Chemical Reactions and Equations

CHAPTER 1

NCERT FOCUS

ANSWERS

Topic 1

1. Magnesium ribbon is cleaned before burning, so that coating of impurity (such as oxide) formed on its surface is removed and it becomes pure magnesium.

2. (a) $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$

(b) $3BaCl_{2(aq)} + Al_2(SO_4)_{3(aq)} \longrightarrow 3BaSO_{4(s)}\downarrow + 2AlCl_{3(aq)}$

(c) $2Na_{(s)} + 2H_2O_{(l)} \longrightarrow 2NaOH_{(aq)} + H_{2(g)}\uparrow$

3. (a) $BaCl_{2(aq)} + Na_2SO_{4(aq)} \longrightarrow BaSO_{4(s)}\downarrow + 2NaCl_{(aq)}$

(b) $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

4. (i) The substance '*X*' is calcium oxide (also called quick lime). Its formula is CaO.

(ii) $\underset{(X)}{CaO_{(s)}} + H_2O_{(l)} \longrightarrow \underset{\text{Calcium hydroxide}}{Ca(OH)_{2(aq)}}$

5. The chemical equation in which the number of atoms of each element on both the sides are equal is called a balanced equation.

A chemical equation should be balanced because there is no loss or gain of any matter during a chemical reaction, *i.e.*, the law of conservation of matter must hold good for the reaction.

6. (a) $H_{2(g)} + N_{2(g)} \longrightarrow NH_{3(g)}$

Balanced equation :

$3H_{2(g)} + N_{2(g)} \longrightarrow 2NH_{3(g)}$

(b) $H_2S_{(g)} + O_{2(g)} \longrightarrow H_2O_{(l)} + SO_{2(g)}$

Balanced equation :

$2H_2S_{(g)} + 3O_{2(g)} \longrightarrow 2H_2O_{(l)} + 2SO_{2(g)}$

(c) $BaCl_{2(aq)} + Al_2(SO_4)_{3(aq)} \longrightarrow AlCl_{3(aq)} + BaSO_{4(s)}\downarrow$

Balanced equation :

$3BaCl_{2(aq)} + Al_2(SO_4)_{3(aq)} \longrightarrow 2AlCl_{3(aq)} + 3BaSO_{4(s)}\downarrow$

(d) $K_{(s)} + H_2O_{(l)} \longrightarrow KOH_{(aq)} + H_{2(g)}$

Balanced equation :

$2K_{(s)} + 2H_2O_{(l)} \longrightarrow 2KOH_{(aq)} + H_{2(g)}$

7. (a) $2HNO_3 + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + 2H_2O$

(b) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

(c) $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$

(d) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

8. (a) $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

(b) $Zn + 2AgNO_3 \longrightarrow Zn(NO_3)_2 + 2Ag$

(c) $2Al + 3CuCl_2 \longrightarrow 2AlCl_3 + 3Cu$

(d) $BaCl_2 + K_2SO_4 \longrightarrow BaSO_4 + 2KCl$

9. The chemical reactions which occur with the evolution of heat are called exothermic reactions.

For example, $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} + \text{Heat}$

$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)} + \text{Heat}$

The chemical reactions which occur with the absorption of heat are called endothermic reactions. For example,

$N_{2(g)} + O_{2(g)} + \text{Heat} \longrightarrow 2NO_{(g)}$

$2NH_{3(g)} + \text{Heat} \longrightarrow N_{2(g)} + 3H_{2(g)}$

10. Rice, potatoes and bread contain carbohydrates. During digestion, these carbohydrates are broken down into simpler substances called glucose. This glucose combines with oxygen in the cells of our body and provides energy. The special name of this reaction is respiration. Thus, respiration is an exothermic process because energy is produced during this process.

$C_6H_{12}O_{6(aq)} + 6O_{2(g)} \longrightarrow 6CO_{2(g)} + 6H_2O_{(l)} + \text{Energy}$

Topic 2

1. (i) $4Na_{(s)} + O_{2(g)} \xrightarrow{\text{heat}} 2Na_2O_{(s)}$ (oxidation: Na; reduction: O_2)

Sodium is oxidised and O_2 is reduced.

