Sanskar international school

Affiliation no -330815

Near Jaitia, Gaurichak, patna



**Basic concept of science**

For class 10 parts—chemistry

By Er. Abhas ranjan

Chapter contents page number

## ***Chapter-1 - CHEMICAL REACTIONS AND EQUATIONS***

Introduction

Chemical reactions are an integral part of technology, of culture, and indeed of life itself. Burning fuels, smelting iron, making glass and pottery, brewing beer, and making wine and cheese are among many examples of activities incorporating che mical reactions that have been known and used for thousands of years

Chemical reactions must be distinguished from physical changes. Physical changes include changes of state, such as ice melting to water , water evaporating to vapour etc. If a physical change occurs, the physical properties of a substance will change, but its chemical identity will remain the same. No matter what its physical state, water ($H_2O$) is the same compound, with each molecule composed of two atoms of hydrogen and one atom of oxygen. However, if water, as ice, liquid, or vapour, encounters sodium metal (Na), the atoms will be redistributed to give the new substances molecular hydrogen ($H_2$) and sodium hydroxide (NaOH). By this, we know that a chemical change or reaction has occurred.

**Basic concepts of chemical reactions**

The process of combination of different atoms to form different products is known as chemical reaction. Braking of the old bonds and formation of the new bonds is responsible for the occurrence of a chemical reaction.the substances which take part in a chemical reaction are called reactanta and the substances which are formed due to chemical reaction are called products

Chemical reaction involves a change in the physical and chemical properties like:

- Change in the colour of the substance
- Change in the state of the substance
- Change in heat energy - Absorption of energy or release of energy
- Release of gas
- Evolution of light and sound

For example, iron (Fe) and sulfur (S) combine to form iron sulfide (FeS).

$$Fe(s) \quad + \quad S(s) \quad ----\rightarrow \quad FeS(s)$$

$$Reactants \quad ----\rightarrow \quad \text{product}$$

The plus sign indicates that iron reacts with sulfur. The arrow signifies that the reaction “forms” or “yields” iron sulfide, the product. The state of matter of reactants and products is designated with the symbols (s) for solids, (l) for liquids, and (g) for gases.The products are the substances that are formed during the chemical change. They are the things that are present at the end.

**The characteristics of chemical reactions are :**

1) Change of colour - When citric acid is added to Potassium permanganate then the purple colour starts discharging.

2*) Change of state* - When hydrogen (gas) reacts with oxygen (gas), they form water a liquid

3) *Evolution of a gas* - When lead nitrate is heated then it decomposes to lead oxide, nitrogen dioxide with oxygen.

*4) Formation of a precipitate* - When lead nitrate reacts with potassium iodide, it forms a yellow precipitate Lead iodide and potassium nitrate.

5) *Change in temperature* -

- *Exothermic reaction* - reaction in which heat is released
  when quick lime reacts with water to form slaked lime, it releases a lot of energy.
- *Endothermic reaction* - reaction in which heat is absorbed
  when hydrogen reacts with iodine to form hydrogen iodide, it absorbs a lot of energy.

**CHEMICAL EQUATION**

A chemical equation describes what happens in a chemical reaction. The equation identifies the reactants (starting materials) and products (resulting substance), the formulas of the participants, the phases of the participants (solid, liquid, gas), and the amount of each substance. Balancing a chemical equation refers to establishing the mathematical relationship between the quantity of reactants and products. The quantities are expressed as grams or moles.

**Rules for writing chemical equations:**

**i.** + *bewteen symbols* and or formula of reactants or products.
**ii.** → separates reactants from products.
**iii.** ⇋ *used for reversible reaction in place of a single arrow* .
**iv.** $(g)$ *indicates a gaseous reactant or product*.
**v.** ↑ *some time used to indicate a gaseous product*.
**vi.** ↓ *some times used to indicate a solid product* .
**vii.** $(aq)$ *indicates that the reactant or product is in aqueous solution* $(dissolved\ in\ water)$
**viii.** $\xrightarrow{\Delta}$ *indicates that heat must be supplied to reactants*.
**ix.** $\xrightarrow{MnO_2}$ *an element or compound written above the arrow is a catalyst; a catalyst speed up a reaction. but is not consumedi the reaction. it may also indicate the solvent, such as water*

Hence, the reaction between two reactants (A and B) to give a single product (c) can be represented in the form of chemical equation as follow:

$$A + B \rightarrow C$$

For example, reaction of iron reacts with water and oxygen to give ferric hydroxide is shown as follows:

$$4Fe(s) + 3O_2(g) + 6H_2O(l) \rightarrow 4Fe(OH)_3(s)$$

The above equation is called a balanced equation because the elements on both the right and left hand side of the equation are tallied, that is, number of atoms of Fe and O are same on both side of the equation.

**Rules for balancing chemical equation**

1. The number of atoms of each element on both sides of the equation is the same and therefore mass is conserved.

2. The sum of the positive and negative charges is the same on both sides of the equation and therefore charge is conserved. (Charge is conserved because electrons are neither created nor destroyed in a chemical reaction.)

For example:

$$Fe \quad + \quad H_2O \quad \rightarrow \quad Fe_3O_4 \quad + \quad H_2$$

To balance the equation, we multiply the atoms with the desired integer to equate the number of atoms on both side of the equation.

a) Count the number of atoms on both sides

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|
| Iron (Fe) | 1 | 3 |
| Hydrogen (H) | 2 | 2 |
| Oxygen (O) | 1 | 4 |

(b) Here, iron and oxygen atoms are not balance. It is a good idea to start balancing with the metal. Three atoms of iron are present in the product side. So multiply (Fe) on reactant side by 3.

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|
| Iron (Fe) | 3 | 3 |
| Hydrogen (H) | 2 | 2 |
| Oxygen (O) | 1 | 4 |

Now the equation becomes

$$3\,Fe \quad + \quad H_2O \quad \rightarrow \quad Fe_3O_4 \quad + \quad H_2$$

(c) Now, to balance the oxygen atoms multiply (O) on reactant side by 4

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|
| Iron (Fe) | 3 | 3 |
| Hydrogen (H) | 8 | 2 |
| Oxygen (O) | 4 | 4 |

It gives,

$$3\,Fe \quad + \quad 4H_2O \quad \rightarrow Fe_3O_4 \quad + \quad H_2$$

(d) Now, hydrogen atoms left unbalanced. It can be done by multiplying the hydrogen atom on the right side by 4.

