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CHEMISTRY

Class 10th (KPK)

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UNIT 10
ACIDS, BASES AND SALTS
SHORT QUESTIONS:

Q1. When a clear liquid is placed in a beaker. How can you identify whether it as an acid, base or neutral?

Ans: Different methods is used to determine the whether the given solution/ liquid is acidic, basic or neutral.

Litmus paper:

One of them is litmus paper test. In this method litmus paper is dipped in a beaker. If it turns the blue litmus paper to red then the given liquid will be acidic. If it turns red litmus paper then the given liquid will be basic. If the litmus paper remains unchanged it will be neutral liquid.

pH scale:

We can also use pH scale to measure the acidity or basicity of a solution. pH scale is a number from 0 to 14. From 0 to 7 are acids. From 7 to 14 are bases while if a liquid has a pH of 7. It will be neutral

Q2.justify H^+ ion as a Lewis acid?

Ans: H^+ ion as a Lewis acid:

According to Lewis concept a positively charged ions that can accept an e**lectron pair** can act as Lewis acid.

As H^+ is positively charged ion and it has tendency to accept lone pair of electrons so it acts as a Lewis acid.

$H^+ + :NH_3 \longrightarrow NH_4^+$

(Acid) (Base) (Ammonium ion)

Q3. Distinguish strong acids from weak acids? Give two example of each.

Strong acid:

Those acids which ionizes completely in aqueous solutions and give higher concentration of H^+ ions are called strong acids". A strong acid is strong electrolyte.

HCI, H_2SO_4 and HNO_3 are the examples of strong acids because they completely ionize in water.

$HCI_{(aq)} \longrightarrow H^+ + CI^-$

$H_2SO_{4\,(aq)} \longrightarrow H^+ + SO_4^-$

$HNO_{3\,(aq)} \longrightarrow H^+ + NO_3^-$

Weak acids:

"Those acids which do not completely ionize in aqueous solutions and give lower concentration of H^+ ions are called weak acids". A weak acid is weak electrolyte.

Examples:

$CH_3COOH\ (aq) \rightleftharpoons H^+ + CH_3COO^-$

Acetic acid (CH_3COOH) is a weak acid because when it is added into water, very few molecules of CH3COOH are dissociated. Some other weak acids are H_2S, H_2CO_3, H_2SO_3 and HNO_2 etc.

Q4. Compare the physical properties of acid and bases.

Ans:

Acids	Bases
i. Acids have sour taste	i. Base have bitter taste
ii. It turns blue litmus paper to red.	ii. It turns red litmus paper to blue
iii. Acids produce H^+ ions when dissolved in water.	iii. Base produces OH^- \ when dissolved in water.

iv.	Acids solution have P^H values less than 7.	**iv.**	Basics solution have P^H values greater than 7.

Q5 A carbonated drink has $[H^+] = 3.2 \times 10^{-3}$ M, classify the drink as neutral acidic or basic with reason.

Ans: Solution:

Data: hydrogen ion concentration = $[H^+] = 3.2 \times 10^{-}M$

Determination of P^H

$P^H = -\log [H^+]$

Putting the value of $[H^+]$ we get:

$P^H = -\log [3.2x10^{-3}]$

$=P^H=-(\log 3.2+\log 10^{-3})$ ∵ log mn = logm + logn

$=P^H=-[\log 3.2-\log 10^{-]3}$

$=P^H= -(0.5051) –(-3) \log 10$ ∵ $\log m^n = n \log m$

$=P^H = -0.5051 + 3\log 10$

$=P^H= -.0.5051 +3\ (1)$ ∵ log10=1

$=P^H= 0.5051 +3$

$=P^H= 2.49$

As the pH is less than 7 so the carbonated drink is acidic solution.

OR

We can also solve this problem by comparing the given $[H]^+$ of the solution with that of neutral water.

As we know that $[H]^+ = [OH]^- = 1\times10^{-7}$

If $[H]^+ > 1\times10^{-7}$ the solution will be acidic.

If $[OH]^{- >} 1\times10^{-7}$ the solution will be basic.

As in the given solution $[H] += 3.2\times10^{-3}$ M $> 1\times10^{-7}$ the solution is acidic.

Q6. Write the chemical name of an acid present in the following.

