



/padhle akshay

PRESENTS

# Acids, Bases And Salts



# WHY THESE NOTES?

- ✓ TOUCHES EVERY CORNER OF NCERT
- ✓ INCLUDES NCERT ACTIVITIES (AKQ), BOXES(BKQ) & EXEMPLAR (EKQ)
- ✓ EACH LINE, FLOWCHART & DIAGRAM IS MOTIVATED FROM PYQs
- ✓ APPROVED BY 3 CBSE TOPPERS

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&  
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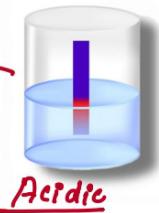
## acids

Acids are those substance which dissociates (or ionise) on dissolving in water to produce hydrogen ions  $[H^+(aq)]$  cons.

### Physical properties

- Acids are sour in taste.
- It turn blue litmus paper into red.
- Acids are good conductor of electricity.
- Strong acids are strong electrolyte and weak acids are weak electrolyte.

#BAR

(Blue Litmus)  
Turn Red

Acidic

### Chemical properties

1. Acids react with metals to form hydrogen gas.



- $H_2SO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + H_2(g)$
- $HCl(aq) + Zn(s) \rightarrow ZnCl_2(aq) + H_2(g)$
- $CH_3COOH(aq) + Zn(s) \rightarrow (CH_3COO)_2Zn(aq) + H_2(g)$
- $HNO_3(aq) + Zn(s) \rightarrow Zn(NO_3)_2(aq) + H_2(g)$

Hydrogen  
Nikae  
denge

ACID  
TO METAL

We can check the presence of  $H_2$  gas taking burning candle near a gas filled bubble  $H_2$  gas burn with a pop sound.

2. Acid react with metal carbonates (and metal hydrogen carbonate) to form carbon dioxide gas.



- $Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$
- $NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$
- $Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$
- $CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2(aq)$

3. Acid react with Base form salt and water.



- $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

4. Metal oxides react with acid form salt and water.



- $CuO + 2HCl \rightarrow CuCl_2 + H_2O$

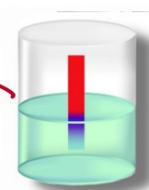
[Metallic oxide are said to be basic oxide]

## base

Bases are those substances which dissociate (or ionise) on dissolving in water to produce hydroxide ions  $[OH^-]$  ions.

### Physical properties

- Bases are bitter in taste.
- It turn red litmus paper into blue.
- They are good conductor of electricity.

(Red Litmus)  
Turns Blue

Basic

### Chemical Properties

1. Base react with some metal to form hydrogen gas.



- $2NaOH(aq) + Zn(s) \rightarrow Na_2ZnO_2(s) + H_2(g)$

2. Non-metallic oxide react with base, form salt and water.



- $\text{CO}_2(\text{g}) + \text{Ca(OH)}_2(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$   
[Non-metallic oxide are acidic in nature.]

## Indicator

Indicators are the substance which indicate the nature of solution that it is acidic or basic by change in its colour or change in smell.

## Types of Indicator

### B.K.Q

### Natural Indicator

Ye Sare pointe Yaad kar lena  
Yaha se Question ban Sakte hai

- litmus is a natural indicator
- its neutral colour is purple
- It is extracted from plant (division Thallophyta) called lichen.  
Acid - (Red) Base - (Blue)
- red cabbage, turmeric, Coloured petal (Hydrangea, Petunia and Geranium)

### Synthetic Indicator

#### Methyl orange

- Neutral - Orange  
Acid - Red  
Base - Yellow

#### Phenolphthalein

- Neutral - Colourless  
Acid - Colourless  
Base - Pink

### Olfactory Indicator

Vanilla, Onion and clove oil.

soong ke bata dunga



### a.k.Q-2.1

What change in colour did you observe with red litmus, blue litmus, phenolphthalein and methyl orange solutions for each of the solutions?

Sample solution	Red litmus solution	Blue litmus solution	Phenolphthalein solution	Methyl orange solution
HCl	No change	Red	Colourless	Pinkish red
$\text{H}_2\text{SO}_4$	No change	Red	Colourless	Pinkish red
$\text{HNO}_3$	No change	Red	Colourless	Pinkish red
$\text{CH}_3\text{COOH}$	No change	Red	Colourless	Pinkish red
NaOH	Blue	No change	Red to pink	Remains yellow
KOH	Blue	No change	Red to pink	Remains yellow
$\text{Mg(OH)}_2$	Blue	No change	Red to pink	Remains yellow
$\text{NH}_4\text{OH}$	Blue	No change	Red to pink	Remains yellow
$\text{Ca(OH)}_2$	Blue	No change	Red to pink	Remains yellow

# Neutralisation Reaction

The reaction between an acid and a base to give a salt and water is known as a neutralisation reaction.

## alkali

A water soluble base is called an alkali.

### Base dissolved in water

- $\text{NaOH}(s) \xrightarrow{\text{H}_2\text{O}} \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq})$
  - $\text{KOH}(s) \xrightarrow{\text{H}_2\text{O}} \text{K}^+(\text{aq}) + \text{OH}^-(\text{aq})$
  - $\text{Mg(OH)}_2(s) \xrightarrow{\text{H}_2\text{O}} \text{Mg}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq})$
- $$\Rightarrow \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$$

## A.K.Q-2.3

? What do you observe on the surface of zinc granules?

Hydrogen gas bubbles are formed on the surface of zinc granules.

? Why are bubbles formed in the soap solution?

Soap bubbles filled with hydrogen are formed.

? Take a burning candle near a gas-filled bubble. What do you observe?

Hydrogen burns with a pop sound.

Bubbles come out vigorously with strong acids. Zinc also reacts with weak acids like acetic acid, but gas is formed slowly.

## Dilution

Mixing an acid or base with water result in decrease in the concentration of ions ( $\text{H}_3\text{O}^+$  /  $\text{OH}^-$ ) per unit volume.

During dilution  $\rightarrow \text{H}^+$  conc. per Volume kam ho jata hai..... aur pH badh jata hai  
(Less acidic = more pH value)

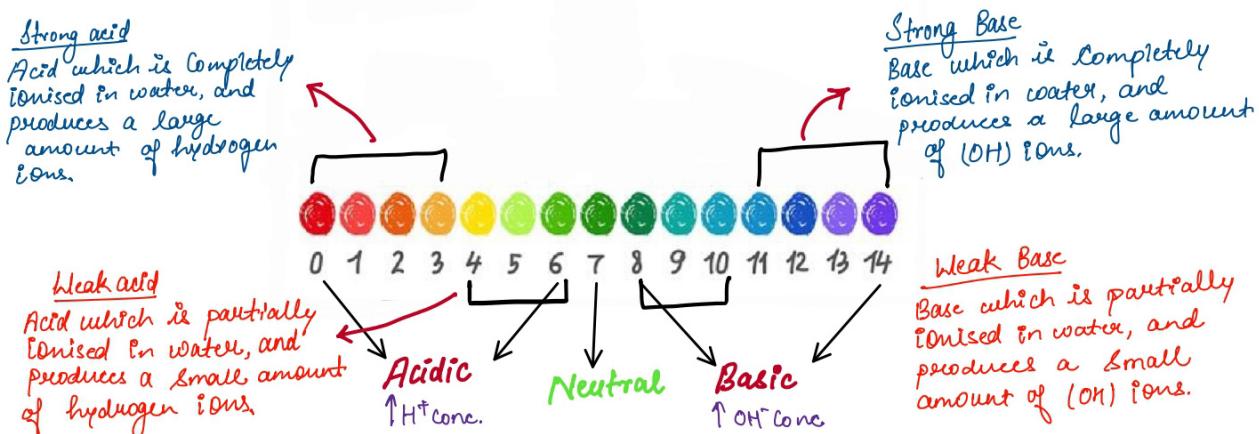
## A.K.Q

acid to water = normal dilution.... but water to acid = accident

# WTA  $\rightarrow$  Wht the accident

## Universal indicators

It is a mixture of several indicator and it show different colours at different concentration of hydrogen ions in a solution.



pH Scale  $\rightarrow$  A scale for measuring hydrogen ion concentration

Acetic acid	← Vinegar	Tartaric acid	← Tamarind
Lactic acid	← sour milk (curd)	Oxalic acid	← Tomato
Citric acid	← Orange, Lemon	Methanoic acid	← Ant, Nettle sting

## Importance of pH in everyday life

### Plant and animal are sensitive to pH change

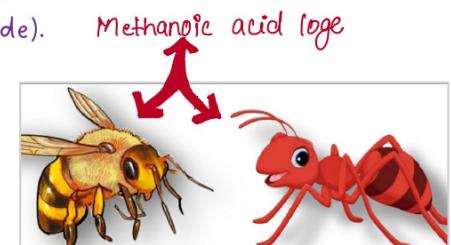
- Our body work with in the pH range of 7.0 to 7.8.
- pH of Rainwater less than 5.6 it is called acid rain.
- This water lower the pH of the river water and aquatic life become difficult.

### Soil in our Backyard

- Plants require a specific pH range for their healthy growth.

### pH in our digestive system /tooth decay.

- Tooth decay start when the pH of mouth is lower than 5.5.
- calcium hydroxy apatite corroded when pH in the mouth is below 5.5
- Using tooth paste (contain base), neutralise the excess acid.
- Our stomach produce HCl acid.
- Indigestion produce too much acid and this cause pain and irritation.
- To get rid of the pain people use, Called antacid. (Magnesium hydroxide).



### Self defence by animal and plants

- Bee-sting leaves as methanoic acid, which causes pain and irritation.
- Nettle leaves inject methanoic acid, causing burning pain.
- To get relief from these we use baking soda and dock plant.

## A.K.Q 2.6

? What is the colour of the solution?

The solution becomes pink colour.

? Is there any colour change for the reaction mixture?

The pink colour changes and disappears.

? Why did the colour of phenolphthalein change after the addition of an acid?

Phenolphthalein is a weak acid. It gives pink colour in a strong base. When an acid is added, it reacts with the base and neutralisation reaction occurs. So pink colour disappears.

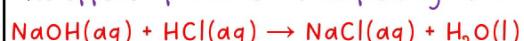
? Does the pink colour of phenolphthalein reappear?

Yes.

? Why do you think this has happened?

It is due to the increase in amount of base ( $\text{NaOH}$ ) than acid.

The effect of a base is nullified by an acid and vice-versa



## Salts

The compound that formed by the reaction of one acid and one base or by the reaction of two simple salt.

- Salts of a strong acid and a strong base - are neutral with pH values of 7.
- Salts of a strong acid and weak base - acidic with pH value less than 7.
- Salts of strong base and weak acid - basic in nature pH value more than 7.

## Common salt - sodium chloride ( $\text{NaCl}$ )

**Extraction** - sea water and Rock salt



**Uses** - 1. Used in cooking food.

2. Used in manufacturing of soap.

3. Used for making important raw material, sodium hydroxide, baking soda, washing soda etc.

## Caustic soda - sodium hydroxide ( $\text{NaOH}$ )

**Chlor-alkali:** When electricity is pass through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. This process is called the chlor-alkali process because of the product formed (chlor) for chlorine and (alkali) for sodium hydroxide.

**Brine** - The solution of salt in water.

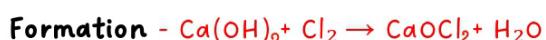


**Uses** - 1.  $\text{Cl}_2$  - water treatment, swimming pool, PVC, disinfectants, CFCs, Pesticides.

2.  $\text{H}_2$  - Fuels, margarine, ammonia for fertiliser.

3.  $\text{NaOH}$  - De-greasing metal, soaps and detergents paper making, artificial fibres.

## Bleaching powder calcium oxychloride ( $\text{CaOCl}_2$ )



**Uses** - 1. for bleaching cotton and Linen in the textile industry

2. for bleaching wood pulp in paper

3. for bleaching washed clothes in laundry

4. as an oxidising agent in many in chemical industries

5. to make drinking water free from germs

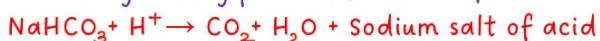
Iske  $\text{Cl}_2$  se yaad rakhna  
C → cotton Industry  
L → linen Industry

## Baking soda - sodium hydrogen carbonate ( $\text{NaHCO}_3$ )



(It is mild non-corrosive basic salt)

**Uses** - 1. for making baking powder, (mixture of mild edible acid and baking soda)



→  $\text{CO}_2$  - used to make cake or bread sponge

2. Used as an antacid

3. Used in acid fire extinguishers

## Washing soda ( $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ )

→ Ye  $10\text{H}_2\text{O}$  se yaad rakhna ki  
..... removes permanent  
hardness of water



**Uses** - 1. Used in glass, soap and paper industries

2. manufacturing of Sodium compounds such as borax

3. used as a cleaning agent for domestic purpose

4. used for removing permanent hardness of water.

## Hydrated Salts

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightarrow$  Copper Sulphate pentahydrate

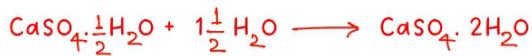
$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} \rightarrow$  sodium carbonate decahydrate

$\text{CaSO}_4 \cdot 2\text{H}_2\text{O} \rightarrow$  Gypsum

## Plaster of Paris - $(\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O})$

Formation -  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O} \xrightarrow{373\text{K}} \text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O} + \frac{1}{2}\text{H}_2\text{O}$   
(gypsum) (P.O.P.)

2  $\text{CaSO}_4$  ke molecule  
1 water ke molecule  
ko share karte hai  
Issliye  $\frac{1}{2}\text{H}_2\text{O}$   
likhte hai 1  
CaSO<sub>4</sub> ke saath



P.O.P. →

Uses - 1. doctor use as plaster for supporting fracture bone  
2. making toys  
3. making surface smooth



## A.K.Q-2.9

? What do you observe? Is there a gas coming out of the delivery tube?

HCl gas comes out of the delivery tube.

? In which case does the litmus paper change colour?

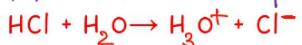
When HCl gas is tested with wet blue litmus paper, it becomes red colour.  
But with dry litmus paper, no colour change occurs.

? On the basis of the above Activity, what do you infer about the acidic character of:

- (i) dry HCl gas
- (ii) HCl solution?

(i) dry HCl gas cannot produce  $\text{H}^+$  ions. So it does not behave as an acid.

(ii) HCl solution can produce  $\text{H}^+$  ions and behave as an acid.



## A.K.Q-2.10

? Is there a change in temperature?

Yes. It becomes hot.

? Is this an exothermic or endothermic process?

Exothermic.

? Repeat the above Activity with sodium hydroxide pellets and record your observations.

It is also an exothermic reaction.

## A.K.Q-2.13

? Identify the acids and bases from which the above salts may be obtained.

? Salts having the same positive or negative radicals are said to belong to a family. For example, NaCl and  $\text{Na}_2\text{SO}_4$  belong to the family of sodium salts. Similarly, NaCl and KCl belong to the family of chloride salts. How many families can you identify among the salts given in this Activity?

Salts & their Chemical formulae	Formed from which Acids & bases?
Potassium sulphate ( $K_2SO_4$ )	$H_2SO_4$ & KOH
Sodium sulphate ( $Na_2SO_4$ )	$H_2SO_4$ & NaOH
Calcium sulphate ( $CaSO_4$ )	$H_2SO_4$ & $CaCO_3$
Magnesium sulphate ( $MgSO_4$ )	$H_2SO_4$ & $Mg(OH)_2$
Copper sulphate ( $CuSO_4$ )	$H_2SO_4$ & $Cu(OH)_2$
Sodium chloride ( $NaCl$ )	HCl & NaOH
Sodium nitrate ( $NaNO_3$ )	$HNO_3$ & NaOH
Sodium carbonate ( $Na_2CO_3$ )	$H_2CO_3$ & NaOH
Ammonium chloride ( $NH_4Cl$ )	HCl + $NH_4OH$

### A.Q.Q 2.14

Answer—

Salt	pH	Acid used	Base used
Sodium chloride	7	HCl	NaOH
Potassium nitrate	7	$HNO_3$	KOH
Aluminium chloride	7	HCl	$Al(OH)_3$
Zinc sulphate	7	$H_2SO_4$	$Zn(OH)_2$
Copper sulphate	< 7	$H_2SO_4$	$Cu(OH)_2$
Sodium acetate	> 7	$CH_3COOH$	NaOH
Sodium carbonate	> 7	$H_2CO_3$	NaOH
Sodium hydrogen carbonate	> 7	$H_2CO_3$	NaOH

### Exemplar Question

1-Which one of the following can be used as an acid base indicator by a visually impaired student?

- (a) Litmus
- (b) Vanilla essence
- (c) Turmeric
- (d) Petunia leaves

Ans-b

2-What happens when a solution of an acid is mixed with a solution of a base in a test tube?

- (i) The temperature of the solution increases
- (ii) The temperature of the solution decreases
- (iii) The temperature of the solution remains the same
- (iv) Salt formation takes place

- (a) (i) only
- (b) (i) and (iii)
- (c) (ii) and (iii)
- (d) (i) and (iv)

Ans-d

3-During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

- (a) Absorb the evolved gas
- (b) Moisten the gas
- (c) Absorb moisture from the gas
- (d) Absorb Cl<sup>-</sup> ions from the evolved gas

Ans- c

4-Which of the following statements is not correct?

- (a) All metal carbonates react with acid to give a salt, water and carbon dioxide
- (b) All metal oxides react with water to give salt and acid
- (c) Some metals react with acids to give salt and hydrogen
- (d) Some non-metal oxides react with water to form an acid

Ans- b

5-Which of the following is (are) true when HCl (g) is passed through water?

- (i) It does not ionise in the solution as it is a covalent compound
- (ii) It ionises in the solution
- (iii) It gives both hydrogen and hydroxyl ion in the solution
- (iv) It forms hydronium ion in the solution due to the combination of hydrogen ion with water molecule

- (a) (i) only
- (b) (ii) and (iv)
- (c) (iii) only
- (d) (iii) and (iv)

Ans- b

6- Which of the following salts does not contain water of crystallisation?

- (a) Blue vitriol
- (b) Baking soda
- (c) Washing soda
- (d) Gypsum

Ans- b

7-Sodium carbonate is a basic salt because it is a salt of

- (a) strong acid and strong base.
- (b) weak acid and weak base.
- (c) strong acid and weak base.
- (d) weak acid and strong base.

Ans- d

8-What are strong and weak acids? In the following list of acids, separate strong acids from weak acids:  
Hydrochloric acid, Citric acid, Acetic acid, Nitric acid, Formic acid, Sulphuric acid

Ans. The acid that ionises completely in aqueous solution, thus producing a high concentration of ions, is called a strong acid, e.g., HCl, etc. Weak acid ionises only partially in aqueous solution of same molar concentration provides a much smaller concentration of H<sub>3</sub>O<sup>+</sup> ions and thus it produces ions as well as molecules, e.g., acetic acid, carbonic acid.

Strong acids -nitric acid & Hydrochloric acid, sulphuric acid

Weak acids-Citric acid, acetic acid and formic acid

9. A dry pellet of a common base B, when kept in open absorbs moisture and turns sticky. The compound is also a by-product of chloralkaline process. Identify B. What type of reaction occurs when B is treated with an acidic oxide? Write a balanced chemical equation for one such solution.

Ans. Sodium hydroxide ( $\text{NaOH}$ ) is a commonly used base and is hygroscopic, that is, it absorbs moisture from the atmosphere and becomes sticky. The acidic oxides react with base to give salt and water. The reaction between  $\text{NaOH}$  and  $\text{CO}_2$  can be given as:  $2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$

10-For making cake, baking powder is taken. If at home your mother uses baking soda instead of baking powder in cake,

- (a) How will it affect the taste of the cake and why?
- (b) How can baking soda be converted into baking powder?
- (c) What is the role of tartaric acid added to baking soda?

Ans. (a) Baking soda is sodium hydrogen carbonate.

On heating, it is converted into sodium carbonate which is bitter to taste-



(b) Baking soda can be converted into baking powder by the addition of suitable amount of tartaric acid to it.

(c) The role of tartaric acid is to neutralise sodium carbonate and cake will not taste bitter.

11.  $\text{HCl}$  and  $\text{HNO}_3$  show acidic characteristics in aqueous solution while alcohol and glucose solutions do not. Give reasons.

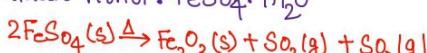
Or Why do  $\text{HCl}$ ,  $\text{HNO}_3$ , etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

Ans.  $\text{HCl}$  and  $\text{HNO}_3$  produce  $\text{H}^+$  ions in aqueous solution. Hence they show acidic characteristics.

Alcohol and glucose do not produce  $\text{H}^+$  ions in aqueous solution, hence they do not show acidic characteristics.

12. A green coloured hydrated metallic salt on heating loses its water of crystallisation and gives the smell of burning sulphur. Identify the salt and write down the reaction involved.

Ans: Green Vitriol :  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$



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