

<b>CLASS- X</b>	<b>SUBJECT- CHEMISTRY</b>
<b>TOPIC- Chap. 1 Chemical equations and balancing of equations.</b>	<b>Prepared by – Rubina Sarkar</b>

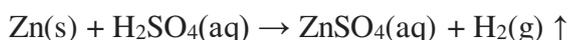
The transformation of chemical substance into another chemical substance is known as Chemical Reaction. For example: Rusting of iron, the setting of milk into curd, digestion of food, respiration, etc.

In a chemical reaction, a new substance is formed which is completely different in properties from the original substance, so in a chemical reaction, a chemical change takes place. Only a rearrangement of atoms takes place in a chemical reaction.

- The substances which take part in a chemical reaction are called reactants.
- The new substances produced as a result of a chemical reaction are called products.

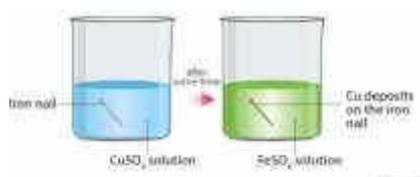
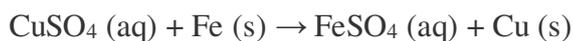
### Characteristics of Chemical Reactions:

**(i) Evolution of gas:** The chemical reaction between zinc and dilute sulphuric acid is characterised by the evolution of hydrogen gas.

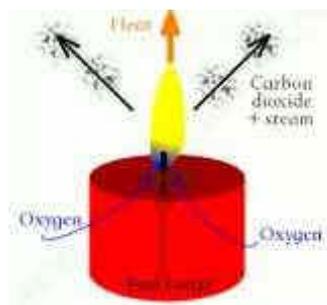


**ii) Change in Colour:** When an iron nail immersed in the solution of copper sulphate than iron displaces copper from the solution of copper sulphate because iron is more reactive than copper. Therefore, copper sulphate solution colour changes from blue to pale green.

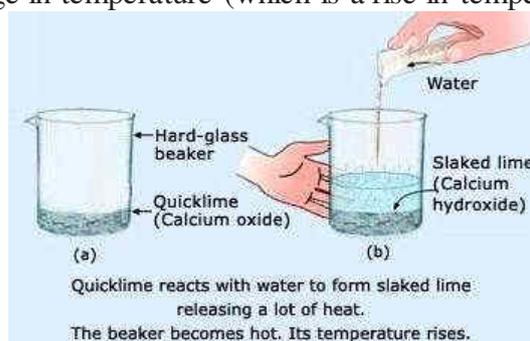
### Reaction



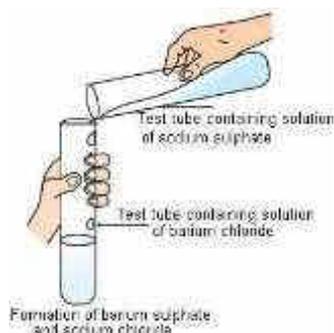
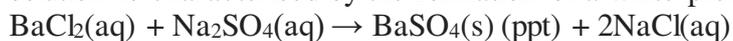
**(iii) Change in state of substance:** The combustion reaction of candle wax is characterised by a change in state from solid to liquid and gas (because the wax is a solid, water formed by the combustion of wax is a liquid at room temperature whereas, carbon dioxide produced by the combustion of wax is a gas).



(iv) **Change in temperature:** The chemical reaction between quick lime water to form slaked lime is characterized by a change in temperature (which is a rise in temperature).



(v) **Formation of precipitate:** The chemical reaction between sodium sulphate and barium chloride solution is characterised by the formation of a white precipitate of barium sulphate.



**Chemical Equation:** The representation of chemical reaction by means of symbols of substances in the form of formulae is called chemical equation. E.g. -  $\text{H}_2 + \text{O}_2 \Rightarrow \text{H}_2\text{O}$

**4. Balanced Chemical Equation:** A balanced chemical equation has number atoms of each element equal on both left and right sides of the reaction.

\*Note- According to Law of Conservation of Mass, mass can neither be created nor destroyed in a chemical reaction. To obey this law, the total mass of elements present in reactants must be equal to the total mass of elements present in products.

Steps of Balancing a Chemical Equation

1. Identify each element found in the equation. The number of atoms of each type of atom must be the same on each side of the equation once it has been balanced.
2. What is the net charge on each side of the equation? The net charge must be the same on each side of the equation once it has been balanced.
3. If possible, start with an element found in one compound on each side of the equation. Change the coefficients (the numbers in front of the compound or molecule) so that the number of

atoms of the element is the same on each side of the equation. Remember, to balance an equation, you change the coefficients, not the subscripts in the formulas.

