- Emphasize on certain key words when carrying out the practical work or during explanations.
- Students need to remember the 1st 20 elements.
- Ensure students understand the concept of bonding with relevant examples.
- Develop an understanding of the types of electrolytes by incorporating a large number of examples.
- Ensure students have knowledge of the existence of various types of oxides and know the criteria to classify them.
- Enumerate these reactions in a tabular form with the associated properties after explaining the various roles of sulphuric acid.
- Regular objective tests will help in retention.
- A comparative study of the properties of ionic and covalent compounds is essential.
- Thorough revision on the main constituents of alloys and the change in properties brought about by alloying.
- Students must be clear about the basic concepts so that understanding relation between mole, molar mass and molar volume is possible.

this part as a dehydrating agent.

(viii) Most candidates correctly answered. A few however incorrectly answered as Ammonium nitrate.

(ix) Most candidates answered this part correctly. Occasional errors showed a lack of understanding of the properties of ionic compounds.

(x) There was confusion between the components of brass and bronze.

(g) (i) Candidates failed to calculate the gram molecular weight correctly.

(ii) Knowledge of gram molecular volume was missing.

(iii) Most candidates answered this part correctly. Some suggested 6.023×10^{23} molecules of N2 or multiplied X by 6.023×10^{23} molecules.

– Adequate practice in application of Avogadro's law after explaining it and pointing out the variations from Gay Lussacs law.

MARKING SCHEME

Question 1

a) Each correct answer carries
   (i) hydronium ions
   (ii) hydroxide ions
   (iii) salt
   (iv) water
   (v) hydrogen

b) Each correct answer carries
   (i) Ethane
   (ii) Sulphur dioxide
   (iii) Nitrogen dioxide
   (iv) Oxygen
   (v) Chlorine

c) One appropriate observation carry
   (i) The crystals turn from blue to white/ crystalline to amorphous or powdery.
   (ii) Gas with a rotten egg smell is produced and the solution turns blue.
   (iii) Yellow oily liquid of nitrogen trichloride is produced
   (iv) Curdy white precipitate is formed which turns colourless on addition of ammonium hydroxide solution.
   (v) Shiny white metal (lead) is deposited at the cathode and reddish gas (bromine) is collected at the anode.

d) Each appropriate chemical term carries
   (i) Co-ordinate bond
   (ii) Acid salt
   (iii) Substitution reaction
   (iv) Water of crystallisation
   (v) Deliquescence

e) (i) When silver nitrate solution is added to sodium chloride solution a curdy white precipitate of silver chloride is formed, when the same silver nitrate solution is added to sodium nitrate solution no visible change occurs.
   (ii) Hydrogen chloride gas gives dense white fumes with ammonia gas, whereas no visible change occurs with hydrogen sulphide and ammonia gas. [or]

Hydrogen sulphide gas forms a shiny black ppt with lead acetate solution, hydrogen chloride gas forms a white precipitate with lead acetate solution.

(iii) Ethene gas decolourises brown coloured bromine water solution. Ethane retains the brown colour of the bromine water solution.

(iv) Calcium nitrate forms a white precipitate with sodium hydroxide solution, in excess the white ppt remains the same. Zinc nitrate solution forms a white ppt with sodium hydroxide solution, with excess it forms a clear solution.

Or

On addition of ammonium hydroxide solution to each of the solutions – No precipitate formed with calcium nitrate and white precipitate formed with zinc nitrate which dissolves in excess.

(v) Carbon dioxide gas has no change with acidified potassium dichromate solution, whereas sulphur dioxide gas turns orange coloured acidified potassium dichromate solution green.

f) Each most appropriate option carry

(i) – D (fluorine)
(ii) - B (ammonium chloride)
(iii) - C (They undergo both substitution as well as addition reactions)
(iv) - A (liquid carbon tetra chloride)
(v) - A (carbon monoxide)
(vi) - C Zinc oxide)
(vii) - B (oxidising agent)
(viii) - B (Ammonium nitrite)
(ix) - C (they are insoluble in water)
(x) - C (Bronze)

g) (i) 2 volume of butane require 13 volumes of oxygen

90 dm^3 butane requires $\frac{90 \times 13}{2}$ i.e. 585 dm^3 of Oxygen.

