MATRIX OLYMPIAD

The Most Innovative Talent Recognition Exam

CHEMISTRY

Class - VII

MATRIX

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Few words for the Readers

Dear Reader,

"*Matrix Olympiad is established to encourage school students to go a step further than their regular studies, and get a chance and exposure to competition on a wide scale. It also helps students enhance their learning of basic cognitive skills and deeper knowledge of subjects like Science, Mathematics, English, Mental Ability, Social Studies.“Matrix Olympiad helps students nurture their minds for higher targets of tomorrow and enables them to study School for JEE, NEET, CLAT, NDA, Olympiads , NSEJS, NTSE , STSE etc.*"

The above thought has been our guiding principle while designing and collating the study material for **Matrix Olympiad** . And hence, we hope that this particular material will be helpful towards your preparation for **Matrix Olympiad**.

Our team at **MATRIX** has put in their best efforts for making this particular module interesting and relevant for you. Additional efforts have been made to ensure that the content is easy to understand and error free to the extent possible. However, there might remain some inadvertent errors in answer keys and theoretical portion and we would welcome your valuable feedback regarding the same.

If there are any suggestions for corrections, please write to us at **smd@matrixacademy.co.in** and we would be highly grateful.

Finally, we would like to end this message by a famous quote by Ernest Hemingway - "*There is no friend as loyal as a book*." So, please give your study material the time and attention it deserves, and it will surely help you reach newer heights in your fight with competition examinations.

With love and best wishes !

Team MATRIX

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(CHANGES AROUND US : PHYSICAL AND CHEMICAL)

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INTRODUCTION

Matter can neither be created nor be destroyed. It just changes its form. If you look around carefully, you will notice every moment some changes are taking place. These changes may involve one or more substances. Some kinds of change always take place in the matter when it is subjected to energy changes.

The changes can be divided into different classes depending upon the nature of the change taking place. The changes differ in terms of appearance, colour, composition, formation of new products or any other change in the form. Broadly, these changes are of two types.

(a) Physical changes (b) Chemical changes

1. PHYSICAL CHANGE

Properties such as shape, size, colour and state of a substance are called its physical properties. A change in which substance undergoes a change in its physical properties is called a physical change. A physical change is generally reversible. In such a change no new substance is formed.

♦ **Characteristics of physical change**

(i) No new different product is formed : The composition of molecules of the substance remains unaltered.

Example : Ice melts to form water. In this example only the appearance (state) of matter has changed from solid to liquid. However, the composition of the molecules of ice or water remains same, i.e., for every 1g of hydrogen, 8g of oxygen is required. Thus, only a physical change has occurred.

(ii) The change is temporary and is usually reversible : It means the change can be reversed by altering the causes which produce the change.

Example : The water formed from ice can be changed back to ice by placing it in a freezing mixture (a mixture of ice and common salt).

(iii) There is no net gain or loss of energy : The amount of energy required to bring about a physical change is generally equal to the amount of energy required to reverse the change. Thus, there is no net energy change involved.

Example : If 1g of water at 100ºC on changing into steam needs 2260 J of heat energy, then 1g of steam at 100º C on changing into water at 100º C, gives out 2260 J of heat energy. Thus, the net energy change is zero.

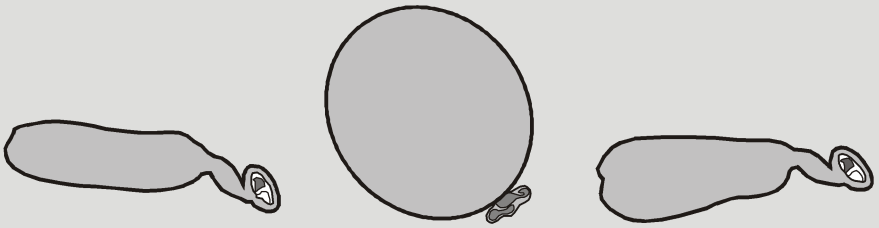
(iv) There is no change in the weight of substance : During a physical change it is only the energy which is added or removed. No matter is added during a physical change. Similarly, no matter is removed during a physical change. Therefore, mass of the substance remains the same.

(v) Chemical properties of substances do not change: In this change only physical properties are changed.

Let's discuss some activities to understand the characteristics of physical change.

LAB TIME
Let's Do & Learn

- **Objective : To show that the physical change involves change in size and shape.**
- **Materials required :** Balloon
- **Procedure :** Take a balloon and inflate it. Observe the change in size and shape. Now deflate the balloon and again observe the change in size and shape.

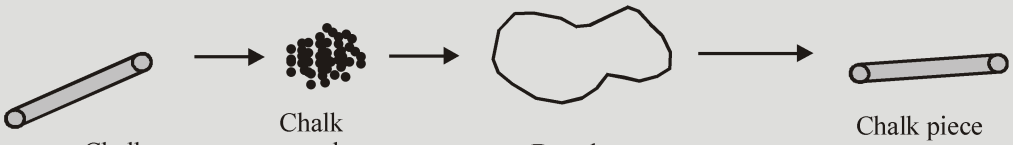


Original balloon Inflated balloon Deflated balloon

- **Observation :** The balloon becomes big and round when air is filled in it. When it deflated, the air comes out and balloon comes back to its original shape.
- **Conclusion :** There is no change in the structure of the balloon. Only its shape and size change. Hence, it is physical and reversible change.

LAB TIME
Let's Do & Learn

- **Objective:To study a physical change using a chalk.**
- **Materials required :** Chalk, water
- **Procedure :** Crush a chalk piece into powder. Add a little water to the chalk powder and roll the dough in the shape of the chalk again.



Chalk → Chalk powder → Dough → Chalk piece

- **Observations :** On crushing, the chalk is converted into powder but the powder is again rolled back to chalk by adding small amount of water. The chalk piece can be used again.
- **Conclusion :** There is no change in the properties of a substance during a physical change.

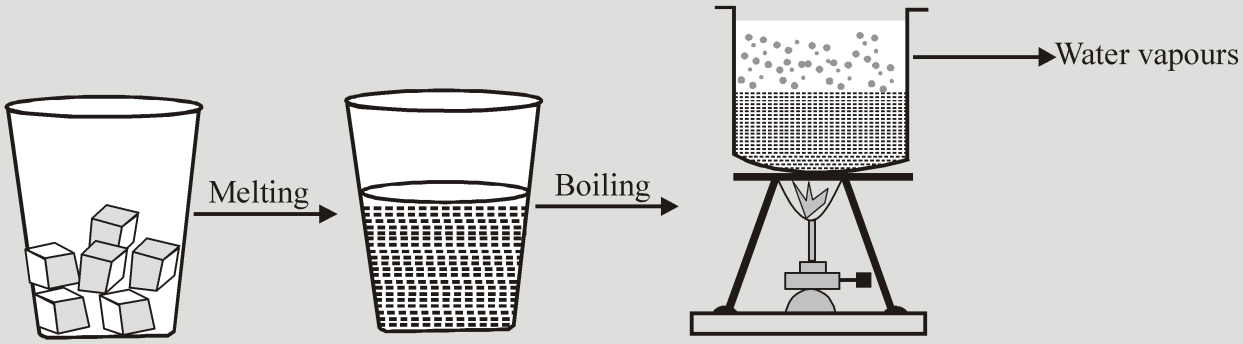
LAB TIME
Let's Do & Learn

- **Objective : To observe the change in physical state of water by boiling and freezing.**
- **Materials required :** Water, ice, container, beaker, burner.
- **Procedure :**

  (i) Take some ice in a container and , keep it outside the fridge for some time.

  (ii) Once the ice melts, keep it again in the freezer and record your observations.

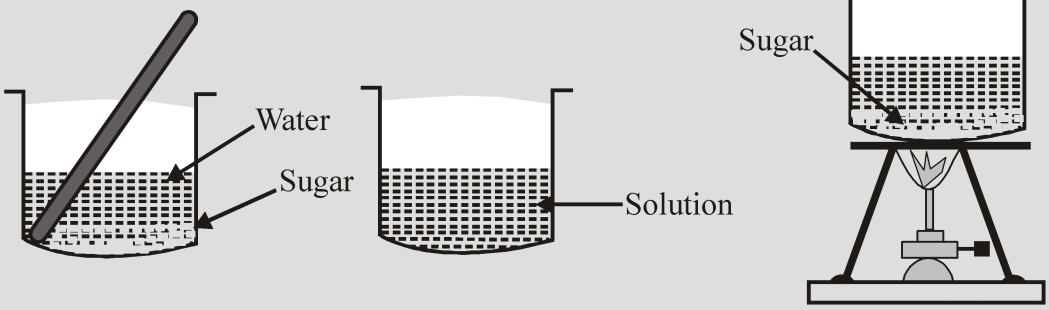
  (iii) Take some water in a beaker and boil it. Cover the beaker with a metallic plate and record your observations.



- **Observations :** On melting, ice is converted to water which can be frozen back to ice. When water is boiled it is converted to steam. If we cover the beaker with a lid, steam condenses back to water.
- **Conclusion :** Freezing, melting and boiling are physical changes since only the physical state of water changes. Chemically all the three states are same.

LAB TIME
Let's Do & Learn

- **Objective: To show that dissolution of sugar in water is a physical change.**
- **Materials required :** Water, sugar, beaker, burner.
- **Procedure :** Take some water in a beaker and add sugar to it. Stir the solution and observe the change. Where does the sugar go? You can taste the solution and find out. Now heat the sugar solution in the beaker till the water is evaporated. Record your observation after evaporation of water.



- **Observation :** When sugar is dissolved in water it disappears. If you taste the solution, the sugar is still present in dissolved form. If water is evaporated, we get back the sugar.
- **Conclusion :** Dissolution of sugar in water is a physical and reversible change.

Some Examples Involving Physical Changes :

Physical change	Observation	Change in physical property
1. Switching on an electric bulb	The bulb glows and gives out heat and light energy.	The physical appearance of the bulb changes.
2. Rubbing a permanent magnet on a steel rod.	The steel rod gets magnetised. if it is brought near iron nails, they get attracted.	The steel rod acquires the property of attracting pieces of iron.
3. Action of heat on iodine	The brownish grey crystals of iodine change to form violet vapours. On cooling, the vapours condense on cooler parts of the test tube to form crystals.	Change in state and colour.
4. Dissolving common salt in water	The white crystalline salt disappears in water. However, the water tastes exactly like common salt. Moreover, common salt can be recovered by evaporation.	Change of state.

Some Common Examples of Physical Changes :

- Formation of dew.
- Crystallisation of sugar from its solution.
- Breaking of a glass pane.
- A rock rolling down a hill.
- Melting of wax.
- Evaporation of water.
- Ringing of an electric bell.
- Freezing of ice cream.
- Bending of a glass tube by heating.
- Sublimation of camphor.

2. CHEMICAL CHANGE

Chemical changes occur when two or more substances combine and react with each other. A change in which one or more new substances are formed is called a chemical change. Chemical changes cause the molecules of matter to change. A chemical change is also called a chemical reaction. This is more than a change in shape or state. Most of the time, an entirely new kind of matter is created.

♦ **Characteristics of chemical change**

(i) A chemical change results in the formation of one or more new products : The products formed has different properties than the original substance. Thus, the composition of the molecules of products is different from the original substance.

Example : Heating of sugar : When sugar is gently heated in a test tube, it melts. It gradually changes into brown colour, giving a large amount of steamy fumes. At the end a black mass is left which consists of carbon. Thus, new substances, which is carbon and water (steam), are formed. In this change, the arrangement between the molecules of carbon, hydrogen and oxygen breaks. The hydrogen and oxygen atoms separate from carbon atoms and join together to form water. The carbon atoms are set free and are left as black residue.

$$\text{Sugar} \xrightarrow{\text{Heat}} \text{Carbon} + \text{Steam}$$

(ii) The weight of the substance undergoing chemical change usually changes

Example : During the heating of sugar, the weight of the black residue is far less than the actual weight of the sugar. However, this is an apparent change in weight. If we take the weight of steam into account and add it to the weight of carbon, then total weight will be equal to the weight of sugar crystals. Thus, strictly speaking, the total weight of the substances taking part in a chemical change remains constant.

(iii) The chemical change is permanent and irreversible : It means the change will not reverse by altering the experimental conditions.

(iv) Evolution of gas : When zine granules are added to dilute sulphuric acid hydrogen gas is evolved. If a bura matchstick is brought near the mouth of a test tube, it burns with a pop sound.