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|

| | | |
|---|---|---|
| Iron (Fe) | 3 | 3 |
| Hydrogen (H) | 8 | 4 |
| Oxygen (O) | 4 | 4 |

Final balanced equation looks like

$$3\,Fe \quad + \quad 4H_2O \quad \rightarrow \quad Fe_3O_4 \quad + \quad 4H_2$$

Example: balance the chemical equation

$$SnO_2 \quad + \quad H_2 \quad \rightarrow \quad Sn \quad + \quad H_2O$$

Step (a) count the number of atoms on both side

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|
| (Sn) | 1 | 1 |
| Hydrogen (H) | 2 | 2 |
| Oxygen (O) | 2 | 1 |

Step (b): Look at the equation and see which elements are not balanced. In this case, there are two oxygen atoms on the left hand side of the equation and only one on the right hand side. Correct this by putting a coefficient of 2 in front of water:

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|
| (Sn) | 1 | 1 |
| Hydrogen (H) | 2 | 4 |
| Oxygen (O) | 2 | 2 |

$$SnO_2 \quad + \quad H_2 \quad \rightarrow \quad Sn \quad + \quad 2\,H_2O$$

Step(c):This puts the hydrogen atoms out of balance. Now there are two hydrogen atoms on the left and four hydrogen atoms on the right. To get four hydrogen atoms on the right, add a coefficient of 2 for the hydrogen gas.

| Name of atom | Number of atoms in reactant | Number of atoms in product |
|---|---|---|
| Iron (Fe) | 1 | 1 |
| Hydrogen (H) | 4 | 4 |
| Oxygen (O) | 2 | 2 |

$$SnO_2 \quad + \quad 2\,H_2 \quad \rightarrow \quad Sn \quad + \quad 2\,H_2O$$

The equation is now balanced. Be sure to double-check your math! Each side of the equation has 1 atom of Sn, 2 atoms of O, and 4 atoms of H.

$$SnO_2(s) \quad + \quad 2\,H_2(g) \quad \rightarrow \quad Sn(s) \quad + \quad 2\,H_2O(g)$$

This is the balanced equation for the reaction

**Advantages of using a chemical equation:**

(i) The representation of a chemical reaction becomes easy. It saves time and space in writing.

(ii) In order to prepare a definite amount of the product, the amount of the reactant to be used can be calculated accurately.

(iii) From a completely balanced chemical equation it becomes easy to determine the effect of temperature, pressure and concentration on the state of a reaction.

(iv) The meaning of a chemical equation is taken to be the same by chemists of any country of the world. Difference in language does not interfere with the meaning of the equation.

**Limitations of chemical equations**

1. A chemical equation does not indicate the physical state of reactants and the products, i.e., it does not tell whether the substance involved in the reaction are solids, liquids or gases,

2. It does not indicate whether heat is evolved or absorbed as a result of reaction, i.e., it does not tell whether the reaction is exothermic or endothermic.

3. It does not indicate the conditions of reaction, i.e., it gives no idea about the pressure, temperature, concentration, presence of catalyst, etc. under which the reaction may occur.

**TYPES OF CHEMICAL REACTION**

1. **Combination reaction:**
2. **Decomposition reaction:**
3. **Displacement reaction:**
4. **precipitation reactions**
5. **neutralization reactions**
6. **Oxidation and reduction reaction:**

1).**combination reaction:**

It may be defined as a chemical reaction in which two or more substances combine to form a single substance under suitable conditions. In combination reaction new bonds are formed that releases energy in the form of heat or light. Hence these reactions are exothermic in nature.

$$A + B \longrightarrow AB$$

Combination reactions are of three types.

a) **Reaction between two or more elements:** An example of this type of combination reaction is the reaction between a metal and a non- metal. Most metals react with non-metals to form ionic compounds. A good example of this would be:

$$2Na(s) + Cl_2(g) \rightarrow 2NaCl(g)$$

Similarly, non-metals may react with highly active metals to form covalent compounds. Example, sulphur reacts with oxygen gas to form gaseous sulphur dioxide.

$$S(s) + O_2(g) \rightarrow SO_2(g)$$

b) **Reaction between elements and compounds**: An element and a compound react to form another compound. Example, carbon monoxide reacts with oxygen gas to form carbon dioxide.

$$O_2(g) + 2C0(g) \rightarrow 2C0_2(g)$$

c) .**Reaction between two compounds:** Two compounds reacts with each other to form a new compound. Example, calcium oxide (quick lime) reacts with carbon dioxide gas to form calcium carbonate (lime stone).

$$CaO(s) + CO_2(g) \rightarrow CaCO_3$$

Most combination reactions are exothermic in nature. Why?

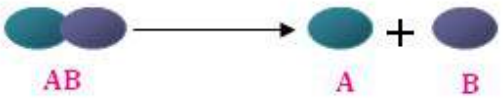
Combination reactions involve the formation of new bonds and this process releases a large amount of energy in the form of heat. Let us discuss some more examples of combination reactions. Formation of Calcium Hydroxide: Reaction between quick lime (Calcium oxide, CaO) and water is a combination reaction. In this reaction, quick lime reacts with water to form slaked lime (calcium hydroxide, Ca(OH)2).The reaction between quick lime and water is highly vigorous as well as exothermic.

$$CaO(s)(quick\ lime) + H_2O(l) \rightarrow Ca(OH)_2(s)(slaked\ lime)$$

## 2. DECOMPOSITION REACTION

It may be defined as the reaction in which a single compound splits into two or more simple substances under suitable conditions. It is just the opposite of the combination reaction. Decomposition reactions are always endothermic because energy is required to break the bond between atoms of the compound. In a combination reaction, a substance is formed as a result of chemical combination, while in a decomposition reaction, the substance breaks into new substances.

The general equation that describes a decomposition reaction is:




The generalized reaction for chemical decomposition is:

$$AB \rightarrow A + B$$

With a specific example being the electrolysis of water to gaseous hydrogen and oxygen:

$$2H_2O\ (l) \rightarrow 2\ H_2(g) + O_2(g)$$

An example of spontaneous decomposition is that of hydrogen peroxide, which will slowly decompose into water and oxygen:

$$2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$$

Decomposition of calcium carbonate to calcium oxide and carbon dioxide on heating is an important decomposition reaction used in various industries. Calcium oxide is called lime or quick lime. It has many uses – one is in the manufacture of cement. When a decomposition reaction is carried out by heating, it is called thermal decomposition.

$$CaCO_3(s) \xrightarrow{heat} CaO(s) + CO_2(g)$$

(Limestone) (Quick lime)

**3. DISPLACEMENT REACTIONS**

(a) **In a single-displacement reaction**, a free element displaces another element from a compound to produce a different compound and a different free element. A more active element displaces a less active element from its compounds. These are all oxidation–reduction reactions. An example is the thermite reaction between aluminum and iron (III) oxide:

$$2Al(s) + Fe_2O_3(s) \rightarrow Al_2O_3(s) + 2Fe(l)$$

The element displaced from the compound is always the more metallic element—the one nearer the bottom left of the Periodic Table. Other examples of displacement reactions are

$$Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$$

(Copper sulphate) (Zinc sulphate)

$$Pb(s) + CuCl_2(aq) \longrightarrow PbCl_2(aq) + Cu(s)$$

(Copper chloride) (Lead chloride)

Zinc and lead are more reactive elements than copper. They displa ce copper from its compounds.

**(b) double displacement reaction:** In this type of reaction, elements from two compounds displace each other to form new compounds. Double displacement reactions may occur when one product is removed from the solution as a gas or precipitate or when two species combine to form a weak electrolyte that remains undissociated in solution

$$AB + CD \longrightarrow CB + AD$$

An example of a double displacement reaction occurs when solutions of calcium chloride and silver nitrate are reacted to form insoluble silver chloride in a solution of calcium nitrate.

$$CaCl_2(aq) + 2AgNO_3(aq) \longrightarrow Ca(NO_3)_2(aq) + 2AgCl(s)$$

A neutralization reaction is a specific type of double displacement reaction that occurs when an acid reacts with a base, producing a solution of salt and water. An example of a neutralization reaction is the reaction of hydrochloric acid and sodium hydroxide to form sodium chloride and water:

$$HCl\ (aq) + NaOH\ (aq) \longrightarrow NaCl\ (aq) + H_2O\ (l)$$

Examples: The reaction

$AgNO_3$ + NaCl ----------→ AgCl + $NaNO_3$

is a double displacement reaction. The silver traded its nitrite ion for the sodium's chloride ion.

