

# Chemical reactions and Equations

## Exercise 1 Chapter 1 Chemical reactions and Equations

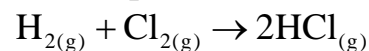
### 1. Why should a magnesium ribbon be cleaned before burning in air?

**Ans:** Magnesium is a kind of a reactive metal. It will react with oxygen and form a white layer of magnesium oxide (MgO) on its surface. Magnesium oxide is a stable compound and will prevent the further reaction of the metal. So, a magnesium ribbon is cleaned before burning in air to remove the layer of magnesium oxide from its surface.

### 2. Write the balanced equation for the following chemical reactions.

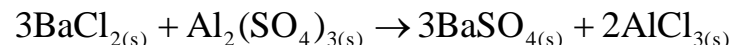
#### (i) Hydrogen + Chlorine → Hydrogen chloride

**Ans:** A balanced equation consists of the same number of moles on the reactants and the products side. The balanced equation for the given reaction is:



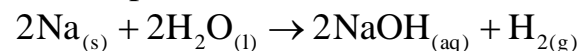
#### (ii) Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride

**Ans:** A balanced equation consists of the same number of moles on the reactants and the products side. The balanced equation for the given reaction is:



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

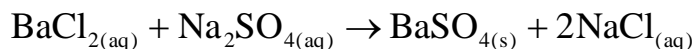
**Ans:** A balanced equation consists of the same number of moles on the reactants and the products side. The balanced equations for the given reaction is:



### 3. Write a balanced chemical equation with state symbols for the following reactions.

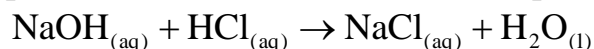
(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.

**Ans:** A balanced chemical equation has the same number of moles of reactants and products. The balanced chemical equation is:



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

**Ans:** A balanced chemical equation has the same number of moles of reactants and products. The balanced chemical equation is:



## **Exercise 2**

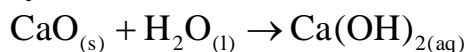
**1.A solution of a substance 'X ' is used for white washing.**

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

**Ans:** Substance ‘X’ is calcium oxide also known as quicklime that is used in white washing. Its chemical formula is CaO.

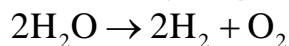
**(ii)Write the reaction of the substance 'X' named in (i) above with water.**

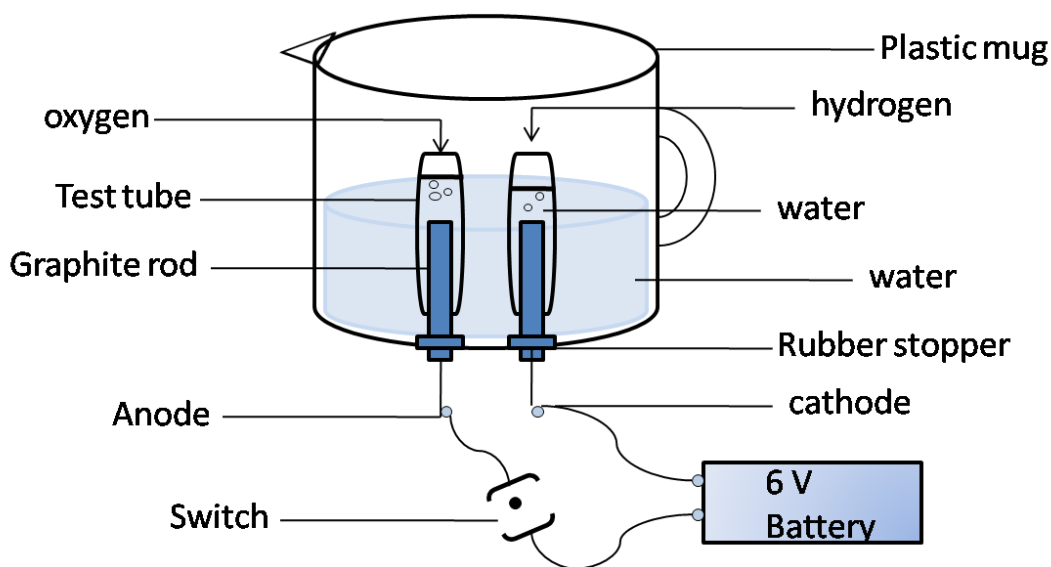
**Ans:** Calcium oxide reacts with water in a combination reaction to form calcium hydroxide also called slaked lime, the reaction is:



**2.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 consists of hydrogen and oxygen atoms. It is a combination of two hydrogen and one oxygen atom. In electrolysis, hydrogen moves towards the cathode and oxygen towards the anode. So, the ratio of hydrogen and oxygen is 2:1. And hydrogen is double the amount of oxygen.

