PART II

✦ INTERNAL ASSESSMENT

- Detection of Anions
- Detection of Cations
- Identification of Gases
- Effect of Adding Acid and Alkali to the Common Indicators
- Effect of Adding Concentrated Hydrochloric Acid to Manganese (IV) oxide and to Copper oxide
- Use of pH in Soil Analyses, Water Analysis, Medical Field-Simple Identification with Universal Indicator
- Viva Voce

DETECTION OF ANIONS

The anions are divided into following categories

(*i*) The anions which are detected by using dilute sulphuric acid.

(*ii*) The anions which are detected by using concentrated sulphuric acid.

(*iii*) The anions which are not detected by either of the acid.

Dilute sulphuric acid group includes

(*i*) Carbonate – CO_3^{2-}

(*ii*) Sulphite – SO_3^{2-}

(*iii*) Sulphide – S^{2-}

Concentrated sulphuric acid group includes

(*i*) Chloride – Cl^-

(*ii*) Nitrate – NO_3^-

The anion which is not detected by using either dilute or concentrated sulphuric acid is sulphate (SO_4^{2-})

1. Dilute Sulphuric Acid Group

Test for Carbonate (CO_3^{2-}) and Identification of CO_2 gas

Experiment	Observation	Inference
(*i*) Dilute sulphuric acid is added to the salt (salt is any metallic carbonate except lead carbonate, barium carbonate and calcium carbonate).	A colourless and odourless gas evolves with brisk effervescence.	H_2, O_2, N_2, CO_2 indicated.
(*ii*) Bring moist blue litmus paper in contact with the evolved gas.	Blue litmus changes to red.	Evolved gas is acidic in nature. CO_2 indicated.
(*iii*) Pass the evolved gas through freshly prepared lime water.	Lime water turns milky.	CO_2 confirmed. CO_3^{2-} confirmed.

Chemical reactions :

$$\underset{\text{Sodium carbonate}}{Na_2CO_3} + H_2SO_4(\text{dil.}) \longrightarrow \underset{\text{Sodium sulphate}}{Na_2SO_4} + H_2O + \underset{\text{Carbon dioxide}}{CO_2\uparrow}$$

$$\underset{\text{Lime water}}{Ca(OH)_2} + CO_2 \longrightarrow \underset{\text{milky}}{CaCO_3} + H_2O$$

Test for Sulphite (SO_3^{2-}) and Identification of SO_2 gas

Experiment	Observation	Inference
(*i*) Dilute sulphuric acid is added to the salt (salt is any metallic sulphite except calcium sulphite and barium sulphite).	A colourless gas having burning sulphur smell evolves.	SO_2 indicated.

(*ii*) Bring a moist blue litmus paper in contact with the evolved gas.	Blue litmus paper changes to red.	Evolved gas is acidic in nature. SO_2 indicated.
(*iii*) Bring a paper dipped in acidified potassium dichromate solution in contact with the evolved gas.	Paper turns green.	SO_2 confirmed.
(*iv*) Bring a paper dipped in potassium permanganate solution in contact with the evolved gas.	The paper decolourizes.	SO_2 confirmed. SO_3^{2-} confirmed.

Chemical reactions :

$$\underset{\text{Sodium sulphite}}{Na_2SO_3} + H_2SO_4(\text{dil.}) \longrightarrow \underset{\text{Sodium sulphate}}{Na_2SO_4} + H_2O + \underset{\text{Sulphur dioxide}}{SO_2}\uparrow$$

$$\underset{\text{Orange}}{K_2Cr_2O_7} + 3SO_2 + H_2SO_4 \longrightarrow K_2SO_4 + \underset{\text{Green}}{Cr_2(SO_4)_3} + H_2O$$

$$\underset{\text{Purple}}{2KMnO_4} + 2H_2O + 5SO_2 \longrightarrow \underset{\text{Colourless}}{K_2SO_4} + 2MnSO_4 + 2H_2SO_4$$

Test for Sulphide (S^{2-}) and Identification of H_2S gas

Experiment	Observation	Inference
(*i*) Dilute sulphuric acid is added to the salt.	A colourless gas having rotten egg smell evolves.	H_2S indicated.
(*ii*) Bring moist blue litmus paper in contact with the evolved gas.	Blue litmus paper changes to red.	The evolved gas is acidic in nature.
(*iii*) Bring a paper dipped in lead acetate solution in contact with the evolved gas.	The paper turns silvery black.	H_2S confirmed. S^{2-} confirmed.