(ii) Gram molecular weight= 2 x VD
= 2x8=16g

Volume occupied by 16g of the gas at STP= 22.4dm^3

Therefore volume occupied by 24g = (24 x22.4)÷16 = 33.6dm^3

(iii) According to Avogadro's hypothesis equal volumes of all gases under the same conditions of temperature and pressure contain the same number of molecules.

Nitrogen gas would contain X molecules.

Question 2

(a)

Group number	IA 1	IIA 2	IIIA 13	IVA 14	VA 15	VIA 16	VIIA 17	0 18
2nd period	Li		D			O	J	Ne
	A	Mg	E	Si		H	M	
	R	T	I		Q	u		y

- In this table H does not represent hydrogen.
- Some elements are given in their own symbol and position in the periodic table.
- While others are shown with a letter.

With reference to the table answer the following questions:

(i) Identify the most electronegative element. [1]

(ii) Identify the most reactive element of group 1. [1]

(iii) Identify the element from period 3 with least atomic size. [1]

(iv) How many valence electrons are present in Q? [1]

(v) Which element from group 2 would have the least ionization energy? [1]

(vi) Identify the noble gas of the fourth period. [1]

(vii) In the compound between A and H what type of bond would be formed and give the molecular formula for the same. [2]

(b) Compare the compounds carbon tetrachloride and sodium chloride with regard to solubility in water and electrical conductivity. [2]

Examiners' Comments

(a) Despite clear instructions being given to use the letters mentioned in the table, candidates identified the element instead of choosing the correct option from among the given elements.
   (i) Chlorine was the occasional incorrect answer.
   (ii) & (iii) Most candidates answered correctly.
   (iv) Some wrote the electronic configuration 2,8,5 instead of valence electrons
   (v) Mg incorrectly selected.
   (vi) Argon instead of y.
   (vii) The common error was H_2A or AH. Some candidates wrote Na_2S without specifying. A was Na and H was S.

(b) Candidates erroneously stated carbonate-trachloride to be a poor conductor of electricity and partially soluble in water or soluble in water.

Suggestions for teachers

- Insist on students reading instructions carefully and give adequate practice on such type of exercises.
- Highlight the difference clearly between electronic configuration, valence electrons and valency.
- Ensure instructions are carefully read and adequate practice is given on such type of exercises.
- Point the difference clearly between electronic configuration, valence electrons and valency.
- Specify the major differences in the arrangements of electrons across a period and down a group and thus help in understanding the nature of electrostatic force that exists within an atom. If students are well versed with

the various terms such as ionization energy, electrons affinity then understanding the trends in these properties across a period and down a group will be easier.
– Ensure students relate the valency to the group in which the element exists and use it to write the formula correctly.
– Clarity of thought over the concept of electrolyte and non-electrolyte can be brought about by enumerating a number of examples after explaining the concept. Instruct students on learning the differences in properties of covalent and ionic compounds with reasons.

MARKING SCHEME

Question-2

a) (i) The most electronegative element is J
(ii) most reactive element is R
(iii) The element with the least atomic size of period 3 is M
(iv) Q has 5 valence electrons
(v) T would have the least ionization energy
(vi) The noble gas is y of the fourth period
(vii) It would be an ionic bond as A is a metal of group 1 and H is a non metal of group 16 with valency 2.
Molecular formula is represented as A_2H

b) Each comparison of the properties carry [1] mark

Carbon tetra chloride	Sodium chloride
Does not conduct electricity in any state	Conducts electricity in the molten and aqueous state
Insoluble in water	Soluble in water

Question 3

(a) Choosing the substances from the list given below, write balanced chemical equations for the reactions which would be used in the laboratory to obtain the following salts:

Dilute Sulphuric acid	Copper	Copper(II) carbonate
	Iron	Sodium carbonate
	Sodium	Sodium chloride
		Zinc nitrate

(i) Sodium sulphate

(ii) Zinc carbonate

(iii) Copper(II) sulphate

(iv) Iron(II) sulphate. [4]

(b) State two **relevant** observations for each of the following:

(i) Ammonium hydroxide solution is added to copper (II) nitrate solution in small quantities and then in excess.