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2 \uparrow$$

Zinc Sulphuric acid Zinc Sulphate Hydrogen gas

(v) Change of colour : When solid lead nitrate is heated Reddish-brown nitrogen dioxide gas is evolved. Also yellow coloured lead monoxide is formed.

$$2[Pb(NO_3)_2] \xrightarrow{\text{Heat}} 4(NO_2) + 2(PbO) + O_2$$

Lead nitrate	Nitrogen dioxide (Reddish Brown) colour	Lead oxide (Yellow colour)

(vi) Abosrption or evolution of heat: When carbon and sulpher are heated, heat energy is absorbed, then carbon disulphide formed.

$$C + 2S + \text{Heat} \xrightarrow[\text{Reaction}]{\text{Endothermic}} CS_2$$

Carbon Sulpher Carbon disulphide

- When water is added to quick lime, heat Energy Evolved.

$$CaO + H_2O \xrightarrow[\text{Reaction}]{\text{Exothermic}} Ca(OH)_2 + \text{Heat}$$

Quicklime Calcium Hydroxide

(vii) Formation of Precipitate: Precipitate is a solid substance that deposits from a solution.

Example: When hydrogen sulphide gas is passed thsough a blue coloured copper sulphate solution, Black precipitate of copper sulphide is formed.

$$CuSO_4 + H_2S \longrightarrow CuS + H_2SO_4$$

Coppor Sulphate	Hydrogen Sulphide	Copper Sulphide	Sulphuric Acid

Focus Point

- All chemical changes are also called chemical reactions.
- **Chemical reaction :** The process in which one or more substances are converted to one or more different substances, known as chemical reaction.
- The substances which are taken initially for chemical reaction are known as reactants and substances which are formed after chemical reaction known as products.

Some examples involving chemical changes :

Chemical change	Observation	Equation
1. Burning of magnesium in air	when a magnesium ribbon is heated in a flame of Bunsen burner, it catches fire and burns with a dazzling white flame to white ash.	Magnesium + Oxygen → Magnesium oxide
2. Rusting or iron	When iron (silver grey) is left exposed to moist air for a few days, reddish brown powdery mass (rust) is found on its surface	Iron + Oxygen (from air) + water vapour → Rust
3. Burning of LPG	When LPG (Liquefied Petroleum Gas) is burnt, it burns with a pale blue flame and liberates colourless gass carbon dioxide along with steam.	Butane (LPG) + Oxygen → Carbon dioxide + water

Let's discuss some activities to understand more about chemical changes.

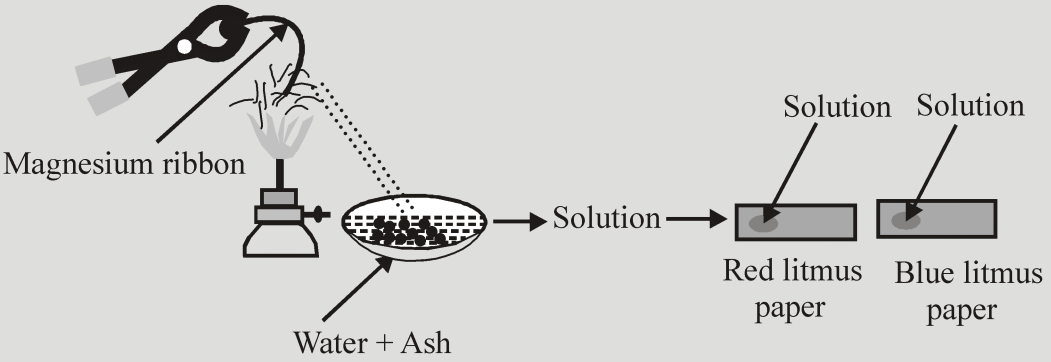
LAB TIME
Let's Do & Learn

- **Objective : To show that burning of magnesium ribbon is chemical change.**
- **Materials required :** Magnesium ribbon, sand paper, pair of tongs, burner, water, blue and red litmus papers.
- **Procedure :**

(i) Take a small piece of magnesium ribbon which is shining after cleaning with a sand paper.

(ii) Hold it with a pair of tongs and heat it on the burner. Let the magnesium ribbon burn completely.

(iii) Collect the ash and dissolve it in water. Test the solution with blue and red litmus paper.



- **Observations :**

(i) When magnesium ribbon is burnt in air, it burns with a dazzling white flame. It forms a powdery ash when it is burnt completely. A new substance is formed after burning magnesium. This powdery ash is known as magnesium oxide.

Magnesium + Oxygen → Magnesium oxide

$2Mg + O_2 \rightarrow 2MgO$

(ii) When magnesium oxide is dissolved in water, a new substance called magnesium hydroxide is formed.

Magnesium oxide + Water → Magnesium hydroxide

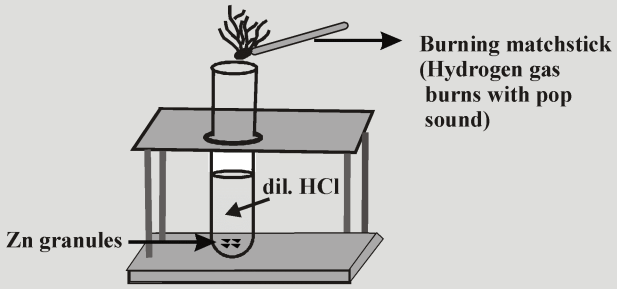
$MgO + H_2O \rightarrow Mg(OH)_2$

(iii) When a drop of this solution is kept over litmus paper, it is observed that it turns red litmus blue.

- **Conclusion :** Burning of magnesium in air is chemical change due to formation of a new compound magnesium oxide. When magnesium oxide is dissolved in water, a new substance called magnesium hydroxide is formed which is basic in nature.

LAB TIME
Let's Do & Learn

- **Objective: To produce hydrogen gas from zinc granules.**
- **Materials required :** Zinc granules, dilute hydrochloric acid, test tube, matchstick.
- **Procedure :** Take clean pieces of zinc granules in a test tube and add dilute hydrochloric acid to it. Take a burning matchstick near the mouth of the test tube and record the observations.



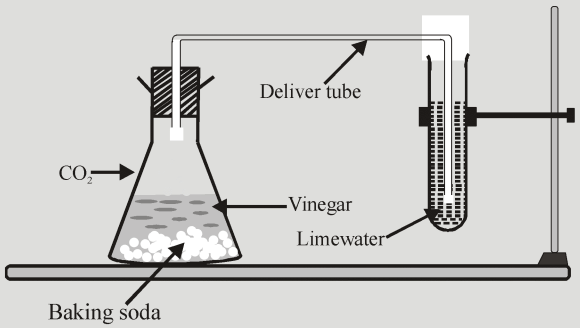
- **Observations :** When zinc granules react with dilute hydrochloric acid, hydrogen gas comes out which burns with a pop sound when a burning matchstick is brought near the mouth of the test tube.
- **Conclusion :** Hydrogen gas is evolved during the reaction which burns with a pop sound.

LAB TIME
Let's Do & Learn

- **Objective : To study reaction between vinegar and baking soda.**
- **Materials required :** Vinegar, baking soda, test tube, conical flask, gas delivery tube, limewater.
- **Procedure :**

  (i) Take some baking soda in a conical flask. Add vinegar to it and put the cork with delivery tube.

  (ii) Pass the gas coming out from the tube into limewater taken in a test tube and record your observations.



- **Observations :** When vinegar is added to baking soda brisk effervescence takes place and bubbles of a gas are given out. The gas evolved is passed through limewater which turns milky.
- **Conclusion :** When vinegar reacts with baking soda, carbon dioxide gas is given out which turns limewater milky, due to formation of calcium carbonate.

  Vinegar + Baking soda → Carbon dioxide + Other products

  Carbon dioxide + Limewater → Calcium carbonate + Water

  $CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

♦ **Some common examples of chemical changes**

- Burning of wood or charcoal
- Burning of candle
- Digestion of food
- Curdling of milk
- Formation of biogas (Gobar gas)
- Burning of petrol or diesel
- Smoking of cigarette
- Drying of paint
- Rusting of iron
- Ripening of fruit
- Clotting of blood
- Fading of the colour of a dyed cloth
- Baking of cake
- Photosynthesis
- Formation of wine
- Butter turning rancid
- Electrolysis of water into hydrogen and oxygen
- Formation of water from hydrogen and oxygen

3. RUSTING OF IRON

Corrosion is the process of slow decay of metals due to attack of atmospheric gases on metals.

Iron corrodes readily when exposed to moisture and gets covered with a brown flaky substance called rust.

This is also called rusting of iron. Chemically, rust is Hydrated iron (III) oxide, $Fe_2O_3.xH_2O$.

The reaction of rusting of iron is given below :

$$\text{Iron} + \text{oxygen} + \text{water} \rightarrow \underset{\text{(rust)}}{\text{hydrated iron oxide}}$$

$$4Fe + xH_2O + 3O_2 \rightarrow 2Fe_2O_3.xH_2O$$

Rusting is an oxidation process in which iron metal is slowly oxidized by the action of air (in presence of water).

♦ **Conditions necessary for rusting**

Both, oxygen and water (or moisture) must be present for the rusting of iron to occur. So two conditions are necessary for the rusting of iron to take place:

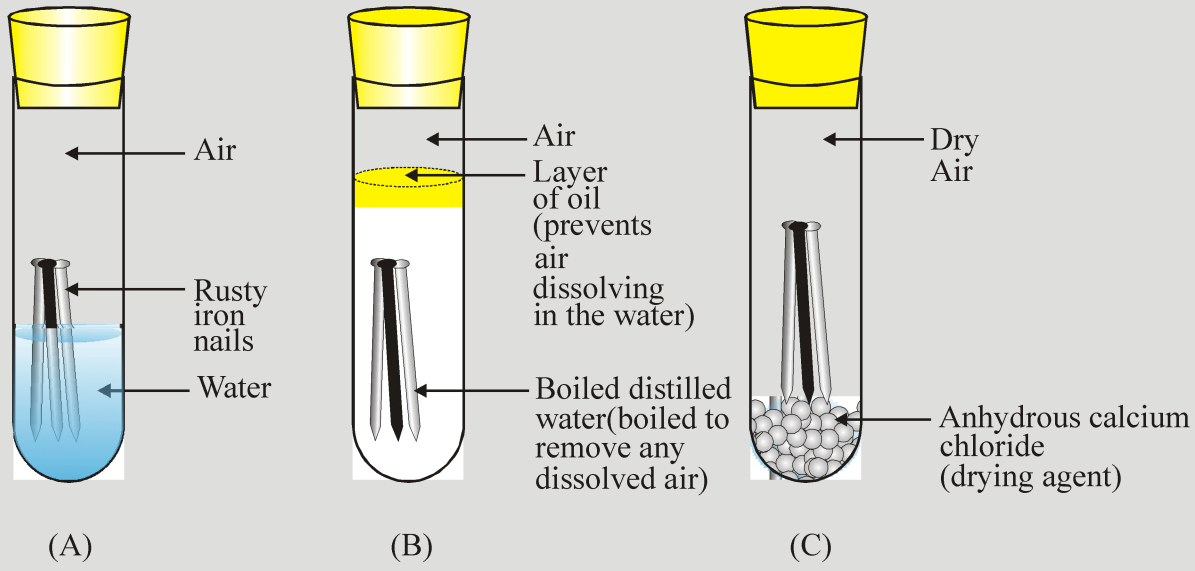
(i) Presence of oxygen (ii) Presence of water or water vapour (moisture)

LAB TIME
Let's Do & Learn

- **Object : To show that rusting of iron requires both air and water.**
- **Preparation materials required :** Test tubes, corks, iron nails, water, oil, anhydrous calcium chloride.
- **Procedure :**
  (i) Take there test tubes and put one clean nail in each of three test tubes. Label these test tubes A, B and C.

(ii) Pour some water in test tube A so that about 2/3 of the nail is immersed in water and cork the test tube.

(iii) Pour some boiling distilled water in test tube B. Then pour 1 mL of oil and cork it.



(iv) Put some anhydrous $CaCl_2$ in test tube C and cork it. Now, have these test tubes for a few days and then

observe.

- **Observation :**

(i) The nail in test tube A will rust due to nail is exposed to both air and moisture.

(ii) The nail in test tubes B and C are does not rust. Because test tube B contain boiling distilled water and oil which prevents air dissolving in the water.

(iii) In test tube C, the anhydrous $CaCl_2$ is drying agent which absorb any moisture (water vapours) from air.

- **Conclusion :** This activity clearly shows that both air and water must be necessary for rusting.

