5. Acids, Bases and Salts

Extra Questions

Identify the odd one out an justify.

Q.1 Chloride, Nitrate, Hydride, Ammonium

Ans- Ammoniums is the odd one here. The other radicals are onions, acidic radicals. Ammonium is the basic radical are formed by removing electrons, from the atoms of metals as Na^{+}, Cu^{2+}.

Q.2 Hydrogen Chloride, Sodium Hydroxide, Calcium Oxide, Ammonia.

Ans.- Hydrogen Chloride is the odd one here. Hydrogen Chloride is acidic, it produces H^{+} ions, due to property to dissolve in water, and others produce OH ions due to acidic property.

Q.3 Acetic acid, Carbonic Acid, Hydrochloric Acid, Nitric acid.

Ans.- Carbonic acid is the odd one here. It is di-basic, while others are monobasic.

Q.4 Ammonium Chloride, Sodium Chloride, Potassium Nitrate, Sodium Sulphate.

Ans.- Ammonium chloride is the odd one here. It is formed of strong acid, weak base. It is an acidic salt. The others are formed from strong acid and strong base. These are neutral salts.

Q.5 Sodium Nitrate, Sodium Carbonate, Sodium Sulphate, Sodium Chloride.

Ans- Sodium carbonate is the odd one here. It is made of a weak acid and strong base. It is a basic salt. The others are formed by strong acid and strong base. These are neutral salts.

Q.6 Calcium oxide, Magnesium oxide, sodium oxide.
Ans Zinc oxide is the odd one here. It is an Amphoteric oxide, while rest are basic oxides.

Q.7 Crystalline Blue vitriol, Crystalline Common salt, Crystalline ferrous sulphate, Crystalline sodium carbonate.
Ans- Crystalline Common Salt is the odd one here. Crystalline common salt is an ionic compound. The ionic compounds are crystalline in nature. It does not contain water of crystallization. The others have a crystalline nature because of their water of crystallization.

Q.8 Sodium chloride, Potassium chloride, Acetic acid, sodium Acetate.
Ans.- Acetic Acid is the odd one here. It is a work electrolyte. The rest are salts and other are strong electrolytes.

Write down the changes that will be seen in each instance and explain the reason behind it.
Q.9 50 ml water is added to 50 ml solution of copper sulphate.
Ans- The solution of copper - It is concentrated solution it becomes dilute, when 50 ml water is added. The intensity of blue color differs in the homogenous mixture. The concentration of copper sulphate decreases.

Q.10 Two drops of the indicators phenolapthaein were added tp 10ml, solution of sodium hydroxids.

Ans- sodium hydroxide is a base and phenolphthalein is a synthetic indicator when two drops of phenolphthalein indicator are added to 10ml of NaOH, it develops light pink color. It is also a test for identifying bases.

Q.11 Two or three of copper fling were added to 10 ml dilute nitric acid an stirred.

Ans.- When two or three flings of copper are added, to 10 ml dilute nitric acid, the copper metal reacts with dilute nitric acid, it does not displace hydrogen from the acid. The reaction produces Nitric oxide (NO) it forms copper Nitrate and Hydrogen gas.

$3(ucs) + 8NHO_3(aq) \rightarrow 3Cu(NO_3)_2(aq) + 2NO(g) + 4H_2O_{(1)}$

copper nitric acid (dil) copper + nitrate nitric + oxide + water

Q.12 A litmus paper was dropped into 2ml dilute HCI. Then 2ml concentrated NaOH was added to it and stirred.

Ans- A litmus paper when added in 2ml dilute HCl, the blue litmus turned red, as HCl is hydrochloric acid. In the same solution, NaOH was added and strred, the red litmus turned blue.

Q.13 Magnesium oxide was added to dilute HCl and Magensium oxide was added to dilute NaOH.

Ans- When Magnesium oxide was added to dilute HCl, it forms Magnesium chloride and water.

Magnesium oxide + dil HCl Magnesium oxide is basic in nature, it neutralizes acid Magnesium oxide being insoluble base, reacts with dilute HCl and procedure soluble salt $MgCl_2$ and water H_2O.

$$MgO_{(5)} + 2HCl_{(aq)} \rightarrow MgCl_2(aq) + H_2O(1)$$

When Magnesium oxide was added to dilute NaOH no chemical reaction takes place in Magnesium oxide and sodium Hydroxide, because both are basic in nature.