- Once you have balanced one element, do the same thing with another element. Proceed until all elements have been balanced. It's easiest to leave elements found in pure form for last.
- Check your work to make certain the charge on both sides of the equation is also balanced.

Balancing the equation,  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$  **step by step.**

**Step :1**

a) Write the equation with the correct chemical formulae for each reactant and product.

Eg : In the reaction of hydrogen with oxygen to yield water. You can write chemical equation as follows :  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$

**Step : 2** a) After writing the molecule formulae of the substances the equation is to be balanced.

b) We should put suitable numbers as the coefficients before the formula to balance the total number of atoms on both sides of an arrow mark.

c) For this we should not change the ratio of atom in the molecule of a substance i.e., subscript of atom.

Eg : 2 Should be added before molecular formula of hydrogen and another 2 should be added before water molecule.  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

d) Therefore the equation is balanced.

**Step :3**

a) Check whether all the coefficients of the substances has a common factor.

b) If so, divide those by common factor to obtain lowest ratio of the substances.

Eg : In the above balanced equation  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ , no common factor of the coefficients.

c) Hence no need to divide.

**Step : 4**

a) Verify the equation for the balancing of atoms on both sides of the equation.

Eg : In the above equation number of atoms in left side is 6 and right side is 6.

b) Both are equal.

c) Hence the equation is balanced.

**1. Which information is not conveyed by a balanced chemical equation?**

- Physical states of reactants and products
- Symbols and formulae of all the substances involved in a particular reaction
- Number of atoms/molecules of the reactants and products formed
- Whether a particular reaction is actually feasible or not

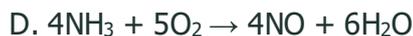
**2. In the balanced equation –  $a\text{Fe}_2\text{O}_3 + b\text{H}_2 \rightarrow c\text{Fe} + d\text{H}_2\text{O}$  The value of a, b, c, d are respectively**

- 1,1,2,3
- 1,1,1,1
- 1,3,2,3
- 1,2,2,3

**Answer - C. 1,3,2,3**

**3. Which of the following reactions is not balanced**

- $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
- $2\text{C}_4\text{H}_{10} + 12\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
- $2\text{Al} + 6\text{H}_2\text{O} \rightarrow 2\text{Al}(\text{OH})_3 + 3\text{H}_2$



**Answer- B.  $2\text{C}_4\text{H}_{10} + 12\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$**

**4.  $\text{Zn(s)} + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$  is an example of**

- A. precipitation reaction
- B. endothermic reaction
- C. evolution of gas
- D. change in colour

**Answer – C, evolution of gas.**

**4. In the reaction  $\text{XPb(NO}_3)_2 \xrightarrow{\text{Heat}} \text{YPbO} + \text{ZNO}_2 + \text{O}_2$  X, Y and Z are –**

- A. 1,1,2
- B. 2,2,4
- C. 1,2,4
- D. 4,2,2

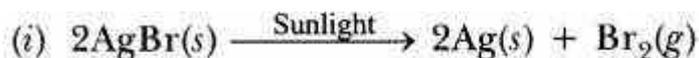
**Answer – 2,2,4**

**Solved questions:**

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

- (i) Silver bromide on exposure to sunlight decomposes into silver and bromine,
- (ii) Sodium metal reacts with water to form sodium hydroxide and hydrogen gas.

**Answer.**



**2. Translate the following statement into chemical equation and then balance it. Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.**

**Answer.**  $3\text{BaCl}_2(\text{aq}) + \text{Al}_2(\text{SO}_4)_3(\text{aq}) \longrightarrow 3\text{BaSO}_4(\text{s}) + 2\text{AlCl}_3(\text{aq})$

**3. State one basic difference between a physical change and a chemical change.**

**Answer.** In physical change, no new substance is formed, whereas in a chemical change, new substance(s) is/are formed.

**Questions to practice;**

- 1. Why Mg ribbon should be cleaned before burning?
- 2. Write the chemical equation of the reaction in which the following changes have taken place with an example of each:
  - (i) Change in colour
  - (ii) Change in temperature
  - (iii) Formation of precipitate
- 3. What happens when water is added to quick lime. Write chemical equation.
- 4. (a) Define a balanced chemical equation. Why should an equation be balanced?  
(b) Write the balanced chemical equation for the following reaction:
  - (i) Phosphorus burns in presence of chlorine to form phosphorus penta chloride.
  - (ii) Burning of natural gas.
  - (iii) The process of respiration.
- 5. What is observed when a solution of potassium iodide solution is added to a solution of lead nitrate? Name the type of reaction. Write a balanced chemical equation to represent the above chemical reaction.