♦ Rusting damage iron objects

Rust is soft and porous, and it gradually falls off from the surface of a rusted iron object, and then the iron below start rusting. Thus, rusting of iron is a continuous process which slowly eats up the iron objects and makes them useless.

♦ **Prevention of Rusting**

(i) Corrosion of metals can be prevented by coating the metal surface with a thin layer of paint, varnish or grease.

(ii) Iron is protected from rusting by coating it with a thin layer of another metal which is more reactive than iron. This prevents the loss of electrons from iron because the active metal loses electrons in preference to iron. Zinc is commonly used for covering the surface of iron.

The process of covering iron with zinc is called galvanization. Iron is also coated with other metals such as tin known as tin coating.

(iii) By alloying : Some metals when alloyed with other metals become more resistant to corrosion. For example, when iron is alloyed with chromium and nickel, it forms stainless steel. This is resistant to corrosion and does not rust at all.

Focus Point

• Rusting is term used only is case of iron. If the rusted surface of iron is rubbed with a sand paper, the rust will appear again in a few days, This shows that the rust is formed by a chemical reaction and not by a physical process.

• **Corrosion of Aluminium :** Due to the formation of a dull layer of aluminium oxide when exposed to moist air, the aluminium metal loses its shine very soon after use. This aluminium oxide layer is very tough and prevents the metal underneath from further corrosion (because moist air is not able to pass through this aluminium oxide layer). This means sometimes corrosion is useful.

• **Corrosion of Copper :** When a copper object remains in damp air for a considerable time, then copper reacts slowly with carbon dioxide and water of air to form a green coating of basic copper carbonate [$CuCO_3.Cu(OH)_2$] on the surface of the object.

$2Cu + O_2 + CO_2 + H_2O \longrightarrow CuCO_3.Cu(OH)_2$

• **Corrosion of Silver :** Silver is a highly unreactive metal, so it does not reacts with oxygen of air easily. But, air usually contains a little of sulphur compounds such as hydrogen sulphide gas (H_2S), which reacts slowly with silver to form a black coating of silver sulphide (Ag_2S). Silver ornaments gradually turn black due to the formation of a thin silver sulphide layer on their surface and silver is said to be tarnished.

$2Ag(s) + H_2S(g) \longrightarrow Ag_2S(s) + H_2(g)$

Silver Hydorgen sulphide Silver sulphide

4. DISPLACEMENT REACTION

The reaction in which a more reactive element displace a less reactive element from its salt solution is known as displacement reaction.

Whenever a more reactive metal is added to a salt solution, the less reactive metal is displaced from its salt solution. For example,

When iron is dipped in copper sulphate solution, a displacement reaction takes place. Iron being more reactive than copper, displaces copper from copper sulphate solution. This copper can be deposited on the iron. The reaction is known as displacement reaction. Displacement reaction is an example of a chemical change or chemical reaction.

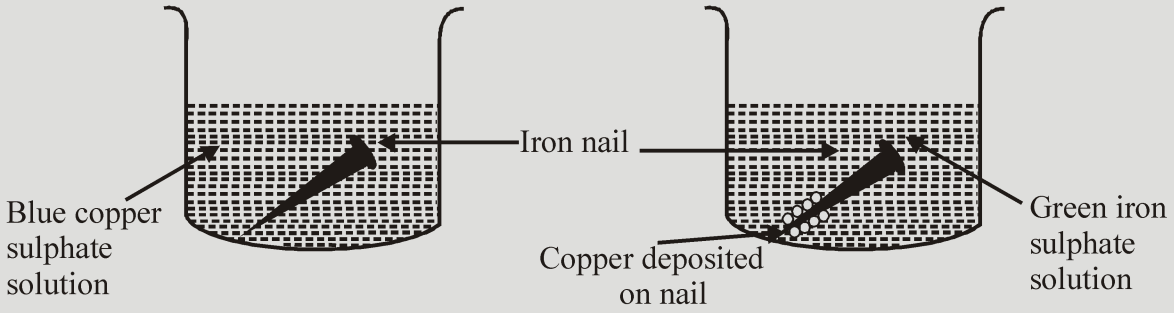
Displacement reaction is often used to deposit a thin layer of one metal on the other. Deposition of the metal is also done by passing electric current through the solution.

Let's discuss an activity to understand more about displacement reaction.

LAB TIME
Let's Do & Learn

- **Objective : To show the deposition of copper on iron nails.**
- **Materials required:** Iron nail, copper sulphate crystals, beaker, glass rod, water.
- **Procedure:** Dissolve copper sulphatein a beaker by adding water and stirring it with a glass rod. A blue copper sulphate solution is formed.

  Drop the iron nail into the solution. After some time observe the change which has taken place.



- **Observations :** The colour of the solution changes from blue to green. The colour of iron nail changes to reddish brown.
- **Conclusion :** Copper from copper sulphate solution deposits on the iron nail giving it a reddish brown copper colour. The solution turns green due to the formation of a new substance—ferrous sulphate.

  $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

5. CRYSTALLISATION

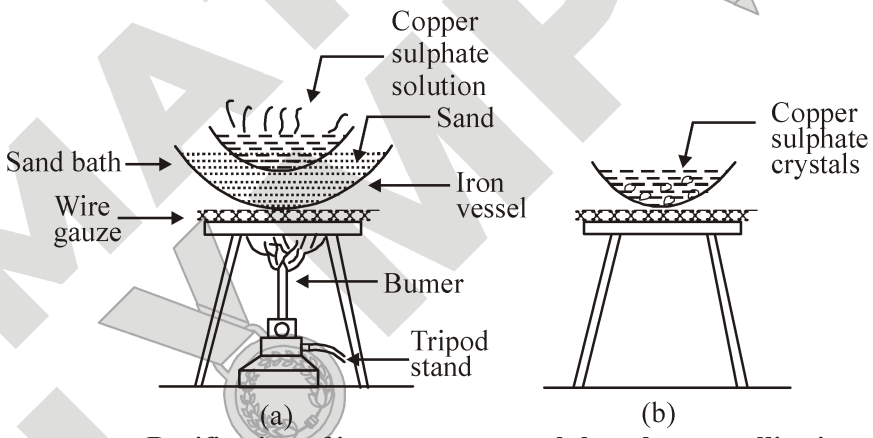
Sea-water contain salts dissolved in it (which make it salty). Salt can be separated from sea-water by the process of evaporation. The process of evaporation (to dryness) is not a good technique of separation because:

(i) The soluble impurities do not get removed in the process of evaporation of a salt solution. So, the salt obtained by evaporation is not pure.

(ii) The crystals of salts obtained by the process of evaporation are small. And the shape of crystals cannot be seen clearly.

The solid particles having flat surfaces, straight edges and regular shapes are called **Crystals**. Many substances form crystals. The process of cooling a hot, concentrated solution of a substance to obtain crystals is called crystallisation. The process of crystallisation is used to obtain large crystals of a pure solid substance from the impure solid substance. An impure solid substance usually contains two types of impurities: insoluble impurities and soluble impurities. The insoluble impurities are removed by filtering its solution whereas soluble impurities get removed during crystallisation.

For example, crystallisation process to obtain pure copper sulphate crystals from copper suphate solution is given below :



Purification of impure copper sulphate by crystallisation

6. CHEMICAL EQUATION

We represent a chemical reaction by writing a chemical equation, in which the chemicals present before the reaction, the reactants are shown to the left of an arrow and the chemicals formed by the reaction, the products, are shown to the right of an arrow. The arrow indicates the direction of the change and is read as " yields " or "gives".

Reactants → Products

For the reaction of methane with oxygen, we have

$$\underset{\text{Methane}}{CH_4} + \underset{\text{Oxygen}}{2O_2} \rightarrow \underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Water}}{2H_2O}$$

From this equation it has been concluded that the products contain the same atoms as the reactants but that the atoms are associated in different ways . That is, a chemical reaction involves changing the ways the atoms are grouped. In a chemical reaction, atoms are neither created nor destroyed. All atoms present in the reactants must be accounted among the products.

6.1 TYPES OF CHEMICAL REACTIONS

(i) Combination reaction : In some reactions, two or more reactants combine to form single product. such a reaction is called as combination reaction.

The combining substances may be elements or simple compounds.

$$A + B \rightarrow AB$$

Examples :

$$2H_2 + O_2 \xrightarrow{\text{Electric spark}} 2H_2O$$

$$CaO + CO_2 \rightarrow CaCO_3$$

(ii) Decomposition reaction : Decomposition means to break up a substance into smaller, simpler substances. When a single compound is broken down into two or more simpler substances (elements or compounds),the reaction is called a decomposition.

$$AB \rightarrow A + B$$

Examples :

$$2H_2O \xrightarrow{\text{Electricity}} 2H_2 + O_2$$

$$2FeSO_4 \xrightarrow{\text{Heat}} Fe_2O_3 + SO_2 + SO_3$$

(iii) Single displacement : When more reactive element displaces the less reactive element from its compound, is called a displacement reaction.

$$A + BC \rightarrow AC + B$$

Example :

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

Mg	2HCl	$MgCl_2$	H_2
Magnesium	Hydrochloric acid	Magnesium chloride	Hydrogen gas

Magnesium displaces hydrogen from hydrochloric acid (hydrogen chloride) and combines with the chloride ion to form magnesium chloride.

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

2Na	$2H_2O$	2NaOH	H_2
Sodium	Water	Sodium Hydroxide	Hydrogen

Sodium displaces hydrogen from water and forms sodium hydroxide.

(iv) Double displacement : When two substances react by exchanging their ions in a aqueous solution and form new substances, the reaction is said to be double displacement reaction.

$$AB + CD \rightarrow AD + CB$$

Examples :

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

Sodium Hydroxide + Hydrochloric acid → Sodium Chloride + Water

$$CaCl_2 + H_2SO_4 \longrightarrow CaSO_4 + 2HCl$$

Calcium Chloride + Sulphuric acid → Calcium Sulphate + Hydrochloric acid

SOLVED EXAMPLES

SE. 1

Write any four characteristics of a physical change.

Ans. (i) No new substance is formed.

(ii) There is a change in shape, size or state.

(iii) Physical change is generally temporary.

(iv) Properties of the substance remain same even after the change.

SE. 2

Breaking of an egg is a physical change while boiling of an egg is a chemical change. Why ?

Ans. When an egg is broken, no new substance is formed hence it is a physical change but when egg is boiled, chemical nature of the egg changes. The properties of a boiled egg are totally different from the raw egg. Hence, boiling of an egg is a chemical change.

SE. 3

Is conversion of milk into ice-cream a chemical change. Justify your answer.

Ans. Yes, conversion of milk into ice-cream is a chemical change since properties of ice-cream are different from the milk.

SE. 4

Why does the colour of copper sulphate change from blue to green if an iron nail is placed in the solution of copper sulphate ?

Ans. When an iron nail is placed in the copper sulphate solution, iron being more reactive than copper displaces copper from copper sulphate solution. Displacement reaction takes place and ferrous sulphate is formed which is green in colour. Brown copper is deposited on the nail.

$CuSO_4 + Fe \rightarrow FeSO_4 + Cu$

SE. 5

What is reversible change ? Give few examples.

Ans. A change in which original substance can be recovered by removing the factor responsible for change or by using simple methods is known as reversible change.

Examples - Conversion of ice into water, inflating of a balloon, stretching of a rubber band, mixing of salt in water, etc.

SE. 6

Explain the reasons for the following :

(i) Cooking of rice is a chemical change.

(ii) Adding sugar to milk is a physical change.

(iii) Burning of coal is a chemical change.

Ans. (i) Rice, when cooked cannot be reverted to its raw form again. There is difference in the properties of rice after cooking.

(ii) There is no difference in the properties of milk or sugar after it is dissolved.

(iii)When coal is burnt, ash is left behind. Ash cannot be converted to coal again. Coal and ash have different properties.

SE. 7

What are the main factors which are responsible for rusting of iron ?

Ans. There are two main factors which are responsible for rusting of iron:

(i) Presence of air or oxygen.

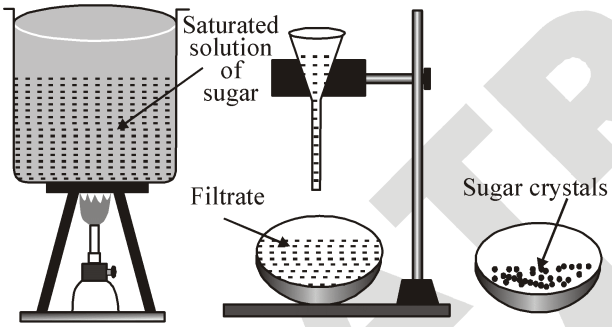
(ii) Presence of water or moisture.