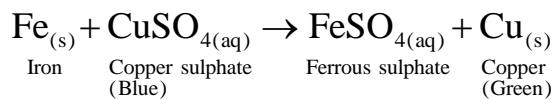




### Exercise 3

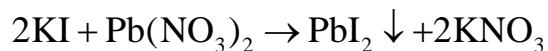
**1. Why does the color of copper sulphate solution change when an iron nail is dipped in it?**

**Ans:** When an iron nail is dipped in a solution of copper sulphate, then the more reactive metal displaces the less reactive metal. As a result the blue solution of copper sulphate gets faded and forms a green compound known as ferrous sulphate.

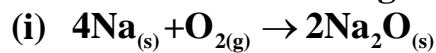


**2. Give an example of a double displacement reaction other than the one given in Activity 1.10.**

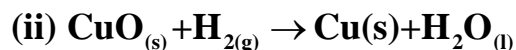
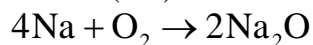
**Ans:** A double displacement reaction consists of two ions replacing each other's position from the reactants to form new compounds in the products. A double displacement reaction occurs when Potassium iodide reacts with lead nitrate to form lead iodide (yellow precipitate) and potassium nitrate.



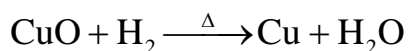
**3. Identify the substances that are oxidised and the substances that are reduced in the following reactions**



**Ans:** Any species is said to be oxidised when it loses electrons and increases the oxidation state, while any species is said to be reduced when it gains electrons and decreases the oxidation state. Sodium (Na) is oxidised and oxygen gets reduced.

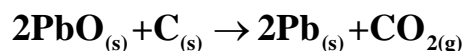


**Ans:** Any species is said to be oxidised when it loses electrons and increases the oxidation state, while any species is said to be reduced when it gains electrons and decreases the oxidation state. Copper oxide (CuO) is reduced to copper (Cu) as it loses oxygen and hydrogen ( $\text{H}_2$ ) is oxidized to water ( $\text{H}_2\text{O}$ )



### NCERT Exercises

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



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

**Options**

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

**Ans:** Incorrect option is (i) (a) and (b)



**The above reaction is an example of a \_\_\_\_\_**

**Options:**

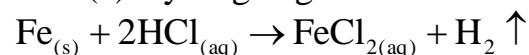
- (a)Combination reaction.
- (b)Double displacement reaction.
- (c)Decomposition reaction.
- (d)Displacement reaction.

**Ans:(d)** The given reaction is an example of a single displacement reaction.

**3.What happens when dilute hydrochloric acid is added to iron filings? 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.**

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



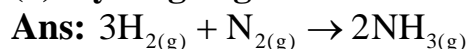
**4.What is a balanced chemical equation? Why should chemical equations be balanced?**

**Ans:** A balanced chemical equation consists of the equal number of moles of the elements in the reactants and that in the products.

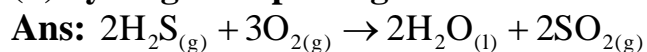
Chemical equations should be balanced, as according to the law of conservation of mass, mass can neither be created nor can be destroyed. Therefore, in a chemical reaction, the total mass of reactant should be equal to the total mass of products. Hence, a balanced chemical equation has total mass of reactants equal to total mass of products.

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

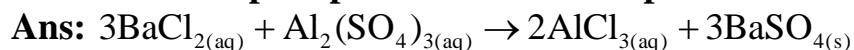
**(a) Hydrogen gas combines with nitrogen to form ammonia.**



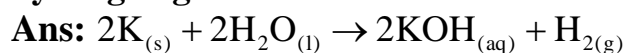
**(b)Hydrogen sulphide gas burns in air to give water and sulphur dioxide.**



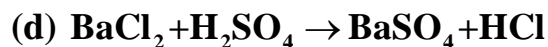
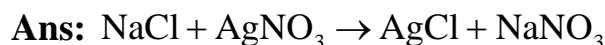
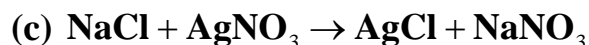
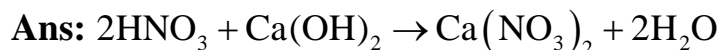
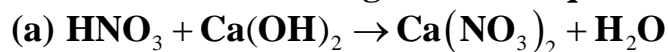
**(c)Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.**