(ii) Ammonium hydroxide solution is added to zinc nitrate solution in minimum quantities and then in excess.

(iii) Lead nitrate crystals are heated in a hard glass test tube. [6]

Examiners' Comments

(a)Only reactions feasible in the lab were to be used.

(i) The following were the wrong choices made:

1. $2\ NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2\ HCl$
2. $Na + H_2SO_4 \longrightarrow Na_2\ SO_4 + H_2$
3. $Na_2CO_3 + H_2SO_4 \quad Na_2SO_4 + H_2CO_3$

(ii) 1. $Na_2CO_3 + ZnNO_3 \longrightarrow NaNO_3 + ZnCO_3$

(incorrect formula)

2. $CuCO_3 + Zn\ (NO_3)_2 \longrightarrow Cu\ (NO_3)_2 +$

(iii) $Cu + dil\ H_2SO_4 \longrightarrow CuSO_4 + H_2$ (not possible) as Cu cannot displace H $ZnCO_3$ insoluble.

(iv) Answered correctly by most candidates. A few however wrote the formula of Iron Sulphate as Fe_2SO_4.

(v) Most candidates answered this part of the question correctly.

(b) (i) and (ii) offered a repeated error in omitting the word ppt and instead writing solution.
Another noticeable error was not mentioning the end result i.e whether ppt was soluble or not in excess reagent.

(ii) The names of the products were listed instead of specifying the observations. A few candidates stated only one observation. Others failed to write the correct colour of the residue.

Suggestions for teachers

- Discuss the various methods of preparation of salts with an emphasis on why certain combinations are not allowed nor possible
- Guide students on preparing a solubility chart of salts as a ready reckoner so that they retain the information.
- Explain that whenever a carbonate is treated with an acid,CO_2 generally escapes as a brisk effervescence. Hence it would be wrong to write H_2CO_3 as a product. Students need to be given regular tests or writing equations and balancing them.
- During regular practical work emphasis must be to check on the colour of the ppt and note its solubility in excess of the reagent. Objective tests based on practical work will help students to analyse and infer correctly during dry heating tests.
- Emphasize on noting the colour / odour of gases evolved as well as that of the residue.
- If a gas is colourless such as O2, students need to state the test for the gas as a part of the observation.

MARKING SCHEME

Question - 3

a) (i) $Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + CO_2 + H_2O$

(ii) $Na_2CO_3(aq) + Zn(NO_3)_2(aq) \longrightarrow ZnCO_3(s) + 2NaNO_3(aq)$

(iii) $CuCO_3 + H_2SO_4 \longrightarrow CuSO_4(aq) + CO_2 + H_2O$

(iv) $Fe + H_2SO_4 \longrightarrow FeSO_4(aq) + H_2$

b) (i) A **pale blue** precipitate is formed which with excess of ammonium hydroxide solution forms an **inky blue** solution.

(ii) **Dirty white** precipitate of Zinc hydroxide is formed in minimum ammonium hydroxide which in excess forms a **clear solution.**

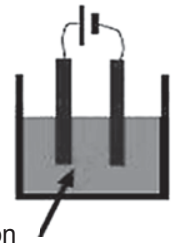
(iii) **Crackling sound** is produced; **reddish brown** nitrogen dioxide gas is produced and forms a **yellow residue** of lead (II)oxide which fuses with glass.

Oxygen gas which rekindles a glowing splint is produced.

Question 4

(a) Copper sulphate solution is electrolysed using copper electrodes.

Study the diagram given below and answer the question that follows:



Copper(II) Sulphate Solution

(i) Which electrode to your left or right is known as the oxidising electrode and why? [2]

(ii) Write the equation representing the reaction that occurs. [1]

(iii) State two appropriate observations for the above electrolysis reaction. [2]

(b)

	X	**Y**
Normal Electronic Configuration	2,8,7	2,8,2
Nature of oxide	Dissolves in water and turns blue litmus red	Very low solubility in water. Dissolves in hydrochloric acid
Tendency for oxidising and reducing reactions	Tends to oxidise elements and	Tends to act as a reducing agent

	compounds	
Electrical and Thermal conductivity	Very poor electrical conductor Poor thermal conductivity	Good Electrical conductor Good Thermal conductor
Tendency to form alloys and amalgums	No tendency to form alloys	Forms alloys

Using the information above, complete the following:

(i) _____ is the metallic element.