Both these factors have to be present for iron to get rusted. If any of these i.e., either air or water are absent, rusting will not take place.

SE. 8

What is crystallisation ? How can you get crystals of pure sugar from its solution ?

Ans. Crystallisation is the process in which pure crystals of a substance are separated from its saturated solution. To get crystals of pure sugar, the sugar is dissolved in minimum amount of water and heated to get its saturated solution. Solution is filtered to remove any impurities present in the sugar. Crystals of pure sugar separate out from the filtrate on cooling the solution.



SE. 9

Write five changes in the characteristics of a substance which can take place during a chemical change.

Ans. (i) Change in colour

(ii) Change in physical state

(iii) Evolution of gas

(iv) Absorption or evolution of heat

(v) Formation of a precipitate

SE. 10

Give one example of the following changes taking place during a chemical change.

(i) Evolution of a gas

(ii) Evolution of heat

(iii) Formation of a precipitate

Ans. (i) Reaction of baking soda with vinegar

Sodium bicarbonate + Acetic acid $\rightarrow$ Sodium acetate + Carbon dioxide + Water

(Baking soda) (Vinegar) (Gas)

(ii) Reaction between sodium hydroxide and hydrochloric acid (Neutralisation reaction).

Sodium hydroxide + Hydrochloric acid $\rightarrow$ Sodium chloride + water + Heat

$NaOH + HCl \rightarrow NaCl + H_2O + Heat$

(iii) Formation of milky precipitate when carbon dioxide gas is passed through limewater.

Limewater + Carbon dioxide $\rightarrow$ Calcium carbonate + Water

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

SE. 11

Define rust.

Ans. Rust is a reddish brown powder deposited on iron objects which is formed by reaction of iron with air and water present in the atmosphere. It is hydrated iron oxide.

Iron + Oxygen + Water $\rightarrow$ Rust(Hydrated iron oxide)

SE. 12

What is alloying ? Name an important alloy of iron.

Ans. Alloying is a method in which a metal is mixed with another metal or a non-metal in molten state to improve the properties of the metal. Iron gets rusted very easily and to make it rust free, iron is combined with carbon and some other metals like chromium or magnanese to make an important alloy called stainless steel. Stainless steel does not get rusted.

SE. 13

What are crystals ?

Ans. Crystals are solids in their purest form that have definite geometrical shapes.

SE. 14

State two points on differences between formation of rust and formation of ice.

Ans. (i) Rusting is a chemical process while formation of ice is a physical process.

(ii) Rusting is irreversible while formation of ice is a reversible process.

SE. 15

Give an example of a physical but irreversible change.

Ans. Breaking of a glass tumbler into small pieces is a physical change since there is no change in the properties of glass even if it is converted into small pieces. It is an irreversible change.

Space for Notes :

NS. 1

Classify the changes involved in the following processes as physical or chemical changes:

(a) Photosynthesis

(b) Dissolving sugar in water

(c) Burning of coal

(d) Melting of wax

(e) Beating aluminium to make aluminium foil

(f) Digestion of food

Ans. (a) Chemical (b) Physical

(c) Chemical (d) Physical

(e) Physical (f) Chemical

NS. 2

State whether the following statements are true or false. In case a statement is false, write the corrected statement in you notebook.

(a) Cutting a log of wood into pieces is a chemical change. (True/False)

(b) Formation of manure from leaves is a physical change.(True/False)

(c) Iron pipes coated with zinc do not get rusted easily. (True/False)

(d) Iron and rust are the same substances.(True/False)

(e) Condensation of steam is not a chemical change. (True/False)

Ans. (a) False

(b) False

(c) True

(d) False

(e) True

NS. 3

Fill in the blanks in the following statements :

(a) When carbon dioxide is passed through limewater, it turns milky due to the formation of___ .

(b) The chemical name of baking soda is _____.

(c) Two methods by which rusting of iron can be prevented are _____ and _____ .

(d) Changes in which only ___ properties of a substance change are called physical changes.

(e) Changes in which new substances are formed are called ____ changes.

Ans. (a) Calcium carbonate

(b) Sodium bicarbonate

(c) Painting & oiling

(d) physical

(e) Chemical

NS. 4

When baking soda is mixed with lemon juice, bubbles are formed with the evolution of a gas. What type of change is it ? Explain.

Ans. It is a chemical change. When baking soda is mixed with lemon juice a gas carbon dioxide comes out and the following reaction takes place.

Baking soda + Lemon juice $\rightarrow$ Carbon dioxide + Other products

(Sodium bicarbonate)

NS. 5

When a candle burns, both physical and chemical changes take place. Identify these changes. Give another example of a familiar process in which both the chemical and physical changes take place.

Ans. When a candle burns, first it melts which is a physical change. When the liquid is converted into vapours and mixed with air during buring, a chemical change takes place. Another example of a change in which both physical and chemical occur is buring of LPG gas. Liquified petroleum gas is filled in the cylinder in the form of a liquid. When these liquids come out of the cylinder in the form of vapours, physical change takes place. When these vapours are mixed with air and burn, chemical change takes place.

NS. 6

How would you show that setting of curd is a chemical change ?

Ans. When milk is set to curd, the properties of milk are completely changed and a new product is formed. Curd cannot be converted back to milk, hence it is a chemical change.

NS. 7

Explain why burning of wood and cutting it into small pieces are considered as two different types of changes.

Ans. Burning of wood is a chemical change due to formation of ash, which has different chemical properties than wood while cutting it into small pieces is a physical change because no new substance is formed.

NS. 8

Describe how crystals of copper sulphate are prepared.

Ans. A saturated solution of copper sulphate is prepared by dissolving in water and heating it. A small amount of dilute sulphuric acid is added in it to prevent hydrolysis of the solution. Saturated solution is filtered and the filtrate is kept undisturbed for some time. On cooling crystals of copper sulphate are separated from the solution.

NS. 9

Explain how painting of an iron gate prevents it from rusting.

Ans. When an iron surface is painted, iron does not come in contact with air or moisture. Paint acts as a protective layer and prevents exposure of iron to the atmosphere. Since air and water are necessary for rusting, iron does not get rusted if painted.

NS. 10

Explain why rusting of iron objects is faster in coastal areas than in deserts.

Ans. Percentage of moisture is high in coastal areas hence iron objects get both water and air for rusting. In deserts the air is dry and there is no water or moisture in the air hence rusting does not take place as fast as in coastal areas.

NS. 11

The gas we use in the kitchen is called liquified petroleum gas(LPG). In the cylinder it exists as a liquid. When it comes out from the cylinder it becomes a gas (Change - A) then it burns (Change-B). The following statements pertain to these changes. Choose the correct one.

(i) Process- A is a chemical change.

(ii) Process- B is a chemical change.

(iii) Both processes A and B are chemical changes.

(iv) None of these processes is a chemical change.

Ans. (ii) Process- A is a physical change while process -B is a chemical change.

NS. 12

Anaerobic bacteria digest animal waste and produce biogas (Change-A). The biogas is then burnt as fuel (Change-B). The following statements pertain to these changes. Choose the correct one.

(i) Process - A is a chemical change.

(ii) Process - B is a chemical change.

(iii) Both processes A and B are chemical changes.

(iv) None of these processes is a chemical change.

Ans. (iii) Making of biogas and burning of biogas both are chemical changes.

Space for Notes :

EXERCISE – I

ONLY ONE CORRECT TYPE

1. What does a chemical change involve ?
   (A) Formation of substance with different states
   (B) Formation of substance with different chemical properties
   (C) Formation of substance with different size
   (D) Formation of substance with different shapes
2. Which of the following is an irreversible physical change ?
   (A) Freezing of water
   (B) Melting of ice
   (C) Burning of paper
   (D) Cutting of wood in small pieces
3. In a displacement reaction
   (A) The colour of the original solution does not change
   (B) A more reactive element displaces a less reactive element from its solution
   (C) A less reactive element displaces a more reactive element from its solution
   (D) The elements with same reactivity displace each other in salt solution.
4. Melting of wax is
   (A) An irreversible physical change
   (B) An irreversible chemical change
   (C) A reversible chemical change
   (D) A reversible physical change
5. Rusting of iron is
   (A) An irreversible chemical change
   (B) A reversible chemical change
   (C) An irreversible physical change
   (D) A reversible physical change
6. The change of state of a substance from solid to liquid and liquid to gas is
   (A) A physical change
   (B) A chemical change
   (C) Combination of a physical and chemical changes
   (D) Sometimes physical change and sometimes chemical change.
7. Galvanisation is a process in which
   (A) Iron is coated on zinc metal
   (B) Zinc and Iron are mixed in molten state
   (C) Zinc is coated as a layer on iron
   (D) Carbon is mixed with iron and heated.
8. Dissolve some common salt in water and leave the solution in an open and sunny place for a day. What do you observe ?
   (A) The whole of the solution evaporates
   (B) Water evaporates leaving behind salt
   (C) Salt evaporates leaving behind water
   (D) No change of any form in the salt solution
9. What kind of change is involved when a sheet of paper is shredded ?
   (A) An irreversible chemical change
   (B) A reversible chemical change
   (C) An irreversible physical change
   (D) A reversible physical change
10. Which of the following is not a physical change ?
    (A) Breaking of a glass tumbler
    (B) Melting of butter
    (C) Dissolving of sugar in water
    (D) Ripening of a fruit

11. When an iron spade is left lying in a moist atmosphere it
(A) Develops brown powdery layer of iron oxide
(B) Develops green layer of iron oxide
(C) Develops brown layer of oxygen
(D) Does not undergo any change

12. Which of the following is a chemical change ?
(A) Cutting of a cloth
(B) Ironing of a cloth
(C) Drying of a cloth
(D) Burning of a cloth

13. Which gas is produced when vinegar reacts with baking soda ?
(A) Hydrogen
(B) Carbon dioxide
(C) Carbon monoxide
(D) Oxygen

14. When carbon dioxide is passed through limewater
(A) It truns milky due to formation of calcium carbonate
(B) It turns green due to formation of iron sulphate
(C) It turns white due to formation of calcium hydroxide
(D) It turns blue due to formation of calcium oxide

15. Copper sulphate solution is .... in colour.
(A) Green (B) Blue
(C) Pink (D) Colourless

16. When an iron nail is dipped in copper sulphate solution, the colour of solution changes to
(A) Green
(B) Blue
(C) Pink
(D) Colourless

17. Carbon dioxide gas turns limewater milky. This change is a
(A) Physical change
(B) Chemical change
(C) Displacement reaction
(D) Neutralisation reaction

18. Which of the following metals burns with a dazzling white flame ?
(A) Zinc (B) Copper
(C) Iron (D) Magnesium

19. Which of the following gas burns with a pop sound?
(A) Hydrogen (B) Oxygen
(C) Nitrogen (D) Carbon dioxide

20. A reversible change is a change which
(A) Cannot be reversed
(B) Is a chemical change
(C) Takes place during a displacement reaction
(D) Can be reversed

21. Choose the incorrect statement.
(A) Chemical reactions are characterised by change in colour and smell
(B) Change in chemical compositions of reactants takes place during a chemical change
(C) Physical changes are always reversible
(D) Change in physical state is a physical change

22. Identify the physical change in the following:
(A) Burning of magnesium ribbon
(B) Formation of solution by dissolving a soluble substance in water
(C) Photosynthesis
(D) Digestion of food

23. Identify the type of change in the following reaction

Ice $\xrightarrow{\text{heat}}$ Water $\xrightarrow{\text{heat}}$ Steam

(A) Physical change

(B) Chemical change

(C) Both physical and chemical changes

(D) None of the above

24. Which type of the chemical reaction is the following reaction ?

$AB + C \rightarrow AC + B$

(A) Decomposition reaction

(B) Neutralisation reaction

(C) Displacement reaction

(D) Combination reaction

25. Crystallisation is the process in which

(A) Crystals of pure substance are obtained

(B) Crystals of impure substance are obtained

(C) Colouress crystals of a coloured substance are obtained

(D) Coloured crystals of a colourless substance are obtained

PARAGRAPH TYPE

PARAGRAPH # 1

Sea-water contain salts dissolved in it (which make it salty). Salt can be separated from sea-water by the process of evaporation. The process of evaporation (to dryness) is not a good technique of separation because :

(i) The soluble impurities do not get removed in the process of evaporation of a salt solution. So, the salt obtained by evaporation is not pure.