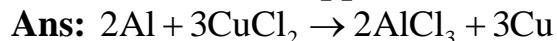
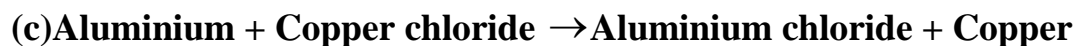
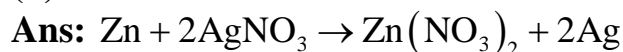
**(d)Potassium metal reacts with water to give potassium hydroxide and hydrogen gas**



**6. Balance the following chemical equation**



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



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



**(c)Hydrogen (g)+ Chlorine (g)→Hydrogen chloride (g)**

**Ans:**  $\text{H}_{2(g)} + \text{Cl}_{2(g)} \rightarrow 2\text{HCl}_{(g)}$ ; Combination reaction

**(d)Magnesium (s) + Hydrochloric acid (aq) →Magnesium chloride (aq) + Hydrogen (g)**

**Ans:**  $\text{Mg}_{(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{MgCl}_{2(aq)} + \text{H}_{2(g)}$ ; Single displacement reaction

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

**Ans:** Exothermic Reaction: The reactions in which heat is evolved along with the formation of new products are called exothermic reactions. In these reactions the energy of the reactants is more than that of the products, so energy is released to complete the reaction.

Energy of reactants > Energy of products

Example: Complete combustion of methane gas produces carbon dioxide and water along with heat and light.  $\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{heat} + \text{light}$

Another example of exothermic reactions is respiration and decomposition of vegetable matter. Endothermic Reaction: The reactions in which energy is absorbed by the reactants to carry on the reaction are called endothermic reactions. In this type of reactions, the energy of the reactants is less than that of the products, so energy is needed and absorbed.

Energy of reactants <Energy of products

Example: Process of Photosynthesis, where plants absorb sunlight in the presence of carbon dioxide and water and make their food in the form of glucose and release oxygen.  $6\text{CO}_{2(g)} + 6\text{H}_2\text{O}_{(l)} \xrightarrow{\text{sunlight}} \text{C}_6\text{H}_{12}\text{O}_{4(aq)} + 6\text{O}_{2(g)}$

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

**Ans:**Exothermic reactions are the reactions in which heat is going to be released. These reactions result in the formation of energy as the energy of reactants is greater than that of products. Respiration is the process in which the glucose from our body combines with oxygen in the cells to provide us with energy. The glucose is broken down through the process of digestion that along with oxygen provides us with energy and hence respiration is an exothermic reaction. The reaction that happens is as follows:  $\text{C}_6\text{H}_{12}\text{O}_{6(aq)} + 6\text{O}_{2(g)} \rightarrow 6\text{CO}_{2(g)} + 6\text{H}_2\text{O}_{(l)} + \text{energy}$

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

**Ans:** A decomposition reaction consists of a single reactant that breaks down into two or more simpler products.

Example: Decomposition of calcium carbonate to give calcium oxide and carbon dioxide as,  $\text{CaCO}_3 + \text{Energy} \rightarrow \text{CaO} + \text{CO}_2$

A combination reaction consists of two reactants that combine or mix together to form a single product.

Example: Combination of Calcium oxide and carbon dioxide to form one single product calcium carbonate  $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{energy}$

Hence, decomposition reactions are the opposite of combination reactions.

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

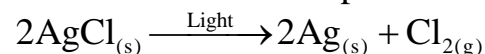
**Ans:** Decomposition reactions are the reactions where a reactant breaks down into two or more products.

(a) Decomposition by heat:

Ferrous sulphate decomposes to give ferrous oxide, sulphur dioxide and sulphur trioxide as,  $2\text{FeSO}_{4(s)} \xrightarrow{\Delta} \text{Fe}_2\text{O}_{3(s)} + \text{SO}_{2(g)} + \text{SO}_{3(g)}$

(b) Decomposition by light:

Silver chloride decomposes in light to form silver and chlorine as,



(c) Decomposition by electricity:

Water decomposes in presence of electricity to form hydrogen and oxygen gases as,  $2\text{H}_2\text{O} \xrightarrow{\text{Electricity}} 2\text{H}_2 + \text{O}_2$

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

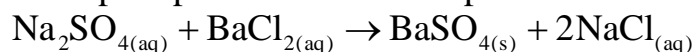
**Ans:** A displacement reaction is a reaction in which a more reactive element displaces a less reactive element from its compound. The elements at the top in the activity series can replace the elements at the bottom.