Q.14 Zinc oxide was added to dilute HCl and zinc oxide was added to dilute NaOH.

Ans.- Zinc oxide when added to dilute HCl forms zinc chloride and water. Zinc oxide is a basic oxide when it is added to dilute NaOH, it forms sodium zincate and water.

$$ZnO_{(S)} + 2NaOH_{(aq)} \rightarrow NaZno_{2(aq)} + H_2O\ (ɪ)$$

Zinc oxide is an Amphoteric oxide. It has both acidic and baisc propertites.

Q.15 Dilute HCl was added to limestone.

Ans- When dilute HCl is added to limestone, carbon dioxide is released, calcium chloride and water. Limestone is calcium carbonate.

$$CaCO_3 + 2HCl \rightarrow Cacl_2 + Co_2 + H_2O$$

Q.16 Pieces of blue vitriol were heated in a test tube on cooling, water was added to it.

Ans- 1) When heated, the crystalline structure of blue vitriol breaks down, a colorless powder is formed, and water is released 2) The water evaporates, which is a part of crystal of blue vitriol 3) It is called water of crystallization. 4) When water is added to while powder, blue vitriol regains its color.

Q.17 Dilute H_2SO_4 was taken in an electrolytic cell and electric current was passed through it.

Ans- When dilute H_2SO_4 taken in an electrolytic cell and electric current is passed through the cell hydrogen gas is produced at cathode while oxygen is liberated at anode due to electrolysis of H_2SO_4

Q.18 Classify the following oxides into three types and name the types CaO, MgO, CO_2, Na_2O, ZnO, Al_2O_3, Fe_2O_3.

Basic Oxides	Acidic oxides	Amphoteric oxides
CaO	Co_2	ZnO
MgO	SO_3	Al_2O_3
Na_2O		
Fe_2O_3		

Explain by drawing a figure of the electronic configuration

Q.19 Formation of sodium chloride form sodium and chlorine

Ans.- 1) The electronic configuration of sodium is (2,8,1) Its atomic number is 11. The electronic configuration of chlorine is (2,8,7) its atomic number is 17.

2) The outermost shell of sodium and chlorine is not in octate state. Sodium atom has one electron in its outermost shell, while chlorine has seven electrons in its outermost shell. Hence sodium and chlorine are unstable.

3) When these two atoms come together, sodium donates one electron, while chlorine accepts it. Sodium donates one electron to chlorine and forms Na^+ ion, that has an octet state. Chlorine gains this electron and forms Cl^- ion, that has complete octet. An ionic bond is formed in oppositely charged Na^+ and Cl^- ions, thus an ionic compound Nacl is formed.

$Na \rightarrow Na^+ + e^-$, $cl + e^- \rightarrow cl^-$

(2,8,1) (2,8)

$Na^+ + cl^- \rightarrow$ Nacl

Q.20 Formation of Magnesium chloride form Magnesium and chlorine.

Ans- 1) Atomic number of Magnesium is 12 and its electronic configuration is (2,8,2). Atomic number of chlorine is 17 and its electronic configuration is (2,8,7).

2) The outermost shell of Magenesium and chlorine is not in octet state.

3) Magnesium atom loses two electrons and forms Mg^{2+} ion, which has complete octet.

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

(2,8,2) (2,8)

4) Chlorine atom accepts an electron to form cl^- ion that has complete octet.

$cl + 1e^- \rightarrow cl^-$

(2,8,7) (2,8,8)

An ionic compound $Mgcl_2$ is formed, between Mg^{2+} and cl^- ions.

Q.21 Show the dissociations of the following compounds on dissolving in water, with the help of chemical equation and write whether the proportion of dissociation is small or large.

Hydrochloric acid, sodium chloride, Potassium Hydroxide, Ammonia, Acetic Acid, Magnesium chloride, copper sulphate.