(ii) Metal atoms tend to have a maximum of _____ electrons in the outermost energy level.

(iii) Non-metallic elements tend to form _____ oxides while metals tend to form _____ oxides.

(iv) Non-metallic elements tend to be _____ conductors of heat and electricity.

(v) Metals tend to _____ electrons and act as _____ agents in their reactions with elements and compounds. [5]

Suggestions for teachers

- Stress on conceptual understanding while teaching electrolysis.
- Instruct students that ionic equations need to be balanced. w.r.t charge also. Besides explaining the reactions occurring at the electrodes during electrolysis, the results / observations need to be enumerated.
- Oxidation / reduction on the basis of loss / gain of e- respectively needs to be addressed from time to time so that students are able to apply these concepts to various situations.

Examiners' Comments

(a) (i) Errors committed in selecting the right electrode as well as in expressing the basis of oxidizing property.

(ii) Many candidates made errors in writing ionic equations such as

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

Or $Cu + 2e^{-} \rightarrow Cu^{2+}$

Or $Cu^{2+} + 2e^{-} \rightarrow Cu$

(iii) Some candidates made no observations on the colour of the deposit at the cathode. A few stated that the colour of the solution fades contrary to the actual observation.
The gain / loss in weight did not match with the electrode mentioned in some of the answers

(b) Majority of candidates answered these parts (i) to (v) correctly.
Only a few candidates made errors in selecting the type of agents in (v)

MARKING SCHEME
Question-4

a) (i) The electrode towards the left is known as the oxidising electrode, this electrode is known as the anode. At the anode the anions lose their electrons and get discharged as neutral molecules.

(ii) Here copper electrode being an active electrode loses electrons and become Cu^{2+} ions.
At the anode
$Cu \longrightarrow Cu^{2+} + 2e^-$

(iii) Copper being an active electrode loses electrons become positively charged copper ions and go into the electrolyte, blue colour of copper sulphate solution is retained. The size of the red coloured copper anode decreases with time.

b) (i) **Y**

(ii) three

(iii) Acidic, basic

(iv) poor

(v) lose, reducing

Question 5

(a) Give balanced equations for each of the following:

(i) Reduction of hot Copper(II) oxide to copper using ammonia gas.

(ii) Oxidation of carbon with concentrated nitric acid.

(iii) Dehydration of concentrated sulphuric acid with sugar crystals [3]

(b) Copy and complete the following table relating to important industrial process: [3]

Name of the process	Temperature	Catalyst	Equation for the catalyzed reaction
Haber's process			

(c) The following questions relate to the extraction of aluminium by electrolysis:

(i) Name the other aluminium containing compound added to alumina and state its significance.

(ii) Give the equation for the reaction that takes place at the cathode.

(iii) Explain why is it necessary to renew the anode periodically. [4]

Examiners' Comments

(a) Candidates who committed errors in this sub question either failed to write the correct reactants / products or did not balance the equations correctly.

(b) Most candidates answered this part of the question correctly.

(c)(i) Fluorspar was the compound incorrectly mentioned as instructions were not read carefully.

(ii) Correctly answered by most candidates but a few made errors by reversing the ionic equations i.e $Al - 3\ e^- \longrightarrow Al^{3+}$.

(iii) Most candidates answered correctly. Few however stated that anodes get corroded or decay.

Suggestions for teachers

- Failure in writing equations correctly is largely due to rote memorisation. Breaking up of the reaction into steps and then adding them up will help students in writing equations correctly.
- Explain the steps in metallurgy clearly, highlighting the role of the substances added at different stages of the extraction. Revision at regular intervals is essential as factual matter is easily forgotten.
- Ensure students understand how the discharge of ions takes place at the electrodes.
- Summarise the essential facts in the electrolytic extraction that are different from normally expected results in an electrolytic process.

