ICSE Question Paper

Class X

Chemistry

Time: 2 hrs **(2016)** **Max. Marks: 80**

Answers to this Paper must be written on the paper provided separately.
You will not be allowed 10 write during the first 15 minutes.
This time is to be spent in reading the Question Paper.
The time given at the head of this paper is the time allowed for writing the answers.

Section I is compulsory. Attempt any four questions from **section II**.
The intended marks for questions or parts of questions are given in brackets [ ]

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(i) 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 ethane to ethane is an example of _____ (hydration / hydrogenation).

(ii) 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

(iii) Write balanced chemical equations for each of the following : **[5]**
(i) Action of warm water on AIN.
(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.

(iv) 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.

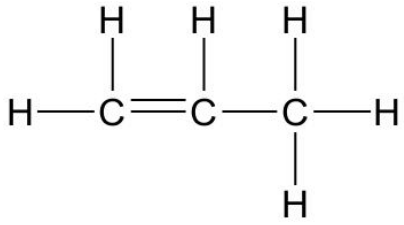
(v) Identify the term / substance in each of the following : **[5]**
(i) The tendency of an atom to attract electrons to itself when combined in a compound.
(ii) The method used to separate ore from gangue by preferential wetting.
(iii) The catalyst used in the conversion of ethyne to ethane.
(iv) The type of reactions alkenes undergo.
(v) The electrons present in the outermost shell of an atom.

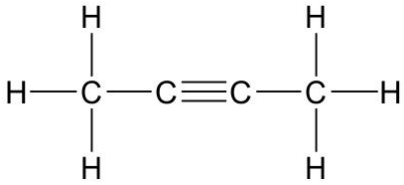
(vi)
(i) A gas of mass 32 gms has a volume of 20 litres at S.T.P. Calculate the gram molecular weight of the gas
(ii) How much Calcium oxide is formed when 82g of calcium nitrate is heated? Also find the volume of nitrogen dioxide evolved :
$2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$
$(Ca=40, N=14, O=16)$ **[5]**

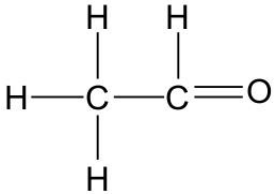
(vii) Match the salts given in Column I with their method of preparation given in Column II : **[5]**

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

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







(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.

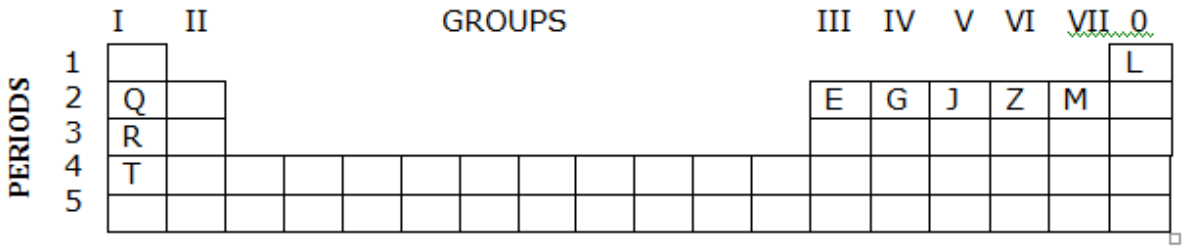
SECTION II (40 Marks)

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

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 : **[2]**

1. X and Z 2. W and X

Question 3

(a) Write a balanced chemical equations for the following : **[3]**

(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.

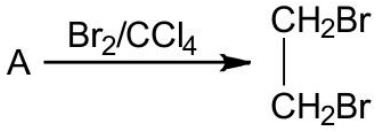
(b) Give the structural formulae of each of the following: **[3]**

(i) 2-methyl propane.

(ii) Ethanoic acid

(iii) Butan – 2 -ol

(c) Equation for the reaction when compound A is bubbled through bromine dissolved in carbon tetrachloride is as follows : **[2]**



i. Draw the structure of A.

ii. State your observation during this reaction.

(d) Fill in the blanks using the appropriate words given below : **[2]**

(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 _____.

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.

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

Question 5

(a) A gas cylinder contains 12×10^{24} molecules of oxygen gas. **[2]**
If Avogadro's number is 6×10^{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 = 11] **[3]**

(c) The equation $4NH_3 + 5O_2 \rightarrow 4NO + 6\ H_2O$, 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]**

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 argentocyanide solution is preferred over silver nitrate solution.
(iii) Although copper is a good conductor of electricity, it is a non-electrolyte.

