CHAPTER- 2
ACIDS, BASES AND SALTS
GIST OF THE LESSON

1) Acids are sour in taste, turn blue litmus red, and dissolve in water to release H^+ ions e.g. HCl, H_2SO_4, HNO_3 etc.

2) Bases are bitter in taste, have soapy touch, turn red litmus blue and give hydroxide ions in solution.

e.g. NaOH, KOH etc.

3) A salt is a compound which is formed by neutralization reaction between an acid and base.
e.g. sodium chloride.

3) Indicators – Indicators are substances which indicate the acidic or basic nature of the solution by their colour change.

The colour of some acid – base indicators in acidic and basic medium are given below

Sr. No.	INDICATORS	COLOUR IN ACIDIC MEDIUM	COLOUR IN BASIC MEDIUM
1	Litmus solution	Red	Blue
2	Methyl Orange	Pink	Orange
3	Phenolphthalein	Colourless	Pink
4	Methyl red	Yellow	Red

5) Chemical properties of acids:

i) Acids react with active metals to give hydrogen gas.

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

ii) Acids react with metal carbonate and metal hydrogen carbonate to give carbon dioxide.

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

iii) Acids react with bases to give salt and water. This reaction is called as neutralization reaction.

$NaOH + HCl \rightarrow NaCl + H_2O$

iv) Acids react with metals oxides to give salt and water.

$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

6) Chemical properties of Bases:

i) Reaction with Metals - Certain reactive metals such as Zinc, Aluminium, and Tin react with alkali solutions on heating and hydrogen gas is evolved.

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

ii) Reaction with acids -Bases react with acids to form salt and water.

$KOH + HCl \rightarrow KCl + H_2O$

iii) Reaction with Non -metallic oxides – These oxides are generally acidic in nature. They react with bases to form salt and water.

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

7) PH Scale: The concentration of hydrogen ion in solution is expressed in terms of pH. The pH of a solution is defined as the negative logarithm of hydrogen ion concentration in moles per liter.

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

For water or neutral solutions, pH = 7 ; For acidic solutions, pH < 7; For basic solutions, pH > 7

8) Some Important Chemical Compounds:

a) Common Salt (NaCl)

Sodium chloride is known as common salt. Its main source is sea water. It is also exists in the form of rocks and is called rock salt.

Common salt is an important component of our food. It is also used for preparing sodium hydroxide, baking soda, washing soda etc.

b) Sodium Hydroxide or Caustic Soda (NaOH)

It is prepared by passing electricity through an aqueous solution of sodium chloride also known as brine.

$2NaCl\ (aq) + 2\ H_2O\ (l) \rightarrow 2NaOH\ (aq) + Cl_2\ (g) + H_2\ (g)$

This process is known as chlor-alkali process.

Properties:

1. It is white translucent solid.
2. Crystals of sodium hydroxide are deliquescent.
3. It is readily soluble in water and gives strong alkaline solution.

c) Bleaching Powder ($CaOCl_2$)

Its chemical name is calcium oxychloride. It is prepared by passing chlorine gas through dry slaked lime.

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Uses –
1. For bleaching cotton and linen in textile industry and wood pulp in paper industry
2. For disinfecting drinking water.

d) Baking Soda ($NaHCO_3$)
Chemical name is Sodium hydrogen carbonate.
It is prepared by passing CO_2 gas through brine solution saturated with ammonia.

$$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$$

Properties:
1. It is white crystalline solid and sparingly soluble in water at room temperature.
2. On heating it decomposes to give sodium carbonate and carbon dioxide.
3. It reacts with acids to give carbon dioxide gas.
4. It aqueous solution is weak alkaline due to hydrolysis.

Uses:
1. It is used in soda – acid fire extinguisher.
2. It acts as mild antiseptic and antacid.
3. It is used as a component of baking powder. In addition to sodium hydrogen carbonate baking soda contains tartaric acid.

e) Washing Soda ($Na_2CO_3.10\ H_2O$)
Chemical name is sodium carbonate decahydrate.
It is prepared by heating baking soda. Recrystallisation of sodium carbonate gives washing soda.

$$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$$
$$Na_2CO_3 + 10\ H_2O \rightarrow Na_2CO_3.\ 10\ H_2O$$

Uses:
1. It is used for removing permanent hardness of water.
2. It is used in glass, soap and paper industries.
3. It can be used as a cleaning agent for domestic purposes.

f) Plaster of Paris ($CaSO_4.{}_{1/2}H_2O$)
Its chemical name is calcium sulphate hemihydrates. It is obtained by heating Gypsum upto 373K.