Ans-

Compound	Chemical equation	Proportion of dissociation
a) Hydrochloric acid (HCl)	$HCl \xrightarrow[\text{dissociation}]{\text{water}} H^+_{(aq)} + cl^-_{(aq)}$	HCl is strong acid. IT dissociates completely and forms an aqueous solution. Proportion of dissociation – large.
b) Sodium chloride (NaCl)	$NaCl_{(s)} \xrightarrow[\text{dissociation}]{\text{water}} Na^+_{(aq)} + cl^-_{(aq)}$	The positive and negative ions are pushed by Water molecules, and get separated. Proportion of dissociation – large.
c) Potassium Hydroxide (KOH)	$KOH_{(ı)} \xrightarrow[\text{dissociation}]{\text{water}} K^+_{(aq)} + OH^-_{(aq)}$	KOH is a strong base, It dissolves completely in resulting in mainly OH^- water and dissociates completely aqueous solution, that contains ions. Proportion of dissociation large.
d)Ammonia (NH_3)	$NH_{3(g)} + H_2O_{(ı)} \xrightarrow[\text{dissociation}]{\text{water}} NH^+_{4(aq)} + OH^-_{(aq)}$	Ammonia when dissolved in water and form NH_4OH. It does not dissociate, completely it is weak base. The aqueous solution contain proportion of OH^- ions and basic radical with large proportion of dissociated molecules of base. i.e NH_4OH. The proportion of

		dissociation is small.
e) Acetic Acid (CH_3COOH)	$CH_3COOH_{(ı)}$ $\xrightarrow[\text{dissociation}]{\text{water}}$ $CH_3COOH_{(aq)}^{-} + H_{(az)}$	Acetic Acid is weak, it does not dissociate completely. The resulting aqueous solution contains H^+ ion and concerned acidic radical in small proportion with large proportion of undissociated molecules of the acid. Proportion of dissociation small
f) Magnesium chloride($Mgcl_2$)	$Mgcl_2(3) \xrightarrow[\text{dissociation}]{\text{water}} Mg^{2}_{(aq)} + 2Cl^{-}_{(aq)}$	When Magnesium chloride ions. When ionic compound dissolve in water, the water molecules push themselves in ions of compound and separate them. Proportion of dissociation Large
g) Copper sulphate	$Cuso_{4(s)} \xrightarrow[\text{dissociation}]{\text{water}}$ Copper Sulphate $Cu^{2+}_{(aq)} + So^{2-}_{4}(aq)$	When copper sulphate dissolves in water copper ions and sulphate ions are formed when ionic compound, dissolves in water, the water molecules push themselves in ions of the compound and separate them. Proportion of dissociation Large.

Write down the concentration of each of the following solutions in g/L and mol/L.

Q.22 7.3 g of HCl in 100ml solution.

Solution- Mass of solute (HCl) = 7.3g

Volume of solution = 100ml

$= \frac{100}{1000} = 0.1L.$

a) Concentration in (g/L)

$$= \frac{\text{Mass of solute in grams}}{\text{Volume of solution in litres}}$$

$$= \frac{7.3\ g}{0.1\ L}$$

$$= \frac{7.3}{0.1}$$

=73 g/L

b) Concentration in mol/L

$$= \frac{\text{Mass of solute in grams}}{\text{Volumes of solution in litres}}$$

$$= \frac{7.3\ g}{0.1\ L}$$

=73 g/L

$$\text{Moles} = \frac{\text{Mass of substance in grams}}{\text{Molecular mass of substance}}$$

$$= \frac{7.3}{36.5} = 0.2 \text{ mol}$$

$$\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Volumes of solution (L)}}$$

$$= \frac{0.2 \text{ mol}}{0.1\ L} = 2\text{mol/L.}$$

Q.23 2g NaOH in 50ml solution

Ans- Mass of solute (NaOH)= 2g

Volume of solution = 50ml

$$= \frac{50}{1000} = 0.05\text{L}.$$

$$\text{Concentration in g/L} = \frac{\text{Mass of solute (NaOH)}}{\text{Volume of solution in litre}}$$

$$= \frac{2}{0.05}$$

$$= 40 \text{ g/L}$$

$$\text{Moles} = \frac{Mass\ of\ substance}{Molecular\ mass}$$

$$= \frac{\text{Mass of NaOH}}{\text{Molecular mass of NaOH}}$$

$$= \frac{2}{40}$$

Moles = 0.05 mol.

∴ Concentration in mol/L (Molarity)

$$= \frac{\text{Number of moles}}{\text{Volumes of solution in litre}}$$

$$= \frac{0.05\ mol}{0.05\ L}$$

= 1 mol/L.