Question 7

(a)

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

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

ICSE QUESTION PAPER

Class X Chemistry

(2016) Solution

Section I

1.

(a)

(i) Metals are good reducing agents because they are electron donors.

(ii) Electrovalent compounds have high melting points.

(iii) Higher the pH value of solution, the more alkaline it is.

(iv) AgCl, a white precipitate, is soluble in excess NH_4OH.

(v) Conversion of ethene to ethane is an example of hydrogenation.

(b)

(i) (A) 17

Element with atomic number 19 will lose 1 electron to achieve the noble gas configuration which can be accepted by element with atomic number 17.

(ii) (C) 1:1

1 mole of hydrogen ≡ 1 g of hydrogen

1 mole of hydrogen ≡ 6.023×10^{23} molecules

1 g of hydrogen ≡ 6.023×10^{23} molecules

2 g of hydrogen ≡ 1.204×10^{24} molecules

1 mole of oxygen ≡ 16 g of oxygen

1 mole of oxygen ≡ 6.023×10^{23} molecules

16 g of oxygen ≡ 6.023×10^{23} molecules

32 g of oxygen ≡1.204×10^{24} molecules

(iii) (D) Copper and tin

Bronze is an alloy which consists of copper and tin.

(iv) (B) mainly ions

Strong electrolytes dissociate into ions.

(v) (C) HCl is highly soluble in water.

HCl is highly soluble in water. Its high solubility may be demonstrated by the fountain experiment.

(c)

(i) $AlN_{(s)} + 3H_2O_{(l)} \rightarrow Al(OH)_{3(aq)} + NH_{3(g)}$

(ii) $Cu_{(s)} + 4HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{2(g)} + H_2O_{(l)}$

(iii) $NaHCO_{3(s)} + HCl_{(l)} \rightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

(iv) $Na_2SO_{3(s)} + H_2SO_{4(l)} \rightarrow Na_2SO_{4(aq)} + H_2O_{(l)} + SO_{2(g)}$

(v) $CH_3CH_2Cl + KOH_{(aq)} \rightarrow CH_3CH_2OH + KCl_{(aq)}$

(d)

(i) When dil. HCl is added to lead nitrate solution and heated, it forms a white precipitate of lead chloride.
$Pb(NO_3)_2 + 2HCl \rightarrow PbCl_2 + 2HNO_3$

(ii) A white precipitate of barium sulphate forms when barium chloride is mixed with sodium sulphate.
$BaCl_{2(aq)} + Na_2SO_{4(s)} \rightarrow 2NaCl_{(aq)} + BaSO_{4(s)}$

(iii) When sugar reacts with conc. H_2SO_4, it gives a black spongy mass of carbon which is called sugar charcoal.
$C_{12}H_{22}O_{11(s)} \xrightarrow{\text{Conc. } H_2SO_4} 12\,C_{(s)} + 11\,H_2O$

(iv) When dilute hydrochloric acid is added to copper carbonate, it decomposes to give copper chloride.
$CuCO_3 + 2HCl \rightarrow CuCl_2 + H_2O + CO_2 \uparrow$

(v) Dil. HCl reacts with thiosulphates to produce sulphur dioxide and yellow sulphur is precipitated.
$Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2 + S \downarrow$

(e)

(i) The tendency of an atom to attract electrons to itself when combined in a compound: Electronegativity
(ii) The method used to separate ore from gangue by preferential wetting: Froth flotation process
(iii) The catalyst used in the conversion of ethyne to ethane: Lindlar catalyst
(iv) The type of reactions alkenes undergo: Addition reaction
(v) The electrons present in the outermost shell of an atom: Valence electrons

(f)

(i)

Given :

Mass of gas = 32 g

Volume occupied by 32 gms of gas = 20 litres

$$\text{Number of moles of gas} = \frac{\text{volume of gas}}{\text{molar gas volume}} = \frac{20}{22.4} = 0.89 \approx 0.9$$

$$\text{Number of moles of gas} = \frac{\text{Mass of gas}}{\text{Gram molecular weight of gas}}$$

$$\text{Gram molecular weight of gas} = \frac{\text{Mass of gas}}{\text{Number of moles of gas}} = \frac{32}{0.9} = 35.55 \text{ g}$$