(ii) The crystals of salts obtained by the process of evaporation are small. And the shape of crystals cannot be seen clearly.

The solid particles having flat surfaces, straight edges and regular shapes are called **Crystals**.

26. Salt can be separated from sea-water by the process of :

(A) Condensation (B) Evaporation

(C) Crystallisation (D) None

27. In which of the following the identity of initial substance remains unchanged ?

(A) Curdling of milk

(B) Formation of crystals by process of crystallisation

(C) Fermentation of grapes

(D) Digestion of food

28. What is meant by crystallisation ?

(A) Concentration of atoms into a highly structured form

(B) Solidification of atoms into a highly structured form

(C) Solidification of solution

(D) Concentration of solution

PARAGRAPH # 2

Corrosion is the process of slow decay of metals due to attack of atmospheric gases on metals. Iron corrodes readily when exposed to moisture and gets covered with a brown flaky substance called rust. This is also called rusting of iron. Chemically, rust is Hydrated iron (III) oxide, $Fe_2O_3.xH_2O$.

The reaction of rusting of iron is given below :

Iron + oxygen + water $\rightarrow$ hydrated iron oxide (rust)

$4Fe + xH_2O + 3O_2 \rightarrow 2Fe_2O_3.xH_2O$

Rusting is an oxidation process in which iron metal is slowly oxidized by the action of air (in presence of water).

29. What is chemical formula of rust ?

(A) $Fe_3O_2.xH_2O$

(B) Fe_2O

(C) $Fe_2O_3.xH_2O$

(D) None

30. Corrosion of metals involves :

(A) Physcial reaction

(B) Chemical reaction

(C) Both

(D) None

31. The following factors play vital role in corrosion process :

(A) Temperature

(B) solute concentration

(C) Both

(D) None

MATCH THE COLUMN TYPE

32.

Column- I	Column - II
(P) Folding of paper	(i) Crystallisation
(Q) Zine coating on iron	(ii) Cut apples
(R) Solid in pure form	(iii) Can be reversed
(S) Oxidation	(iv) Galvanisation

(A) (P)→(iii), (Q)→(iv), (R)→(ii), (S)→(i)

(B) (P)→(iii), (Q)→(iv), (R)→(i), (S)→(ii)

(C) (P)→(iv), (Q)→(iii), (R)→(ii), (S)→(i)

(D) (P)→(i), (Q)→(ii), (R)→(iv), (S)→(iii)

33.

Column- I	Column - II
(P) Iron nail + Copper sulphate	(i) Carbon dioxide
(Q) Vinegar + Baking soda	(ii) Calcium carbonate
(R) Iron + Moisture + Air	(iii) Displacement reaction
(S) Lime water + Carbon dioxide	(iv) Rust

(A) (P)→(iii), (Q)→(i), (R)→(iv), (S)→(ii)

(B) (P)→(iii), (Q)→(i), (R)→(ii), (S)→(iv)

(C) (P)→(ii), (Q)→(iii), (R)→(i), (S)→(iv)

(D) (P)→(i), (Q)→(ii), (R)→(iv), (S)→(iii)

EXERCISE – II

VERY SHORT ANSWER TYPE

1. What is the process of depositing a layer of zinc on iron called ?
2. What is alloying ?
3. Which gas turns limewater milky ?
4. Can rusting take place in dry air ?
5. What type of a change is digestion of food ?
6. Name one alloy of iron which does not get rusted.
7. Burning of magnesium wire is which type of a change ?
8. What is the name given to the reaction in which blue colour of copper sulphate turns green when iron is added to it ?
9. What is an irreversible change ?
10. Name the change in which no new substance is formed.

SHORT ANSWER TYPE

1. Define an irreversible physical change.
2. What happens when a saturated solution is left for cooling ?
3. What is evaporation ? How is evaporation useful in getting salt from sea water ?
4. Give three main properties which change during a physical reaction.
5. Which change is represented by the following examples ?
   (i) When an iron piece is left in a moist atmosphere, a brown layer of rust is formed on it.
   (ii) Carbon dioxide is evolved when vinegar is added to sodium bicarbonate.

LONG ANSWER TYPE

1. With a diagram explain what happens when an iron nail is exposed to
   (a) Dry air (b) Moisture and air
   (c) Only moisture
2. What is crystallisation ? How will you obtain crystals of alum from an impure sample ?
3. What is a displacement reaction ? Why is it a chemical reaction ? Explain with an example.
4. State three differences between a physical and a chemical change.
5. Discuss various methods which prevent rusting of iron.

TRUE AND FALSE

1. The iron gate if not painted gets rusted due to presence of air and moisture.
2. The process of separation of crystals from a saturated solution on cooling is called evaporation.
3. Burning of wax is a chemical change, while melting of wax is a physical change.
4. When exposed to air a cut brinjal turns black at the surface. This is an example of a chemical change.
5. Rusting of iron is a reversible chemical change.

FILL IN THE BLANKS

1. When ..... gas is passed through limewater it turns milky.
2. The process of mixing a non-metal or metal to a molten metal is known as ..... .
3. Physical changes are generally ..... in nature.
4. Exposed cut surfaces of fruits and vegetables turn brown, it it a ..... .
5. Chemical changes are permanent and usually ..... in nature.

Answer Key

EXERCISE–I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	D	B	D	A	A	C	B	C	D	A	D	B	A	B
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	B	D	A	D	C	B	A	C	A	C	B	B	C	B
31	32	33												
A	B	A												

EXERCISE – II

TRUE / FALSE

1. T **2.** F **3.** T **4.** T **5.** F

FILL IN THE BLANKS

1. Carbon dioxide **2.** Alloying **3.** Reversible **4.** Chemical change **5.** Irreversible

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : PHYSICAL AND CHEMICAL CHANGES)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
Solved Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :

ACIDS, BASES & SALTS
(EXPLORING SUBSTANCES : ACIDIC BASIC AND NEUTRAL)

2

Concepts

Introduction

1. *Acids*
   - *1.1 Classification of Acids*
2. *Bases*
   - *2.1 Classification of Bases*
3. *Indicators*
   - *3.1 Natural Indicators*
   - *3.2 Synthetic Indicators*
4. *Uses of Acids And Bases*
   - *4.1 Uses of Acids*
   - *4.2 Uses of Bases*
5. *Neutralisation*
6. *Importance of Neutralisation Reactions in Everyday Life*
7. *Acidic, Basic or Neutral Solutions of Salts*
8. *Uses of Salts*

Solved Examples

NCERT Solutions

Exercise – I (Competitive Exam Pattern)

Exercise – II (Board Pattern Type)

Answer Key

INTRODUCTION

The chemicals which we come across are usually categorised as acids, bases and salts.

Earlier this classification was based on different taste of chemicals.

Acids were first recognized as substances that taste sour. Vinegar tastes sour because it is a dilute solution of acetic acid. Citric acid is responsible for the sour taste of a lemon.

Bases, sometimes called alkalis, are characterised by their bitter taste and they are soapy to feel. Most hand soaps and commercial preparation for unclogging drains are highly basic.

Substances having taste similar to that of common salt are called salts.

However, some substances have very unpleasant taste and even may be poisonous. Usually salts are prepared by chemical reaction between acids and bases.

Now, the question arises – how to test that the given substance is an acid or a base without tasting it ?

In this chapter, we shall discuss the common characteristics of acid and bases and their chemical nature.

1. ACIDS

- The substances which taste sour contain acids in them and are called acidic substances or acid.
- Some of the acids are naturally occuring acids which are generally present in food items. Lemon juice, orange juice, vinegar, curd, tamarind etc. are sour in taste due to presence of acids.
- Acids are corrosive in nature and soluble in water.

1.1 CLASSIFICATION OF ACIDS

Classification of acids can be done in different ways as given below :

(A) Classification of acids on the basis of their Source

(B) Classification on the basis of their concentration

(C) Classification on the basis of their strength

(A) Classification of acids on the basis of their Source

On the basis of their source, acids can be classified in two categories :

(i) Organic acids

(ii) Inorganic acids

(i) Organic acids :

The acids which are usually obtained from organisms are known as organic acids. Oxalic acid [$(COOH)_2$], acetic acid (CH_3COOH) etc. are very common examples of organic acids. Some other organic acids with their natural sources are given in the following Table.

Some Organic Acids with Their Natural Sources

S.No.	Organic acid	Natural sources
1.	Acetic acid	Micro-organism (bacteria)
2.	Citric acid	Citrus fruits (like orange and lemon)
3.	Butyric acid	Rancid butter
4.	Formic acid	Sting of bees and ants
5.	Lactic acid	Sour milk
6.	Malic acid	Apples
7.	Oleic acid	Olive oil
8.	Stearic acid	Fats
9.	Amino acid	Proteins
10.	Uric acid	Urine
11.	Tartaric acid	Tamarind
12.	Oxalic acid	Tomatoes

Substance that contains Acid

(ii) Inorganic Acids.

The acids which are usually obtained from minerals are known as inorganic acids. Since the acids are obtained from minerals, therefore, these acids are also called mineral acids.

Some common examples of inorganic acids are :

Hydrochloric acid HCl

Sulphuric acid H_2SO_4

Nitric acid HNO_3

Phosphoric acid H_3PO_4

Carbonic acid H_2CO_3

(B) Classification on the basis of Concentration of the Acid :

By the term concentration, we mean the amount of water present in the given sample of acid solution in water.

(i) Concentrated Acid :

The sample of an acid which contains very small or no amount of water is called a concentrated acid.

(ii) Dilute Acid :

The sample of an acid which contains very large amount of water is called a dilute acid.

(C) Classification of acids on the basis of their strength :

(i) Strong Acids :

The acids which dissociate completely in water to give a large number of hydrogen ions (H^+) are known as strong acid.

Examples of strong acids :

Some examples of strong acids are :

(i) Hydrochloric acid (HCl) (ii) Sulphuric acid (H_2SO_4) (iii) Nitric acid (HNO_3)

All these three mineral acids are considered to be strong acids because they ionise almost completely in their dilute aqueous solutions.

(ii) Weak Acids :

The acids which do not dissociate completely in water and give a small number of hydrogen ions (H^+) are known as weak acid.

Examples of weak acids :

Some examples of weak acids are :

(i) Acetic acid (CH_3COOH) (ii) Formic acid (HCOOH)

(iii) Oxalic acid [$(COOH)_2$] (iv) Carbonic acid (H_2CO_3)

(v) Sulphurous acid (H_2SO_3) (vi) Hydrogen sulphide (H_2S)

(vii) Hydrocyanic acid (HCN)

Focus Point

- **According to Arrhenius: "**The substances which give hydrogen ions (H^+) in water are known as acids. For example, HCl is an example of acid because it gives H^+ ion in water.

$$HCl \rightarrow H^+ + Cl^-$$

- Generally mineral acids are strong acids while organic acids are weak acids.

2. BASES

- The substances which are bitter in taste and are soapy to touch contain bases in them and are called basic substance or bases.
- All bases are not soluble in water. The bases which are soluble in water are known as alkalis.
- Following table shows examples of a few bases with their chemical names:

Some Common bases

Common Name	Chemical Name
Caustic soda	Sodium hydroxide
Washing soda	Sodium carbonate
Milk of magnesia	Magnesium hydroxide
Slaked lime	Calcium hydroxide
Baking soda	Sodium bicarbonate (Sodium hydrogen carbonate)

2.1 CLASSIFICATION OF BASES

Classification of bases or alkalis can be done in different ways as given below :

(A) Classification on the basis of their concentration

(B) Classification on the basis of their strength

(A) Classification of Bases or Alkalis on the Basis of their Concentration :

By the term concentration, we mean the amount of water present in the given sample of alkali solution in water. On the basis of concentration, the alkalis can be classified as under :

(i) Concentrated alkali :

A solution of alkali having a relatively high percentage of alkali in its aqueous solution is known as concentrated alkali.

(ii) Dilute alkali :

A solution of alkali having a relatively low percentage of alkali in its aqueous solution is known as a dilute alkali.

(B) Classification of the Bases or Alkalis on the Basis of their Strength

(i) Strong alkalis or bases :

The alkalis or bases which undergo almost complete ionisation in aqueous solution to produce high concentration of hydroxyl (OH^-) ions are known as strong alkalis or strong bases.