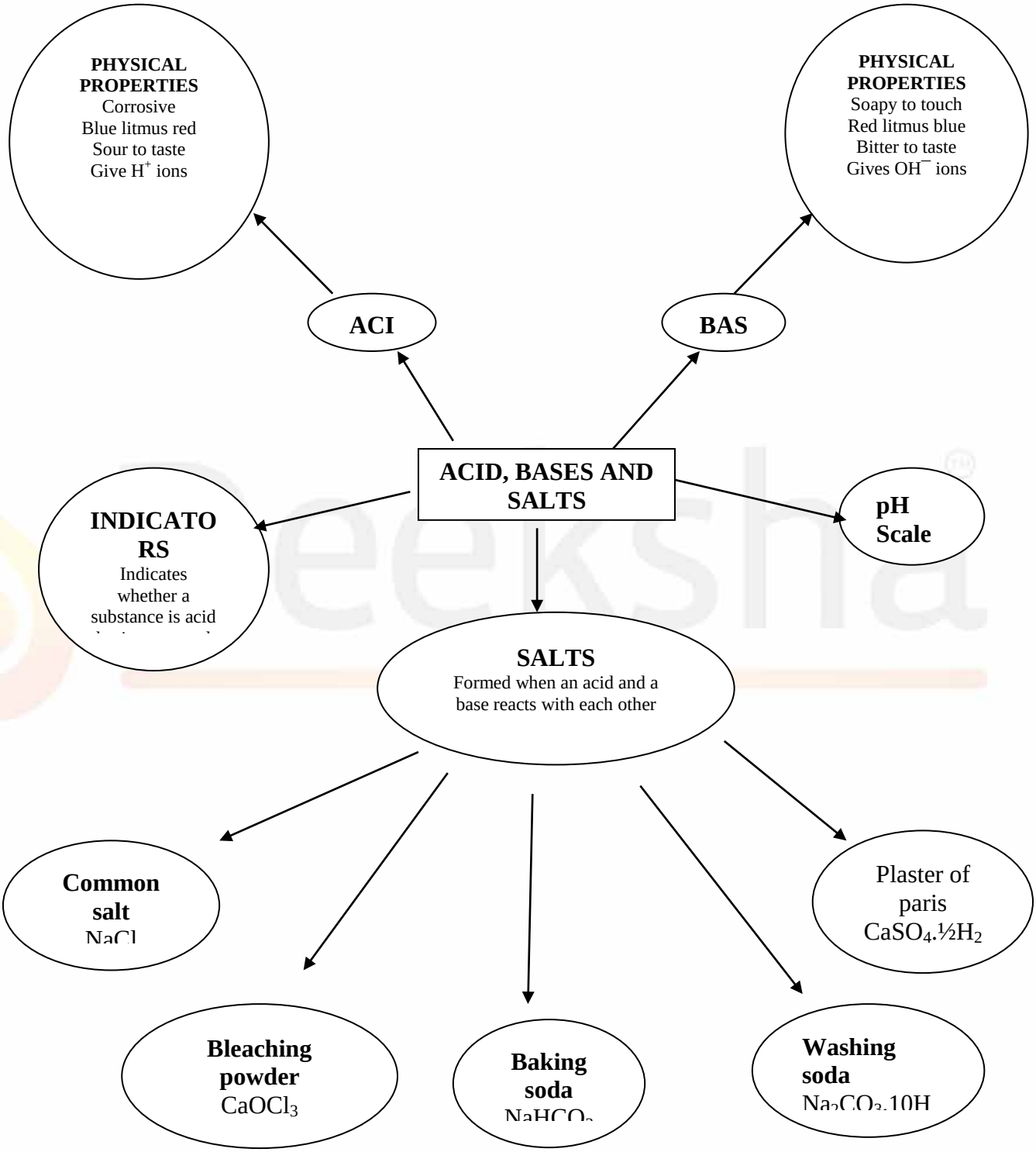
$$CaSO_4.2H_2O \rightarrow CaSO_4.{}_{1/2}H_2O + 1_{1/2}H_2O$$

On treatment with water it is again converted into gypsum and sets as a hard mass.

$$CaSO_4.{}_{1/2}H_2O + 1_{1/2}H_2O \rightarrow CaSO_4.2H_2O$$

Uses:-
1. It is used by doctors for setting fractured bones.
2. It is used for making statues, models and other decorative materials.