**4. PRECIPITATION REACTIONS**

Precipitation reactions are those in which the reactants exchange ions to form an insoluble salt—one which does not dissolve in water. Reaction occurs when two ions combine to form an insoluble solid or precipitate. We predict whether such a compound can be formed by consulting solubility rules . If a possible product is insoluble, a precipitation reaction should occur. A mixture of aqueous solutions of barium chloride and sodium sulfate contains the following ions: $Ba^{2+}(aq)$, $Cl^{-}(aq)$, $Na^{+}(aq)$, and $SO_4^{2-}(aq)$. According to solubility rules, most sulphate, sodium, and chloride salts are soluble. However, barium sulphate is insoluble. Since a barium ion and sulphate ion could combine to form insoluble barium sulphate, a reaction occurs.

**FORMATION OF A PRECIPITATE:**

The formation of a solid precipitate can also pull a reaction forward. A precipitate forms because the combination of a positive and a negative ion forms a compound that is insoluble in water.

For example

$$2KI_{(aq)} + Pb(NO_3)_{2(aq)} \text{--------→ } PbI_{2(s)} + 2KNO_{3(aq)}$$

$Pb^{2+}$ and $I^-$ ions combine to form a compound that is insoluble in water.

**5. NEUTRALIZATION REACTIONS**

A neutralization reaction is a double-displacement reaction of an acid and a base. Acids are compounds that can release hydrogen ions; bases are compounds that can neutralize acids by reacting with hydrogen ions. The most common bases are hydroxide and oxide compounds of the metals. Normally, an acid reacts with a base to form a salt and water. Neutralization reactions occur because of the formation of the very stable covalent water molecule, $H_2O$, from hydrogen and hydroxide ions.

$$HCl(aq) + NaOH(aq) \text{------→ } NaCl(aq) + H_2O(l)$$

Acid + base salt + water

Recognizing the pattern of reactants (element or compound, and the number of each) allows us to assign a possible reaction to one of the described class

**6. OXIDATION AND REDUCTION REACTION:**

**Oxidation:** Addition of oxygen or non-metallic element or removal of hydrogen or metallic element from a compound is known as oxidation. Elements or compounds in which oxygen or non-metallic element is added or hydrogen or metallic element is removed are called to be oxidized.

**Oxidizing agent:** Compounds which can add oxygen or a non-metallic compound or remove hydrogen or metallic element are known as oxidizing agents.

**Reduction:** Addition of hydrogen or metallic element or removal of oxygen or non-metallic element from a compound is called reduction. The compound or element which goes under reduction is called to be reduced.

**Reducing agent:** Compounds or elements which can cause reduction are called reducing agents. In a chemical reaction oxidation and reduction both take place simultaneously and such reactions are also known as REDOX REACTIONS. In the word REDOX, 'Red' stands for reduction and 'Ox' stands for oxidation.

Example: When iron reacts with air, it forms iron oxide (rust)

$$4Fe + 3O_2 \Rightarrow 2Fe_2O_3$$

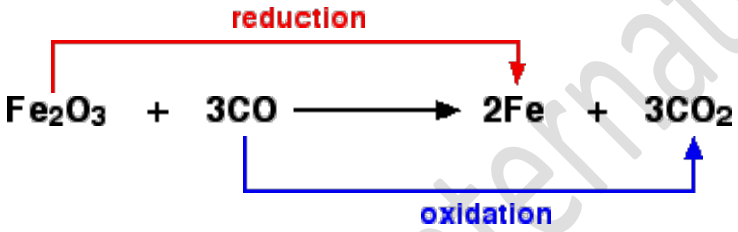
In this reaction, oxygen is added to iron, thus, iron is oxidized. Here oxygen is oxidizing agent. When cupric oxide reacts with hydrogen, it gives copper and water

**Oxidation and reduction in terms of oxygen transfer**

Definitions

- Oxidation is gain of oxygen.
- Reduction is loss of oxygen.

For example, in the extraction of iron from its ore:




Because both *red*uction and *ox*idation are going on side-by-side, this is known as a *redox* reaction.

**Oxidising and reducing agents:**

An oxidising agent is substance which oxidizes something else. In the above example, the iron (III) oxide is the oxidising agent. A reducing agent reduces something else. In the equation, the carbon monoxide is the reducing agent.

- Oxidising agents give oxygen to another substance.
- Reducing agents remove oxygen from another substance.

**Oxidation and reduction in terms of hydrogen transfer**

These are old definitions which aren't used very much nowadays. The most likely place you will come across them is in organic chemistry.

Definitions

- Oxidation is loss of hydrogen.

- Reduction is gain of hydrogen.

Notice that these are exactly the opposite of the oxygen definitions.

For example,

Ethanol can be oxidised to Ethanal:

$$CH_3CH_2OH \xrightarrow{oxidtion} CH_3OH$$

**Rancidity**

Oxidation of fats, generally known as rancidity, is caused by a biochemical reaction between fats and oxygen. In this process the long-chain fatty acids are degraded and short-chain compounds are formed. One of the reaction products is butyric acid, which causes the typical rancid taste.

When food scientists talk about rancidity, they are often talking about a specific type of rancidity involving oxygen damage to foods, and this type of rancidity is called "oxidative rancidity." During the process of oxidative rancidity, oxygen molecules interact with the structure of the oil and damage its natural structure in a way that can change its odour, its taste, and its safety for consumption.

Rancidification is the decomposition of fats, oils and other lipids by hydrolysis or oxidation, or both. Hydrolysis will split fatty acid chains away from the glycerol backbone in glycerides. These free fatty acids can then undergo further auto-oxidation. Oxidation primarily occurs with unsaturated fats by a free radical-mediated process. These chemical processes can generate highly reactive molecules in rancid foods and oils, which are responsible for producing unpleasant and noxious odours and flavours. These chemical processes may also destroy nutrients in food. Under some conditions, rancidity, and the destruction of vitamins, occurs very quickly.

**How can the effects be minimized.**

Antioxidants are often added to fat-containing foods in order to retard the development of rancidity due to oxidation. Natural anti-oxidants include flavonoids, polyphenols, ascorbic acid (vitamin C) and vitamin E. The effectiveness of water-soluble antioxidants is limited in preventing direct oxidation within fats, but is valuable in intercepting free radicals that travel through the watery parts of foods. Avoid using vessels that are wet, this will also speed up the problems associated with oxidation, allow tanks to drain and dry adequately before use.

**Corrosion**

Corrosion of metals refers to the natural process wherein a refined metal is converted into its more chemically stable form. Examples for such stable forms of metals are metal oxides, metal hydroxides, and metal sulfides. When metals undergo corrosion, they degrade and break down. A common example of this is the rusting of iron.

$$Fe_2O_3 + xH_2O ----\rightarrow Fe_2O_3.xH_2O$$

You must have observed that iron articles are shiny when new, but get coated with a reddish brown powder when left for some time. This process is commonly known as rusting of iron.