Example of strong alkalis or bases :

Some example of strong alkalis or bases are : Sodium hydroxide (NaOH), Potassium hydroxide (KOH) and Barium hydroxide [$Ba(OH)_2$] etc.

$$\left.\begin{aligned} &NaOH(aq) \longrightarrow Na^+(aq) + OH^-(aq) \\ &KOH(aq) \longrightarrow K^+(aq) + OH^-(aq) \\ &Ba(OH)_2(aq) \longrightarrow Ba^{2+}(aq) + 2OH^-(aq) \end{aligned}\right\} \text{(Almost completely ionised)}$$

(ii) Weak alkalis or bases :

The alkalis or bases which undergo only partial ionisation in aqueous solution to produce a relatively low concentration of hydroxyl (OH^-) ions are known as weak alkalis or weak bases.

Some examples of weak alkalis or bases are :

Ammonium hydroxide (NH_4OH), Calcium hydroxide [$Ca(OH)_2$], Magnesium hydroxide [$Mg(OH)_2$] etc

Focus Point

- **According to Arrhenius:** "The substances which give hydroxyl ions (OH^-) in water are known as bases. For example, NaOH is an example of base because it gives OH^- ion in water.

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

- **Alkalis:** The bases which are soluble in water are known as alkalis.

For example, NaOH, KOH etc are also known as alkalis because they are soluble in water.

3. INDICATORS

- An indicator is a substance which changes colour when added to an acid or a base. The change in colour indicates whether the substance is acidic or basic. If there is no change in the colour of the indicator, the substance is called a neutral substance.
- Indicators can be natural dyes extracted from plants or chemical compounds.

3.1 NATURAL INDICATORS

The indicators which are obtained from natural resources known as natural indicators. Some examples of natural indicators are given below :

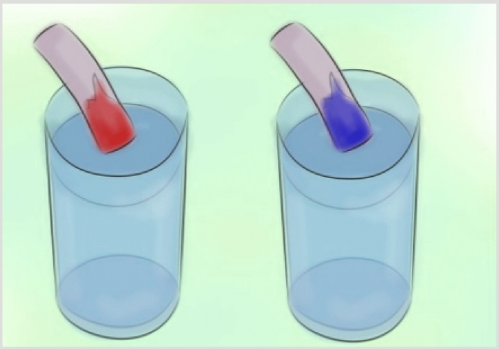
(A) Litmus :

- Litmus is a natural dye which is extracted from lichens. Litmus solution is prepared from this extract. It is also used in the form of litmus paper which is prepared by absorbing litmus solution on filter paper.
- Litmus is available in the form of blue litmus paper and red litmus paper.
- Acidic substances change blue litmus paper to red while basic substances change red litmus paper to blue.
- Substances which do not change the colour of the litmus paper are known as neutral substances.

Action of litmus on acidic or basic solutions can be understood by following activity.

LAB TIME
Let's Do & Learn

- **Object : To identify the given substances as acidic or basic in nature.**
- **Materials required**: Vinegar, lemon juice, soap solution, soda water, curd, limewater, window cleaner, orange juice, aerated soft drink, sugar solution, salt solution, red litmus paper, blue litmus paper, dropper.
- **Procedure :**
  (i) Take a drop of the sample solution and put it on the blue litmus paper. Note the change in colour.
  (ii) Now put a drop of the same solution on red litmus paper and note the change in colour.



Acid Base

- **Observations :**

Sample	Change in colour with blue litmus paper	Change in colour with red litmus paper
Vinegar	Red	No change
Lemon juice	Red	No change
Soap solution	No change	Blue
Soda water	Red	No change
Curd	Red	No change
Limewater	No change	Blue
Window cleaner	No change	Blue
Orange juice	Red	No change
Aerated soft drink	Red	No change
Sugar solution	No change	No change
Salt solution	No change	No change

- **Conclusion**: Substances which change blue litmus paper to red are acidic substances. Substances which change red litmus paper to blue are basic substances and substances which do not change the colour of litmus paper are neutral substances.

(B) China rose :

- China rose makes another natural indicator which is prepared by soaking the petals of the flower in water.
- Acidic substances change China rose indicator into dark pink or magenta while basic substances turn China rose indicator into green.
- Substances which do not change the colour of China rose indicator are neutral in nature.

LAB TIME
Let's Do & Learn

- **Object : To test the samples by China rose indicator for identification of acidic or basic nature.**
- **Materials required :** Vinegar, lemon juice, soap solution, soda water, curd, limewater, window cleaner, orange juice, aerated soft drink, sugar solution, salt solution, China rose, warm water, dropper.
- **Procedure :**
  (i) Take some warm water in a beaker and put few China rose petals in it. Keep the petals dipped for some time till the water becomes coloured.
  (ii) Take the coloured water and use it as an indicator by putting few drops in the sample solution.
  (iii) Observe the change in colour of the China rose solution with each sample.
- **Observations :**

Sample	**Change in colour of China rose indicator**
Vinegar	Magenta
Lemon juice	Magenta
Soap solution	Green
Soda water	Magenta
Curd	Magenta
Limewater	Green
Window cleaner	Green
Orange juice	Magenta
Aerated soft drink	Magenta
Sugar solution	No change
Salt solution	No change

- **Conclusion :**
  (i) Samples which turn China rose indicator to magenta (dark pink) are acidic in nature.
  (ii) Samples which turn China rose indicator to green are basic in nature.
  (iii) Sugar and salt solutions which do not show any colour change in the indicator are neutral.

(C) Turmeric :

- Turmeric or haldi powder is another natural indicator.
- Turmeric paste made by adding water to turmeric powder is used as an indicator for making turmeric paper.
- With acidic or neutral substances turmeric paper remains yellow. Turmeric paper changes to red colour in basic solutions.

Let's discuss an activity to understand action of turmeric on acidic or basic solution.

LAB TIME
Let's Do & Learn

- **Object : To test acidic or basic solutions using turmeric powder as indicator.**
- **Materials required :** Vinegar, lemon juice, soap solution, soda water, curd, limewater, window cleaner, orange juice, aerated soft drink, sugar solution, salt solution, turmeric powder, water, blotting paper.
- **Procedure :**
  (i) Take one teaspoon of turmeric powder. Add a small amount of water to it to make a paste.
  (ii) Apply this paste on a blotting paper and let it dry. Cut the dried paper into thin strips.
  (iii) Dip the strip into each sample solution and note down the change in colour.
- **Observations :**

Sample	**Change in colour of turmeric paper**
Vinegar	No change
Lemon juice	No change
Soap solution	Red
Soda water	No change
Curd	No change
Limewater	Red
Window cleaner	Red
Orange juice	No change
Aerated soft drink	No change
Sugar solution	No change
Salt solution	No change

- **Conclusion :**
  With basic samples like soap solution, limewater and window cleaner turmeric paper changes from yellow to red.

(D) Red Cabbage :

- Red cabbage can also be used for making a natural indicator to test acids and bases.
- Red cabbage indicator can be prepared by boiling chopped red cabbage in water.
- Acidic solutions change purple colour of red cabbage indicator to red while basic solutions change purple colour of red cabbage to green.
- Neutral substances do not change the colour of red cabbage indicator.

Let's discuss an activity to understand action of red cabbage on acidic or basic solution.

LAB TIME
Let's Do & Learn

- **Object : To identify acidic, basic and neutral substances by using red cabbage indicator.**
- **Materials required :** Vinegar, lemon juice, soap solution, soda water, curd, limewater, window cleaner, orange juice, aerated soft drink, sugar solution, salt solution, red cabbage, water.
- **Procedure :**

  (i) Add chopped red cabbage to warm water and keep it dipped for some time.

  (ii) Strain the solution and use this purple coloured solution as indicator and test the given samples to note any change in colour.
- **Observations :**

Sample	Change in colour of red cabbage indicator
Vinegar	Red
Lemon juice	Red
Soap solution	Green
Soda water	Red
Curd	Red
Limewater	Green
Window cleaner	Green
Orange juice	Red
Aerated soft drink	Red
Sugar solution	No change
Salt solution	No change

- **Conclusion :**

  (i) The samples which turn purple colour of red cabbage indicator to red are acidic in nature.

  (ii) The samples which turn purple colour of red cabbage indicator to green are basic in nature.

  (iii) Solutions which do not change the colour of red cabbage indicator are neutral.

3.2 SYNTHETIC INDICATORS

- Some chemical compounds which are prepared in laboratory can also be used as indicators to identify bases and acids.
- Methyl orange and phenolphthalein are two common indicators used to test acids and bases.

(A) Phenolphthalein :

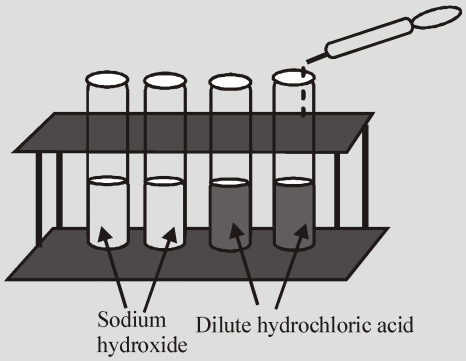
It is also an organic dye and acidic in nature. In neutral or acidic solution, it remains colourless while in the basic solution, the colour of indicator changes to pink.

(B) Methyl Orange :

Methyl orange is an orange coloured dye and basic in nature. In the acidic medium the colour of indicator becomes red and in the basic medium, colour of indicator becomes yellow and in neutral medium, its colour remains unchanged.

LAB TIME
Let's Do & Learn

- **Object : To identify the given samples of acid and base by using phenolphthalein and methyl orange as indicators.**
- **Materials required :** Dilute hydrochloric acid, sodium hydroxide solution, phenolphthalein, methyl orange, dropper, test tubes.
- **Procedure :**
  (i)Take a small amount of given solution in a test tubes and add two drops of phenolphthalein.
  (ii) Repeat the experiment with methyl orange and record the observations.



- **Observations :**

Sample	Indicator	Colour
Sodium hydroxide	Phenolphthalein	Pink
Sodium hydroxide	Methyl orange	Yellow
Dilute hydrochloric acid	Phenolphthalein	Colourless
Dilute hydrochloric acid	Methyl orange	Red

- **Conclusion :**
  Phenolphthalein remains colourless in hydrochloric acid while turns pink with sodium hydroxide.
  Methyl orange remains yellow with sodium hydroxide while turns red with hydrochloric acid.

Action of various indicators on acidic, basic or neutral solutions

Indicator	Acid solution	Basic solution	Neutral
Methyl orange	Red	Yellow	Orange
Phenolphthalein	Colourless	Pink	Colourless
Blue litmus solution	Red	No colour change	No change
Red litmus solution	No change	Blue	No change
Red cabbage Juice	Red or pink	Green	Purple
Turmeric juice	Yellow	Reddish	Yellow
China Rose	Dark pink or Magenta	Green	Pink

Focus Point

Olfactory indicator :

The indicators which change their smell in acidic or basic solution known as Olfactory indicator.

For exmaple : Clove oil, Chopped onion etc.

4. USES OF ACIDS AND BASES

4.1 USES OF ACIDS

- Sulphuric acid is used for manufacturing fertilisers, drugs, plastics, paints. It is also used in making batteries for vehicles and used in paper, textile and leather industries.
- Nitric acid is used for manufacturing explosives and fertilisers.
- Hydrochloric acid is used as a cleaner, to remove scales or deposits in the boilers.

4.2 USES OF BASES

- Bases are used as common reagents in various industries.
- Calcium hydroxide is used for white washing of buildings.
- Sodium hydroxide is used for manufacturing soap. It is also used for manufacturing paper, rayon, textiles, etc.
- Ammonium hydroxide is used for manufacturing, fertilisers, plastics, dyes, etc.

Focus Point

pH of acidic, basic and neutral solution

• The strength of an acid and a base is measured by a scale called pH scale. pH value of solution indicates the concentration of hydrogen ions in the solution. Pure water which is nautral has a pH value 7. A pH paper is used to find out pH of a solution by matching the change in colour with a universal indicator paper.

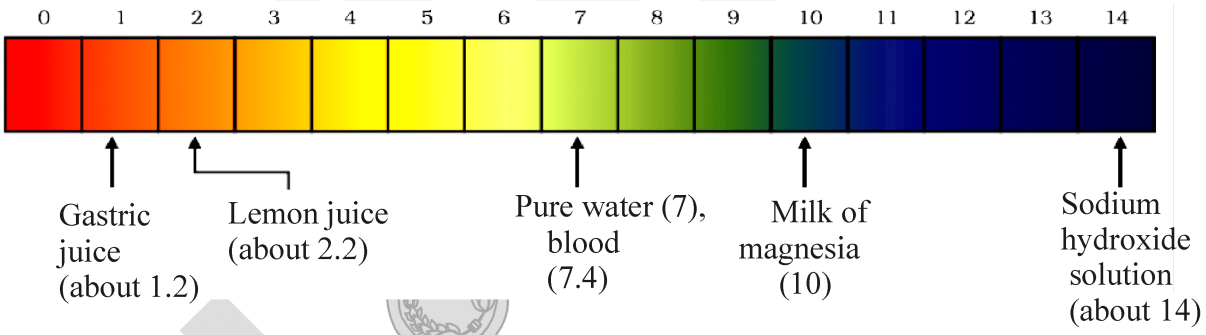
• In general, lesser the pH of a solution, more will be its acidic strength. Similarly, higher the pH of a solution, more will be its basic strength.