MIND MAP


PHYSICAL PROPERTIES
Corrosive
Blue litmus red
Sour to taste
Give H^+ ions
PHYSICAL PROPERTIES
Soapy to touch
Red litmus blue
Bitter to taste
Gives OH^- ions
ACI
BAS
ACID, BASES AND SALTS
INDICATORS
Indicates whether a substance is acid
pH Scale
SALTS
Formed when an acid and a base reacts with each other
Common salt
NaCl
Plaster of paris
$CaSO_4.½H_2$
Bleaching powder
$CaOCl_3$
Baking soda
$NaHCO_3$
Washing soda
$Na_2CO_3.10H$

ACID, BASES AND SALTS
FORMATIVE ASSESSMENT I
Q.PAPER

MARKS-30 TIME- 70 MINUTES

Instructions:

- Questions : 1 to 5 – 1 Mark each
- Questions : 6 to 9 – 2 Marks each
- Questions : 10 to 13 – 3 Marks each
- Question 14 – 5 Marks

ii. Name the gas formed when sodium hydroxide reacts with zinc.

iii. Write the chemical name of baking soda.

iiii. What happens when gypsum is heated at 373K?

iiv. Which has a higher pH value 1M HCl or 1M NaOH solution?

iv. Hydrogen ion concentration of an acid is 1×10^{-2} mol/l. what is its pH?

ivi. What is meant by 'Water of Crystallisation' of a substance? Describe an activity to show that.

ivii. Why does tooth decay start when the pH of mouth is lower than 5.5?

iviii. What is baking powder? How does it make the cake soft and spongy?

iix. Give Arrhenius definition of an acid and a base. Choose strong acid and strong base from the following:

CH_3COOH, NH_4OH, KOH, HCl

ix. What happens when nitric acid is added to egg shell? Give the chemical equation.

ixi. A student prepared solutions of an acid and a base in two separate beakers. She forgot to label the solutions and litmus paper is not available in the laboratory. Since both the solutions are colourless, how will she distinguish between the two?

ixii. Identify the compound 'X' on the basis of the reactions given below. Write the names and chemical formulae of A, B, C

Compound X	+ Zn	(A) + $H_{2\,(g)}$
	+HCl	(B) + H_2O
	+ CH_3COOH	(C) + H_2O

ixiii. How is plaster of Paris prepared? What is its chemical formula? Write is chemical name.

ixiv.

a) Define strong acid and weak acid.

b) A student working in the laboratory added some water to a syrupy liquid taken in tube. The tube immediately cracked and the liquid escaped out, that produced blisters on the skin of the student. Why?

HOTS QUESTIONS

Q.1. In one of the industrial process used for manufacture of sodium hydroxide, a gas 'X' is formed as by – product. The gas 'X' reacts with lime water to give a compound 'Y' which is used as a bleaching agent in chemical industry. Identify 'X' and 'Y' giving the chemical equation of the reaction.

Ans. In the manufacture of sodium hydroxide, hydrogen gas and chlorine gas (X) are formed as by products. When chlorine gas (X) reacts with lime water, it forms calcium oxy chloride (bleaching powder) Y.

$2NaCl_{(aq)} + 2H_2O_{(L)} \rightarrow 2NaOH_{(Aq)} + Cl_{2(G)} + H_{2(G)}$

'X' $\Rightarrow Cl_2$ gas

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Q.2. Dry hydrogen chloride gas does not turn blue litmus, whereas hydrochloric acid does. Why?

Ans. In the dry state, hydrogen chloride (HCl) does not release H^+ ions. Therefore, it cannot behave as an acid. When dissolved in water, it forms hydrochloric acid. It dissociates to give H^+ ions in solution and behaves as an acid.

