CHAPTER 1

CHEMICAL REACTIONS AND EQUATIONS

CLASS 10TH

NCERT EXERCISE AND SOLUTIONS - SCIENCE

Q. 1. 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

ANSWER:-

The incorrect options are (i) (a), and (b).

(a) Oxygen is being removed.

(b) The oxygen removed from lead is transferred to the elemental carbon.

Q. 2. $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

The above reaction is an example of a

(a) Combination reaction.
(b) Double displacement reaction.
(c) Decomposit tion.
(d) Displacement reaction.

ANSWER:-

(d) displacement reaction.

The oxygen in ferrous oxide is transferred to aluminium metal, resulting in the formation of aluminium oxide. In this reaction, aluminium, being more reactive than iron, displaces iron from its oxide. This type of reaction is called a displacement reaction, where a more reactive element replaces a less reactive one.

Q. 3. What happens when dilute hydrochloric acid is added to iron fillings? Tick the correct answer.

(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.

ANSWER:-

(a) Hydrogen gas and iron chloride are produced. The reaction is as follows:

$Fe(s) + 2HCl(aq) \rightarrow FeCl_2(aq) + H_2\uparrow$

Q. 4. What is a balanced chemical equation? Why should chemical equations be balanced?

ANSWER:-

A balanced chemical equation contains an equal number of moles of each element in both the reactants and the products. Chemical equations must be balanced because, according to the law of conservation of mass, mass cannot be created or destroyed. Therefore, in a chemical reaction, the total mass of the reactants must be equal to the total mass of the products. Thus, a balanced chemical equation ensures that the total mass of the reactants is equal to the total mass of the products.

Q. 5. 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 sulphur 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.

ANSWER:-

(a) $3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$
(b) $2H_2S(g) + 3O_2(g) \rightarrow 2H_2O_{(l)} + 2SO_2(g)$
(c) $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 2AlCl_3(aq) + 3BaSO_4(s)$
(d) $2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$

Q. 6. 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) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$

ANSWER:-

(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) $BaCl_2+H_2SO_4 \rightarrow BaSO_4+2HCl$.

Q. 7. 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

ANSWER:-

(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) $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2KCl$

Q. 8. 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)

ANSWER:-

(a) $2KBr(aq) + BaI_2(aq) \rightarrow 2KI(aq) + BaBr_2(aq)$; Double displacement 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) $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$; Single displacement reaction

Q. 9. What does one mean by exothermic and endothermic reactions? Give examples.

ANSWER:-

Exothermic Reaction: These are reactions in which heat is released during the formation of new products. In exothermic reactions, the energy of the reactants is greater than that of the products, leading to the release of energy as the reaction progresses.

Energy of reactants > Energy of products

Example: The complete combustion of methane gas produces carbon dioxide and water, along with heat and light.

$$CH_4(g)+2O_2(g) \rightarrow CO_2(g)+2H_2O(l)+ \text{heat} + \text{light}$$

Other examples of exothermic reactions include respiration and the decomposition of vegetable matter.

Endothermic Reaction: These are reactions in which the reactants absorb energy to proceed with the reaction. In such reactions, the energy of the reactants is lower than that of the products, so energy is required and absorbed.

Energy of reactants < Energy of products

Example: The process of photosynthesis, where plants absorb sunlight in the presence of carbon dioxide and water to produce glucose and release oxygen.

Q. 10. Why is respiration considered an exothermic reaction? Explain.

ANSWER:-

Exothermic reactions are those in which heat is released. These reactions result in the release of energy because the energy of the reactants is greater than that of the products. Respiration is a process in which glucose from our body combines with oxygen in the cells to produce energy. The glucose is broken down during digestion, and along with oxygen, it generates energy. Therefore, respiration is an exothermic reaction. The reaction can be represented as follows:

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

Q. 11. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

ANSWER:-

A decomposition reaction involves a single reactant that breaks down into two or more simpler products.

Example: The decomposition of calcium carbonate results in calcium oxide and carbon dioxide:

$$CaCO_3 \rightarrow CaO + CO_2$$

A combination reaction involves two reactants that combine to form a single product.

Example: The combination of calcium oxide and carbon dioxide forms a single product, calcium carbonate:

$$CaO + CO_2 \rightarrow CaCO_3 + \text{energy}$$

Therefore, decomposition reactions are the reverse of combination reactions.

Q. 12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

ANSWER:-

Decomposition reactions are those in which a reactant breaks down into two or more products.

a. Decomposition by heat

Ferrous sulphate decomposes when heated to produce ferrous oxide, sulphur dioxide, and sulphur trioxide:

$$4FeSO_4 \rightarrow 2Fe_2O_3 + 3SO_2 + SO_3$$

b. Decomposition by light

Silver chloride decomposes when exposed to light, forming silver and chlorine:

$$2AgCl \rightarrow 2Ag + Cl_2$$

c. Decomposition by electricity

Water decomposes in the presence of electricity to produce hydrogen and oxygen gases:

$$2H_2O \rightarrow 2H_2 + O_2$$

Q. 13. What is the difference between displacement and double displacement reactions?

Write equations for these reactions.

ANSWER:-

A displacement reaction is a type of reaction where a more reactive element replaces a less reactive element in its compound. Elements higher up in the activity series can displace those lower down.

Example: Since zinc is more reactive than copper, it replaces copper from copper sulphate:

$$CuSO\ A_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$$

A double displacement reaction occurs when two compounds react, causing the exchange of positive and negative ions to form new compounds as products.

Example: When sodium sulphate solution is mixed with barium chloride solution, a white precipitate of barium sulphate is formed:

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

Q. 14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.

ANSWER:-

The equation for the recovery of silver from silver nitrate solution during silver refining is as follows:

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

In this reaction, copper displaces silver because copper is more reactive than silver.

Q. 15. What do you mean by a precipitation reaction? Explain by giving examples.

ANSWER:-

A precipitation reaction is a type of reaction in which an insoluble substance, known as a precipitate, is formed due to the exchange of ions between the reactants.

Example 1: When sodium carbonate solution is mixed with calcium chloride solution, a white precipitate of calcium carbonate forms:

$$Na_2CO_3(aq) + CaCl_2(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$$

Example 2: When sodium sulphate solution is mixed with barium chloride solution, a white precipitate of barium sulphate forms:

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

Q. 16. Explain the following in terms of gain or loss of oxygen with two examples each.

(a) Oxidation

(b) Reduction

ANSWER:-

(a) **Oxidation:** This is a type of reaction in which oxygen or an electronegative species is added to a substance, or hydrogen or a positive species is removed from it.

For example:

$$CO + H_2 \rightarrow CO_2 + H_2$$

(Addition of oxygen to H_2)

$$Cu + O_2 \rightarrow CuO$$

(Addition of oxygen to copper)

(b) **Reduction:** This is a type of reaction in which hydrogen or an electropositive species is added to a substance, or oxygen or an electronegative species is removed.

For example:

$$CO_2 + H_2 \rightarrow CO + H_2O$$

(Oxygen is removed from CO_2)

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

(Oxygen is removed from CuO)

Q. 17. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black coloured compound formed.

ANSWER:-

Copper (Cu) is represented as 'X' and the black-colored compound is copper (II) oxide (CuO). When copper reacts with oxygen, it forms the black compound copper (II) oxide, as shown by the following reaction:

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

Q. 18. Why do we apply paint on iron articles?

ANSWER:-

Iron is a reactive metal that can react with both moisture and air. When iron objects are exposed to moisture or air for extended periods, they can corrode and develop rust. To prevent rusting, paint is applied to iron items, creating a protective layer that shields them from exposure to air and moisture.

Q. 19. Oil and fat containing food items are flushed with nitrogen. Why?

ANSWER:-

Items containing oils and fats are perishable and can spoil when exposed to oxygen. This is because oils

and fats are reactive and easily undergo oxidation when they react with oxygen. To prevent this, these products are flushed with nitrogen gas. As nitrogen is an inert gas, it does not react with oils or fats easily. Therefore, food products containing oils and fats are stored in packets filled with nitrogen gas, which helps extend their shelf life and keeps them fresh for longer.

Q. 20. Explain the following terms with one example each.

(a) Corrosion

(b) Rancidity

ANSWER:-

(a) **Corrosion:** Corrosion is a process in which a substance, typically a metal, deteriorates and forms an oxide layer on its surface. Metals are transformed into their hydrated oxides or sulphides. For example, iron, copper, and silver can undergo corrosion.

Example:

Hydrated iron oxide:

$Fe_2O_3 \cdot 3H_2O \rightarrow Fe_2O_3 + 3H_2O$

(b) **Rancidity:** Rancidity is the process in which food items, particularly those containing fats and oils, undergo oxidation. This leads to a change in the taste and smell of the food, making it unpleasant. For instance, when fried food is exposed to air for too long, it becomes rancid due to altered taste and smell.

Rancidity can be prevented by:

- Adding antioxidants such as BHA (Butylated Hydroxy Anisole)
- Refrigerating food items
- Storing food in airtight containers
- Adding nitrogen to food packaging to prevent oxidation.