Chemical reactions :

$$\underset{\text{Sodium sulphide}}{Na_2S} + H_2SO_4(\text{dil.}) \longrightarrow \underset{\text{Sodium sulphate}}{Na_2SO_4} + \underset{\text{Hydrogen sulphide}}{H_2S}\uparrow$$

$$\underset{\text{Lead acetate}}{(CH_3COO)_2Pb} + H_2S \longrightarrow 2CH_3COOH + \underset{\text{Black ppt.}}{PbS}$$

2. Concentrated Sulphuric Acid Group

Test for Chloride (Cl^-) and Identification of HCl gas

Experiment	Observation	Inference
(*i*) Concentrated sulphuric acid is added to the salt (any metallic chloride except $CaCl_2$, $BaCl_2$, $PbCl_2$).	A colourless gas having pungent suffocating smell which fumes in moist air evolves.	HCl gas indicated.

(*ii*) Bring moist blue litmus paper in contact with the evolved gas.	Blue litmus paper changes to red.	Evolved gas is acidic in nature.
(*iii*) Bring a glass rod dipped in ammonium hydroxide solution in contact with the evolved gas.	Dense white fumes are observed.	HCl gas indicated.
(*iv*) Pass the evolved gas through silver nitrate solution.	White precipitate appears which dissolves in excess of ammonium hydroxide.	HCl gas confirmed. Cl^- confirmed.

Chemical reactions :

$$NaCl + H_2SO_4(Conc.) \longrightarrow NaHSO_4 + HCl\uparrow$$

$$NH_4OH + HCl \longrightarrow \underset{\text{Dense white fumes}}{NH_4Cl} + H_2O$$

$$AgNO_3 + HCl \longrightarrow \underset{\text{White precipitate}}{AgCl\downarrow} + HNO_3$$

$$AgCl + 2NH_4OH \longrightarrow \underset{\text{Diamminesilver chloride (soluble complex salt)}}{[Ag(NH_3)_2]Cl} + 2H_2O$$

Test for Nitrate (NO_3^-) and Identification of NO_2 gas

Experiment	Observation	Inference
(*i*) Concentrated sulphuric acid is added to the salt. (salt may be any metallic nitrate).	No change appears.	–
(*ii*) Heat the contents of the test tube.	Reddish brown coloured gas having pungent suffocating smell evolves.	NO_2 indicated.
(*iii*) Add copper turnings to the test tube.	Reddish brown fumes becomes more dense.	NO_2 indicated.
(*iv*) Pass the evolved gas through freshly prepared acidified ferrous sulphate solution.	The solution turns brown black	NO_2 confirmed. NO_3^- confirmed.

Chemical reactions :

$$NaNO_3 + H_2SO_4(Conc.) \longrightarrow NaHSO_4 + HNO_3$$

$$4HNO_3 \xrightarrow{\Delta} 4NO_2\uparrow + 2H_2O + O_2\uparrow$$

$$Cu + 4HNO_3(Conc.) \longrightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2\uparrow$$

$$FeSO_4 + NO_2 \longrightarrow \underset{\text{Nitrosoferrous sulphate}}{FeSO_4.NO}$$

Special test for Nitrate (Ring Test)

Experiment	Observation	Inference
Salt solution of any metallic nitrate is taken in a test tube and equal quantity of freshly prepared acidified ferrous sulphate solution is added to it followed by concentrated sulphuric acid very slowly by the sides of the test tube.	A brown ring appears at the junction of the two liquids.	NO_3^- confirmed.

Note : Lead nitrate, barium nitrate and calcium nitrate do not respond to the ring test.

Chemical reactions :

$$NaNO_3 + H_2SO_4\,(Conc.) \longrightarrow NaHSO_4 + HNO_3$$

$$2HNO_3 + 3H_2SO_4 + 6FeSO_4 \longrightarrow 3Fe_2(SO_4)_3 + 2NO + 4H_2O$$

$$FeSO_4 + NO \longrightarrow FeSO_4.NO$$

Nitrosoferrous sulphate (Brown ring)

3. The anion which is not detected by using either dilute or concentrated sulphuric acid.

Test for Sulphate (SO_4^{2-})

Experiment	Observation	Inference
(*i*) To the salt solution of any soluble sulphate (except lead sulphate, calcium sulphate and barium sulphate) add barium chloride solution.	White precipitate appears.	SO_4^{2-} or SO_3^{2-} indicated.
(*ii*) Add concentrated hydrochloric acid to the white precipitate.	The precipitate remains insoluble.	SO_4^{2-} confirmed.

Chemical reaction :

$$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4\downarrow + 2NaCl$$

White precipitate

Sulphate can also be detected with the help of lead acetate solution.

Experiment	Observation	Inference
(*i*) Lead acetate solution is added to acidified salt solution.	White precipitate appears.	SO_4^{2-} indicated.
(*ii*) Add ammonium acetate solution to the white precipitate.	Precipitate dissolves.	SO_4^{2-} confirmed.

Chemical reactions :

$$Na_2SO_4 + (CH_3COO)_2Pb \longrightarrow 2CH_3COONa + PbSO_4$$

$$PbSO_4 + 2CH_3COONH_4 \longrightarrow (NH_4)_2SO_4 + (CH_3COO)_2Pb$$

Lead acetate

DETECTION OF CATIONS

The cations are detected by using sodium hydroxide and ammonium hydroxide solutions. The cations are :

(*i*) Ammonium (NH_4^+)

(*ii*) Lead (Pb^{2+})

(*iii*) Zinc (Zn^{2+})

(*iv*) Copper (Cu^{2+})

(*v*) Ferrous (Fe^{2+})

(*vi*) Ferric (Fe^{3+})

(*vii*) Calcium (Ca^{2+})

The first step in the detection of cations (except ammonium) is the preparation of original solution.

Method of preparing original solution :

Add distilled water to the given unknown salt, shake it well. If the salt dissolves completely, add some more salt in small quantity to obtain concentrated solution. This solution is known **as water extract** or **original solution.** If the given salt does not dissolve in cold distilled water, heat the contents to prepare original solution. If the given salt remains **insoluble** in **both hot** and **cold distilled water** then add **dilute hydrochloric acid** or **concentrated hydrochloric** acid to prepare the **original solution**.

Test for Ammonium ion (NH_4^+) and Identification of NH_3 gas

Experiment	Observation	Inference
(*i*) To ammonium salt, sodium hydroxide solution is added and then warmed gently.	A colourless gas having pungent irritating odour evolves.	NH_3 indicated.
(*ii*) Bring moist red litmus paper in contact with the evolved gas.	Paper turns blue.	Evolved gas is basic in nature.
(*iii*) Bring a glass rod dipped in concentrated hydrochloric acid in contact with the evolved gas.	Dense white fumes are observed.	NH_3 indicated.
(*iv*) Bring a paper dipped in Nessler's reagent in contact with the evolved gas.	Paper turns brown.	NH_3 confirmed. NH_3 confirmed

Chemical reactions :

$$NH_4Cl + NaOH \xrightarrow{\Delta} NaCl + H_2O + NH_3$$

$$NH_3 + HCl(Conc.) \longrightarrow \underset{\text{Dense white fumes}}{NH_4Cl}$$

Test for Lead ion (Pb^{2+})

Experiment	Observation	Inference
(*i*) To the original solution sodium hydroxide solution is added first a little and then in excess.	White precipitate appears which is soluble in excess of sodium hydroxide.	Pb^{2+} or Zn^{2+} indicated.
(*ii*) To the original solution ammonium hydroxide solution is added first a little and then in excess.	White precipitate appears which is insoluble in excess of ammonium hydroxide.	Pb^{2+} confirmed.
(*iii*) To the original solution potassium iodide solution is added.	Yellow precipitate appears.	Pb^{2+} confirmed.
(*iv*) To the original solution dilute hydrochloric acid is added and then heated.	White precipitate appears which dissolves on heating.	Lead chloride is soluble in hot water but insoluble in cold water. Pb^{2+} confirmed.

Chemical reactions :

$$Pb(NO_3)_2 + 2NaOH \longrightarrow \underset{\text{White ppt.}}{Pb(OH)_2\downarrow} + 2NaNO_3$$

$$Pb(OH)_2 + 2NaOH \longrightarrow Na_2PbO_2 + 2H_2O$$

$$Pb(NO_3)_2 + 2NH_4OH \longrightarrow \underset{\text{White ppt.}}{Pb(OH)_2\downarrow} + 2NH_4NO_3$$

$$Pb(NO_3)_2 + 2KI \longrightarrow \underset{\text{Yellow ppt.}}{PbI_2\downarrow} + 2KNO_3$$

$$Pb(NO_3)_2 + 2HCl \longrightarrow \underset{\text{White ppt. (Soluble in hot water)}}{PbCl_2\downarrow} + 2HNO_3$$