MARKING SCHEME

Question - 5

a) (i) $3CuO + 2NH_3 \longrightarrow 3Cu + 3H_2O + N_2$

(ii) $C + 4HNO_3 \longrightarrow CO_2 + 2H_2O + 4NO_2$

(iii) $C_{12}H_{22}O_{11} \xrightarrow{conc.H_2SO_4} 12C + 11H_2O$

b) **Haber's process**: Temperature : 450°C – 500 °C.
Catalyst: iron Equation: $N_2 + 3H_2 \longrightarrow 2NH_3$

c) (i) Cryolite or Na_3AlF_6. Lowers the melting point of Alumina/ Increases the conductivity of the mixture.

(ii) $Al^{3+} + 3e^- \longrightarrow Al$

(iii) The O_2 formed at the anode reacts with graphite anode and hence gets consumed.

Question 6

(a) Give balanced equations for the laboratory preparations of the following organic compounds:

(i) A saturated hydrocarbon from iodomethane.

(ii) An unsaturated hydrocarbon from an alcohol.

(iii) An unsaturated hydrocarbon from calcium carbide.

(iv) An alcohol from ethyl bromide. [4]

(b) Give the structural formulae for the following:
  (i) An isomer of n-butane.
  (ii) 2-propanol.
  (iii) Diethyl ether. [3]

(c) Give reasons for the following:
  (i) Methane does not undergo addition reactions, but ethene does.
  (ii) Ethyne is more reactive than ethane.
  (iii) Hydrocarbons are excellent fuels. [3]

Examiners' Comments

(a) (i) Reactants and products were correctly stated however the essential conditions were omitted by many candidates, hence marks were scored in parts (i) & (ii).
  (iii) The product $Ca(OH)_2$ was replaced by CaO by few candidates.
  (iv) Aqueous KOH was incorrectly substituted by alcoholic KOH

(b) Errors made by candidates included the following:
  (i) Drew only the condensed formulae and not the detailed structural formulae.
  (ii) Some represented 2-propanol by the structure of butanol
  (iii) Diethyl ether was not known to a vast majority of candidates.

(c) (i) Most candidates failed to present the essential features of both compounds and focused on only 1 compound.
  (ii) Incomplete answers observed by not referring to both compounds by a few candidates.
  (iii) Most candidates were unaware about the calorific value of a fuel and the reasons for hydrocarbon being excellent fuels.

Suggestions for teachers

- Students may be asked to prepare a table listing the equations for tab. Preparation of various organic compounds at a glance with their essential conditions.
- Insist on written practice especially where organic chemistry is concerned.
- Highlight the differences in the products formed on changing the reagent from agueous to alcoholic KOH. with the fact that one is a substitution reaction while the other is an elimination reaction.
- Pay adequate attention to IUPAC nomenclature and structures of organic compounds followed by drill work. Students invariably do not position the bonds correctly especially between carbon, carbon or not well versed with all the functional groups and these are areas needed to focus on.
- Students must be conversant with the various functional groups and the association between addition reaction and unsaturation or substitution reaction and saturated compounds (all single bonds)
- Practical uses of compounds studied would make learning chemistry more meaningful. Students must be able to relate subject matter to daily life.

MARKING SCHEME
Question-6

a) (i) $CH_3I + 2[H] \xrightarrow[Alcohol]{Zn/Cu} CH_4 + HI$

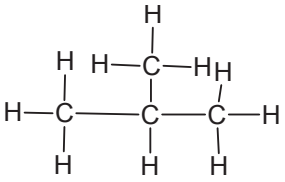
(ii) $C_2H_5OH \xrightarrow[heat]{Conc.H_2SO_4} C_2H_4 + H_2O$

(iii) $CaC_2 + 2H_2O \longrightarrow C_2H_2 + Ca(OH)_2$

(iv) $C_2H_5Br + KOH\ (aq) \longrightarrow C_2H_5OH + KBr$

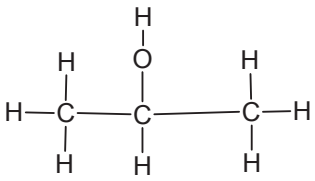
b) each relevant structure carry [1] mark

(i)



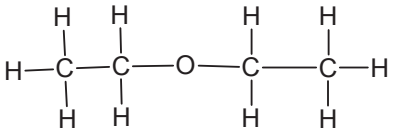
Isobutane

(ii)



2-propanol

(iii)



Diethylether

c) Give reasons

(i) Methane is a saturated hydrocarbon it can only undergo substitution reaction whereas ethene is an unsaturated hydrocarbon with a double bond it can undergo addition reaction.