A neutral salt solution has pH = 7.

An acidic salt solution has pH < 7.

A basic salt solution has pH > 7.

• pH plays vital role in our daily life because most of the biochemical reactions take place at specific pH values. pH of our blood is in the range of 7.36 – 7.42. Our body becomes prone to disease when pH of blood alters due to some reason.



5. NEUTRALISATION

When an acid and a base are mixed, they react and form a new compound called salt. Water is formed during the reaction and heat is evolved. The reaction between an acid and a base is called neutralisation.

Acid + Base ⟶ Salt + Water + Heat

LAB TIME
Let's Do & Learn

- **Object : To study the reaction between an acid and a base (neutralisation reaction).**
- **Materials required :** Dilute hydrochloric acid, dilute sodium hydroxide solution, phenolphthalein, test tubes, dropper.
- **Procedure :**

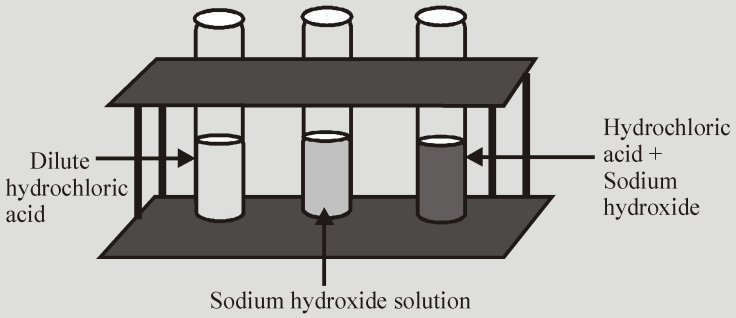
(i) Take a test tube and add some dilute hydrochloric acid to it.

(ii) Add few drops of phenolphthalein. Observe if there is any change in colour.

(iii) Now add sodium hydroxide solution slowly. Keep shaking the test tube and observe change in colour.

(iv) Keep adding sodium hydroxide till the solution becomes pink. Add one more drop of sodium hydroxide and observe the colour of the solution.

(v) Touch the test tube and observe the temperature.



- **Observations :** When phenolphthalein is added to dilute hydrochloric acid, the solution is colourless. As we keep adding sodium hydroxide to it there is appearance of pink colour which disappears on shaking. When the acid and base neutralise each other, the resulting solution is neutral hence the solution is colourless. When an extra drop of sodium hydroxide is added, the solution turns pink. When we touch the test tube it feels warm.
- **Conclusion :**

(i) When a base and an acid are mixed in just right amount, neutralisation reaction takes place. When there is extra base in the solution, it turns phenolphthalein pink. Heat is evolved during neutralisation.

(ii) In the above reaction dilute hydrochloric acid (HC1) and sodium hydroxide (NaOH) react to form sodium chloride (NaCl) and water (H_2O). Sodium chloride is also known as common salt.

Hydrochloric acid + Sodium hydroxide $\rightarrow$ Sodium chloride + Water

HC1 + NaOH $\rightarrow$ NaCl + H_2O

Focus Point

Universal indicator :

An indicator is a substance that changes colour in different pH environments. It is the brown coloured solution containing a mixture of indicator that can be added to any substance to determine its pH.

For low pH Red colour

For neutral Green colour

For high pH Blue or violet

6. IMPORTANCE OF NEUTRALISATION REACTIONS IN EVERYDAY LIFE

- **Treatment of Acidity and Indigestion :**

In our stomach hydrochloric acid helps in digestion. But excess of Acid in the stomach causes acidity and indigestion. It can be treated by neutralising the acid with a mild base. These bases are called antacids. Milk of magnesia is an antacid which contains a mild base, i.e, magnesium hydroxide.

- **Treatment of Acidity of Soil:**

Due to use of excess of fertilisers in the soil, the nature of the soil becomes acidic. Acidic soil is not good for plants. To neutralise the acidity of the soil some bases like slaked lime (calcium hydroxide) or quick lime (calcium oxide) is added to the soil.

- **Treatment of Ant sting :**

The sting of an ant contains formic acid which causes pain and inflammation. To get relief from ant sting the acid is neutralised by bases like sodium bicarbonate (baking soda) or zinc carbonate (calamine solution).

- **Treatment of Factory Waste :**

When acidic waste from factories is disposed off in rivers, the water becomes acidic and is harmful for aquatic life. To avoid pollution of rivers the factory waste is first neutralised by bases and then thrown in water.

- **Prevention of Tooth Decay :**

The bacteria present in mouth produce acids which lead to tooth decay. Tooth decay is prevented by brushing the teeth with tooth paste which contains bases, resulting in neutralisation of the acid thus preventing cavities.

7. ACIDIC, BASIC OR NEUTRAL SOLUTIONS OF SALTS

- Salts formed by a strong acid and a strong base are called neutral salts. Neutral salts produce neutral solutions when dissolved in water, e.g., sodium chloride (salt of HCl and NaOH).
- Salts formed by neutralisation of a strong acid and a weak base give acidic solution e.g., ammonium chloride (salt of HCl and NH_4OH).

• Salts formed by neutralisation of a strong base and a weak acid give basic solution e.g., sodium acetate (salt of NaOH and CH_3COOH).

8. USES OF SALTS

• Sodium chloride (common salt) is an important part of our food and vital to health. It is used as a preservative, in making soaps and preparing many chemicals.

• Sodium carbontate (washing soda) is an important part of detergents. It is also used in making glass.

• Sodium bicarbonate (baking soda) is used in baking cakes and bread. It is also used in extinguishers.

• Copper sulphate (blue vitriol) is used as a fungicide and in electroplating.

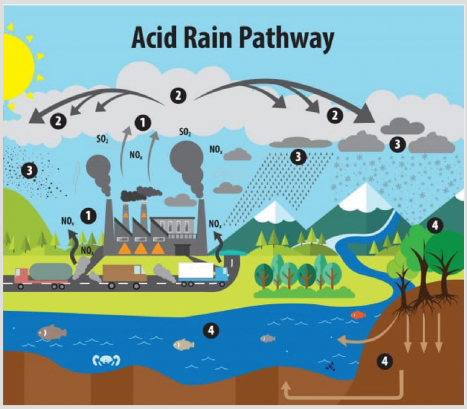
Focus Point

Acid rain

• The rain which contains excess of acids dissolved in it, is called acid rain.

• The acidic oxides present in the air like carbon dioxide, sulphur, dioxide and nitrogen dioxide are dissolved in rain water to form acids like carbonic acid, sulphuric acid and nitric acid.

• Acid rain causes damage to crops, soil and buildings made up of marbles.



Water of Crystallisation

• The fixed number of water molecules which remains with the crystalline salts is known as a water of crystallisation, e.g. $FeSO_4.7H_2O$, $CuSO_4.5H_2O$, $Na_2CO_3.10H_2O$.

SOLVED EXAMPLES

SE. 1

Baking soda is used to treat bee sting while vinegar is used to treat wasp sting. Based on the information what is the difference in chemical nature of wasp sting and bee sting?

Ans. Since baking soda is used to treat bee sting it means bee sting contains acid which is neutralised by baking soda. Since vinegar is used to treat wasp sting it indicates that wasp sting contains some base which is neutralised by vinegar.

SE. 2

Name three acids obtained from natural sources.

Ans. (i) Citric acid from oranges

(ii) Lactic acid from curd

(iii) Oxalic acid from tomatoes

SE. 3

Why does a milkman usually add a very small amount of baking soda to fresh milk during summer season?

Ans. Baking soda is basic in nature. It neutralises the lactic acid present in milk and prevents it from turning sour.

SE. 4

What is a neutralisation reaction? Give one examples.

Ans. The reaction of an acid and a base to form salt and water is known as neutralisation reactio

Example:Sodium hydroxide (NaOH) + Hydrochloric acid (HCl) → Sodium chloride (NaCl) + Water (H_2O)

SE. 5

Can we dilute concentrated sulphuric acid by adding water to it? Explain.

Ans. No, water should never be added to acid since a large amount of heat is evolved which results boiling of acid. Acid is diluted by adding concentrated acid to water since the heat evolved gets absorbed in water.

SE. 6

What will you observe when

(i) methyl orange is added to dilute hydrochloric acid?

(ii) a drop of phenolphthalein is added to limewater?

Ans. (i) Methyl orange will change to red in acidic solution.

(ii) The colour of phenolphthalein will become pink in basic solution.

SE. 7

Why should a farmer add quick lime to the soil if he thinks his crop is not growing well?

Ans. The farmer should add quick lime to the soil if the soil condition is more acidic than the required conditions. Quick lime will neutralise the excess of acid present in soil.

SE. 8

Why are factory wastes treated with bases before discharging?

Ans. The factory waste contains harmful acids which if flown to rivers causes lot of damage to aquatic plants and animals. Hence, these acids are first neutralised by bases.

SE. 9

Name the base used in manufacture of soap.

Ans. Sodium hydroxide is used to manufacture soap. Soaps are sodium salts of fatty acids.

SE. 10

You are provided with three test tubes containing three colourless liquids namely water, vinegar and caustic soda. How will you identify the liquids?

Ans. (i) Add blue litmus paper in all the three test tubes. The test tube in which the litmus paper turns red contains vinegar.

(ii) Add red litmus paper in the remaining two test tubes. The solution which turns red litm blue contains caustic soda.

(iii) The solution which does not change the colour of the red and blue litmus paper is water.

Space for Notes :

NS. 1

State differences between acids and bases.

Ans. **Acids**

1. Sour in taste
2. Turn blue litmus red
3. Acids change methyl orange to red
4. Phenolphthalein remains colourless
5. Acids do not give soapy touch
6. Give hydrogen ions in solution

Bases

1. Bitter in taste
2. Turn red litmus blue
3. Bases change methyl orange to yellow
4. Phenolphthalien gives pink colour
5. Soapy to touch
6. Give hydroxyl ions in solution

NS. 2

Ammonia is found in many household products such as window cleaners. It turns red litmus blue. What is its nature?

Ans. Ammonia is basic in nature. Products like window cleaner contains ammonium hydroxide, which is a base.

NS. 3

Name the source from which litmus solution is obtained. What is the use of this solution?

Ans. Litmus solution is extracted from lichens. It is used as an indicator. When extracted, it has a light purple colour. When added to acids it turns red while with bases it turns blue.

NS. 4

Is the distilled water acidic/basic/neutral? How would you verify it?

Ans. Distilled water is neutral in nature. To verify it, take a small amount of distilled water in two test tubes. Add blue litmus paper to one test tube and red litmus paper to the other test tube. It is observed that there is no change in colour of either blue or red litmus paper which shows distilled water is neither acidic nor basic, hence neutral.

NS. 5

Describe the process of neutralisation with the help of an example.

Ans. Neutralisation is a process in which an acid reacts with a base to produce salt and water. Take some dilute hydrochloric acid in a test tube and add 2-3 drops of phenolphthalein. The solution will remain colourless. Add to this acidic solution, sodium hydroxide solution with the help of a dropper and shake the test tube after adding each drop. The pink colour which appears keeps disappearing on shaking. Stop adding sodium hydroxide drop when the pink colour does not disappear. This is the point where neutralisation reaction has taken place. After this, if you keep on adding sodium hydroxide the solution will remain pink since it is basic in nature.

NS. 6

Mark T if the statement is true and 'F' if it is false.

(i) Nitric acid turns red litmus blue. (T/F)

(ii) Sodium hydroxide turns blue litmus red. (T/F)

(iii) Sodium hydroxide and hydrochloric acid neutralise each other and form salt and water. (T/F)

(iv) Indicator is a substance which shows different colours in acidic and basic solutions.(T/F)

(v) Tooth decay is caused by the presence of a base. (T/F)

Ans. (i) F, Nitric acid turns blue litmus red.

(ii) F, Sodium hydroxide turns red litmus blue.