Ans: (a). Apple juice: Malic acid

(b).Grape: Tartaric acid

(c). Lemon juice: Citric acid

(d). Sour milk: Lactic acid.

Q7.What determine the strength of a base? Give one example of each solution of strongly acidic and weakly acidic.

Ans: Strong bases:

"Those bases which completely dissociate in aqueous solution and give a higher concentration of OH^- are called strong bases".

Strong bases completely ionize in water and almost no unionized molecule is left behind.

Examples:

Examples of some of the strong bases are given below:

$NaOH_{(aq)} \longrightarrow Na^+ OH^-$

$KOH_{(aq)} \longrightarrow K^+ + OH^-$

$LiOH_{(aq)} \longrightarrow Li + OH^-$

Weak bases:

"Those bases which do not dissociate completely in aqueous solution and give a lower concentration of OH^- are called weak bases".

Examples:

Some bases which do not completely ionize in water are given below:

$NH_4OH_{(aq)} \rightleftharpoons NH_4^+ + OH^-$

$Ba(OH)_{2(aq)} \rightleftharpoons Ba^{+2} + 2OH^-$

$Mg(OH)_{2(aq)} \rightleftharpoons Mg^{+2} + 20H^-$

Q8. Calculate the pH and pOH of O.5 M solution of HCl.

Calculate the P^H and P^{OH} of 0.5M HCL solution.

Given:

Molarity of hydrochloric acid (HCI) solution= 0.05M

Required:

To calculate the P^H and P^H

Solution:

Chemical equation for ionization of hydrochloric acid is:

$HCI \rightarrow H^+ + CI^-$

0.5M 0.05M

Hydrogen ion concentration $[H^{+}] = 0.5 = \frac{5}{10} = 5x10^{-1}$ M

Determination of P^H

$P^H = -\log [H^+]$

Putting the value of $[H^+]$ we get:

$P^H = -\log [5x10^{-1}]$

$=P^H=-(\log 5+\log 10^{-1})$ ∵ log mn = logm + logn

$=P^H=-\log 5-\log 10^{-1}$

$=P^H= -(.06989) - (-1) \log 10$ ∵ $\log m^n = n \log m$

$=P^H = -0.6989+1\log 10$

$=P^H= -.06989 +1 (1)$ ∵ log10=1

$=P^H= -.06989 +1$

$=P^H= 0.301$

Determination of P^{OH}:

We know that:

$P^H + P^{OH} = 14$

$P^{OH} = 14 - P^H$

Putting the value of P^H we get:

$P^{OH} = 14-0.3o1$

$\Longrightarrow P^{OH} = 13.$

Result:

$P^H = 0.301$ and $P^{OH} = 13.69$

Q9. Calculate the P^H and P^{OH} of 0.005M H_2SO_4 solution.

Given:

Molarity of H_2SO solution= 0.005M

Required:

To calculate the P^H and P^H

Solution:

Chemical equation for ionization of nitric acid is:

$\mathbf{H_2SO} \rightarrow 2H^+ + \mathbf{SO_4^{-2}}$

0.005M 0.005M

Hydrogen ion concentration $[H^+]$:$0.005 = \frac{5}{1000} = 5x10^{-3}$ M

Determination of P^H

$P^H = -\log [H^+]$

Putting the value of $[H^+]$ we get:

$P^H = -\log [5x10^{-3}]$

$=P^H=-(\log5+\log10^{-3})$ ∵ log mn = logm + logn

$=P^H=-\log5-\log10^{-3}$

$=P^H= -(.06989) – (-3) \log 10$ ∵ $\log m^n = n \log m$

$=P^H = -0.6989+3\log10$

$=P^H= -.06989 +3\ (1)$ ∵ log10=1

$=P^H= -.06989 +3$

$=P^H= 2.301$

Determination of P^{OH}:

We know that:

$P^H + P^{OH} = 14$

$P^{OH} = 14 - P^H$

Putting the value of P^H we get:

$P^{OH} = 14- 2.301$

$\Longrightarrow P^{OH} = 11.699$

Result:

$P^H = 2.301$ and $P^{OH} = 11.699$

10. Calculate the P^H of 0.2M NaOH solution?

Given:

Concentration of NaOH solution = 0.2M

Required:

P^{OH} =?