Q.24 3g CH_3COOH in 100 ml solution

Mass of CH_3COOH =3g

Volume of solution = 100 mL $= \frac{100}{1000} = 0.1\text{L}$

Concentration in g/L

$$= \frac{\text{Mass of solute in grams}}{\text{Volume of solution in Litres}}$$

$$= \frac{3}{0.1}$$

= 30 g/L

Concentration in mol/L.

$$= \frac{\text{Number of moles of solute}}{\text{Volume of solution in litre}}$$

$$= \frac{0.05\ mol}{0.1\ L}$$

= 0.5 mol/L

$$\text{Moles} = \frac{\text{Mass of substance}}{\text{Molecular mass}}$$

$$= \frac{3}{60}$$

= 0.05 mol

$$\frac{\text{Mass of CH3COOH}}{\text{Molecular mass of CH3COOH}}$$

Q.25 4.9 g H_2So_4 in 200 ml solution

Mass of H_2So_4 = 4.9 g. Volume of solution = $\frac{200}{1000}$ = 0.2 L.

Concentration in g/L

$$= \frac{\text{Mass of solute in grams}}{\text{Volume of solution in litres}}$$

$$= \frac{4.9\ g}{0.2\ L}$$

= 24.5 L

Concentration in mole/L

$$= \frac{\text{No.of moles of solute}}{\text{Volume of solution in litre}}$$

$$= \frac{0.05\ mole}{0.2\ L}$$

= 0.25 mole/L

$$\text{Moles} = \frac{\text{Mass of substance}}{\text{Molecular mass}}$$

$$= \frac{4.5}{98}$$

=0.05 mole/L.

Q.26 Obtain a sample of rainwater. Add to it a few drops of universal indicator. Measure its PH. Describe the nature of the sample of rainwater and explain effect if it has on living world.

Ans- 1) When an universal indicator is added to a sample of rain water, colors rainwater turns greenish yellow. Its PH is between 5 and 5.5, which shows that rainwater is slightly acidic.

2) Rainwater contains micro-nutrients that are useful for the growth of plants. Plants receive nitrates that are formed when nitrogen present in air which dissolves in water.

Effects of acid rain - 1) When acid rain combines with soil, acid adds hydrogen ions to soil, they get pushed in deeper soil. Roots use these ions for nutrients, the roots of plants die.
2) Acid rain affects chemical and PH balance of ground water and other water bodies.
3) It leaches calcium from soil that badly affects plants.
4) It damages human respiratory system, if inhaled deeply.
5) It dames buildings, structures made of stone or metal, paints etc.
6) Animals reproductive system gets affected, Bone decalcification, abnormal growth or may prove fatal.

Answer the following questions

Q.27 Classify the acids according to their basicity and give one example of each type

Classification of acids according to their basicity [i.e. number of ionizable]	Example
a) Monobasic acids	Hydrochloric acid (HCl)
b) Dibasic acids	Sulphuric acid (H_2SO_4)
c) Tribasic acids	Phosphric acid (H_3PO_4)

Q.28 What is meant by neutralization? Give two examples from everyday life of the neutralization reaction.

Ans- Neutralization - Neutralization is a type of chemical reaction that is formed when an acid reacts with a base to from salt and water.

Acid	+	Base	→	Salt	+	Water
$HCl_{(aq)}$	+	$NaOH_{(aq)}$	→	$NaCl_{(aq)}$	+	H_2O
Hydrochloric Acid		Sodium Hydroxide		Sodium Chloride		

H^+ ions are formed from acid and OH^- ions are formed from base. They combine and form H_2O molecules.

$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

Examples – 1) when a person is suffering from acidity he uses antacids to prevent it. Anti-acid are medicines which contain Aluminum hydroxide ($Al(OH)_3$) and magnesium hydroxide ($Mg(OH))_2$ that neutralizes the excess acid in stomach.

2) When an ant stings on us the pain is caused due to formic acid. It can be neutralized by rubbing moist baking soda, it is basic in nature vinegar can cure stings of wasp.

3) Food particles in the teeth contain micro-nutrients that cause decaying of teeth. Before brushing teeth, PH of saliva is 7. Hence, toothpaste that contain alkaline substance, neutralizes acid produced in mouth, and prevent decaying of teeth.

Q.29 Explain what is meant by electrolysis of water. Write the electrode reactions and explain them.

