

# Chemical Reactions and Equations

## ***Solved Intext Exercises***

**Q1. Why should a magnesium ribbon be cleaned before burning in air?**

**Sol.** Magnesium ribbon should be cleaned before burning in air to remove the dust and layer of magnesium oxide formed on it.

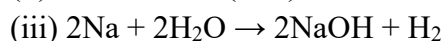
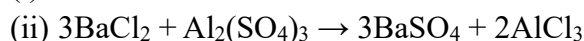
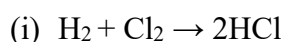
**Q2. Write the balanced equation for the following chemical reactions:**

(i) **Hydrogen + Chlorine → Hydrogen Chloride**

(ii) **Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride**

(iii) **Sodium + Water → Sodium hydroxide + Hydrogen**

**Sol.**

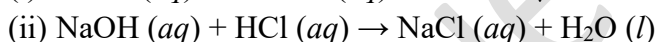
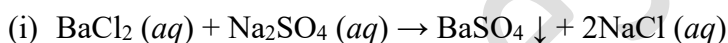


**Q3. Write a balanced chemical equation with state symbols for the following reactions:**

(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.**

**Sol.**



**Q4. 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.**

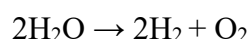
**Sol.**

(i) Calcium oxide (quick lime),  $\text{CaO}$



**Q5. 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.**

**Sol.** When water is decomposed in activity 1.7, hydrogen and oxygen gas is formed.



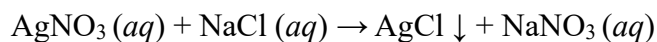
Then according to law of conservation of mass when two molecules of water decompose then 2 molecules of hydrogen gas and one molecule of oxygen gas is produced. Thus the amount of hydrogen gas produced is double the amount of oxygen produced. Hence the amount of hydrogen gas is double in one of the tubes.

**Q6. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?**

**Sol.** The blue colour of copper sulphate solution changes because iron is above copper in the reactivity series. Hence it displaces copper from its solution of copper sulphate and iron sulphate is formed which is green in colour.

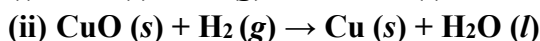
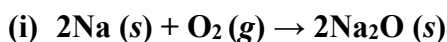
**Q7. Give an example of a double displacement reaction other than the one given in the Activity 1.10.**

**Sol.**



When silver nitrate solution is added to sodium chloride solution, the white precipitate of silver chloride is formed instantaneously. This is a double displacement reaction.

**Q8. Identify the substances that are oxidised and the substances that are reduced in the following reactions:**



**Sol.**

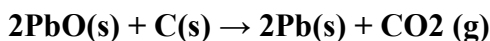
(i) Na is oxidised to  $\text{Na}_2\text{O}$ .

(ii) CuO is reduced to Cu

$\text{H}_2$  is oxidised to  $\text{H}_2\text{O}$ .

### ***Solved NCERT Exercises***

**Q1. Which of the statements about the reaction below are incorrect?**



(a) Lead is getting reduced.

(b) Carbon dioxide is getting oxidised.

(b) 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)



The above reaction is an example of a

(a) combination reaction

(b) double displacement reaction.

(c) decomposition reaction.

(d) displacement reaction.

**Sol.** (d) displacement reaction.

**Q3. 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.

**Sol.** (a) Hydrogen gas and iron chloride are produced

**Q4. What is a balanced chemical equation? Why should chemical equations be balanced?**

**Sol.** A balanced equation has an equal number of atoms of different elements in the reactants and products. The chemical equations are balanced to satisfy the law of conservation of mass in chemical reactions since matter can neither be created nor destroyed in a chemical reaction.

**Q5. 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.

**Sol.**

- (a)  $\text{H}_2 (\text{g}) + \text{N}_2 (\text{g}) \rightarrow \text{NH}_3 (\text{g})$   
 $3\text{H}_2 (\text{g}) + \text{N}_2 (\text{g}) \rightarrow 2\text{NH}_3 (\text{g})$
- (b)  $\text{H}_2\text{S} (\text{g}) + \text{O}_2 (\text{g}) \rightarrow \text{SO}_2 + \text{H}_2\text{O}$   
 $2\text{H}_2\text{S} (\text{g}) + 3\text{O}_2 (\text{g}) \rightarrow 2\text{SO}_2 + 2\text{H}_2\text{O}$
- (c)  $\text{BaCl}_2 (\text{aq}) + \text{Al}_2(\text{SO}_4)_3 (\text{aq}) \rightarrow \text{BaSO}_4 \downarrow + \text{AlCl}_3 (\text{aq})$   
 $3\text{BaCl}_2 (\text{aq}) + \text{Al}_2(\text{SO}_4)_3 (\text{aq}) \rightarrow 3\text{BaSO}_4 \downarrow + 2\text{AlCl}_3 (\text{aq})$
- (d)  $\text{K} (\text{s}) + \text{H}_2\text{O} \rightarrow \text{KOH} (\text{aq}) + \text{H}_2 \uparrow$   
 $2\text{K} (\text{s}) + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} (\text{aq}) + \text{H}_2 \uparrow$

**Q6. Balance the following chemical equations.**

- (a)  $\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- (b)  $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
- (c)  $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
- (d)  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{HCl}$

**Sol.**

- (a)  $2\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
- (b)  $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
- (c)  $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
- (d)  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$

**Q7. Write the balanced chemical equations for the following reactions.**

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

**Sol.**

- (a)  $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
- (b)  $\text{Zn} + \text{AgNO}_3 \rightarrow \text{Zn(NO}_3)_2 + \text{Ag}$   
 $\text{Zn} + 2\text{AgNO}_3 \rightarrow \text{Zn(NO}_3)_2 + 2\text{Ag}$
- (c)  $\text{Al} + \text{CuCl}_2 \rightarrow \text{AlCl}_3 + \text{Cu}$   
 $2\text{Al} + 3\text{CuCl}_2 \rightarrow 2\text{AlCl}_3 + 3\text{Cu}$
- (d)  $\text{BaCl}_2 + \text{K}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{KCl}$   
 $\text{BaCl}_2 + \text{K}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{KCl}$

**Q8. Write the balanced chemical equation for the following and identify the type of reaction in each case.**

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

**Sol.**

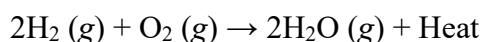
- (a)  $\text{KBr (aq)} + \text{BaI}_2 \text{ (aq)} \rightarrow \text{KI (aq)} + \text{BaBr}_2 \text{ (s)}$   
 $2\text{KBr (aq)} + \text{BaI}_2 \text{ (aq)} \rightarrow 2\text{KI (aq)} + \text{BaBr}_2 \text{ (s)}$   
It is double displacement reaction.
- (b)  $\text{ZnCO}_3 \text{ (s)} \rightarrow \text{ZnO (s)} + \text{CO}_2 \text{ (g)}$   
It is decomposition reaction.
- (c)  $\text{H}_2 \text{ (g)} + \text{Cl}_2 \text{ (g)} \rightarrow \text{HCl (g)}$   
 $\text{H}_2 \text{ (g)} + \text{Cl}_2 \text{ (g)} \rightarrow 2\text{HCl (g)}$   
It is combination reaction.
- (d)  $\text{Mg (s)} + \text{HCl (aq)} \rightarrow \text{MgCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$   
 $\text{Mg (s)} + 2\text{HCl (aq)} \rightarrow \text{MgCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$   
It is displacement reaction.

**Q9. What does one mean by exothermic and endothermic reactions? Give examples.**

**Sol.**

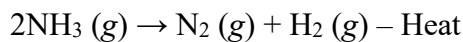
**Exothermic reactions:** The chemical reactions which occur with the evolution of heat are called exothermic reactions. i.e. Reactants  $\rightarrow$  Products + Heat

e.g.  $\text{C (s)} + \text{O}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (g)} + \text{Heat}$



**Endothermic reactions:** The chemical reactions which occur with the absorption of heat are called endothermic reactions. i.e. Reactants  $\rightarrow$  Products – Heat or Reactants + Heat  $\rightarrow$  Products

e.g.  $\text{N}_2 \text{ (g)} + \text{O}_2 \text{ (g)} \rightarrow 2\text{NO (g)} - \text{Heat}$

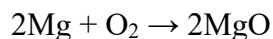


**Q10. Why is respiration considered an exothermic reaction? Explain.**

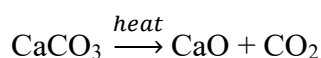
**Sol.** Respiration is considered an exothermic reaction because in this reaction glucose produced by digestion of food combines with oxygen in the cells of our body and produces energy.