Test for Zinc ion (Zn^{2+})

Experiment	Observation	Inference
(*i*) To the original solution sodium hydroxide solution is added first a little and then in excess.	White precipitate appears which is soluble in excess of sodium hydroxide.	Pb^{2+} or Zn^{2+} indicated.
(*ii*) To the original solution ammonium hydroxide solution is added first a little and then in excess.	White precipitate appears which is soluble in excess of ammonium hydroxide.	Zn^{2+} confirmed.
(*iii*) Potassium ferrocyanide is added to the original solution.	Dirty white precipitate appears.	Zn^{2+} confirmed.

Chemical reactions :

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

$$Zn(OH)_2 + 2NaOH \longrightarrow Na_2ZnO_2 + 2H_2O$$

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

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

$$K_4[Fe(CN)_6] + 2Zn(NO_3)_2 \longrightarrow \underset{\text{Dirty white ppt.}}{Zn_2[Fe(CN)_6]} + 4KNO_3$$

Test for Copper ion (Cu^{2+})

Experiment	Observation	Inference
(*i*) To the original solution sodium hydroxide solution is added first a little and then in excess.	Pale blue or bluish white precipitate appears which is insoluble in excess of sodium hydroxide.	Cu^{2+} indicated.
(*ii*) To the original solution ammonium hydroxide solution is added first a little and then in excess.	Pale blue or bluish white precipitate appears which dissolves in excess of ammonium hydroxide to give deep blue or inky blue solution	Cu^{2+} confirmed.
(*iii*) Potassium ferrocyanide is added to the original solution.	Chocolate brown precipitate appears.	Cu^{2+} confirmed.

Chemical reactions :

$$CuSO_4 + 2NaOH \longrightarrow \underset{\text{Bluish white ppt.}}{Cu(OH)_2\downarrow} + Na_2SO_4$$

$$CuSO_4 + 2NH_4OH \longrightarrow \underset{\text{Bluish white ppt.}}{Cu(OH)_2\downarrow} + (NH_4)_2SO_4$$

$$Cu(OH)_2 + 4NH_4OH \longrightarrow \underset{\text{Inky blue solution}}{[Cu(NH_3)_4](OH)_2} + 4H_2O$$

$$2CuSO_4 + K_4[Fe(CN)_6] \longrightarrow \underset{\text{Chocolate brown ppt.}}{Cu_2[Fe(CN)_6]} + 2K_2SO_4$$

Test for Ferrous ion (Fe^{2+})

Experiment	Observation	Inference
(*i*) To the original solution sodium hydroxide solution is added first a little and then in excess.	Dirty green precipitate appears which changes to reddish brown after sometime and is insoluble in excess of sodium hydroxide.	Fe^{2+} confirmed.
(*ii*) To the original solution ammonium hydroxide solution is added first a little and then in excess.	Dirty green precipitate appears which changes to reddish brown after sometime and is insoluble in excess of ammonium hydroxide.	Fe^{2+} confirmed.
(*iii*) Potassium ferricyanide is added to the original solution.	Deep blue precipitate appears.	Fe^{2+} confirmed.

Chemical reactions :

$$FeCl_2 + 2NaOH \longrightarrow \underset{\text{Dirty green ppt.}}{Fe(OH)_2\downarrow} + 2NaCl$$

$$\downarrow [O]$$

$$\underset{\text{Reddish brown ppt.}}{Fe(OH)_3}$$

$$FeCl_2 + 2NH_4OH \longrightarrow Fe(OH)_2\downarrow + 2NH_4Cl$$

$$\downarrow [O]$$

$$Fe(OH)_3$$

Test for Ferric ion (Fe^{3+})

Experiment	Observation	Inference
(*i*) To the original solution sodium hydroxide solution is added first a little and then in excess.	Reddish brown precipitate appears and is insoluble in excess of sodium hydroxide.	Fe^{3+} confirmed.
(*ii*) To the original solution ammonium hydroxide solution is added first a little and then in excess.	Reddish brown precipitate appears and is insoluble in excess of ammonium hydroxide.	Fe^{3+} confirmed.
(*iii*) Potassium ferrocyanide is added to the original solution.	Deep blue precipitate appears.	Fe^{3+} confirmed.
(*iv*) Potassium thiocyanate is added to the original solution.	Blood red colour precipitate appears.	Fe^{3+} confirmed.