(ii)

$$2\,Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 \uparrow + O_2$$

At STP, 1 mole of any gas contains 22.4 L

Since, 4 moles of NO_2 are produced,

$\therefore$ volume of nitrogen dioxide obtained = $4 \times 22.4 = 89.6$ L

2 moles of $Ca(NO_3)_2$ produces 2 moles of CaO

328 g $Ca(NO_3)_2$ produces = 112 g CaO

1 g $Ca(NO_3)_2$ will produce = $\frac{112}{328}$ g CaO

= 0.34 g CaO

Hence, 82 g of $Ca(NO_3)_2$ will produce = $82 \times 0.34 = 27.88$ g of CaO

(g)

Column-I	**Column-II**
$Pb(NO_3)_2$ from PbO	Precipitation
$MgCl_2$ from Mg	Simple displacement
$FeCl_3$ from Fe	Combination
$NaNO_3$ from NaOH	Neutralisation
$ZnCO_3$ from $ZnSO_4$	Titration

(h)

(i)

1. 1-Propene
2. 2-Butyne
3. Ethanal

(ii)

1. less than
2. less than

2.

(a)

(i) 5

Atom J is a Group 5 element and a group is determined by the number of electrons present in the outermost shell.

(ii) Element M from Group 7 accepts one electron to form an ion with a single negative charge.

(iii) T is more reactive than R.

The tendency of losing electrons increases down the group. Because chemical reactivity depends on the tendency to lose electrons, thus reactivity increases on going down the group.

(iv) Element T has its electrons arranged in four shells.

Element T belongs to Period 4, and all elements of this period have four shells.

(b)

(i) Metallic

(ii) Smallest

(c)

(i)

(1) Ionic bond is formed by transfer of one electron from element W to element X.

(2) Covalent bond is formed by sharing of electrons between elements Y and Z.

(ii)

(1) HCl

(2) NaCl

3.

(a)

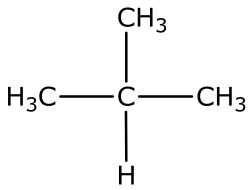
(i) $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

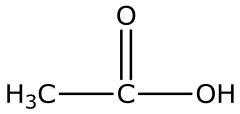
(ii) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

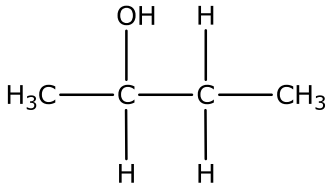
(iii) $C_2H_5OH \xrightarrow{Conc.H_2SO_4/170^\circ C} CH_2 = CH_2 + H_2O$

(b)

(i)



(ii) 

(iii) 

(c)

(i) $CH_2 = CH_2$

(ii) When bromine dissolved in CCl_4 is added to ethene, the orange colour of bromine disappears because of the formation of colourless ethylene bromide.

(d)

(i) Nitric oxide

(ii) Nitrogen dioxide

4.

(a)

(i) Sulphur dioxide

Freshly prepared $K_2Cr_2O_7$ paper changes from orange to green.

(ii) Hydrogen sulphide

The gas released has a rotten egg smell.

(b)

(i) When NH_4OH is added to copper sulphate solution drop-wise, a pale blue ppt. is obtained.

$$CuSO_4 + 2NH_4OH \longrightarrow Cu(OH)_2 + (NH_4)_2SO_4$$

With excess of NH_4OH, the ppt. dissolves to give a deep blue solution of tetrammine copper(II)sulphate.

$$Cu(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \longrightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$$

When NH_4OH is added to zinc sulphate solution drop-wise, a white, gelatinous ppt. is obtained.

$$ZnSO_4 + 2NH_4OH \longrightarrow Zn(OH)_2 + (NH_4)_2SO_4$$

With excess of NH_4OH, the ppt. dissolves to give a colourless solution of tetrammine zinc(II)sulphate.

$$Zn(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \longrightarrow [Zn(NH_3)_4]SO_4 + 4H_2O$$

(c)

(i) Electrodes: Cathode: Copper
Anode: Platinum
Reaction at the cathode: $Cu^{2+} + 2e^- \rightarrow Cu$
Reaction at the anode: $4OH^- - 4e^- \rightarrow 4OH$
$2OH + 2OH \rightarrow 2H_2O + O_2$

(ii) The cathode and anode are both made of graphite plates.
Reaction at the cathode: $Pb^{2+} + 2e^- \rightarrow Pb$
Reaction at the anode: $Br^- - e^- \rightarrow Br$
$Br + Br \rightarrow Br_2$

(d)

(i) Oxygen is the product formed at the anode.
(ii) Ag^+ and Na^+.