**Q11. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.**

**Sol.** Decomposition reactions are called the opposite of combination reactions because in a combination reaction, two or more substances simply combine to form a new substance, e.g. magnesium combines with oxygen to give magnesium oxide.



In a decomposition reaction, a single compound breaks down to produce two or more simpler substances, e.g. calcium carbonate on heating decomposes to calcium oxide and carbon dioxide.



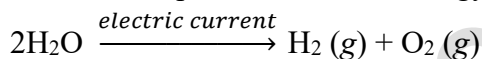
**Q12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.**

**Sol.**

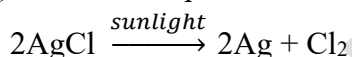
(i) In the decomposition of calcium carbonate energy is supplied in the form of heat.



(ii) In the decomposition of water energy is supplied in the form of electricity.

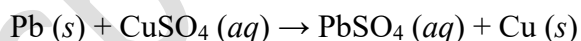


(iii) In the decomposition of silver chloride energy is supplied in the form of light.



**Q13. What is the difference between displacement and double displacement reactions? Write equations for these reactions.**

**Sol. Displacement reactions.** In these reactions, a more active element displacement or removes another element from a compound,

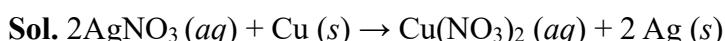


**Double displacement reaction.** In this reaction two different atoms or group of atoms are displaced by other atoms/group of atoms,



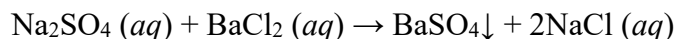
Here,  $\text{SO}_4^{2-}$  ions displace  $\text{Cl}^-$  ion and vice versa.

**Q14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.**



**Q15. What do you mean by a precipitation reaction? Explain by giving examples.**

**Sol.** Precipitation reactions are those reactions in which precipitates are formed by mixing two compounds.



On mixing solution of sodium sulphate and barium chloride, a precipitate of barium sulphate is formed.

**Q16. Explain the following in terms of gain or loss of oxygen with two examples each.**

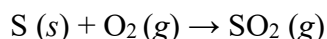
**(a) Oxidation**

**(b) Reduction**

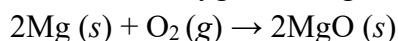
**Sol.**

**(a) Oxidation.** It is the process in which oxygen is added up.

(i) Addition of oxygen to sulphur gives sulphur dioxide

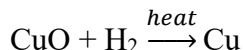


(ii) Addition of oxygen to magnesium gives magnesium oxide



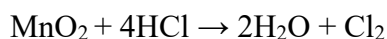
**(b) Reduction.** It is the process in which oxygen is removed.

(i) In the reaction



Copper (II) oxide loses oxygen and is reduced to copper.

(ii) In the reaction



MnO<sub>2</sub> is reduced to MnCl<sub>2</sub>

**Q17. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black coloured compound formed.**

**Sol.** Element 'X' is copper (Cu). Black coloured compound is Copper (II) oxide (CuO).

**Q18. Why do we apply paint on iron articles?**

**Sol.** Iron articles are prevented from rusting by applying paint on them. Rusting weakens the iron articles.

**Q19. Oil and fat containing food items are flushed with nitrogen. Why?**

**Sol.** To prevent oxidation of oil and fat containing food items, we flush them with nitrogen. Fats and oil become rancid and their smell and taste change when they oxidised.

**Q20. Explain the following terms with one example each.**

**(a) Corrosion**

**(b) Rancidity**

**Sol.**

**(a) Corrosion.** When the surface of a metal is attacked by air, water or any other substance around it, it is said to corrode and the effect is known as corrosion. Example. Iron gets rusted. Rust is mainly hydrated Iron (III) oxide  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ . Rusting weakens the structure of iron bodies. Corrosion of iron is a serious problem as every year enormous amount of money is spend to replace damaged iron.

**(b) Rancidity.** When fats and oils are oxidised, they become rancid and their smell and taste change. Oxidation of fats and oils can be prevented by adding antioxidants or keeping the food in air-tight

containers or flushing them with nitrogen. Example. Bags of potato chips are flushed with nitrogen to prevent them from getting oxidised.

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