Ans.- Electrolysis of water - Electrolysis of water means decomposition of water, into oxygen and hydrogen gas due to an electric current passed through water.

$$2H_2O \xrightarrow{\text{electric current}} 2H2\uparrow + O_2\uparrow$$

Cathode reaction - The volume of gas formed near the cathode is more than that of gas formed near anode.
Hydrogen gas is formed near canoe and oxygen gas near anode.

$2H_2O_{(1)} + 2e^- \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4\ e^-$

At anode, oxidation reaction takes place and oxygen gas is produced.

Give reason for the follwong

Q.30 Hydronium ions are always in the form H_3O^+

Ans- 1) The (H^+) hydrogen atom / hydrogen ion in an aqueous solution is a single proton

2) When an electron H^+ is removed, then tiny positively charged nucleus remains. The positive charge is concentrated into small volume of a space compared to the volume occupied by an atom.

3) The high density of a proton strongly attracts the negatively charged region. It attracts the water molecule and forms hydronium ion, H_3O^+

4) The hydrogen ions are always in form of H_3O^+

Q.31 Buttermilk spoils if kept in copper or brass container.

Ans Buttermilk contains an organic acid which is lactic acid. Acid reacts with metals and produce salts and hydrogen gas. If buttermilk is kept in brass or copper container, the reaction, the reaction and hydrogen gas spoils the buttermilk, and if consumed by human beings cause food poisoning.

Write down the chemical equations for the following activities.

Q.32 NaOH solution was added to HCl solution.

Ans.- $NaOH_{(aq)}$ + $HCl_{(aq)}$ → $Nacl_{(aq)}$ + $H_2O_{(l)}$

Zinc Sulphuric Acid — Zinc Sulphuric — Hydrogen

Q.33 Zinc dust was added to dilute H_2SO_4

Ans.- $Zn(s)$ + $H_2SO_{4(aq)}$ → $ZnSO_{4(aq)}$ + $H_{2(g)}$

Zinc — Sulphric acid — zinc sulphate — hydrogen

Q.34 Dilute nitric acid was added to calcium oxide

$CaO_{(s)}$ + $2HNO_{3(aq)}$ → $Ca(NO_3)_{2(aq)}$ + $H_2O_{(l)}$

Calcium Oxide — nitric acid — calcium nitrate — water

Q.35 Carbon dioxide gas was passed through KOH solution.

Ans- $2KOH_{(ag)}$ + CO_2 → $K_2CO_{3(aq)}$ + $H_2O_{(l)}$

Potassium Hydroxide — carbon dioxide` — potassium carbonate — water

Q.36 Dilute HCl was poured on baking soda.

Ans- $NaHCO_{3(s)}$ + $HCl_{(aq)}$ → $Nacl_{(aq)}$ + $H_2O_{(l)}$ + $CO_{2(g)}$

Sodium bi Carbonate — hydrochloric acid — sodium chloride — water — carbon dioxide

State the difference.

Q.37 Acids and bases

Ans.-

Acids	Bases
1)The acids contain H^+ as the basic radical	1) The bases contain OH^- as the acidic radical
2) Acids have sour taste.	2) Bases have bitter taste
3) Blue litmus turns red in an acid	3) Red litmus turn blue in a base.
4) An acid in aqueous solution gives H^+ ions	4) A base in a aqueous solution gives OH^- ions.
5) The PH value of acidic solution is less than 7 e.g HCl, H_2SO_4	5) The PH value of basic solution is greater than 7 eg. NaOH, KOH

Q.38 Cations and Anions

Ans.-

Cations	Anions
a) cations, are ions that have a net positive charge	Anions are ions that have a net negative charge
b) cations are basic radicals.	anions are acidic radicals
c) cations are formed by metal atoms metals donate electrons, they have extra protons, and form catons.	Anions are formed by non-metals The non-metals accept the electrons, they have extra electrons and form anions.
d) cation gets attracted to the cathode	Anion get attracted to the anode
e) cathode undergoes electrostatic in reaction with anion to form ionic compound eg. Na^+, Ca^{2+}, Mg^{2+}, K^+ etc	Anion undergoes electrostatic interaction with cation to form ionic compound. Eg.Cl^-, Bl^-, $SO^{2-}{}_4$+, O^{2-}, S^{2-}, Cl^-, Bl^- etc

Q.39) anode and cathode.