(ii) Ethyne is an unsaturated hydrocarbon with a triple covalent bond hence it is more reactive than ethene.

(iii) Hydrocarbons on combustion with air produces carbon dioxide and water vapour and large amount of heat energy, hence they are good fuels.

Question 7

(a) O_2 is evolved by heating $KClO_3$ using MnO_2 as a catalyst

$2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

(i) Calculate the mass of $KClO_3$ required to produce 6.72 litre of O_2 at STP. [atomic masses of K = 39, Cl = 35.5, O = 16] . [2]

(ii) Calculate the number of moles of oxygen present in the above volume and also the number of molecules. [2]

(iii) Calculate the volume occupied by 0.01 mole of CO_2 at STP. [1]

(b) Identify the following substances which are underlined:

(i) An alkaline gas which produces dense white fumes when reacted with hydrogen chloride gas.

(ii) An acid which is present in vinegar.

(iii) A gas which does not conduct electricity in the liquid state but conducts electricity when dissolved in water.

(iv) A dilute mineral acid which forms a white precipitate when treated with barium chloride solution.

(v) The element which has the highest ionization potential. [5]

Examiners' Comments

(a) The following errors were made by candidates:
(i) Molecular mass of $KClO_3$ was wrongly calculated.
(ii) Three moles of O_2 were not taken into consideration and only 22.4 l used in the calculation.
(iii) Substitution was incorrect in the calculation.

(b) Most candidates answered correctly in parts (i), (ii), (iii), (iv).

Suggestions for teachers

– Establish relations between number of molecules, mole, molar mass and molar volume. Frequent testing of these concepts will help build confidence. The students may then be explained the molar relationship from the chemical equation and then trained to convert to mass or volume as the requirement in the numerical.

MARKING SCHEME

Question-7

a) (i) According to the equation
3 x 22.4 litres of oxygen gives a mass of 2 x 122.5g of $KClO_3$
Therefore 6.72 litres of oxygen would produce a mass of $KClO_3$
(6.72 x 2x 122.5) ÷(3 x 22.4) =24.5g

(ii) No of moles of oxygen=6.72 ÷ 22.4
=0.3 moles
No. of molecules = 0.3 x 6.02 $x10^{23}$
= 1.806 x 10^{23}

(iii) Volume occupied by 0.01 mole of CO_2 at STP = 0.01 × 22.4 = 0.224 litre.

b) (i) Ammonia
(ii) Acetic acid
(iii) Hydrogen chloride/ ammonia
(iv) Dilute sulphuric acid
(v) Helium.

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

- Observations based on practical chemistry
- Co-ordinate bonding.
- Methods of salt preparation
- Balancing of chemical equations.
- Application of the mole concept.
- Chemical tests to distinguish between compounds.
- Organic Chemistry – the IUPAC nomenclature and structural formulae.
- Certain scientific terms and their applications.
- Basics of Electrolysis.

Suggestions for candidates:

- Pay special attention to colour and the other relevant observations obtained from Practical Work in Chemistry.
- Ensure every equation written is balanced.
- While practising numericals ensure the stepwise working habit is developed.

- Study Alloys in a tabulated form identifying the main metal and other metals and the property specific to alloy.
- Confusing terms / concepts are to be dealt with by making a comparative study.
- Read questions carefully and practice application based questions.
- Read the rules of IUPAC nomenclature and practice drawing the structures of organic compounds.
- Details of preparations of compounds may be tabulated along with specific conditions and learnt.
- Learn the laws, principles and definitions related to different topics accurately and be aware of how and where to apply them also.
- Avoid selective study. Give importance to each part of the syllabus and pay attention to every detail of the topic.

– Practice solving the previous year's Board papers to gain insight into the answering of Chemistry Board papers.