Some other metals also get tarnished in this manner. Have you noticed the colour of the coating formed on copper and silver? When a metal is attacked by substances around it such as moisture, acids, etc., it is said to corrode and this process is called corrosion. The black coating on silver and the green coating on copper are other examples of corrosion. Corrosion causes damage to car bodies, bridges, iron railings, ships and to all objects made of metals, especially those of iron. Corrosion of iron is a serious problem. Every year an enormous amount of money is spent to replace damaged iron.

**Causes of Corrosion**

- Reactivity of metal-Highly reactive metals corrode faster.
- Presence of impurity-Presence of salts like **NaCl** etc acts as catalyst to corrosion.
- Presence of air, moisture, gases like **$SO_2$** and **$CO_2$** near metal.
- Presence of electrolytes.
- Characteristics of water in contact.(Like alkalinity of it / presence of ions / hardness / pH etc.)
- In the presence of oxygen, the corrosion of metals increases.
- For example, iron corrodes faster in seawater. The presence of pollutants, for example, NO2 and CO2 increases rusting

**Methods to prevent rather to avoid corrosion are:**

- **Environmental Modification**: Reduce or decrease the presence of those factors which causes corrosion near the metal surface. Like Park the car in garage and avoid its direct exposure to direct sun light, moisture, rain and large quantity of oxygen.
- **Painting**: Metal surfaces like grills,chairs,tables made up of iron are painted so that its direct contact to moisture and oxygen is reduced and rate of corrosion is reduced.
- **Greasing/Oiling**: Ball bearing, cycle chain etc. are greased regularly to avoid corrosion by cutting its contact with environment.
- **Galvanization**: The method in which a reactive metal like zinc is coated on Iron or steel surface so that it will be corroded by atmospheric condition and finally protect the iron or steel layer below. Also called sacrificial protection.
- The usage of chemicals that can react with the metal or the environment to prevent corrosive reactions can help curb the corrosion process. These chemicals are called corrosion inhibitors.

Why Prevention of Corrosion is Necessary?

Corrosion can lead to the loss in the purity of the metal. Some important properties of the metal might also be lost due to corrosion. For example, the sturdiness of iron is lost when it undergoes rusting and the rusted iron crumbles easily.

When a metal structure undergoes corrosion, it loses its strength and the tendency to undergo structural collapse increases. The appearance of the metal is also compromised as it loses its lustre.If measures for the prevention of corrosion are not taken, the corrosive attacks on the metal can greatly increase the cost of maintenance of the structure.

Corrosion can also prove dangerous to humans. A good example would be the cuts that pierce the skin from rusted iron leading to tetanus.

# Activities corner

## Activity 1.1 (Experiment):

Aim: To show the reaction between magnesium and oxygen present in the air.

Apparatus: Mg ribbon, watch – glass, pair of tongs, burner, sand paper

Procedure: Clean a magnesium ribbon about 2 cm long by rubbing it with sandpaper. Hold it with a pair of tongs Burn it using a burner and collect the ashes so formed in a watch – glass.
while burning the magnesium ribbon keep it as far as possible from your eyes.

Observation: magnesium ribbon burns with a dazzling white flame and changes into a white powder.

This powder is magnesium oxide Conclusion: MgO is formed due to the reaction between magnesium and oxygen present in the air.

Equation, $2Mg + O2 \rightarrow 2MgO$

## Activity 1.2 (Experiment):

Aim: To show change in state and colour when a chemical reaction takes place.

Apparatus: lead nitrate solution, potassium iodide solution, test tube, and a conical flask.

Procedure: Take lead nitrate solution in a test tube Add potassium iodide solution to this.

Observation: lead nitrate reacts with potassium iodide to give lead iodide and potassium nitrate.

The colour of the products is different from that of the reactants.

Conclusion: $Pb(NO3)2 + 2KI \rightarrow PbI2 + 2KNO3$.

The change in colour is because lead iodide and potassium nitrate have been formed after the reaction. $PbI_2$ is a yellow ppt. $KNO_3$ is a colourless solution

# Activity 1:3 (Experiment):

Aim: To show the interaction between zinc granules and hydrochloric acid or sulphuric acidformation of H gas)

Apparatus: Zinc granules, conical flask, test tube, hydrochloric acid / sulphuric acid

Procedure: Take a few zinc granules in a conical flask or a test tube. Add dilute hydrochloric acid or sulphuric acid to this.

Touch the conical flask or test tube.

Observation: A gas is evolved and the conical flask is warm
Conclusion: From this we conclude that when a chemical reaction takes place there is a change in the state, colour, and temperature.

$Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow + heat$

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

# Activity 1.4 (Experiment):

Aim: Formation of slaked lime by the reaction of calcium oxide with water

Apparatus: Calcium oxide, beaker, and water

Procedure: Take a small amount of calcium oxide or quick lime in a beaker. Slowly add water to this. Touch the beaker

Observation: The beaker becomes hot (exothermic reaction). It reacts vigorously with water.

Conclusion: Slaked lime is formed by the reaction of the combination of calcium oxide with water
$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + heat$

(quick lime) (Slaked lime) (exothermic reaction)

This is a combination reaction, and also an exothermic reaction.

# Activity 1.5 (Experiment):

Aim: To show a decomposition reaction

Apparatus: ferrous sulphate crystals, dry boiling tube and burner

Procedure: Take about 2g ferrous sulphate crystals in a dry boiling tube. Note the colour of the ferrous sulphate crystals. Heat the boiling tube over the flame of a burner or spirit lamp observe the colour of the crystals after heating

Observation: The green colour of the ferrous sulphate crystals has changed there is also the characteristic odour of burning sulphur.

Conclusion: This is a Decomposition reaction, shown by the reaction

$2FeSO4(s) + Heat \rightarrow Fe2O3 + SO2(g) + SO3(g)$

## Activity 1.6 (Experiment):

Aim: Heating of lead nitrate and emission of nitrogen dioxide

Apparatus: lead nitrate powder, boiling tube, pair of tongs and burner Procedure: Take about 2 g lead nitrate powder in a boiling tube. Hold the boiling tube with a pair of tongs and heat it over a flame. Observe the change if any.

Observation: We observe the emission of brown fumes.

Conclusion: These fumes are of nitrogen dioxide ($NO2$). The reaction that takes place is

$2Pb(NO3)2(s) \xrightarrow{Heat} 2PbO(s) + 4NO2(g) + O2(g)$

(Lead nitrate) (Lead oxide) (Nitrogen dioxide) (Oxygen)

## Activity 1.7 (Experiment):

Aim: To show that water is a compound containing two atoms of hydrogen and 1 atom of oxygen

Apparatus: Plastic mug, rubber stoppers, carbon electrodes, 6 volt battery, water, dilute sulphuric acid, burning candle

Procedure: Take a plastic mug. Drill two holes at its base and fit rubber stoppers in these holes. Insert carbon electrodes in these rubber stoppers as shown in fig then connect these electrodes to a 6 volt battery. Fill the mug with water such that the electrodes are immersed.

Add a few drops of dilute sulphuric acid to the water. Take two test tubes filled with water and invert them over the two carbon electrodes. Switch on the current and leave the apparatus undisturbed for some time. Observe the formation of bubbles at both the electrodes. These bubbles displace water in the test tubes. The volume of the gas collected is not the same in both the test tubes. Once the test tubes are filled with the respective gases, remove them carefully.