Q.3. Acid when react with metals release hydrogen gas but there is one acid which when reacts with metals does not release hydrogen except for two metals. Prove this statement.

Ans. Acid + Metal $\rightarrow$ Salt + Hydrogen

e.g. $2HCl + 2Na \rightarrow 2NaCl + H_2$

$H_2SO_4 + 2Na \rightarrow Na_2SO_4 + H_2$

$HNO_3 + Na \rightarrow$ No hydrogen gas.

Because nitric acid is strong oxidising agent. Nitric acid reacts only with Mg and Mn to give hydrogen gas.

$Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$

$Mn + 2HNO_3 \rightarrow Mn(NO_3)_2 + H_2$

Q. 4 Name the properties responsible for the following uses of baling powder. (i) Baking industry (ii) As an antacid (ii) As soda-acid fire extinguisher.

Q. 5 What is meant by water of crystallisation of a substance? What is its importance?

Q. 6 What effect does an increase in concentration of 'H' ions in a solution have on the pH of a solution

Q. 7 Fresh milk has a pH Of 6. When it changes to curd, will its pH value increase or decrease? Why?

Q. 8 How does the flow of acid rain water into a river make the survival of aquatic life in a river difficult?

Q. 9 Arrange in the increasing order of their pH values: NaOH solution, Blood, Lemon juice,

Q. 10 Two solutions A and B have pH values of 5 and 8 respectively. Which solution will be basic in nature?

Q. 11 Why does an aqueous solution of acid conduct electricity?

Q. 12 How is alkali different from a base?

FA II
ACIDS, BASES AND SALTS
ORAL QUESTIONS – (Conversation Type)

1. a) Acids are sour in taste. Is it a way to find whether a substance is an acid or a base?

   b) What is other physical test?

   c) Any test with solid acid?

   d) Can you check the evolution of CO_2 chemically?

2. a) What are acids?

   b) Can presence of H^+ ion in water be estimated? How?

   c) How is pH related to strength of an acid?

   d) Name one strong acid and one weak acid.

3. a) What are salts?

   b) How many types of salts are formed?

   c) What are neutral salts?

   d) What do you mean by acidic salts?

   e) Define basic salts.

   f) Give the corresponding acid and base from which sodium carbonate is formed.

4. a) What is common salt?

   b) Why does common salt become moist in rainy season?

   c) How is it used as a freezing mixture?

   d) Name two important laboratory chemicals prepared from common salt on large scale.

5. a) What is washing soda?

b) Name the process by which sodium carbonate is manufacture.

c) What are the raw materials used in the preparation of washing soda?

d) Sodium carbonate is obtained from another carbonate on heating. Name it.

6. a) Name the substance used for bleaching cotton and wood pulp in textiles.

b) What is its chemical name?

c) How is it manufactured?

d) What is slaked lime?

e) Why does bleaching powder smell of chlorine?

ORAL QUESTIONS

1. Name the acid present in lemon juice.
2. What is the chemical difference between washing soda and baking powder?
3. Name the acid present in ant sting.
4. What is the ideal pH of the soil for the healthy growth of a plant?
5. At what pH the mouth teeth start decaying?
6. How is pH of an acid solution affected when it is diluted?
7. Name the gas responsible for extinguishing fire in a soda – acid fire extinguisher.
8. Out of glucose and acetic acid which one will conduct electricity in water?
9. What is the pH of blood?
10. What is the chemical name of the compound which has the property of hardening when mixed with water?

QUIZ – WHO AM I

1. I can roughly measure pH value from 0 – 14.
2. I am called antichlor and am used to remove excess chlorine from clothes when treated with bleaching powder.
3. I am a product of gypsum and am used to making chalks and fire proof materials.
4. I am a compound of calcium and can be used for disinfecting drinking water as well as for decolourisation.
5. I give different smell in acid and base solution.

6. I am an oxide capable of showing properties for both acids and bases.
7. I am a covalent compound and conducts electricity in aqueous medium.
8. I am a salt of potassium hydroxide and nitric acid.
9. I am the term used when a solid becomes liquid when exposed to moist air.
10. I am derived from tomato and turn blue litmus into red.