5.

(a)

1 mole oxygen molecule $= 6.022 \times 10^{23}$ molecules
x moles of oxygen molecule $= 12 \times 10^{24}$ molecules
19.93 moles of oxygen molecule $= 12 \times 10^{24}$ molecules

$$\text{Number moles of } O_2 = \frac{\text{Mass of } O_2}{\text{Molar mass of } O_2}$$

Mass of $O_2 = 32 \times 19.93 = 637.76$ g
6.022×10^{23} molecules occupies 22.4 L

$$12 \times 10^{24} \text{ molecules occupies} = \frac{12 \times 10^{24} \times 22.4}{6.022 \times 10^{23}} = 446.36 \text{ L volume.}$$

(b) Vapour density = 29

Element	Percentage	At. mass	Gram atom	Ration	
Carbon	82.76	12	82.76/12 = 6.9	6.9/6.9 = 1	**2**
Hydrogen	17.24	1	17.24/1 = 17.24	17.24/6.9 = 2.5	**5**

Empirical formula is C_2H_5
Molecular weight = 2 × Vapour density
Molecular weight = n × (Empirical formula weight)
58 = n × (12 × 2 + 1 × 5)
n = 2
So, molecular formula = C_4H_{10}

(c)

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

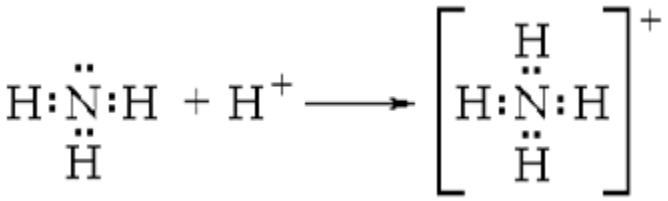
4 moles of ammonia = 100 cm^3

1 mole of ammonia = 25 cm^3

4 moles of ammonia requires 5 moles of O_2.

So, volume of oxygen required = $5 \times 25 = 125$ cm^3

(d)



6.

(a)

(i) Ammonia

(ii) Nitrogen

(b)

(i) $8NH_3 + 3Cl_2 \rightarrow N_2 + 6NH_4Cl$

(ii) $3PbO + 2NH_3 \rightarrow 3Pb + 3H_2O + N_2$

(c)

(i) B

(ii) A

(iii) C

(d)

(i) Electrostatic forces of attraction between ions in the solid state are very strong. These forces weaken in the fused state or in the solution state. Hence, ions become mobile.

(ii) If silver nitrate solution is used directly instead of double cyanide of silver and sodium, the deposition of silver will be very fast and hence not very smooth and uniform.

(iii) Copper has no mobile electrons in the solid state and an electrolyte should dissociate into oppositely charged ions to conduct electricity. Hence, copper is a non-electrolyte.

7.

(a)

(i) Conc. caustic soda

(ii) $2Al(OH)_3 \xrightarrow[1000^\circ C]{Heat} Al_2O_3 + 3H_2O$

(iii) Cryolite

(iv) At the cathode: $Al^{3+} + 3e^- \rightarrow Al$

(v) The anode has got to be replaced from time to time as it gets oxidised by the oxygen evolved at the anode.

(b)

(i) When exposed to the atmosphere, it becomes a monohydrate.

$Na_2CO_3.10H_2O \xrightarrow{Dry\ air} Na_2CO_3.H_2O + 9H_2O$

(ii) It absorbs moisture from the atmosphere to become moist and ultimately dissolves in the absorbed water, forming a saturated solution.

(c)

(i) Fe^{3+} ion

$FeCl_3 + 3NaOH \longrightarrow Fe(OH)_3 + 3NaCl$

(Reddish brown ppt.)

(ii) Pb^{2+} ion

$Pb(NO_3)_2 + 2NH_4OH \longrightarrow Pb(OH)_2 + 2NH_4NO_3$

(chalky white ppt. insoluble in excess)

(iii) Ca^{2+} ion

$Ca(NO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2 + 2NaNO_3$

(White ppt. sparingly soluble)