(ii) $CuO_{(s)} + H_{2(g)} \xrightarrow{\text{heat}} Cu_{(s)} + H_2O_{(l)}$ (oxidation: H_2; reduction: CuO)

H_2 is oxidised and CuO is reduced.

2. (a) $2KBr_{(aq)} + BaI_{2(aq)} \longrightarrow 2KI_{(aq)} + BaBr_{2(s)}$ (Double displacement reaction)

(b) $ZnCO_{3(s)} \longrightarrow ZnO_{(s)} + CO_{2(g)}$ (Decomposition reaction)

(c) $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$ (Combination reaction)

(d) $Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$ (Displacement reaction)

3. The decomposition reactions are those in which a compound breaks up into two or more simpler substances. On the other hand, combination reactions are those in which two or more substances combine to form single substance.

Thus, the decomposition reactions are opposite of the combination reactions.

For example, decomposition reactions are :

$CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$

$2H_2O_{(l)} \xrightarrow{\text{Electricity}} 2H_{2(g)} + O_{2(g)}$

For example, combination reactions are :

$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$

$NH_{3(g)} + HCl_{(g)} \longrightarrow NH_4Cl_{(s)}$

4. Decomposition reaction involving absorption of heat :

$\underset{\text{Zinc carbonate}}{ZnCO_{3(s)}} \xrightarrow{\Delta} \underset{\text{Zinc oxide}}{ZnO_{(s)}} + \underset{\text{Carbon dioxide}}{CO_{2(g)}}$

Decomposition reaction involving absorption of light :

$\underset{\text{Hydrogen peroxide}}{2H_2O_{2(l)}} \xrightarrow{\text{Light}} \underset{\text{Water}}{2H_2O_{(l)}} + \underset{\text{Oxygen}}{O_{2(g)}}$

Decomposition reaction involving absorption of electrical energy :

$\underset{\text{Alumina}}{2Al_2O_{3(l)}} \xrightarrow{\text{Electric current}} \underset{\text{Aluminium}}{4Al_{(s)}} + \underset{\text{Oxygen}}{3O_{2(g)}}$

5. The chemical reactions in which one element displaces the another element from its compound is called displacement reaction.

For example : Zinc displaces copper from copper sulphate solution :

$Zn_{(s)} + CuSO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + Cu_{(s)}$

Double displacement reactions are those in which two compounds react to form two other compounds by mutual exchange of atoms or group of atoms. For example, in the reaction between barium chloride and sulphuric acid, barium chloride exchanges its Cl^- ions with SO_4^{2-} ions of H_2SO_4.

$BaCl_{2(aq)} + H_2SO_{4(aq)} \longrightarrow BaSO_{4(s)} + 2HCl_{(aq)}$

6. $2AgNO_{3(aq)} + Cu_{(s)} \longrightarrow 2Ag_{(s)} + Cu(NO_3)_{2(aq)}$

7. The reaction in which precipitates are formed are called precipitation reactions. For example,

$2AgNO_{3(s)} + BaCl_{2(aq)} \longrightarrow \underset{\text{ppt.}}{2AgCl_{(s)}} + Ba(NO_3)_{2(aq)}$

$Na_2SO_{4(aq)} + BaCl_{2(aq)} \longrightarrow \underset{\text{ppt.}}{BaSO_{4(s)}} + 2NaCl_{(aq)}$

8. (a) Oxidation is a reaction which involves addition or gain of oxygen. For example,

$4Na + O_2 \longrightarrow 2Na_2O$; $2Cu + O_2 \xrightarrow{\text{Heat}} 2CuO$

(b) Reduction is a reaction which involves loss or removal of oxygen. For example,

$\overset{\text{Reduction}}{\overbrace{CuO + H_2 \xrightarrow{\text{Heat}} Cu + H_2O}}$; $\overset{\text{Reduction}}{\overbrace{ZnO + C \longrightarrow Zn + CO}}$

9. The element *X* is copper, Cu.

Black coloured coating is of copper oxide, CuO.

$\underset{\substack{\text{Copper}\\(X)}}{2Cu_{(s)}} + \underset{\substack{\text{Oxygen}\\\text{(from air)}}}{O_{2(g)}} \xrightarrow{\Delta} \underset{\substack{\text{Copper(II) oxide}\\\text{(Black)}}}{2CuO_{(s)}}$

10. We apply paint on iron articles so as to prevent it from rusting. When the surface of iron is coated with paint, its surface does not come in contact with oxygen and moisture, therefore, rusting does not take place.

11. Oil and fats containing articles are flushed with nitrogen to prevent them from getting oxidised. This will protect them from becoming rancid.

12. (a) **Corrosion :** It is a process of deterioration of metals as a result of its reaction with air or water present in environment. Therefore, when metals are exposed to atmosphere, they react with air or water present in the environment and form undesirable compounds on their surfaces. This process is called corrosion. Almost all metals except noble metals such as gold, platinum and palladium get corroded. For example, when iron is exposed to moisture for a long time, its surface acquires a brown flaky substance called rust. Similarly, surface of copper acquires a green coating of basic copper carbonate, etc.

(b) **Rancidity :** When fats and oils are exposed to air, they get oxidised and become rancid and their smell and colour change. This phenomenon is called rancidity. To prevent rancidity of food materials containing fats and oils, certain substances (called antioxidants) are added which prevent oxidation and hence rancidity. Some food materials are stored in air tight containers or the bags containing the food materials (such as chips) are flushed with inert gas such as nitrogen to prevent them from getting oxidised.

13. (a) $Pb_3O_4 + 8HCl \longrightarrow 3PbCl_2 + Cl_2 + 4H_2O$

Pb_3O_4 is an oxidising agent. It oxidises HCl to Cl_2.

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

O_2 an is an oxidising agent. It oxidises Mg to MgO.

(c) $CuSO_4 + Zn \longrightarrow Cu + ZnSO_4$

$CuSO_4$ is an oxidising agent. It oxidises Zn to $ZnSO_4$.

(d) $V_2O_5 + 5Ca \longrightarrow 2V + 5CaO$

V_2O_5 is an oxidising agent. It oxidises Ca to CaO.

(e) $3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

H_2O acts as an oxidising agent. It oxidises Fe to Fe_3O_4.

(f) $CuO + H_2 \longrightarrow Cu + H_2O$

CuO acts as oxidising agent. It oxidises H_2 to H_2O.

14. (a) $N_{2(g)} + 3H_{2(g)} \xrightarrow[773\ K]{\text{catalyst}} 2NH_{3(g)}$

(Combination reaction)

(b) $NaOH_{(aq)} + CH_3COOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

(Double displacement reaction/Neutralisation reaction)

(c) $C_2H_5OH_{(l)} + CH_3COOH_{(l)} \xrightarrow{H^+} CH_3COOC_2H_{5(l)} + H_2O_{(l)}$

(Double displacement reaction)

(d) $C_2H_{4(g)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 2H_2O_{(g)}$ + heat + light

(Redox reaction/combustion reaction/ exothermic reaction)

15. The reaction between copper(II) sulphate and iron is represented as

$\underset{\text{Blue}}{CuSO_{4(aq)}} + \underset{\text{Grey}}{Fe_{(s)}} \longrightarrow \underset{\text{Light green}}{FeSO_{4(aq)}} + \underset{\text{Brown}}{Cu_{(s)}}$

In this displacement reaction, a more reactive element iron displaces less reactive element from its compound copper(II) sulphate. The brown copper metal gets deposited on the iron nails. The colour of the solution changes from blue to light green due to the formation of Fe^{2+} ions.

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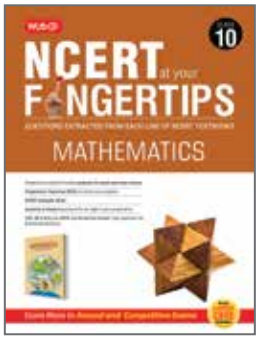

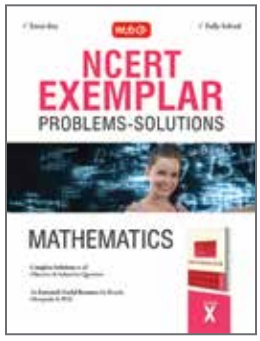

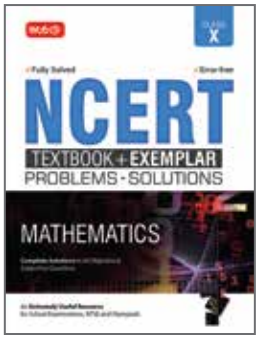

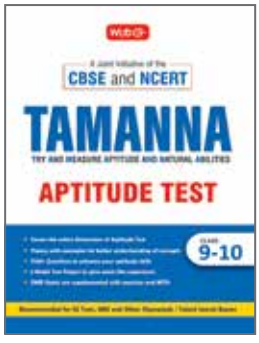

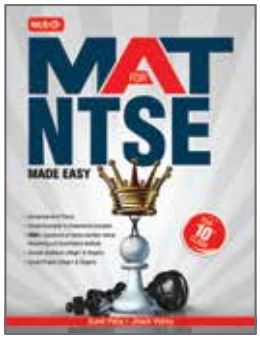

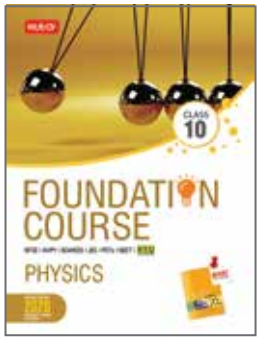

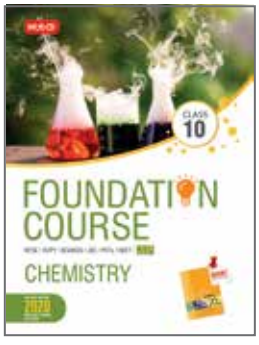

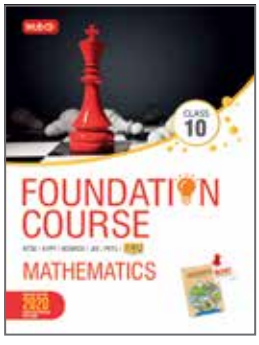

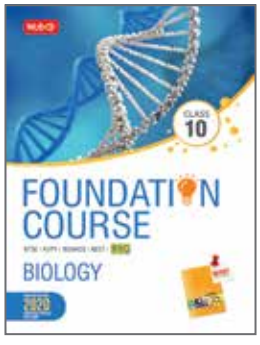

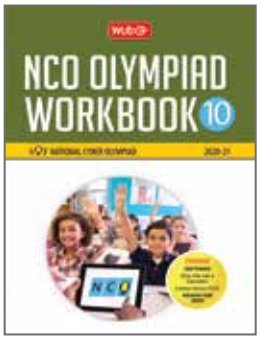

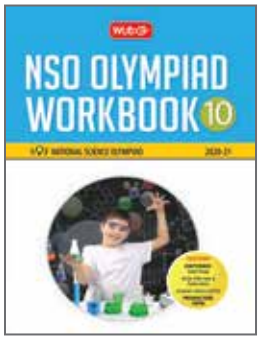

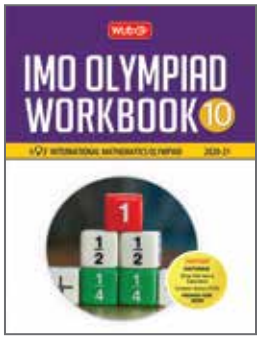

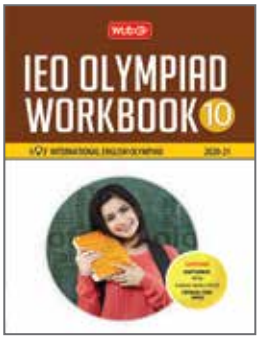

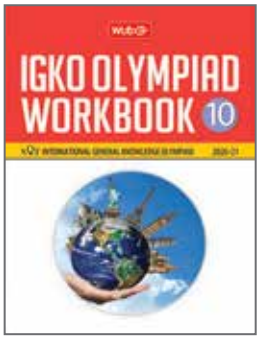

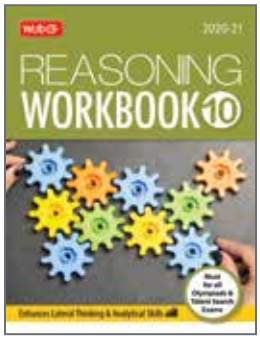

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