Chemical reactions :

$$FeCl_3 + 3NaOH \longrightarrow \underset{\text{Reddish brown ppt.}}{Fe(OH)_3\downarrow} + 3NaCl$$

$$FeCl_3 + 3NH_4OH \longrightarrow \underset{\text{Reddish brown ppt.}}{Fe(OH)_3\downarrow} + 3NH_4Cl$$

Test for Calcium ion (Ca^{2+})

Experiment	Observation	Inference
(*i*) To the original solution sodium hydroxide solution is added first a little and then in excess.	White precipitate appears which is insoluble in excess of sodium hydroxide.	Ca^{2+} confirmed.
(*ii*) To the original solution ammonium hydroxide solution is added first a little and then in excess.	No visible reaction.	Ca^{2+} confirmed.

Chemical reactions :

$$Ca(NO_3)_2 + 2NaOH \longrightarrow \underset{\text{White ppt.}}{Ca(OH)_2\downarrow} + 2NaNO_3$$

$$Ca(NO_3)_2 + 2NH_4OH \longrightarrow \text{No visible reaction}$$

Effect of Adding Sodium Hydroxide

	Name of metallic ion	Colour of the precipitate	Soluble/insoluble in excess
(*i*)	Lead	White	Soluble
(*ii*)	Zinc	White	Soluble
(*iii*)	Copper	Pale blue	Insoluble
(*iv*)	Ferrous	Dirty green	Insoluble
(*v*)	Ferric	Reddish brown	Insoluble
(*vi*)	Calcium	White	Insoluble

Effect of Adding Ammonium Hydroxide

	Name of metallic ion	Colour of the precipitate	Soluble/insoluble in excess
(*i*)	Lead	White	Insoluble
(*ii*)	Zinc	White	Soluble
(*iii*)	Copper	Pale blue	Soluble
(*iv*)	Ferrous	Dirty green	Insoluble
(*v*)	Ferric	Reddish brown	Insoluble
(*vi*)	Calcium	No visible reaction	No visible reaction

IDENTIFICATION OF GASES

Test for Hydrogen :

Experiment	Observation	Inference
(*i*) Dilute hydrochloric acid or dilute sulphuric acid is added to any active metal (except lead).	A colourless, odourless gas evolved.	H_2, O_2, N_2 and CO_2 indicated.
(*ii*) Bring moist blue litmus paper in contact with the evolved gas.	No change appears.	H_2, O_2 and N_2 indicated.
(*iii*) Bring a burning splinter in contact with the evolved gas.	The splinter extinguishes and the gas burns with a popping sound.	H_2 confirmed.

Chemical reaction :

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2\uparrow$$

Test for Oxygen

Experiment	Observation	Inference
(*i*) Lead dioxide is heated in a hard glass test-tube.	A colourless, odourless gas evolved.	O_2, N_2, H_2 and CO_2 indicated.
(*ii*) Bring a moist blue litmus paper in contact with the evolved gas.	No change appears.	O_2, N_2 and H_2 indicated.
(*iii*) Bring a glowing splinter in contact with the evolved gas.	The splinter glows more brightly.	O_2 confirmed.

Chemical reaction :

$$2PbO_2 \xrightarrow{\Delta} 2PbO + O_2\uparrow$$

Test for Water vapour

Experiment	Observation	Inference
(*i*) Hydrated copper sulphate is heated in a hard glass test tube.	The blue colour of the salt slowly changes to white and the vapours condenses to give colourless liquid.	Hydrated salt gets converted to anhydrous.
(*ii*) The colourless liquid is dropped over anhydrous white copper sulphate.	The salt turns blue.	Water vapours are confirmed.

Chemical reaction :

$$\underset{\text{Blue hydrated copper sulphate}}{CuSO_4.5H_2O} \xrightarrow{\Delta} \underset{\text{White anhydrous copper sulphate}}{CuSO_4} + 5H_2O$$

Effect of Adding Acid and Alkali to The Common Indicators

	Name of Indicator	Colour change in	
		Acid	Alkali
(*i*)	Blue litmus	Red	No change
(*ii*)	Red litmus	No change	Blue
(*iii*)	Phenolphthalein	Colourless	Pink
(*iv*)	Methyl orange	Red or pink	Yellow
(*v*)	Alkaline phenolphthalein	Colourless	No change