Test these gases one by one by bringing a burning candle close to the mouth of the test tubes.

Observation: We observe the formation of bubbles at both the electrodes. These bubbles displace water in the test tubes. The volume in one test tube is twice that in the other test tube. `The test tube containing hydrogen gas has double the volume of the test tube containing oxygen gas. Hydrogen gas burns with a light blue flame with a pop sound.

Conclusion: Water is a compound containing two atoms of hydrogen and 1 atom of oxygen.

## Activity 1.8 (Experiment):

Aim: To show how silver chloride is affected by sunlight
Apparatus: silver chloride and a china dish.

Procedure: Place this china dish containing silver chloride in sunlight for some time. Observe the colour of the silver chloride after some time.

Observation: White silver chloride turns grey in sunlight.

Conclusion: This is due to the decomposition of silver chloride into silver and chlorine by light

$2AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl2(g)$

## Activity 1.9 (Experiment):

Aim: To show displacement reaction

Apparatus: two iron nails, sand paper, copper sulphate solution, thread and two test tubes.
Procedure: Take two iron nails and clean them by rubbing them with sand paper. Take two test tubes marked as (A) and (B). In each test tube, take about 10 ml copper sulphate solution.

Tie one iron nail with a thread and immerse it carefully in the copper sulphate solution in test tube A
for about 20 minutes. Keep one iron nail aside for comparison.

After 20 minutes, take out the iron nail from the copper sulphate solution. Compare the intensity of the blue colour of copper sulphate solutions in the test tubes (A) and (B). Also, compare the colour of the iron nail dipped in the copper sulphate solution with the one kept aside.

Observation: the iron nail dipped in the copper sulphate solution in test tube A becomes brownish in colour and the blue colour of copper sulphate solution fades in test tube A. While the blue colour of copper sulphate solution in test tube B remains the same.

Conclusion: iron has displaced or removed another element, copper, from copper sulphate solution in test tube A. This reaction is known as displacement reaction.

$$Fe(s) + \underset{\text{[copper sulphate]}}{CuSO4(aq)} \rightarrow \underset{\text{[Iron sulphate]}}{FeSO4(aq)} + Cu(s)$$

# Activity 1.10 (Experiment):

Aim: To show double displacement reaction

Apparatus: 3 ml of sodium sulphate, 2 test tubes, 3 ml of barium chloride solution.
Procedure: Take about 3 ml of sodium sulphate solution in a test tube. In another test tube, take about 3 ml of barium chloride solution, Mix the two solutions.

Observation: A white substance, which is insoluble in water, is formed. This insoluble substance formed is known as a precipitate. Any reaction that produces a precipitate can be called a precipitation reaction.

Conclusion: This is a double displacement reaction shown by the equation below where Na+ being more reactive than Ba+2 displaces Ba+2 from its compound BaCl2 and takes its place to form NaCl.

$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

(sodium sulphate) (Barium chloride) (Barium sulphate) (Sodium chloride)

# Activity 1.11 (Experiment):

Aim: To show oxidation and reduction reaction

Apparatus: China dish 1g copper powder, burner, wire gauze, tripod stand and Hydrogen gas.

Procedure:
Heat a china dish containing about 1 g copper powder.
Now pass hydrogen gas over this heated material.

Observation:
The surface of copper powder becomes coated with black copper oxide.
Hydrogen gas is passed over this heated material [CuO] the black coating on the surface turns brown as the reverse reaction takes place and copper is obtained.

Conclusion: In the first case copper, was oxidized to copper oxide by the following reaction

$2Cu + O_2 \xrightarrow{\text{Heat}} 2CuO$

this is an oxidation reaction (black coating)

In the second case when hydrogen gas was passed over heated [CuO] copper metal was obtained because copper oxide got reduced to copper metal by the following reaction

# *Solved example*

1.Write the balanced equation for the following chemical reactions.

A. Hydrogen + Chlorine ⇨ Hydrogen Chloride

Answer: $H_2 + Cl_2 \Rightarrow 2HCl$

B. Barium chloride + Aluminium sulphate ⇨ Barium sulphate + Aluminium chloride

Answer: $3BaCl + Al_2(SO_4)_3 \Rightarrow 3BaSO_4 + 2AlCl_3$

C. Sodium + Water ⇨ Sodium hydroxide + Hydrogen

Answer: $2Na + 2H_2O \Rightarrow 2NaOH + H_2$

D. Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.

Answer: $BaCl_2\ (aq) + Na_2SO_4 \Rightarrow BaSO_4\ (s) + 2NaCl\ (aq)$

E. Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

Answer: $NaOH\ (aq) + HCl \Rightarrow NaCl\ (aq) + H_2O\ (l)$

1. A solution of a substance 'X' is used for white washing. .Name the substance 'X' and write its formula.

Answer: The chemical name of substance, which is used for white washing is Calcium oxide. Its common name is lime or quick lime. The chemical formula of Calcium Oxide is CaO.

2. Write the reaction of the substance 'X' named in (i) above with water.

Answer: $CaO + H_2O \Rightarrow Ca(OH)_2$

When calcium oxide reacts with water it forms calcium hydroxide. Calcium hydroxide is also known as slaked lime.

3. Balance the given equations.

- $H_2 + O_2 \Rightarrow H_2O$
  Answer: $2H_2 + O_2 \Rightarrow 2H_2O$
- $Fe + H_2O \Rightarrow Fe_2O_3 + H_2$
  Answer: $2Fe + 3H_2O \Rightarrow Fe_2O_3 + 3H_2$
- $CO_2 + H_2O \Rightarrow C_6H_{12}O_6 + O_2$
  Answer: $6CO_2 + 6H_2O \Rightarrow C_6H_{12}O_6 + 6O_2$
- $Fe_2O_3 + C \Rightarrow Fe + CO_2$
  Answer: $2Fe_2O_3 + 3C \Rightarrow 4Fe + 3CO_2$

4. Why should a magnesium ribbon be cleaned before burning in air?

Ans- When magnesium ribbon is stored, it reacts with oxygen of air to form a layer of magnesium oxide. This layer of magnesium oxide is quite stable and prevents further reaction of magnesium with oxygen. Hence, a magnesium ribbon should be cleaned before burning in air to remove this layer of magnesium oxide.

6. Write the balanced equation for the following chemical reactions:

(i) Hydrogen + Chlorine ⟶ Hydrogen chloride

(ii) Barium chloride + Aluminium sulphate ⟶ Barium sulphate + Aluminium chloride

(iii) Sodium + Water ⟶ Sodium hydroxide + Hydrogen

7. Write balanced chemical equations with state symbols for the following reactions:

(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.
(ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water

Ans:

(i) $BaCl_{2\,(aq)} + Na_2SO_{4\,(aq)} \rightarrow BaSO_{4\,(S)} + 2NaCl_{\,(aq)}$
(ii) $NaOH_{\,(aq)} + HCl_{\,(aq)} \rightarrow NaCl_{\,(aq)} + H_2O_{\,(l)}$

8. A solution of a substance 'X' is used for white washing.

(i) Name the substance 'X' and write its formula.