Example: Zinc is more reactive than copper and replaces copper from copper sulphate as:  $\text{CuSO}_{4(aq)} + \text{Zn}_{(s)} \rightarrow \text{ZnSO}_{4(aq)} + \text{Cu}_{(s)}$



Double displacement reaction is the type of reaction where two compounds react in the way that there is exchange of positive and negative ions and new compounds are formed as products.

Example: On mixing sodium sulphate solution with barium chloride solution, a white precipitate of barium sulphate is formed as



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

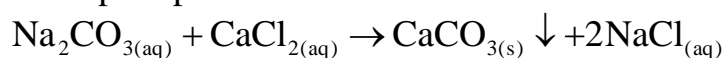
**Ans:** The equation of recovery of silver from silver nitrate solution in silver refining is as follows:  $2\text{AgNO}_{3(\text{aq})} + \text{Cu}_{(\text{s})} \rightarrow \text{Cu}(\text{NO}_3)_{2(\text{aq})} + 2\text{Ag}_{(\text{s})}$

Here displacement of silver by copper happens as copper is more reactive than silver.

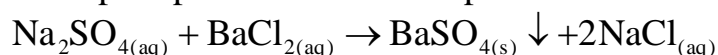
**15. What do you mean by a precipitation reaction? Explain by giving examples.**

**Ans:** The type of reaction where an insoluble substance called a precipitate is formed when there is exchange of ions between the reactants is called a precipitation reaction.

Example 1: On mixing sodium carbonate solution with calcium chloride solution, a white precipitate of calcium carbonate is formed.



Example 2: On mixing sodium sulphate solution with barium chloride solution, a white precipitate of barium sulphate is formed.

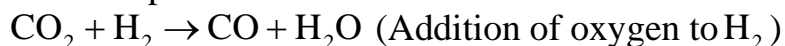


**16. Explain the following in terms of gain or loss of oxygen with two examples each.**

**(a) Oxidation**

**Ans:** Oxidation: A type of reaction in which oxygen or an electronegative species is added to a substance or there is removal of hydrogen or a positive species from a substance is called oxidation.

For example:



**(b)Reduction**

**Ans:** Reduction: A type of reaction in which hydrogen or an electropositive species is added to a substance or oxygen or an electronegative species is removed, is called reduction.

For example:



**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.**

**Ans:** Copper (Cu) is ‘X’ and the black colour compound is copper (II) oxide (CuO). Copper reacts with oxygen to form a black colour compound called copper (II) oxide as:  $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$

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

**Ans:** Iron is a reactive metal and can react with moisture and air. Iron articles, if exposed for a long time in moisture or air, can get corroded and form rust. So, paint is applied on iron articles to prevent rusting and form a protective layer for exposure to air and moisture.

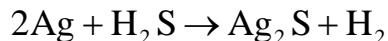
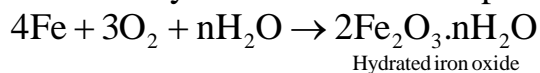
**19.Oil and fat containing food items are flushed with nitrogen. Why?**

**Ans:** Oils and fat containing items are perishable and can be spoiled when exposed to oxygen. This is because oil and fats are reactive and can react with oxygen easily and get oxidised. To prevent oxidation, these items are flushed with nitrogen gas. Nitrogen is an inert gas and cannot react with oils or fats easily. So, food items with oils and fats are kept in packets having nitrogen gas that increases the shelf life and makes these items last for a long time.

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

**(a) Corrosion**

**Ans:** Corrosion: Corrosion is defined as a process where a substance, generally metal deteriorates and forms a layer of oxide on its surface. Metals get converted into their hydrated oxides or sulphides. Ex; Iron, Cu, Ag



**(b)Rancidity**

**Ans:** Rancidity: It is a process in which food items like fats and oils are oxidised. This results in the change in taste and smell of the food item and is called rancidity. For example, when any fried food is exposed to air for a long time then it has a change in smell and taste and it becomes rancid.

Rancidity can be avoided by:

- Adding antioxidants like BHA (Butylated tri hydroxy anisole)
- Refrigerate the food items
- keep food items in airtight containers
- Adding nitrogen to food packets to prevent oxidation.