Ans.-

cathode	anode
1) The electrode that is connected to negative terminal of battery in an electric circuit is called negative electrode.	1) The electrode connected to the positive terminal of a battery in an electric circuit is called the positive electrode
2) Negative electrode is called as cathode.	2) Positive electrode is called as anode.
3) Negative electrode attracts positively charged ions (cations).	3) Positive electrode attracts negatively charged ions (anions).

Q.40 Classify queues solutions of the following substances according to their. PH into three groups 7, more than 7, less than 7.

Common Salt Sodium Acetate, Hydrochloric acid, carbon dioxide, Potassium Bromide, Calcium Hydroxide, Ammonium chloride vinegar, sodium carbonate, ammonia, Sulphur dioxide.

Ans.-

PH = 7	PH > 7	PH < 7
a) Potassium Bromide	a) Sodium acetate	a) Sulphur dioxide.
b) Common salt	b) Ammonia	b) Hydrochloric acid
	c) Sodium carbonate	c) Carbon-dioxide
	d) Calcium hydroxide	d) Vinegar
		e) Ammonium chloride

Q. 41 Name the following.

The gas released when magnesium metal reacts with dilute hydrochloric acid.

Ans.- Hydrogen gas.

Q. 42 Right or wrong. If wrong, write the correct sentence.
An aqueous solution of $FeCl_3$ is reddish in color.
Ans.- Wrong. An aqueous solution of $FeCl_3$ is yellowish in color.

Q. 43 Match the following.

Group 'A'	Group 'B'
i) KOH	a) Weak base
ii) H_2CO_3	b) Strong acid
iii) NH_3	c) strong base
iv) HBr	d) Weak acid

Ans.-

Group 'A'	Group 'B'
i) KOH	a) strong base
ii) H_2CO_3	b) Weak acid
iii) NH_3	c) Weak base
iv) HBr	d) Strong acid

Q. 44 What are alkalies?
Ans.- Bases, which are highly soluble in water, are called alkalies.

Q. 45 Define Molarity.
Ans.- The number of moles of the solute dissolved in one litre of the solution is called the molarity of the solution.

Q. 46 Define electrolytes. Give two examples.

Ans.- Substances which undergo dissociation to a great extent in the liquid state or a solution are called electrolytes.

E.g. $CuSO_4$, H_2SO_4 etc

Q. 47 What is water of crystallization?

Ans.- The definite number of water molecules present in the crystal structure of a salt is called the water of crystallization.

Q. 48 Give examples of each.

i) Strong acids

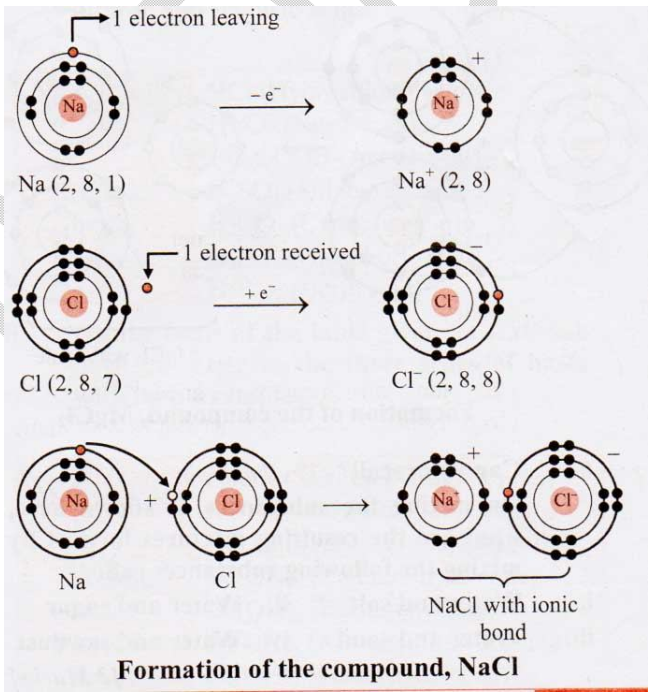
Ans.- Hydrochloric acid (HCl), Nitric acid (HNO3).

ii) Strong bases

Ans.- Sodium hydroxide (NaOH), Potassium hydroxide (KOH).

Q. 49 Draw the electronic configuration diagram.

Ans.-



Formation of the compound, NaCl

Q. 50 What are the strong acids?

Ans.- Acids, which on dissolving in water, dissociate almost completely and the resulting aqueous solution contains mainly H+ ions and the concerned acidic radicals, are called strong acids.