(ii) Write the reaction of the substance 'X' named in (i) above with water

Ans: (i) The substance 'X' is calcium oxide (lime). Its chemical formula is CaO.
(ii) Calcium oxide reacts vigorously with water to form calcium hydroxide (slaked lime).

9. Why is the amount of gas collected in one of the test tubes in Activity 1.7 double of the amount collected in the other? Name this gas.

Ans : Water ($H_2O$) contains two parts of hydrogen and one part of oxygen. Therefore, the amount of hydrogen and oxygen produced during electrolysis of water is in a 2:1 ratio. During electrolysis, since hydrogen goes to one test tube and oxygen gas goes to another hence, the amount of gas collected in one of the test tubes is double the amount collected in the other. The gas collected in double the amount is hydrogen and the other gas is oxygen

10.Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

Ans: When an iron nail is placed in a copper sulphate solution, iron displaces copper from the blue colored copper sulphate solution forming light green colored ferrous sulphate solution and copper metal.

11.Identify the substances that are oxidised and the substances that are reduced in the following reactions:

(i) $4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$

(ii) $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$

Sol:(i) Sodium (Na) is oxidised to sodium oxide as it gains oxygen and oxygen ($O_2$) gets reduced.

(ii) Copper oxide (CuO) is reduced to copper (Cu) while hydrogen ($H_2$) gets oxidised to water ($H_2O$).

12 .**What is a balanced chemical equation? Why should chemical equations be balanced?**

Solution : A chemical equation is balanced when the numbers of atoms of each type involved in a chemical reaction are same on both the reactant and product sides of the equation.The chemical equations must always be balanced to satisfy the law of conservation of mass which states that "Mass can neither be created nor destroyed in a chemical reaction." This means that the total mass of the elements present in the products of a chemical reaction has to be equal to the total mass of the elements present in the reactants. Hence, the number of atoms of each element in the products must be equal to the number of atoms of these elements in the reactants.

13 .**Translate the following statements into chemical equations and then balance them.**

(a) Hydrogen gas combines with nitrogen to form ammonia.

(b) Hydrogen sulphide gas burns in air to give water and sulpur dioxide.

(c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.

(d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

Solution

(a) $3H_2 + N_2 \rightarrow 2NH_3$
(b) $2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$

(c) $3BaCl_2 + Al_2(SO_4)_3 \rightarrow 2AlCl_3 + 3BaSO_4$
(d) $2K + 2H_2O \rightarrow 2KOH + H_2$

14 .**Balance the following chemical equations.**

(a) $HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$
(b) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
(c) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
(d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$

Solution

(a) $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$
(b) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
(c) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
(d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

15. **Write the balanced chemical equations for the following reactions.**

(a) Calcium hydroxide + Carbon dioxide →Calcium carbonate + Water
(b) Zinc + Silver nitrate →Zinc nitrate + Silver
(c) Aluminium + Copper chloride →Aluminium chloride + Copper
(d) Barium chloride + Potassium sulphate →Barium sulphate + Potassium chloride

Solution :(a) $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
(b) $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$
(c) $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$
(d) $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2KCl$

16 .**Write the balanced chemical equation for the following and identify the type of reaction in each case.**

(a) Potassium bromide(aq) + Barium iodide(aq) →Potassium iodide(aq) + Barium bromide(s)
(b) Zinc carbonate(s) →Zinc oxide(s) + Carbon dioxide(g)
(c) Hydrogen(g) + Chlorine(g) →Hydrogen chloride(g)
(d) Magnesium(s) + Hydrochloric acid(aq) →Magnesium chloride(aq) + Hydrogen(g)

Solution

(a) $2KBr\ (aq) + BaI_2 \rightarrow 2KI\ (aq) + BaBr_2\ (s)$, Double displacement reaction and precipitation reaction

(b) $ZnCO_3\ (s) \rightarrow ZnO\ (s) + CO_2\ (g)$, Decomposition reaction

(c) $H_2\ (g) + Cl_2\ (g) \rightarrow 2HCl(g)$, Combination reaction

(d) $Mg(s) + 2HCl(aq) \rightarrow MgCl_2\ (s) + H_2\ (g)$, Displacement reaction

17. **What does one mean by exothermic and endothermic reactions? Give examples**.

Ans: Reactions in which heat is released along with the formation of products are called exothermic reactions. Example of exothermic reaction:

Burning of natural gas: $CH_4(g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (g) + Heat$

Reactions in which energy is absorbed are known as endothermic reactions. Example of endothermic reaction:

$$2AgBr(s) \leftarrow 2Ag(s) + Br_2(g)$$

18 .**Why is respiration considered an exothermic reaction? Explain**.

Solution: Food that we eat includes carbohydrates, proteins, vitamins etc. During digestion, carbohydrates are broken down into simpler substances called glucose. Glucose combines with oxygen in the cells of our body to form carbon dioxide and water along with energy. This reaction is called respiration. Since energy is released during this process, respiration is an exothermic reaction.

$$C_6H_{12}O_6\,(aq) + 6\,O_2\,(g) \rightarrow 6\,CO_2\,(aq) + 6\,H_2O\,(l) + Energy$$

19 .**Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions**.

Solution: In a decomposition reaction, a single substance decomposes to give two or more substances. Whereas in a combination reaction two or more substances combine to form a new single substance. And hence, decomposition reactions are opposite of combination reactions.
Decomposition reaction: AB + Energy → A + B

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Combination reaction: A + B → AB + Energy

Burning of coal : $C(s) + O_2(g) \rightarrow CO_2(g)$

20 .**Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity**

Solution:

Heat : $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Light : $2AgBr(s) \rightarrow 2Ag(s) + Br_2(g)$

Electricity : $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

**21. What is the difference between displacement and double displacement reactions? Write equations for these reactions.**

Solution : A displacement reaction is a chemical reaction in which a more reactive element displaces a less reactive element from its salt solution.

Example: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
In this reaction, one displacement is taking place. Fe is displacing Cu.

Double displacement reaction is a chemical reaction in which there is an exchange of ions between the reactants to give new substances. There are two displacements taking place in a double displacement reaction.

Example:

$3\ BaCl_2 + Al_2(SO_4)_3 \rightarrow 2\ AlCl_3 + 3\ BaSO_4$

two displacements are taking place. Ba is displacing Al and Al is displacing Ba.

**22. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reactions involved**.

$2AgNO_3(aq) + Cu(s) \rightarrow Cu(NO_3)_2 + 2Ag(s)$

**23. What do you mean by a precipitation reaction? Explain by giving examples**

Ans: Any reaction that produces an insoluble solid (precipitate) can be called a precipitation reaction.These insoluble salts separate out from the solution and settle down as precipitate.

For example: When aqueous sodium sulphate solution and aqueous barium chloride are reacted, aqueous solution of sodium chloride and white precipitate of barium sulphate are formed.

**24.Explain the following in terms of gain or loss of oxygen with two examples each.**

(a) Oxidation
(b) Reduction

Solution :a).Oxidation: It is the gain of oxygen by a substance in a reaction. (b) Reduction: It is the loss of oxygen by a substance in a reaction. When magnesium is burned in air, magnesium oxide is formed.

$$2Mg + O_2 \rightarrow 2MgO$$

Here, magnesium is oxidized to magnesium oxide. It has gained oxygen. When copper oxide is heated with hydrogen, copper metal and water are formed.

$$CuO + H_2 \rightarrow Cu + H_2O$$

Here, $H_2$ is getting oxidised to $H_2O$. It has gained oxygen.

**25.A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black coloured compound formed**.

Solution: The shiny brown coloured element 'X' is copper and the black coloured compound is copper oxide (CuO) .The chemical reaction is:

$$2Cu + O_2 \rightarrow 2CuO$$

In this reaction, recall the element which is shiny brown in colour. When it will be heated in air, it will form its oxide. So, which oxide is black in colour?

**26. Why do we apply paint on iron articles?**

Ans:- We apply paint on iron articles to avoid their rusting. When a coat of paint is applied to the surface of an iron article, it stops the contact of air and moisture with the iron metal and hence no rusting takes place.In this reaction, it is to think that what will happen to iron articles if we do not apply paint on them. Iron will react with air and moisture and corrode. Therefore, to prevent corrosion of iron articles we have to apply paint on them.

**27. Oil and fat containing food items are flushed with nitrogen. Why?**

Solution: When fats and oils are kept for a long time, they get oxidized by aerial oxidation and become rancid and their smell and taste change. Food items containing oil and fat are flushed with nitrogen to prevent rancidity of oil and fat as nitrogen is an inert gas and prevent the oxidation of oil and fats.

**28.Explain the following terms with one example each.**
(a) Corrosion
(b) Rancidity

Solution :(a) Corrosion: Corrosion is the process of eating away of metals by the attack of substances such as moisture, acids, etc. Example - the black coating on silver and the green coating on copper are other examples of corrosion.

(b) Rancidity: When food items containing fats and oils are kept for a long time, they get oxidized and their smell and taste change. This process is known as rancidity.

Example: Butter when kept in open for long time, tastes and smells bad because of rancidity.

**29.What factors influence the rate of chemical reaction?**

Ans: following are the factors that can influence the rate of reaction

- Nature of reactants
- Concentration of reactants
- Surface area of reactants
- Temperature
- Catalyst

# Exercises- MCQs

**1. The reaction $H_2+Cl_2 \rightarrow 2HCl$ represents :**

(a) Oxidation

(b) Reduction

(c) Decomposition

(d) Combination

Ans- (d)

**2. In the reaction $2PbO + C \dashrightarrow 2Pb + CO_2$**

(a) Pbo is oxidised

(b) C act as an oxidising agent

(c) C act as a reduction agent

(d) Reaction does not represent redox reaction.

Ans- (c)

**3. A substance which oxidizes itself and reduces other is known as**

(a) Oxidising agent

(b) reducing agent

(c) Both (a) and (b)

(d) None of these.

Ans- (d)

**4. Which of the statements about the reaction below are incorrect?**

$2PbO(s) + C(s) \rightarrow 2Pb(s) + CO_2(g)$

(a) Lead is getting reduced.
(b) Carbon dioxide is getting oxidised.
(c) Carbon is getting oxidised.
(d) Lead oxide is getting reduced.

(i) (a) and (b)
(ii) (a) and (c)
(iii) (a), (b) and (c)
(iv) all

Sol:(i) (a) and (b)

**5. $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$**

The above reaction is an example of a:

(a) combination reaction

(b) double displacement reaction

(c) decomposition reaction

(d) displacement reaction

Ans (d)

**6.What happens when dilute hydrochloric acid is added to iron fillings?**

(a) Hydrogen gas and iron chloride are produced

(b) Chlorine gas and iron hydroxide are produced

(c) No reaction takes place

(d) Iron salt and water are produced

Soln:(a)

**7.A chemical reaction involve in**

a) Only breaking of bonds
b) Only formation of bonds
c) Both breaking and formation of bonds
d) None of these ans: (c)

**8. single displacement reaction involves**

a) Oxidation
b) Reduction
c) Redox
d) Heating ans (c)

**9.string of ants and bee contain**

a) Formic acid
b) Vinegar
c) Succinic acid
d) Common salt ans : (a)

**10 a red brown gas is released on heating lead nitrate.it is an example of**

a) Combination reaction
b) Oxidation reaction
c) Decomposition reaction
d) Reduction reaction ans:(c)

**11.CaO and CO2 are produced by heating CaCO3. What is the type of the reaction and the process?**

(a) displacement reaction and endothermic process
(b) decomposition reaction and exothermic process
(c) decomposition reaction and endothermic process
(d) combination reaction and endothermic process ans: (d)

**12. When ferrous sulphate is heated the following reaction takes place:**

2FeSO4 (s) --------> Fe2O3 (s) + SO2 (g) + SO3 (g)

The above reaction is called _____ of ferrous sulphate.

(a) Thermal Displacement

(b) Combination

(c) Thermal Decomposition

(d) Double displacement ans:©

**13.How the colour changes when the gases after thermal decomposition of ferrous sulphate come in contact with an acidified solution of potassium dichromate?**

(a) Green to orange

(b) Orange to green
(c) Blue to green

(d) Red to colourless ans: (b)

**14. What is the type of the reaction between sodium sulphate and barium chloride?**

(a) Decomposition (b) Direct combination

(c) Single displacement (d) Double displacement.

Ans : (d)

**A.QUESTION CARRY ONE MARKS**

1. What is a chemical equation?

2. What happens when magnesium ribbon burns in air?

3. Name the gas evolved when zinc reacts with dil. HCl.

4. A zinc rod is left for nearly 20 minutes in a copper sulphate solution. What change would you observe in zinc rod?

5. What is rust?

6. Name four types of chemical reactions?

7. What are combination reactions?

8. Give two example of combination reaction?

9. What are displacement reactions?

10. What are double displacement reactions?

11. What are oxidation reactions?

12. What are reduction reactions?

13. What is rancidity?

14. Why do we apply paint on iron articles?

15.what is the name of gas which burns with pop sounds

**B.QUESTION CARRY TWO MARKS**

1.A milkman added a small amount of baking soda to fresh milk.

(a) Why does he shift the pH of fresh milk to slightly alkaline?

(b) Why does this milk take a longer time to set as a curd?

2.Write the balanced equation for the following reaction and identify the type of reaction in each case.

I. Potassium bromide +Barium Iodide→ Potassium iodide +Barium bromide.
II. Hydrogen (g) +Chlorine(g)→ Hydrogen Chloride (g)

3.(a) Balance the chemical equation :

Fe(s)+H2O(g)→ Fe3O4(s)+H2(g)

(b) Identify the type of reaction in the equation given below.

Na2SO4(aq)+BaCl2(aq)→ BaSO4(s)+NaCl(aq)

4. Select

(i) combination reaction

(ii) decomposition reaction and

(iii) displacement reaction from the following chemical equations:
i. $ZnCO_3$ (s) ——→ ZnO (s) + $CO_2$ (g)
ii. Pb(s) + $CuCl_2$ (aq) ——→ $PbCl_2$ + Cu (s)
iii. NaBr (aq) + $AgNO_3$ (aq) ——→ AgBr (s) + $NaNO_3$ (aq)
iv. $H_2$ (g) + $Cl_2$ (g) ——→ 2HCl (g)

5. Zinc liberates hydrogen gas when reacted with dilute hydrochloric acid, where as copper does not. Explain why?

6.what happen when Zn metal is dipped in CuSO4 solution ?give the chemical reaction involved. State which is more reactive Zn or Cu ?

7. When hydrogen gas is passed over heated copper (II) oxide, copper and steam are formed. Write the balanced chemical equation for this reaction and state:
(i) the substance oxidised.
(ii) the substance reduced in the reaction.

8. What are characteristics of chemical reaction?

9. Identify the substance oxidized, substance reduced, oxidising and reducing agent.

$$MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$$

**C.QUESTION CARRY THREE MARKS**

1. what is corrosion? State the conditions necessary for rusting of iron. How rusting is harmful?

2. what is rancidity? Write the common method to prevent it.

3. Write balanced chemical equations for the following chemical reactions

(a) Hydrogen + Chlorine → Hydrogen Chloride

(b) Lead + Copper Chloride →Lead Chloride + Copper

(c) Zinc Oxide + Carbon → Zinc + Carbon Monoxide

4.What is redox reaction? When magnesium ribbon burns in the air and forms a white ash, is magnesium oxidized or reduced?

5. (a) What happens when Iron nails are kept into a Copper sulphate solution? Write the balanced chemical equation for the reaction.

(b) Give one example of precipitation reaction.

6.Explain why:

(a) Respiration is an exothermic reaction?

(b) All decomposition reactions are endothermic reaction?

(c) When blue salt of copper sulphate is heated, it becomes colourless?

7.The chemical reaction between barium chloride and sodium sulphate is an example of

(a) combination reaction (b) decomposition reaction

(c) displacement reaction (d) double displacement reaction

8. Identify the type of reaction in the following

(a) $ZnCO_3 + 2HCl (aq) \longrightarrow ZnCl_2 (aq) + H_2CO_3 (aq)$

(b) $2NaBr (aq) + Cl (g) \longrightarrow 2Nacl (aq) + Br_2 (aq)$

(c) $2CuO (S) \xrightarrow{heat} 2Cu (s) + O_2 (g)$

9. When hydrogen gas is passed over heated copper (II) oxide, copper and steam are formed. Write the balanced chemical equation for this reaction and state:

(i) the substance oxidised.

(ii) the substance reduced in the reaction.

10.a solution of a substance "X" is used for white washing

(i) name the substance "X" and write its formula

(ii) write the reaction of the substance "X" named in (i) above with water

11. How does a displacement reaction differ from a double displacement reaction? Give examples to explain.

12. What way the two reactions in each of the following pairs are different from each other?

(i) (a) $NH_3 (g) + H_2O (l) \longrightarrow NH_4OH (aq)$

(b) $2 Mg (s) + O_2 (g) \longrightarrow 2 MgO (s)$

(ii) (a) $Zn (s) + CuSO_4 (aq) \longrightarrow ZnSO_4 (aq) + Cu (s)$

(b) $H_2S (aq) + CuSO_4 (aq) \longrightarrow CuS (s) + H_2 SO_4 (aq)$

(iii) (a) $CaCO_3 \longrightarrow CaO (s) + CO_2 (g)$

(b) $2H_2O (l) \longrightarrow 2H_2 (g) + O_2 (g)$

**D.QUESTION CARRY FIVE MARKS**

1. Write balanced chemical equation for the following statements:
(i) NaOH solution is heated with zinc granules.
(ii) Excess of carbon dioxide gas is passed through lime water.
(iii) Dilute sulphuric acid reacts with sodium carbonate.
(iv) Egg shells are dropped in hydrochloric acid.
(v) Copper (II) oxide reacts with dilute hydrochloric acid

2. (a) Define corrosion
(b) What is corrosion of iron called?
(c) How will you recognise the corrosion of silver?
(d) Why corrosion of iron is serious problem?
(e) How can we prevent corrosion?

3.what is the colour of $FeSO_4.7H_20$ crystals ?how does this colour change upon heating? give balanced chemical equation for the changes.

4. Write the following in the form of balanced chemical equations:-

(a) Calcium carbonate decomposes on heating to form calcium oxide and carbon dioxide.

(b) When ammonium hydroxide is added to a solvent of iron (ll) Sulphate, a green ppt of iron (ll) hydroxide and ammonium Sulphate are formed.

(c) When a nail of iron is added to a solution of copper Sulphate, iron (ll) Sulphate and copper metal are formed.

(d) Zinc reacts with dil hydrochloric acid to form zinc chloride and hydrogen gas is liberated.

6.write balanced chemical equations for the following reactions:

(i) carbon dioxide gas is passed through lime water to form a precipitate of calcium carbonate.

(ii)zinc metal reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.

(iii) potassium metal reacts with water to form potassium hydroxide and hydrogen gas.

(iv) silver nitrate is treated with sodium chloride to form silver chloride and sodium nitrate.

(v) liquid hydrogen peroxide decomposes to form water and oxygen gas.

**7**. Balance the following chemical equations :

I. $Al(OH)_3 --\Delta\rightarrow Al_2O_3 + H_2O$
II. $SO_2 + H_2S --\rightarrow H_2O + S$
III. $Mg + CO_2 ---\rightarrow MgO + C$
IV. $NH_3 + O_2 ---\rightarrow N_2 + H_2O$
V. $BaCl_2 + Al_2(SO_4)_3 ---\rightarrow AlCl_3 + BaSO_4$

**8.**What happens when:

(i) Silver metal is added to copper sulphate solution.

(ii) Aluminium metal is treated with dilute hydrochloric acid.

(iii) Hydrogen gas and chlorine gas combine together.

(iv) Zinc metal is added in copper sulphate solution.

(v) Sodium is treated with water.

**9.**What happens when zinc granules are reacted with dilute HCl, H2SO4, HNO3, KI, NaCl separately. Write the chemical reactions involved.

**10.** what do you mean by corrosion? what are rusting and rust ? Explain the methods to prevent rusting of iron.

# Chapter-2 ACIDS, BASES AND SALTS

Introduction

Acids and bases are common solutions that exist everywhere. Almost every liquid that we encounter in our daily lives consists of acidic and basic properties. The word acid is derived from the latin word acidus meaning sour to taste. There are some other substances know as alkalis and bases, whose properties are/is different and opposite to that of acids. The word alkali is derived from the arabic word meaning calcined ashes of plants. These were first isolated from the ashes of plants. Acid can destroy the properties of bases and vice versa, the process being called neutralisation. The table below compares the different properties between them:

| ACIDS | BASES |
|---|---|
| produce a piercing pain in a wound. | give a slippery feel. |
| taste sour. | taste bitter. |
| are colorless when placed in phenolphthalein (an indicator). | are pink when placed in phenolphthalein (an indicator). |
| are red on blue litmus paper (a pH indicator). | are blue on red litmus paper (a pH indicator). |
| have a pH<7. | have a pH>7. |
| produce hydrogen gas when reacted with metals. | produce carbon dioxide when reacted with carbonates. |
| Common examples: Lemons, oranges, vinegar, urine, sulfuric acid, hydrochloric acid | Common Examples: Soap, toothpaste, bleach, cleaning agents, limewater, ammonia water, sodium hydroxide. |

In 1884, the Swedish chemist Svante Arrhenius proposed two specific classifications of compounds, termed acids and bases. When dissolved in an aqueous solution, certain ions were released into the solution.