Solution:

Chemical equation for ionization of sodium hydroxide is:

$NaOH \rightarrow Na^+ + OH^-$

0.2M 0.2M

Hydroxide ion concentration $[OH^-]$: $0.2M = \frac{1}{10} = 10^{-1}M$

Determination of P^{OH}

$P^{OH} = -\log [OH^-]$

Putting the value of $[OH^-]$ we got:

$P^{OH} = -\log [2x10^{-1]}$

$P^{OH} =-(\log2+\log10^{-1})$ ∵ log mn = logm + logn

$P^{OH} =-\log5-\log10^{-3}$

$P^{OH} = -(0.301) –(-1) \log 10$ ∵ $\log m^n = n \log m$

$P^{OH} = -0.301+ 1\log10$

$P^{OH} = -.0.301+1\ (1)$ ∵ log10=1

$P^{OH} = 0.699$

Determination of P^H:

We know that:

$P^H + P^{OH} = 14$

$P^H = 14 – P^{OH}$

Putting the value of P^H we get:

$P^H = 14 - 0.699$

$\Longrightarrow P^H = 13.301$

Result:

$P^H = 13.301$ and $P^{OH} = 0.699$

LONG QUESTIONS:

Q1, (a). What is salt?

Salt:

"The substance obtained due to neutralization reaction of an acid base reaction is called salt".

Composition of salt:

A salt consists of positive ions combined with negative ions. Positive ions come from a base while negative ions come from an acid i.e. In NaCI Na^+ is from NaOH while CI^- is from HCI.

Examples of some salts:

Examples of salts are given below:

ii. Silver bromide (AgBr)

iii. Potassium sulphate (K_2SO_4)

iv. Ferric phosphate ($FePO_4$).

Q1. (b). write down the different types of salts with example?

Ans: Types of salts:

There are three types of salts i.e. neutral salt, acidic salts and basic salts their detail is given below:

i. Neutral salts:

"The salts formed when hydrogen atom of an acid is completely replaced by a metal ion or group of atoms behaving like metal ion are called normal salts".

Neutral salts are formed when a strong acid react with strong base.

Examples:

$NaOH + HCI \rightarrow NaCI + H_2O$

Base Acid Normal Salt

Some other examples of normal salts are given below:

i. Potassium sulphate (K_2SO_4)

ii. Sodium phosphate (Na_3PO_4)

iii. Ammonium sulphate [$(NH_4)_2SO_4$]

iv. Sodium carbonate (Na_2CO_3)

ii. Acidic salts:

"The salts formed when hydrogen atom of a polyprotic acid is partially replaced by a metal ion or group of atoms behaving like metal ion are called acidic salts".

Examples:

$$H_2SO_4 + KOH \rightarrow KHSO_4 + H_2O$$

These acids can further react with bases forming neutral salt

$$KHSO_4 + KOH \rightarrow K_2SO_4 + H_2O$$

Some other examples of acidic salts are given below:

i. Ammonium bi phosphate [NH_4) H2PO4]

ii. Potassium bicarbonate ($KHCO_3$)

ii. Sodium bicarbonate [($NaHCO_3$] etc.

iii. Basic salts:

"The salts formed when hydroxide ions (OH^-) of a base are partially neutralized by an acids are called basic salts".

Basic salts are formed by poly acid bases only e.g.

Examples:

$Pb(OH)_2$, $Mg(OH)_2$, $AI(OH)_3$ etc.

$Pb(OH)_2 + HCI \rightarrow Pb(OH)CI + H_2O$.

Q2. (a). Define the auto-ionization of water. How can you find the pH of Water?

Ans: Auto-ionization of water:

The reaction in which two water molecules produce ions is called as the self-ionization or auto-ionization of water.

Explanation:

In order to understand the concept of self-ionization or auto ionization of water, we take one molecule of water and its dissociation at 25^0C, as

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

Equilibrium constant expression for this reaction is:

$$K_c = \frac{[H^+][OH^-]}{[H_2O]}$$

As concentration of H_2O remains constant and the above equation can be written as:

$Kc\ [H_2O] = [H^+]\ [OH^-]$

$Kw = [H^+]\ [OH^-]$

where $Kw = Kc\ [H_2O]$

Dissociation constant of water (K_w):

K_w is called dissociation constant or ionization constant of water. It is defined as " the product of molar concentration of $H^+(H_3O^+)$ and OH^- ions is called dissociation constant of water". The value of K_w of water at 25^0C is $1.0x10^{-14}$ i.e.

$K_w = [H^+]\ [OH^-] = 1x10^{-14}$ mol/dm^3 of water at 25^0C

As one molecule of water produces one H^+ and oneOH^- ion on dissociation.

Therefore, we can say that,

$[H^+]\ [OH^-] = 1x10^{-14}$

$[H^+] = [OH^-]$

Or $[H^+]\ [H^+] = 1x10^{-14}$

$(H^+)^2 = 1x10^{-14}$

$(H^+)^2 = 1x10^{-14}$

Therefore

$(H^+) = 1x10^{-7}$

And $[OH^-] = 1.0\times 10^{-7}$

In water at 25^0C, $(H^+) = 1x10^{-7}$Mand $[OH^-] = 1.0\times 10^{-7}$M

$K_w = [H^+]\ [OH^-]$

$K_w = 1x10^{-7}M \times 1x10^{-7}M$

$K_w = 1x10^{-14}\ M^2$

pH Definition:

P^H can also be defined as:

"The negative logarithm of molar concentration of H^+ ions is called P^H".

$P^H = -\log [H^+]$

P^H of Water:

According to this scale, pH of water is calculated as,

$pH = -\log [H^+]$

putting values of $[H^+]$,

$pH = -\log[1.0\times 10^{-7}]$

pH = - (-7.0) log10 log10= 1

pH = 7.0

Q.2(b). Why some acids are called monoprotic, diprotic and polyprotic acids. Explain your answer with suitable examples.

Ans: Acids can be classified in term of number of protons that can be given by per molecule of an acid when added to water. Acids are classified as,

i. Mono-protic acids

ii. Poly-protic acids

Monoprotic or monobasic acids:

"Those acids which give one proton per molecule are called monoprotic acids or monobasic acids".

Examples:

HCI, $HNO3$, CH_3COOH, HBr, HCN etc are some of the examples of monoprotic acids because they give only one portion per molecule.

$HCI_{(aq)} \longrightarrow H^+ + CI^-$

$HNO_{3\,(aq)} \longrightarrow H^+ + NO^-$

$CH_3COOH_{(aq)} \longrightarrow H^+ + CH_3COO^-$

$HBr_{(aq)} \longrightarrow H^+ + Br^-$

$HCN_{(aq)} \longrightarrow H^+ + CN^-$

Polyprotic acids:

"Those acids which give more than one proton per molecule are called polyprotic acids or polybasic acids".

These are further divided into the following subgroups:

i. **Diprotic acids:**

"Those acids which give two protons per molecule are called diprotic acids or dibasic acids".

Examples:

$H_2SO_4H_2CO_3$ etc. are the examples of diprotic acids because they give two protons per molecule.

$H_2SO_{4\,(aq)} \longrightarrow 2H^+ + SO^{-2}$

$H_2CO_{3\,(aq)} \longrightarrow 2H^+ + CO_3^{-2}$

ii. **Triprotic acids:**

"Those acids that give three protons per molecule are called Triprotic acids or tribasic acids".

Example:

Phosphoric acid is an example of triprotic acid as clear from the following chemical equation:

$H_3PO_{4(aq)} \longrightarrow 3H^+ + PO_4^{-2}$

Q3. (a). Discuss the concept of lewis acids and bases with examples.

Ans: The Lewis concept:

Introduction:

G.N Lewis presented his own concept of acids and bases in 1923.

Definitions of acids and bases:

Acids:

According to this concept an acid is a species that can accept an election pair.

Base: Base is a species which can donate electron pair.

An acid is electrophile (electron loving) while a base is a nucleophile (nucleus loving).

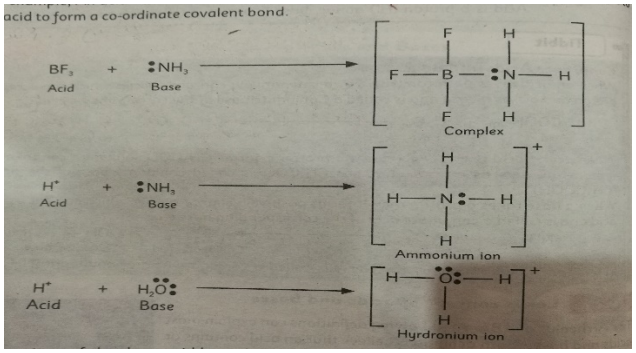
Species which acts as Lewis acids:

Those compound in which central atom has less than eight electrons in valance shell or positively charged ions that can accept an electron pair act as Lewis acids. e.g. BF_3, $AICI_3$,H^+ etc.

Species which acts as Lewis Base:

Those compounds in which central atom has lone pair of electrons in valance shell or negatively charged ions that can donate an electron pair can act as Lewis bases. act as Lewis bases e.g. NH_3, H_2O,CN^-,CI^-

Example:



Q3. (b) Give the bronsted-lowery definition of acids and bases. Write equation that explain the definition.

Ans: Introduction:

Bronsted and Lowry presented a broader concept about acids and bases in 1923.

Definitions of acids and bases:

According to Bronsted-Lowry concept.

Acids: Acids are defined as the substances which donate or tend to donate protons (H^+ ions).

Bases: Bases are defined as the substances which accept or tend to accept protons.

Examples:

i. When ammonia (NH_3) is added to water, the following reaction occurs:

$$\mathbf{HCl_{(aq)} + NH3_{(aq)} \longrightarrow NH_{4(aq)}^{+} + Cl^-_{(aq)}}$$

(Acid) (Base)

In the above example the ammonia accepts a proton from HCI, therefore, it acts as a base while HCI donates a proton and therefore it acts as an acid.

ii. $\mathbf{HCl + H2O \longrightarrow H_3O^+ + Cl^-}$

Acid Base

In this example water act as a **bronsted-lowery** base and HCl act as **bronsted-lowery** acid?

iii. $\mathbf{H_2O_{(l)} + NH_3 \longrightarrow NH_{4(aq)}^{+} + OH}$

In the above example the ammonia accepts a proton from H_2O, therefore, it acts as a base while H_2O donates a proton and therefore it acts as an acid.

Q4. Below are two equations showing how two alkalis react with water.

$$\mathbf{NaOH_{(aq)} + H_2O_{(i)} \rightleftharpoons Na^+_{(aq)} + OH^-}$$

$$\mathbf{NH_{3\,(aq)} + H_2O \rightleftharpoons NH_4^+{}_{(aq)} + OH_{-(aq)}}$$

A). name both alkalis.

Ans: NaOH = sodium hydroxide

NH_3 = ammonia

B. which is classified as weak alkali and why?

NaOH is a strong base while NH_3 is weak base.

c. What is the likely pH of each alkali?

PH of NaOH is13 while that of NH_3 is 11.6

Q5. Write the balanced neutralization reaction of,

i. Strong acid and strong base:

$HCl + NaOH \rightarrow NaCl + H_2O$
(Acid) (Base)

ii.Strong acid with weak base:
$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$

iii.weak acid and strong base:
$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

iv.weak acid and weak base:
$CH_3COOH + NH_4OH \rightarrow CH_3COONH4 + H_2O$

Q5.(b). Define pH and pOH.
Ans: Meaning of P in pH and pOH
P stands for potenz (potential to be). Thus, P^H means potential of H^+ ions while pOH means potential of OH^+ ions while it denotes negative log i.e.=-log.
pH Definition:
P^H can also be defined as:
"The negative logarithm of molar concentration of H^+ ions is called P^H".
$P^H = -\log [H^+]$
According to this scale, pH of water is calculated as,
$pH = -\log [H^+]$
putting values of $[H^+]$,
$pH = -\log[1.0\times 10^{-7}]$
$pH = - (-7.0) \log 10$ $\log 10 = 1$
$pH = 7.0$
pH Definition:
pOH can also be defined as:
"The negative logarithm of molar concentration of OH^+ ions is called poH.
$pOH = -\log [OH^+]$
According to this scale, pOH of water is calculated as,
$pOH = -\log [OH^+]$
Putting values of $[OH^+]$,
$pOH = -\log[1.0\times 10^{-7}]$
$pOH = - (-7.0) \log 10$ $\log 10 = 1$
$pOH = 7.0$
Comparison of $_pH$ values:
A solution having P^H value of 7 is neutral, less than 7 is acidic while a solution having P^H value more than 7 is basic.
Q6. (a). According to your understanding which one is the three acid definitions is the broadest? Explain.
Ans: The three basic definitions of acid and bases are as follow;
1. The Arrhenius concept (The classical concept):
Introduction: The first concept about acids was presented by Arrhenius in 1884.
Definitions of acids: According to this concept acids are defined as follows:
Acid:" The compound which gives H^+ ions in water is called acid".

Examples of Arrhenius acids:

HCI, H_2SO_4, HNO_3, HBr, HI, CH_3COOH etc. are some of the examples of Arrhenius acids because when these are added to water, they ionize to give H^+ ions which react with water to form hydronium ions H_3O^+. The chemical equations for the ionization of some acids are as follows:

$HCI_{(aq)} + H_2O_{(I)} \longrightarrow H_3O^+_{(aq)} + CI_{(aq)}$

$HNO_{3(aq)} + H_2O_{(I)} \longrightarrow H_3O^+_{(aq)} + NO_3^-{}_{(aq)}$

Introduction:

Bronsted and Lowry presented a broader concept about acids in 1923.

Definitions of acid:

According to Bronsted-Lowry concept.

Acids: Acids are defined as the substances which donate or tend to donate protons (H^+ ions).

Examples:

i. When ammonia (NH_3) is added to water, the following reaction occurs:

$\mathbf{HCl_{(aq)}} + \mathbf{NH_{3(aq)}} \longrightarrow N\mathit{H}^+_{4(aq)} + \mathbf{Cl^-_{(aq)}}$

Proton donor Proton acceptor

(acid) (base)

In the above example the ammonia accepts a proton from HCI, therefore , It acts as a base while HCI donates a proton and therefore it acts as an acid.

The Lewis concept:

Introduction:

G.N Lewis presented his own concept of acids and bases in 1923.

Definitions:

According to this concept an acid is a species that can accept an election pair.

An acid is electrophile (electron loving)).

Species which acts as Lewis acids:

Those compound in which central atom has less than eight electrons in valance shell and positive ions act as Lewis acids i.e. they accept electron pair e.g. BF_3, $AICI_3$, H^+ etc.

Q6.(b). Write the uses of any three salts.

Ans: Uses of salts:

i. Sodium carbonate (Na_2CO_3):

Sodium carbonate (Na_2CO_3) is called soda ash or washing soda. It is used as cleaning agent in laundries and as water softener. It is also used as raw material in the manufacture of glass. It is also used in paper industry, leather industry and petroleum refining industry.

ii. Sodium bicarbonate ($NaHCO_3$):

It is also called as baking soda because it is used in baking of cakes and other confectionaries. It is also as antacids in medicines and in toothpastes etc.

iii. Copper sulphate ($CuSO_4.5H_2O$)(Blue vitriol):

It is used as electrolyte in copper electroplating process. It is also used to kill algae in water reservoirs and in agric substancriculture spray.

TOPIC WISE QUESTIONS

Q. What are amphoteric substances?

Ans: Amphoteric substances:

"Those substances which can act both as an acids and a base are called amphoteric substances".

Examples:

i. Water is amphoteric because it acts as a base with an acid while it acts as an acid with a base.

$HCI + H\text{-}OH \longrightarrow H_3O^+ + CI^-$

Acid Base conjugate acid conjugate base

$NH_3 + H_2O \longrightarrow NH^+ + OH^-$

Base Acid conjugate acid conjugate base

ii. During self-ionization of water some water molecules acts as an acid while some acts as a base:

$H_2O + H2O \longrightarrow H_3O^+ + OH^-$

Acid Base conjugate acid conjugate base.

Q. What is neutralization reaction?

Ans: Neutralization:

"The reaction of an acid with a base to form salt and water is called neutralization reaction".

Explanation with example:

For example, when HCL reacts with NaOH, NaCI and water and formed.

$HCI + NaOH \rightarrow NaCI + H_2O$

Acid base salt water

In order to understanding the process of neutralization, we need to write the acid, base and salt in their ionic forms.

$H^+ + CI^- + Na^+ + OH^- \rightarrow Na^+ + CI^- + H_2O$

In solution HCI exist as H^+ or H_3O^+ and CI^-, and NaOH exist as Na^+ and OH^-. In neutralization H^+ reacts with OH^- to form water, leaving Na^+ and CI^- ions in the solution which are present on both sides of the equation and they have not reacted. They are called spectator ions.

Thus, the net reaction of neutralization is the reaction of H^+ with OH^- to form water as given below:

$H^+ + OH^- \rightarrow H_2O$

The Na^+ and CI^- ions remain in the solution and can be obtained by evaporation the solution.

Q. Write down different method of preparation of salts?

Preparation of Salts:

Various preparation methods of salts are given below:

i. By neutralization reaction:

One of the most important and common method of preparation of salt is neutralization reaction in which an

acid reacted with a base to form salt and water

$NaOH + HCI \rightarrow NaCI + H_2O$

Base Acid salt water

ii. By the reaction of acid and metal (Direct displacement method:

In this method H^+ of an acid is replaced by the reactive metal to produce respective salt and hydrogen gas. For example, magnesium (Mg), Calcium (Ca), Zinc (Zn) etc

$2HCl_{(aq)} + Mg_{(s)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

iii. By the reaction of acids with carbonates and bicarbonate

When an acid reacts with carbonate such as sodium carbonate (Na_2CO_3) or bicarbonate such as sodium bicarbonate ($NaHCO_3$) it produces salts e.g.

$Na_2CO_3 + 2HCI \rightarrow 2NaCI + CO_2 + H_2O$

$NaHCO_3 + HCI \rightarrow NACI + CO_2 + H_2O$

iv. By the reaction of an acid and metallic:

The metallic oxide such as copper oxide (CuO), Calcium oxide (CaO), react with acids to form salt and water.

$H_2SO_{4(aq)} + CaO_{(aq)} \rightarrow CaSO_{4(aq)} + H_2O_{(l)}$

Q.What are double salts?

Ans: Double salts:

Definition:

"The type of salts which consist of two specific salts containing water of crystallization are called double salts".

Preparation:

Double salts are formed by mixing the saturated solutions of two specific salts in a simple mole ratio, followed by crystallization. Double salts crystallize out containing water molecules in them. These water molecules are called water of crystallization.

Examples:

Following are some of the examples of double salts:

Salt name	Chemical formula
Potash alum	K_2SO_4, $AI_2(SO_4)_3$, $24H_2O$
Chrome alum	K_2SO_4, $Cr_2(SO_4)_3$, $24H_2O$
Ferric alum	$(NH_4)_2SO_4$,$Fe_2(SO_4)_3$, $24H_2O$

Q. Describe the uses of salts?

Ans: Uses of salts:

Salts have many different uses, ranging from household to big industries. Some important uses of different salts are given below:

i. Sodium chloride (NaCI):

It is daily used in our food to give it taste. It is used for seasoning and preserving food. In industry it is used as basic raw material for the extraction of sodium preparation of caustic soda (NaOH), washing soda etc. one of the major applications of sodium chloride is de-icing of roadways in sub-freezing weather.

ii. Calcium sulphate ($CaSO_4.2H_2O$):

It is also called gypsum. It is used as fertilizer in the preparation of plaster of Paris, and in cement industry.

iii. Sodium carbonate(Na_2CO_3):

Sodium carbonate (Na_2CO_3) is called soda ash or washing soda. It is used as cleaning agent in laundries and as water softener. It is also used as raw material in the manufacture of glass. It is also used in paper industry, leather industry and petroleum refining industry.

iv. Sodium bicarbonate ($NaHCO_3$):

It is also called as baking soda because it is used in baking of cakes and other confectionaries. It is also as antacids in medicines and in toothpastes.

v. Copper sulphate ($CuSO_4.5H_2O$) (Blue vitriol):

It is used as electrolyte in copper electroplating process. It is also used to kill algae in water reservoirs and in agriculture spray.

vi. Magnesium sulphate ($MgSO_4 7H_2O$) (Epsom Salt):

It is used as antacid and laxative in medicines. It is also used in dye industries.

vii. Potash alum ($K_2SO_4.AI_2 (AO_4)_3$, $24H_2O$):

It is used for water purification to remove suspended impurities. It is also used in textile industry and as blood coagulant in small injuries.

viii. Potassium nitrate (KNO_3):

It is used as a fertilizer and for the manufacture of flint glass.

ix. Calcium Carbonate ($CaCO_3$):

It is used in the preparation of cement and in ceramics industry.

x. Sodium sulphate:

It is used in the manufacture of paper, detergents and glass etc.