Effect of Adding Concentrated Hydrochloric Acid to Manganese(IV) oxide and Identification of Cl_2 gas

Experiment	Observation	Inference
(*i*) Concentrated hydrochloric acid is added to black powder of MnO_2 and warmed slightly.	A greenish yellow coloured gas evolved having pungent suffocating smell. A slight frothing is observed.	Chlorine indicated.
(*ii*) Bring moist blue litmus paper in contact with the evolved gas.	Moist blue litmus paper changes to red and finally bleaches it to white (decolourizes).	The evolved gas is acidic in nature and is a bleaching agent.
(*iii*) Bring moist starch iodide paper in contact with the evolved gas.	Paper turns blue black.	Chlorine confirmed.
(*iv*) Filter the solution.	Residue left – black Filtrate – brown	Manganese(IV) oxide which is black powder confirmed.

Chemical reactions :

$$\underset{\text{Black powder}}{MnO_2} + 4HCl\,(Conc.) \xrightarrow{\text{Warm}} \underset{\text{Light brown solution}}{MnCl_2} + \underset{\text{Greenish yellow coloured gas}}{Cl_2\uparrow} + 2H_2O$$

$$H_2O + Cl_2 \longrightarrow HCl + HClO\ (\text{Blue litmus} \longrightarrow \text{Red})$$

$$HClO \longrightarrow HCl + [O]$$

$$[O] + \underset{\text{colouring matter}}{\text{Hydrogen of the}} \longrightarrow \underset{\text{product}}{\text{Bleached}} + H_2O\ (\text{decolourizes})$$

$$2KI + Cl_2 \longrightarrow 2KCl + I_2$$

$$I_2 + \text{Starch} \longrightarrow \text{Blue black}$$

Effect of Adding Concentrated Hydrochloric Acid to Copper oxide

Experiment	Observation	Inference
(*i*) Concentrated hydrochloric acid is added to black powder of copper oxide and warmed slightly.	A greenish yellow coloured gas evolved having pungent suffocating smell. No frothing is observed.	Chlorine indicated.
(*ii*) Bring moist blue litmus paper in contact with the evolved gas.	Moist blue litmus paper changes to red and finally bleaches it to white (decolourizes).	The evolved gas is acidic in nature and is a bleaching agent
(*iii*) Bring moist starch iodide paper in contact with the evolved gas.	Paper turns blue black.	Chlorine confirmed.
(*iv*) Filter the solution.	Residue left–black Filtrate – bluish	Copper oxide which is black powder is confirmed.

Chemical reactions :

$$CuO + 2HCl\ (Conc.) \xrightarrow{\Delta} CuCl_2 + H_2O$$

$$2CuCl_2 \xrightarrow{\Delta} Cu_2Cl_2 + Cl_2$$

$$Cl_2 + H_2O \longrightarrow HCl + HClO\ (\text{Blue litmus} \longrightarrow \text{red})$$

$$HClO \longrightarrow HCl + [O]$$

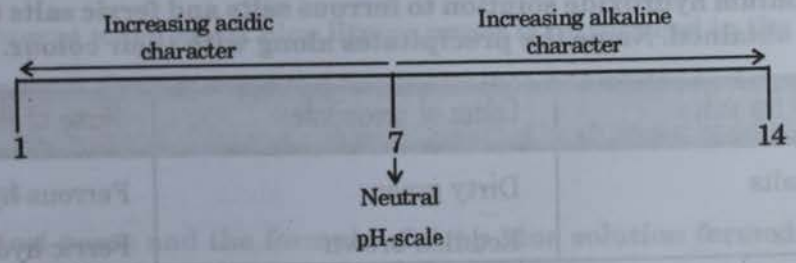
$$[O] + \text{Hydrogen of the colouring matter} \longrightarrow \text{Bleached product} + H_2O$$

$$2KI + Cl_2 \longrightarrow 2KCl + I_2$$

$$I_2 + \text{Starch} \longrightarrow \text{Blue black.}$$

USE OF pH IN SOIL ANALYSES, WATER ANALYSIS, MEDICAL FIELD-SIMPLE IDENTIFICATION WITH UNIVERSAL INDICATOR.

pH scale : It is a scale which tells whether the solution is acidic, alkaline or neutral.



(*i*) pH = 7 neutral

(*ii*) pH < 7 acidic

(*iii*) pH > 7 alkaline

Universal indicator ion which shows different colours with different solutions at different pH values.