(iii) T

(iv) T

(v) F, Tooth decay is caused by the presence of an acid.

NS. 7

Dorji has a few bottles of soft drink in his restaurant. But unfortunately, these are not labelled He has to serve the drinks on the demand of customers. One customer wants acidic drink another wants basic and third one wants neutral drink. How will Dorji decide which drink to be served to whom?

Ans. Dorji can test a small amount of drink with litmus paper. The drink which turns blue litmus red is acidic, the drink which turns red litmus blue is basic and the drink which does not change the colour of the litmus paper is neutral drink.

NS. 8

Explain why:

(a) An antacid tablet is taken when you suffer from acidity.

(b) Calamine solution is applied on the skin when an ant bites.

(c) Factory waste is neutralised before disposing it into water bodies.

Ans. (a) An antacid tablet contains a mild base like magnesium hydroxide which neutralises the excess of hydrochloric acid present in the stomach.

(b) The sting of an ant is acidic in nature since it contains formic acid. This is neutralised by applying calamine solution which contains zinc carbonate.

(c) Factory waste contains harmful acids and if it is disposed off in water bodies without neutralising, it will be harmful for aquatic plants and animals.

NS. 9

Three liquids are given to you. One is hydrochloric acid, another is sodium hydroxide and this is sugar solution. How will you identify them? You have only turmeric indicator.

Ans. Take small amount of the liquids and add turmeric indicator. The solution which gives red colour with turmeric is sodium hydroxide. Now add small amount of the remaining solutions to water The solution which becomes warm on adding water is hydrochloric acid and the third liquid is sugar solution.

NS. 10

Blue litmus paper is dipped in a solution. It remains blue. What is the nature of the solution Explain.

Ans. The solution can be either a base or a neutral solution. Acidic solutions change blue litmus red hence it is not acidic. Bases change red litmus to blue hence there is no change in colour of blue litmus paper. Neutral solutions have no effect on litmus paper.

NS. 11

Consider the following statements :

(a) Both acids and bases change colour of all indicators.

(b) If an indicator gives a colour change with an acid, it does not give a change with base.

(c) If an indicator changes colour with a base, it does not change colour with an acid.

(d) Change of colour in an acid and a base depends on the type of indicator.

Which of these statements are correct?

(i) All four (ii) a and d

(iii) b and c (iv) only d

Ans. (iv),Change of colour in an acid and a base depends on the type of indicator.

EXERCISE – I

ONLY ONE CORRECT TYPE

1. A boy was given two test tubes one containing water and other containing sodium hydroxide. To identify the solutions which of the following indicators can be used by him?
(i) Blue litmus
(ii) Turmeric indicator
(iii) Phenolphthalein
(iv) Red litmus
(A) (i) and (iv) (B) (ii), (iii) and (iv)
(C) only (iv) (D) only (iii)

2. Which of the following will turn blue litmus red?
(A) Limewater (B) Lemon water
(C) Sugar solution (D) Salty water

3. Which of the following acids is present in sour milk?
(A) Lactic acid (B) Formic acid
(C) Acetic acid (D) Citric acid

4. Vinegar is
(A) Bitter in taste (B) Sour in taste
(C) Sweet in taste (D) Tasteless

5. The acid present in the stomach which helps in digestion is
(A) Sulphuric acid (B) Citric acid
(C) Lactic acid (D) Hydrochloric acid

6. Hydrochloric acid can be neutralised by
(A) Sodium hydroxide
(B) Calcium hydroxide
(C) Sodium carbonate
(D) All of these.

7. Acidic soil can be neutralised by
(A) Vinegar (B) Quick lime
(C) Orange juice (D) Tamarind juice

8. When added to acids, phenolphthalein
(A) Changes to pink
(B) Changes to green
(C) Remains colourless
(D) Changes to orange

9. When an acid and a base react, salt (X) and another product (Y) are formed. (Y) is
(A) An acid (B) A base
(C) Water (D) Hydrogen

10. A substance that changes colour in acidic and basic solutions is called
(A) an indicator (B) a weak base
(C) a weak acid (D) a neutral salt

11. Neutralisation is used in the treatment of
(A) Tooth decay (B) Indigestion
(C) Soil treatment (D) All of these.

12. Lemon juice and coffee
(A) Are both acidic
(B) Are both basic
(C) Lemon juice is acidic, coffee is basic
(D) Lemon juice is basic, coffee is acidic.

13. Citric acid is present in
(A) Curd (B) Milk
(C) Lemon (D) Spinach

14. Which of the following is a mineral acid?
(A) Lactic acid (B) Formic acid
(C) Tartaric acid (D) Nitric acid

15. Which of the following explains the properties corrosive, sour, water soluble, present in citrus fruits?
(A) Acid (B) Base
(C) Salt (D) Alkali

16. Which of the following is not an inorganic acid?
(A) Hydrochloric acid (B) Nitric acid
(C) Sulphuric acid (D) Acetic acid

17. Which of the following types of medicines is used for treating indigestion?
(A) Antibiotic (B) Antacid
(C) Antiseptic (D) Antipyretic

18. Which of the following statements is not correct?
(A) Acids turn blue litmus red.
(B) Bases are bitter in taste.
(C) Neutralisation reaction gives salt and water.
(D) All the indicators change colour in acids and bases.

19. The common salt is
(A) Sodium carbonate
(B) Sodium bicarbonate
(C) Sodium chloride
(D) Sodium nitrate

20. Which of the following is a strong acid?
(A) Hydrochloric acid (B) Carbonic acid
(C) Acetic acid (D) Lactic acid

21. What is the colour of turmeric indicator in a basic solution?
(A) Green (B) Red
(C) Yellow (D) Pink

22. Lemon juice will turn
(A) Phenolphthalein pink
(B) Red litmus blue
(C) Turmeric indicator red
(D) Methyl orange red

23. Common name of sodium bicarbonate is
(A) Common salt (B) Baking soda
(C) Washing soda (D) Quick lime

24. Which of the following is not the property of an alkali?
(A) They have bitter taste.
(B) They turn red litmus blue.
(C) They are insoluble in water.
(D) They give pink colour with phenolphthalein.

25. The acidic waste of factories, before disposing off in the river is treated with
(A) Hydrochloric acid
(B) Bleaching powder
(C) Bases
(D) Salts

PARAGRAPH TYPE

PARAGRAPH # 1

Neutralisation is a process in which an acid reacts with a base to produce salt and water. Take some dilute hydrochloric acid in a test tube and add 2-3 drops of phenolphthalein. The solution will remain colourless. Add to this acidic solution, sodium hydroxide solution with the help of a dropper and shake the test tube after adding each drop. The pink colour which appears keeps disappearing on shaking. Stop adding sodium hydroxide drop when the pink colour does not disappear. This is the point where neutralisation reaction has taken place. After this, if you keep on adding sodium hydroxide the solution will remain pink since it is basic in nature. pH of a neutral solution is 7.

26. Products of a neutralisation reactions are always-
(A) An acid and a base
(B) An acid and a salt
(C) A salt and water
(D) A salt and a base

27. Name the solution which do not change the colour of either red or blue litmus ?
(A) Base solution
(B) Acid solution
(C) Neutral solution
(D) Indicator

28. What is p^H of a neutral solution ?
(A) 8 (B) 6
(C) 7 (D) 4

PARAGRAPH # 2

Acid rain, or acid deposition is a broad term that includes any form of precipitation with acidic components, such as sulphuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms. The acidic oxides present in air like carbon dioxide, sulphur dioxide and nitrogen dioxides are dissolved in rain water to form acids like carbonic acid, sulphric acid and nitric acid.

Typical acid rain has pH value of 4. A decrease in pH values from 5 to 4 means that the acidity is 10 times greater.

29. Which of the following gases are main contributors to acid rain ?
(A) CO_2 & CO (B) SO_2 & CO_2
(C) SO_2 & NO_2 (C) SO_2 & N_2O

30. Liquids with a p^H less than_____ are acidic.
(A) 10 (B) 9
(C) 8 (D) 7

31. Who discovered the phenomenon of acid rain ?
(A) George brown
(B) James T. stewart
(C) Robert Angus Smith
(D) Charles David

MATCH THE COLUMN TYPE

In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (B), (C) and (D) out of which one is correct.

32.

List-I	List-II
(P) Quicklime	(i) Sodium hydroxide
(Q) Caustic soda	(ii) Magnesium hydroxide
(R) Washing soda	(iii) Calcium oxide
(S) Milk of magnesia	(iv) Sodium carbonate

(A) (P)→(i), (Q)→(ii), (R)→(iii), (S)→(iv)
(B) (P)→(iii), (Q)→(i), (R)→(iv), (S)→(ii)
(C) (P)→(ii), (Q)→(iii), (R)→(iv), (S)→(i)
(D) (P)→(iv), (Q)→(ii), (R)→(i), (S)→(iii)

33.

List-I	List-II
(P) Citric acid	(i) Tamarind
(Q) Lactic acid	(ii) Tomatoes
(R) Oxalic acid	(iii) Orange
(S) Tartaric acid	(iv) Sour milk

(A) (P)→(iii), (Q)→(iv), (R)→(ii), (S)→(i)
(B) (P)→(iv), (Q)→(iii), (R)→(ii), (S)→(i)
(C) (P)→(i), (Q)→(iii), (R)→(iv), (S)→(ii)
(D) (P)→(ii), (Q)→(i), (R)→(iii), (S)→(iv)

EXERCISE – II

VERY SHORT ANSWER TYPE

1. Name the acid present in vinegar.
2. Give names of any two natural indicators.
3. What is a neutral salt?
4. What is the colour of phenolphthalein in basic solution?
5. Write the chemical name and formula of baking soda.
6. Name two synthetic acid-base indicators.
7. Name the acid present in tomatoes.
8. What is the reaction between an acid and a base called?
9. Which acid is present in sour milk?
10. What are olfactory indicators ? Give are example.

SHORT ANSWER TYPE

1. What is an indicator?
2. How will you prepare China rose indicator?
3. What are strong and weak bases? Give two examples of each.
4. What is the difference between an ant sting and a wasp sting?
5. Why do antacid tablets relieve the uneasiness due to indigestion?

LONG ANSWER TYPE

1. Four solutions A, B, C and D are taken in four test tubes. They were tested with four indicators—methyl orange, phenolphthalein, China rose and blue litmus. The observations are recorded below. Identify A, B, C and D as acids, bases or neutral salts.

Soln.	Methyl orange	Phenol-phthalein	China rose	Blue litmus
A	Orange	Colourless	Pink	Blue
B	Yellow	Pink	Green	Blue
C	Red	Colourless	Magenta	Red
D	Yellow	Pink	Green	Blue

2. Demonstrate a neutralisation reaction between sodium hydroxide and dil. hydrochloric acid using phenolphthalein as indicator. Explain the changes in colour of the indicator during the reaction.
3. Give few important applications of neutralisation reactions.
4. How will you prepare turmeric indicator? Using this indicator give tests for limewater,salt solution and soap solution.
5. Complete the following table :

Indicator	Colour in acidic medium	Colour in basic medium	Colour neutral medium
Blue litmus	_____	_____	_____
Red litmus	_____	_____	_____
China rose	_____	_____	_____
Turmeric	_____	_____	_____
Methyl orange	_____	_____	_____
Phenolphthalein	_____	_____	_____

TRUE AND FALSE

1. Litmus is an indicator prepared by dissolving litmus salt in water.
2. Antacids neutralise the bases present in the stomach.
3. When an acid reacts with a base, neutralisation reaction takes place to give salt and water.
4. Acids have a sour taste and they are soapy to touch.
5. All bases are alkalis but all alkalis are not bases.

FILL IN THE BLANKS

1. Bases which are soluble in water are called.....
2. Substances used for testing acids and bases are called..... .
3. Bases react with acids to form.....and.....
4. Acids turn..... litmus to ..... while bases turn ..... litmus to ..... .
5 The colour of phenolphthalein is ..... in acidic and ..... in basic solutions.

Space for Notes :

Answer Key

EXERCISE–I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	B	A	B	D	D	B	C	C	A	D	A	C	D	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D	B	D	C	A	B	D	B	C	C	C	C	C	C	D
31	32	33												
C	B	A												

EXERCISE – II

TRUE / FALSE

1. F **2.** F **3.** T **4.** F **5.** F

FILL IN THE BLANKS

1. Alkalis **2.** Indicators **3.** Salt, water **4.** Blue, Red, Red, Blue **5.** Colourless, pink

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : ACIDS, BASES & SALTS)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
Solved Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :