43. (c) An element X with atomic number 12 is magnesium.

Now, valency of Mg = + 2

Valency of N (azide) = – 3

∴ The formula of azide is Mg_3N_2

$$\overset{+2}{Mg} \times \overset{-3}{N} \text{ or } X_3N_2$$

44. (c) Elements A B
Valencies 3 2 } compound is A_2B_3

Elements A B
Valencies 5 2 } compound is A_2B_5

45. (b) $^{12}C_6$ used as a standard in the expression of atomic weights in term of amu.

46. (b) Law of multiple proportions explains the formation of CO and CO_2, in these same weight of carbon that combines with weights of oxygen are in simple rate of 1 : 2.

47. (c)

48. (d) (ii) 20 moles of water = 20 × 18 g = 360 g of water, because mass of 1 mole of water is the same as its molar mass i.e., 18 g.

(iv) 1.2044×10^{25} molecules of water contains

$\frac{1.2044 \times 10^{25}}{N_A}$ number of moles, $N_A = 6.023 \times 10^{23}$

$\therefore \frac{1.2044 \times 10^{25}}{6.022 \times 10^{23}} = 20$ moles

20 moles of water = 20 × 18 g = 360 g of water

49. (c) Weight of a sample in gram = number of moles × molar mass

(a) 0.2 moles of $C_{12}H_{22}O_{11}$ = 0.2 × 342 = 68.4 g

(b) 2 moles of CO_2 = 2 × 44 = 88 g

(c) 2 moles of $CaCO_3$ = 2 × 100 = 200 g

(d) 10 moles of H_2O = 10 × 18 = 180 g

50. (d)

51. (a)

52. (a)

53. (b)

54. (c) Isotopes have same atomic number (number of protons) but different mass number (number of neutron + number of protons).

55. **(c)**

56. **(d)** In compound CS_2

12 g of carbon are combined with sulphur = 64 g

3 g of carbon are combined with sulphur

$$= \frac{(64g) \times (3g)}{(12g)} = 16g$$

57. **(b)** 6.022×10^{23} molecules of CO_2 correspond to mass = 44 g

3.011×10^{23} molecules of CO_2 correspond to mass = 22 g

58. **(b)** Mg is represented as $^{24}_{12}Mg$. It has protons, electrons and neutrons equal to 12 (all are same).

59. **(a)** The electronic configuration of element X is 2, 5. It has 5 valence electrons.

60. **(d)** 1 mole of Cl_2 = 34g = 6.023×10^{23} atoms

$$71g \text{ of } Cl_2 = \frac{6.023 \times 10^{23}}{34} \times 71$$

$= 12.577 \times 10^{23}$ atoms

1 mole of Mg = 24 g = 6.023×10^{23} atoms

$$48g \text{ of Mg} = \frac{6.023 \times 10^{23}}{24} \times 48$$

$= 12.046 \times 10^{23}$ atoms

1 mole of I_2 = 126 L = 6.023×10^{23} atoms

$$127g \text{ of } I_2 = \frac{6.023}{126} \times 127 \times 10^{23}$$

$= 6.070 \times 10^{23}$ atoms

1 mole of H_2 = 1g = 6.023×10^{23} atoms

$$4g \text{ of } H_2 = \frac{6.023 \times 10^{23} \times 4}{1}$$

$= 24.092 \times 10^{23}$ atoms

Hence, 4g of H_2 have largest number of atoms.

61. **(d)** One P_4 molecule is made up of four atoms of phosphorus

1 mole of P_4 molecules = 6.023×10^{23} atoms

4 mole of P_4 molecules = $6.023 \times 10^{23} \times 4$

$= 2.409 \times 10^{24}$ atoms

62. **(d)** $$\text{No. of mol} = \frac{63}{\text{mol.weight of } HNO_3} = \frac{63}{63} = 1 \text{ mole}$$

No. of oxygen atoms = moles × no. of oxygen atoms present × Avogadro no.

$$= 1 \times 6 \times 10^{23} \times 3$$
$$= 18 \times 10^{23}$$
$$= 1.8 \times 10^{24}$$

63. (c) Becquerel

64. (b) B rays consists of negatively charged electrons ($_{-1}e^{0}$)

65. (d)

66. (c)

67. (c)

Chapter 3

Chemical Reactions and Chemical Compounds

CHEMICAL EQUATION

The qualitative representation of a chemical reaction in a short hand or concise form in term of symbols and formulae, is called a chemical equation. For example. The burning of magnesium wire in oxygen(air) to produce magnesium oxide can be written as under in the form of a *word equation.*

$$\underbrace{\text{Magnesium} + \text{oxygen}}_{\text{Reactants}} \longrightarrow \underset{\text{Product}}{\text{Magnesium oxide}}$$

Word equations represent simply change of reactants into products. They do not give the true picture of the chemical reactions.

Skeletal Chemical Equation or Symbol Equation

A chemical equation written in the form of symbols and formulae is called a skeletal chemical equation. *Such a chemical equation may or may not be balanced* e.g.

$$\text{Magnesium} + \text{oxygen} \longrightarrow \text{Magnesium oxide}$$

(word equation)

$$Mg + O_2 \longrightarrow MgO$$ (skeletal equation)

In the skeletal equation given above there are two oxygen atoms (O_2 = 2 atoms of oxygen) in the reactants and only one oxygen atom in products so it is not a balanced equation.

Balanced Chemical Equation

A chemical equation in which number of atoms of each elements on L.H.S. (i.e. reactants) and R.H.S. (i.e.products) is equal is called a balanced chemical equation for example, magnesium reacts with sulfuric acid to form magnesium sul-

phate and hydrogen, can be represented as follows.

Magnesium + Sulfuric acid $\longrightarrow$ Magnesium Sulphate + Hydrogen (word equation)

$Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2\uparrow$ (Balanced equation)

The balancing of a chemical equation is essential or necessary to fulfill the requirement of the **Law of Conservation of Mass.**

Balancing of Chemical Equations

The process of making the number of different elements on both side of the equation equal is known as balancing of chemical equation.

Hit and Trial Method : The reaction between hydrogen and oxygen to form water can be represented as under :-

Hydrogen + oxygen $\longrightarrow$ water (word equation)

$H_2 + O_2 \longrightarrow H_2O$ (skeletal equation)

This equation is **unbalanced** and can be balanced by hit and trial method as follows :-

Oxygen will be balanced if 2 is written before H_2O (product). It will give us the following equation.

$$H_2 + O_2 \longrightarrow 2H_2O$$

In doing so the number of hydrogen atoms becomes unbalanced. On the L.H.S. there are only 2 atoms of hydrogen while on RHS we have 4 atoms of hydrogen. To balance hydrogen atoms write 2 before H_2.

$2H_2 + O_2 \longrightarrow 2H_2O$ (balanced equation)

In a balanced chemical equation, homoatomic gases with atomicity two or more are always written in molecular from e.g. H_2, O_2, N_2, Cl_2, O_3 etc. Atomicity may be defined as the number of atoms in one molecule of the gas.

Essential of a Chemical Equation

A chemical equation-

(i) should represent an actual chemical change

(ii) should be balanced, and

(iii) should be molecular, i.e., all the substances should be in the form of molecules.

Implications of a Chemical Equation or Information by a Chemical Equation

A chemical equation conveys a large number of informations as described below-

(i) It tells us about the names of the reactants and products.

(ii) It expresses the number of molecules of reactants and products.

(iii) It expresses the relative weight of the reactants and the products.

(iv) It expresses the volume of the gaseous reactants and products.

CHEMICAL REACTION

The process in which a substance undergoes change to produce new substances with new properties are known as chemical reaction.

Types of Chemical Reactions

Decomposition reactions

Decomposition reactions are those reactions in which a compound breaks down into simpler compounds (or substances). This type of reaction is simply the reverse of combination reactions. These reactions require energy in the form of heat, light, electricity etc.

Kinds of decomposition reactions

Various kinds of decomposition reactions are :

(i) **Thermal decomposition :** This type of reaction takes place on heating a substance. For example,

$$ZnCO_3(s) \xrightarrow{heat} ZnO(s) + CO_2(g)$$

(ii) Electrolytic decomposition : This type of reaction takes place on passing electric current for example

$$2H_2O(\ell) \xrightarrow{\text{Electric current}} 2H_2(g) + O_2(g)$$

(acidified water)

(iii) Catalytic decompositions : This type of reaction takes place in presence of a catalyst. For example

$$CH_4(g) \xrightarrow{\text{Catalyst}} CO + 2H_2(g)$$

(iv) Photochemical decomposition : This type of reaction takes place in presence of light. For example

$$2AgBr \xrightarrow{light} 2Ag + Br_2$$

- The reaction in which a hydrated salt loses molecules of water of crystallisation is known as **dehydration reaction**.

$$\underset{\text{(Green)}}{FeSO_4.7H_2O} \xrightarrow{Heat} \underset{\text{(Dirty white)}}{FeSO_4(s)} + 7H_2O(g)$$

Simple Displacement Reaction and Simple Substitutions

A displacement reaction is a reaction in which an atom, or group of atoms, present in a molecule is displaced by another atom. Some examples of displacement reactions are :

(i) $CuSO_4(aq) + Mg(s) \longrightarrow MgSO_4(aq) + Cu(s)$

(ii) $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + Fe$

A more reactive metal will displace a less reactive metal from its compound in solution. There are the sorts of things you observe in this type of reaction :

- the more reactive metal gradually dissolves
- the less reactive metal coats the more reactive metal
- the solution may change colour

Double Displacement Reactions or Double Decomposition

The reactions in which mutual exchange of radicals takes place are known as double decomposition reactions. As a result of double decomposition reactions two new substances are formed.

Examples :

(I) When sodium chloride reacts with conc. sulphuric acid, two new substances (sodium sulphate and hydrogen chloride) are formed.

$$2NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$$

(II) When potassium bromide and silver nitrate reacts together, silver bromide and potassium nitrate are formed.

$$KBr + AgNO_3 \longrightarrow KNO_3 + AgBr$$

The double-displacement reactions have two major features in common. First, two compounds exchange ions or elements to form new compounds. Second, one of the products is either a compound that will separate from the reaction mixture in some way (commonly as a solid or gas) or a stable covalent compound, often water.

Precipitation Reactions

A precipitation reaction occurs when two solutions are mixed together and a solid separates from the solution. The solid part that forms and separates from the mixture is called the precipitate the reaction shown below is a precipitation reaction.

$$BaCl_2 + 2Na_2SO_4 \longrightarrow BaSO_4 \downarrow + 2NaCl$$

Oxidation-Reduction Reactions

Oxidation reactions : Oxidation is defined as a process which involve addition of oxygen or removal of hydrogen.

Addition of oxygen

$$N_2 + O_2 \longrightarrow 2NO$$

Removal of hydrogen :

$$Cl_2 + H_2S \longrightarrow 2HCl + S$$

Reduction

The term reduction is defined as a process which involve the removal of oxygen or addition of hydrogen.

Removal of oxygen :

$$CuO + H_2 \longrightarrow Cu + H_2O$$

Addition of hydrogen :

$$H_2 + S \longrightarrow H_2S$$

Oxidation - Reduction in terms of Electronic Concept

Oxidation is a loss of electrons

Reduction is a gain of electrons.

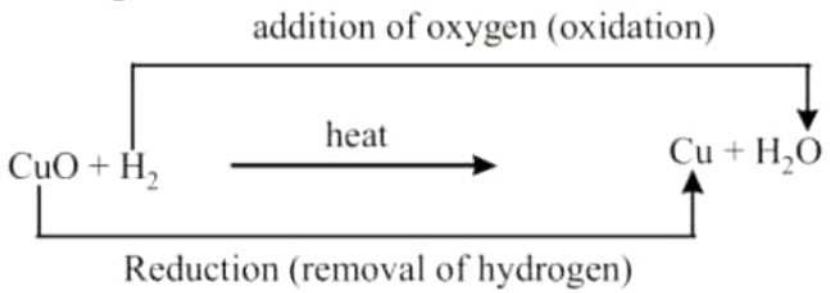
Oxidizing agent accepts electrons. Some common oxidising agents are $KMnO_4$, $K_2Cr_2O_7$ etc.

Reducing agent lose electrons. Some common reducing agents are $LiAlH_4$, $NaBH_4$ etc.

Redox Reactions

Those reactions in which oxidation and reduction takes place simultaneously, are known as redox reactions.

Example :



Redox processes are very important as they play important role in governing a number of natural processes like corrosion, combustion, biological processes like respiration etc.

Exothermic Reactions

The chemical reactions which proceed with the evolution of heat energy are called exothermic reactions.

The heat energy produced during the reaction is indicated by writing +q on the product side. In general, exothermic reactions may be represented as :

$$A + B \longrightarrow C + D + Q(\text{heat energy})$$

(i) All combustion reactions are exothermic.

(ii) Respiration is an exothermic reaction.

(iii) The decomposition of vegetable matter into compost is also an example of exothermic reaction.

Endothermic Reactions

The chemical reactions which proceed with the absorption of heat energy are called endothermic reactions.

The heat energy absorbed during the reaction can be indicated by writing +q with the reactants or it can be indicated by writing –q (or the actual numerical value) with the products. In general, an endothermic reaction can represented as : $A + B \longrightarrow C + D - Q(\text{heat})$, where Q is the heat absorbed.

(i) Decomposition reactions are generally endothermic.

(ii) The number of endothermic reactions is much less than the exothermic reactions.

Combustion Reactions

A chemical reaction in which a substance burns or gets oxidised in the presence of air or oxygen is called combustion reaction. For example, kerosene, coal, charcoal, wood etc, burn in air and thus undergo combustion. All substances acting as fuels undergo combustion reactions. These are highly exothermic and are accompa-

nied by release of energy which is quite useful in our daily life. All combustion reactions are not accompanied by flame. Combustion accompanied by release of energy.

Homogeneous Reactions

In case all the reactants and products of a chemical reaction are in the same physical state then such a reaction is known as **homogeneous reactions.**

For representation of a physical state of reactants/products we write (g) for gases, (l) for liquids and (s) for solids state.

Example :

$$H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$$

Heterogeneous Reaction

If in a chemical reaction, all the products and reactants are *not* in the same physical state then such a reaction is known as **heterogeneous reaction**.

Example :

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

Corrosion (Erosion by Chemical Action)

Corrosion is the degradation of metals and generally called rust. Corrosion causes damage to car bodies, iron railings, ships and to all objects made of metals, specially those of iron. Corrosion of iron is a serious problem. Corrosion is the primary means by which metals deteriorate. Most metal corrode on contact with water (and moisture in the air), acids, bases, salts, oils, aggressive metals polishes, and other solid and liquid chemicals. To minimize corrosion, protective coatings are applied to prevent the direct contact of moisture and oxygen with that metal.

Rancidity

The most important cause of deterioration in fats and fatty foods is oxidation of fats. What we perceive is an unpleasant change in the flavour and odour of a food, called rancidity. Factors which accelerate fat oxidation include trace metals (iron, zinc, etc.), salt, light, water, bacteria, and moulds. Fat oxidation can be retarded by use of antioxidants by use of spices such as sage and rosemary, and by use of light and or air tight wrapping.

Fertilizers

Fertilizers are chemical compounds which when added to the soil increase their fertility and directly supply the need of essential elements [N, P, K] of primary importance.

Classification

Chemical fertilizers are broadly classified into the following three types:

(i) **Nitrogenous fertilizers:** Ammonium sulphate, urea etc.

(ii) **Phosphatic fertilizers:** Super phosphate, ammonium phosphate

(iii) **Potash fertilizers:** Potassium chloride, potassium sulphate.

SOAPS AND DETERGENTS

Soap: Fatty acid salts of sodium and potassium are known as soaps. These are prepared by the action of fatty acids with sodium hydroxide or potassium hydroxide.

Fatty acid + sodium hydroxide → Soap + glycerol.

Detergents are sodium salt of long chain sulphonic acids or alkyl hydrogen sulphate.

Advantages of Detergents Over Soaps

(i) Detergents can be used for laundering even with hard water as they are soluble even in hard water.

(ii) Detergents possess better cleansing properties than soaps.

Disadvantages of detergents over soap: Detergents are prepared from hydrocarbons, while soaps are prepared from edible fatty oils. Thus they are non biodegradable.

Saponification

- It is the process of making of soap by the hydrolysis of fats and oils with alkalis.
- Both soaps and detergents are soluble in water and act as surfactants which reduce the surface tension of water to a great extent. This increases the water - fabric interaction as a consequence of which dirt particles, grease spots etc are washed away effectively. In other words soaps and detergents enhance the cleansing action of water.

Industrial Names of some Important Compounds

Industrial Name	Chemical Name and Formula
Alum	Potassium aluminium sulphate ($K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24 H_2O$)
Alcohol	Ethyl alcohol (C_2H_5OH)
Baking powder	Sodium bicarbonate ($NaHCO_3$)
Blue vitriol	Copper sulphate ($CuSO_4 \cdot 5H_2O$)
Bleaching powder	Calcium hypochlorite ($CaOCl_2$)

Borax	Sodium tetraborate decahydrate ($Na_2B_4O_7 \cdot 10H_2O$)
Brine or salt	Sodium chloride (NaCl)
Calomel	Mercurous chloride (Hg_2Cl_2 or HgCl)
Caustic potash	Potassium hydroxide (KOH)
Caustic soda	Sodium hydroxide (NaOH)
Chile salt petre	Sodium nitrate ($NaNO_3$)
Chloroform	Trichloromethane ($CHCl_3$)
Dry ice	Solid carbon dioxide (CO_2)
Epsum	Magnesium sulphate ($MgSO_4 \cdot 7H_2O$)
Glauber's salt	Sodium sulphate decahydrate ($Na_2SO_4 \cdot 10H_2O$)
Green vitriol	Ferrous sulphate ($FeSO_4 \cdot 7H_2O$)
Gypsum	Calcium sulphate ($CaSO_4 \cdot 2H_2O$)
Hypo	Sodium thiosulphate pentahydrate ($Na_2S_2O_3 \cdot 5H_2O$)
Laughing gas	Nitrous oxide (N_2O)
Litharge	Lead oxide (PbO)
Lunar castic	Silver nitrate ($AgNO_3$)
Magnesia	Magnesium oxide (MgO)
Marble or chalk or pearl	Calcium carbonate ($CaCO_3$)
Marsh gas	Methane (CH_4)

Mohr's salt	Ferrous ammonium sulphate, $(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$
Mosaic gold	Stannous sulphide (SnS_2)
Muriatic acid	Hydrogen chloride (HCl)
Pearl ash	Potassium carbonate (K_2CO_3)
Plaster of Paris	Calcium sulphate hemihydrate $\left(CaSO_4\frac{1}{2}H_2O\right)$
Quicklime	Calcium oxide (CaO)
Red lead	Lead peroxide (Pb_3O_4)
Rock salt	Sodium chloride (NaCl)
Ruby or sapphire	Aluminium oxide, (Al_2O_3)
Sand	Silicon dioxide (SiO_2)
Sal ammoniac	Ammonium chloride (NH_4Cl)
Slaked lime	Calcium hydroxide [$Ca(OH)_2$]
Spirit	Methyl alcohol (CH_3OH)
Soda ash	Sodium carbonate (Na_2CO_3)
Vinegar	Acetic acid (CH_3COOH)
Vermilion	Mercuric sulphide (HgS)
Washing soda	Sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$)
White vitriol	Zinc sulphate ($ZnSO_4 \cdot 7H_2O$)

Exercise

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which only one is correct.

1. A student added dilute HCl to a test tube containing zinc granules and made following observations :

   I. The zinc surface became dull and black.

   II. A gas evolved which burnt with a pop sound.

   III. The solution remained colourless.

   Correct observations are -

   (a) I and II
   (b) I and III
   (c) II and III
   (d) I, II and III

2. A balanced chemical equation is accordance with-
   (a) Law of multiple proportion
   (b) Law of conservation of mass
   (c) Both (a) and (b)
   (d) Neither (a) nor (b)

3. A change is said to be a chemical change when-
   (a) Energy change occurs
   (b) New substances are formed
   (c) The change cannot be easily reversed
   (d) All statements are correct

4. Which of the following are chemical changes ?
   (i) Digestion of food
   (ii) Liquefaction of air
   (iii) Ripening of fruit
   (iv) Dissolution of sulphur in carbon disulphide
   (v) Freezing of water
   (vi) Electrolysis of water

   (a) (i) to (iv) all
   (b) (i), (iii) and (v)
   (c) (i), (iii) and (vi)
   (d) (iii), (iv) and (vi)

5. Which of the following statements is true?
   (a) The total mass of the substance remains same in chemical change
   (b) Chemical change is permanent and irreversible
   (c) Physical change is temporary and reversible
   (d) All of these
6. Which of the following statements is not correct?
   (a) A chemical equation tells us about the substances involved in a reaction.
   (b) A chemical equation informs us about the symbols and formula of substances involved in a reaction
   (c) A chemical equation tells us about the atom or molecules of the reactants and products involved in a reaction
   (d) All are correct
7. Which one is not a balanced equation?
   (a) $Fe + Cl_2 \longrightarrow FeCl_3$
   (b) $Mg + CuSO_4 \longrightarrow MgSO_4 + Cu$
   (c) $Zn + S \longrightarrow ZnS$
   (d) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$
8. Which of the following reactions involved the combination of two element ?
   (a) $CaO + CO_2 \longrightarrow CaCO_3$
   (b) $4Na + O_2 \longrightarrow 2Na_2O$
   (c) $SO_2 + \frac{1}{2}O_2 \longrightarrow SO_3$
   (d) $NH_3 + HCl \longrightarrow NH_4Cl$
9. Consider the reaction
   $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$
   The above reaction is an example of
   (a) combination reaction
   (b) double displacement reaction
   (c) decomposition reaction
   (d) simple displacement reaction

10. What happens when dilute hydrochloric acid is added to iron fillings? Tick the correct answer.
    (a) Hydrogen gas and iron chloride are formed.
    (b) Chlorine gas and iron chloride are formed.
    (c) No reaction takes place.
    (d) Iron salts and water are produced.
11. What happens when copper rod is dipped in iron sulphate solution?
    (a) Copper displaces iron
    (b) Blue colour of copper sulphate solution is obtained
    (c) No reaction takes place
    (d) Reaction is exothermic
12. Which of the following is a decomposition reaction?
    (a) $2HgO \xrightarrow{Heat} 2Hg + O_2$
    (b) $CaCO_3 \xrightarrow{Heat} CaO + CO_2$
    (c) $2H_2O \xrightarrow{Electrolysis} H_2 + O_2$
    (d) All of these
13. $AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$
    Above reaction is -
    (a) precipitation reaction
    (b) double displacement reaction
    (c) combination reaction
    (d) (a) and (b) Both
14. The reaction in which two compounds exchange their ions to form two new compounds is -
    (a) a displacement reaction
    (b) a decomposition reaction
    (c) an isomerization reaction
    (d) a double displacement reaction
15. When the gases sulphur dioxide and hydrogen sulphide mix in the presence of water, the reaction is

$SO_2 + 2H_2S \longrightarrow 2H_2O + 3S$. Here hydrogen sulphide is acting as

(a) an oxidising agent
(b) a reducing agent
(c) a dehydrating agent
(d) a catalyst

16. $CuO + H_2 \longrightarrow H_2O + Cu$ reaction is an example of -

(a) redox reaction
(b) synthesis reaction
(c) neutralisation
(d) analysis reaction

17. A substance which oxidises itself and reduces other is known as-

(a) oxidising agent
(b) reducing agent
(c) Both of these
(d) None of these

18. In the reaction $PbO + C \longrightarrow Pb + CO$

(a) PbO is reducing agent
(b) C acts as a oxidising agent
(c) C acts as a reducing agent
(d) This reaction does not represent redox reaction

19. A redox reaction is one in which -

(a) both the substance are reduced
(b) both the substance are oxidised
(c) an acid is neutralised by the base
(d) one substance is oxidised while the other is reduced

20. In the equation, $NaOH + HNO_3 \longrightarrow NaNO_3 + H_2O$ nitric acid is acting as -

(a) an oxidising agent
(b) an acid
(c) a nitrating agent
(d) a dehydrating agent

21. Which of the statement about the following reaction is correct ?

$$2PbO(s) + C(s) \longrightarrow 2Pb(s) + CO_2(s)$$

(i) Lead is getting reduced

(ii) Carbon dioxide is getting oxidised

(iii) Carbon is getting oxidised

(iv) Lead oxide is getting reduced.

(a) (i) and (ii)
(b) (iv) and (iii)
(c) (i), (ii) and (iii)
(d) All are correct

22. Slow eating away of iron articles in the presence of moist air is called
(a) galvanisation
(b) crystallisation
(c) rusting
(d) neutralisation

23. An oxidation reaction involves
(a) addition of hydrogen or removal of oxygen
(b) addition of oxygen or removal of hydrogen
(c) addition of oxygen only
(d) addition of hydrogen only

24. A neutralization reaction is a
(a) decomposition reaction.
(b) displacement reaction.
(c) combination reaction.
(d) double displacement reaction.

25. In a combination reaction, how many products are formed?
(a) Only one
(b) Only two
(c) One or two only
(d) Many

26. Which of the following reaction is based on activity series of metals?
(a) Decomposition reaction
(b) Displacement reaction
(c) Double displacement reaction

(d) Synthesis reaction

27. Which of the following reaction is endothermic?

(a) $C + O_2 \longrightarrow CO_2$

(b) $CaCO_3 \longrightarrow CaO + CO_2$

(c) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

(d) $CaO + H_2O \longrightarrow Ca(OH)_2$

28. Which of the following is a homogeneous reaction?

(a) $C(s) + O_2(g) \longrightarrow CO_2(g)$

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

(c) $N_2(g) + O_2(g) \longrightarrow 2NO(g)$

(d) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$

29. The conversion of Fe^{++} to Fe^{+++} is:

(a) oxidation

(b) reduction

(c) ionisation

(d) nuclear reaction

30. Consider the following reactions :

(a) $Cu + I_2 \rightarrow CuI_2$

(b) $Fe + S \rightarrow FeS$

Which of the above reactions is/are redox reactions ?

(a) Only (a)

(b) Only (b)

(c) Both (a) and (b)

(d) Neither (a) nor (b)

31. Which one of the following statements is correct ?

In the reaction

$$2FeCl_2 + Cl_2 \; f \quad 2FeCl_3$$

(a) $FeCl_2$ is an oxidizing agent

(b) Cl_2 is an oxidizing agent

(c) $FeCl_3$ is an oxidising agent

(d) Cl_2 is a reducing agent

32. The following reaction is an example of a

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

(i) displacement reaction
(ii) combination reaction
(iii) redox reaction
(iv) neutralisation reaction

(a) (i) and (iv)
(b) (iii) and (iii)
(c) (i) and (iii)
(d) (iii) and (iv)

33. Which of the following statements about the given reaction are correct ?

$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

(i) Iron metal is getting oxidised
(ii) Water is getting reduced
(iii) Water is acting as reducing agent
(iv) Water is acting as oxidising agent

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

37. Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?

(i) Displacement reaction
(ii) Precipitation reaction
(iii) Combination reaction
(iv) Double displacement reaction

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

38. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate?

(a) Lead sulphate (insoluble)

(b) Lead acetate

(c) Ammonium nitrate

(d) Potassium sulphate

39. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?

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

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

(c) $2H_2(g) + O_2(g) \rightarrow 2H_2O(a)$

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

40 The following reaction is used for the preparation of oxygen gas in the laboratory

$$2KClO_3\,(s) \xrightarrow[\text{Catalyst}]{\text{Heat}} 2KCl\,(s) + 3O_2\,(g)$$

Which of the following statement(s) is (are) correct about the reaction?

(a) It is a decomposition reaction and endothermic in nature

(b) It is a combination reaction

(c) It is a decomposition reaction and accompanied by release of heat

(d) It is a photochemical decomposition reaction and exothermic in nature

45. Two test tubes 'A' and 'B' contain aqueous solution of potassium iodide and lead nitrate separately. When these two test-tubes 'A' and 'B' are mixed to each other, results into 'X' and 'Y' . The 'X' and 'Y' are:

(a) Yellow ppt, yellow solution

(b) Yellow ppt, colourless solution

(c) White ppt, yellow solution

(d) White ppt, colourless solution

46. Oily and fatty food items are flushed with nitrogen gas because :

(a) Nitrogen reacts with oils and fats and thus prevents rancidity.

(b) Nitrogen is inert gas and prevent a direct contact of air with oily and fatty food items

(c) Nitrogen helps in the decomposition of food items and makes them tasty

(d) All given statements are wrong

47. In an experiment to prepare a compound using iron filings and sulphur powder, the teacher instructed the students not to heat the mixture or iron and sulphur without test-tube holder because :

(a) the reaction between iron and sulphur is exothermic

(b) the reaction between iron and sulphur is endothermic

(c) the test-tube is likely to melt

(d) the reaction is explosive

48. In order to study the reaction between barium chloride and sodium sulphate, the two compounds are mixed in the form of :

(a) aqueous solutions

(b) dry powders

(c) molten liquids

(d) gases

49. The equation

$Cu + xHNO_3 \rightarrow Cu(NO_3)_2 + yNO_2 + 2H_2O$

The values of x and y are –

(a) 3 and 5

(b) 8 and 6

(c) 4 and 2

(d) 7 and 1

51. Write the physical states of reactants and products denoted by 'x', 'y', 'z' and 'w'.

$CH_4(x) + 2O_2(y) \longrightarrow CO_2(z) + H_2O(w)$

(a) g, g, g, l

(b) g, g, g, g

(c) g, g, l, l
(d) l, g, g, g

52. Main Component of Urea is
(a) Nitrogen
(b) Phosphorus
(c) Potassium
(d) Carbon

53. Soaps are fatty acid salts of ?
(a) Sodium
(b) Potassium
(c) Both
(d) None of these

54. Which of the following is used for washing cloths in presence of hard water?
(a) Soaps
(b) Detergents
(c) Sodium hydroxide
(d) Glycerol

55. Fe $SO_4.7H_2O$ is Commonly known as ?
(a) White Vitriol
(b) Blue Vitriol
(c) Green Vitriol
(d) Black Vitriol

56. CaO is also known as
(a) Quick lime
(b) Soda lime
(c) Slaked lime
(d) Sweet lime

57. Laughing gas is ?
(a) Nitrous oxide
(b) Nitric oxide
(c) Lead oxide
(d) Sulphur oxide

Hints & SOLUTIONS

1. **(d)** $Zn\,(s) + 2\,HCl\,(aq) \longrightarrow ZnCl_2\,(aq) + H_2$
2. **(b)**
3. **(d)**
4. **(c)**
5. **(d)**
6. **(d)**
7. **(a)** Balanced equation is $2\,Fe + 3Cl_2 \longrightarrow 2FeCl_3$
8. **(b)**
9. **(d)** It is an example of displacement reaction. In it Al metal displaces iron from Fe_2O_3 when reaction is carried out in aqueous solution.
10. **(a)** $Fe(s) + 2HCl(dil) \rightarrow FeCl_2(aq) + H_2(g)$
11. **(c)** As iron is above copper in reactivity series.
12. **(d)** As in all above reactions complex substances decomposes to give simple subtances.
13. **(d)** This reaction is double displacement and precipitation as well because insoluble silver chloride gets precipitated.
14. **(d)**
15. **(b)**
16. **(a)** As here H_2 gets oxidised and CuO reduced to Cu.
17. **(b)**
18. **(c)** Carbon reduces PbO to Pb.
19. **(d)**
20. **(b)** Here HNO_3 acts as an acid which on combining with base NaOH forms corresponding salt and water.
21. **(b)** Addition of oxygen is oxidation in given reaction C is oxidised to CO_2. Removal of oxygen is reduction in given reaction PbO is getting reduced to Pb.
22. **(c)** Rusting is a process in which iron gets converted into hydrated iron oxide in presence of moisture.

$$2Fe + \frac{3}{2}O_2 + xH_2O \longrightarrow \underset{\text{rust}}{Fe_2O_3.xH_2O}$$

23. **(b)**

24. **(d)** A neutralization reaction is a double displacement reaction. In this reaction two reactants exchange their ions to form two new products. For example

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

25. **(a)** In a combination reaction only one product is formed. For example : $N_2(g) + 3H_2\,(g) \longrightarrow 2NH_3(g)$

26. **(b)**

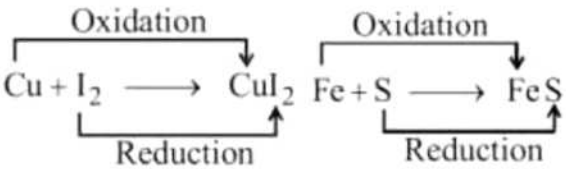
27. **(b)** Heat is required to decompose calcium carbonate. Thus this reaction proceeds with absorption of heat therefore it is endothermic reaction.

28. **(c)** Formation of NO involves all reactants and products in gaseous phase.

29. **(a)** $Fe^{++} \rightarrow Fe^{+++}$
(loss of electrons)

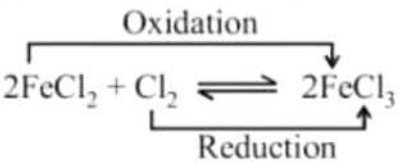
$\therefore$ Oxidation process

30. **(c)** The reactions which involve both reduction and oxidation are abbreviated as redox reactions.



So, both are redox reactions.

31. **(b)**



Oxidising agent is that substance which donate electrons while reducing agent is that substance which accepts electrons.

$\therefore$ Cl_2 is a oxidising agent.

32. **(c)**

33. **(c)** The substance which oxidises the other substances in a chemical reaction is known as an oxidising agent. Likewise, the substance which reduces the other substance in a chemical reaction is known as reducing agent.

37. **(d)**

38. **(b)** Lead sulphate being insoluble will not dissociate into Pb^{2+} ions.

39. **(d)**

40. **(a)**

45. **(b)**

46. **(b)**

47. **(a)** This is essential as a safety measure usually when an exothermic chemical reaction is carried out in a test-tube.

48. **(a)** Solid compounds do not show chemical reaction.

49. **(c)** $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

51. **(a)**

52. **(a)**

53. **(c)**

54. **(b)**

55. **(c)**

56. **(a)**

57. **(a)**

Chapter 4 Acids, Bases and Salts

ACIDS

- The term acid, in fact, comes from the latin term acere, which means 'Sour'. In everyday life we come across many compounds that chemists classify as acids.
- **Common Acids are:**

Acid	Occurrence
Tartaric acid	Grapes, tamarind, *imli*, unripe mango
Latic acid	Sour milk, curd
Formic acid	Ant's sting
Ascorbic acid (vitamin C)	Citrus fruits, *Amla*
Acetic acid	Vinegar
Tannic acid	Tea
Citric acid	Citrus fruits like orange and lemon
Oxalic acid	Spinach
Malic acid	Apple
Hydrochloric acid	Stomach

- **Organic acids** are naturally occurring acids and are mostly found in plants and animals. These acids are the compounds of carbon.
- **Mineral acids or inorganic acids** are synthesised from minerals found on earth.
- **Concentrated acid :** An acid that has a relatively high percentage of the acid dissolved in the aqueous solution is classified as a concentrated acid

- **Dilute acid :** An acid, which has a relatively low percentage of the acid dissolved in the aqueous solution, is classified as a dilute acid.
- **Strong acids** give a large number of hydrogen ions or gets completely dissociated when dissolved in water. Mineral acids are generally strong acids.
- **Weak acids** give very few hydrogen ions or gets partially ionised when dissolved in water. For example, citric acid, acetic acid and formic acid.

Properties of Acids

Physical properties :

(i) *Acids are sour in taste* e.g. *lemon juice* is sour in taste as it contains an acid.

(ii) Generally acids are good conductors of electricity.

(iii) Mineral acids are corrosive in nature.

Chemical properties :

(i) Action of metals : Metals generally react with dilute acids to form their respective salt and hydrogen.

$$\underset{\text{Magnesium}}{Mg(s)} + \underset{\text{Hydrochloric acid}}{2HCl(aq)} \longrightarrow \underset{\text{Magnesium Chloride}}{MgCl_2(aq)} + \underset{\text{Hydrogen}}{H_2(g)}$$

(ii) Action with metal oxides (Basic oxides) : The oxides that can add an hydroxyl ion (OH^-) to their molecules are called basic oxides. Metal oxides are generally basic oxides. These oxides get *neutralised* when they react with acids. These reactions are mostly carried upon heating e.g.

$$\underset{\text{Sodium oxide (Basic oxide)}}{Na_2O(s)} + \underset{\text{Hydrochloric acid}}{2HCl(aq)} \longrightarrow \underset{\text{Sodium Chloride}}{2NaCl(aq)} + \underset{\text{Water}}{H_2O(l)}$$

(iii) Action with metal hydroxides (Basic hydroxides) : Acids undergo neutralization reaction with basic hydroxides (metal hydroxides) to form salt and water (i.e. neutralisation reaction)

$$\underset{\text{Pot.Hydroxide}}{2KOH(aq)} + \underset{\text{Carbonic acid}}{H_2CO_3(aq)} \longrightarrow \underset{\text{Pot.Carbonate}}{K_2CO_3(aq)} + \underset{\text{Water}}{2H_2O(l)}$$

(iv) Action with metal carbonates and metal hydrogen carbonates : Acids react with carbonates and hydrogen carbonates to form their respective salts, water and carbondioxide gas.

$$\underset{\text{Zinc carbonate}}{ZnCO_3(s)} + \underset{\text{Sulphuric acid}}{H_2SO_4(aq)} \longrightarrow \underset{\text{Zinc sulphate}}{ZnSO_4(aq)} + \underset{\text{Water}}{H_2O(l)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$