Chemical reaction

**Unit - 15**

**Exercise**

1. Choose the best option for the following questions:

**a. What type of chemical reaction is the reaction between sodium chloride and silver nitrate?**

i. Combination reaction

ii. Single displacement reaction

iii. Decomposition reaction

iv. Double displacement reaction

**b. What type of reaction is 4Na + O2 🡪 2NaO?**

i. Addition reaction

ii. Decomposition reaction

iii. Acid base reaction

iv. Displacement reaction

**c.Which substance is X in the given chemical reaction?**

HCI + X 🡪 NaCl + H20

i. NaOH

ii. Na

iii. NaH

iv. Na+H2O

**d. What type of reaction is the heating of CaCO3 ?**

i. Combination reaction

ii, Single displacement reaction

iii. Decomposition reaction

iv. Double displacement reaction

2.Give reason:

**i. Hydrogen peroxide is not stored in a transparent vessel.**

Answer: Hydrogen peroxide is not stored in a transparent vessel because it is light-sensitive and can decompose when exposed to light. Storing it in a dark or opaque container helps to prevent this decomposition reaction.

**ii. Acid base reaction is also known as neutralization reaction.**

Answer: Acid base reaction is also known as neutralization reaction because in this type of reaction, the properties of both the acid and base are lost as they react with each other to form neutral compounds, which are salt and water.

**iii. The rate of chemical reaction is different according to type of the reaction.**

Answer: the rate of chemical reaction is different according to the type of the reaction because different reactions have different reaction mechanisms and factors that affect their rates. For example, combination reactions tend to have faster rates because the reactants directly combine to form the product. On the other hand, decomposition reactions may have slower rates because the reactant needs to break down into multiple products. Additionally, factors such as temperature, concentration, surface area, and the presence of catalysts can also affect the rate of chemical reactions.

3.Write differences between:

**a. Single and double displacement reaction**

Answer:

|  |  |
| --- | --- |
| **Single displacement reaction** | **Double displacement reaction** |
| In single displacement reaction, a more reactive element replaces a less reactive element from its compound. | In double displacement reaction, two reactants exchange  ions to form two new compounds. |
| In this reaction, there is change in color generally and no precipitate formation takes place. | In this reaction, precipitate formation takes place |
| In this, metals react with the salt solution of another metal. | In this, salt solutions of two different metals react with each other. |
| e.g., Zn(s) + CuSO4(aq) - ZnSO4(aq) + Cu(s) | e.g., Pb(N03)2(aq) + 2KI(s) -> Pbl2(s) + 2KNO3(aq) |

**b. Combination and decomposition reaction**

Answer:

|  |  |
| --- | --- |
| **Combination Reaction** | **Decomposition Reaction** |
| In this reaction, two reactants combine to form a single product. | In this reaction, a compound breaks to form two or more single substances. |
| These are generally exothermic. | These are generally endothermic |
| Example, 2 Mg + O2 2MgO | Example, 2NaCl → 2Na + Cl2 |

4.Balance the following chemical reactions and mention their types.

The balanced chemical reactions and their types are :

a. KCIO3 —> 2KCl + 3O2

Balanced Reaction: 2KCIO3 —> 2KCl + 3O2

Type: Decomposition reaction

b. CH4 + O2 —> CO2 + H2O

Balanced Reaction: CH4 + 2O2 —> CO2 + 2H2O

Type: Combustion reaction

c. Fe + O2 --> Fe2O3

Balanced Reaction: 4Fe + 3O2 --> 2Fe2O3

Type: Synthesis (or Combination) reaction

d. Zn + H2SO4 —> ZnSO4 + H2

Balanced Reaction: Zn + H2SO4 —> ZnSO4 + H2

Type: Single displacement (or Single replacement) reaction

e. Al + H2SO4 —> Al2(SO4)3 + H2

Balanced Reaction: Al + 3H2SO4 —> Al2(SO4)3 + 3H2

Type: Double displacement (or Double replacement) reaction

5.Answer the following questions:

**a.What do you mean by a chemical reaction? Explain with an example.**

Answer: a chemical reaction is a process where substances (reactants) transform into new substances (products) by breaking and forming chemical bonds. It follows the law of conservation of mass, meaning the total number of atoms remains the same. For example, the reaction between hydrogen gas and oxygen gas to form water:

E.g. 2H2 + O2 → 2H2O

**b. What is the rate of chemical reaction? Write any four factors which affect the rate of chemical reaction.**

Answer: The rate of a chemical reaction refers to how fast or slow the reaction occurs. It is the measure of the change in concentration of reactants or products over time.

Four factors that affect the rate of a chemical reaction:

1. Temperature: Higher temperature generally increases the rate of a reaction because it provides more energy to the reacting molecules, leading to more frequent and energetic collisions.

2. Concentration: An increase in the concentration of reactants typically accelerates the reaction rate since it results in more reactant particles per unit volume, leading to a higher chance of collision.

3. Surface area: When the surface area of a solid reactant is increased (e.g., by grinding it into a fine powder), the rate of the reaction increases because more particles are exposed to the other reactants, allowing for more effective collisions.

4. Catalysts: Catalysts are substances that speed up a reaction without being consumed in the process. They provide an alternative reaction pathway with lower activation energy, making it easier for the reaction to occur and, consequently, increasing the reaction rate.

**c, What do you mean by a displacement reaction? Write its two examples with their balanced chemical equations.**

Answer: A displacement reaction, also known as a replacement reaction or single replacement reaction, is a type of chemical reaction where one element displaces another element from a compound. In this reaction, a more reactive element replaces a less reactive element in a compound.

Two examples of displacement reactions with their balanced chemical equations:

1. Zinc displacing hydrogen from hydrochloric acid:

Zn + 2HCl → ZnCl2 + H2

In this reaction, zinc (Zn) displaces hydrogen (H) from hydrochloric acid (HCl) to form zinc chloride (ZnCl2) and hydrogen gas (H2).

2. Magnesium displacing copper from copper sulfate:

Mg + CuSO4 → MgSO4 + Cu

In this reaction, magnesium (Mg) displaces copper (Cu) from copper sulfate (CuSO4) to form magnesium sulfate (MgSO4) and copper metal (Cu).

**d. Write two examples of decomposition reactions with balanced chemical equations,**

Answer: Two examples of decomposition reactions with balanced chemical equations:

1. Decomposition of water (electrolysis):

2H2O → 2H2 + O2

In this reaction, water (H2O) decomposes into hydrogen gas (H2) and oxygen gas (O2) through the process of electrolysis.

2. Decomposition of hydrogen peroxide:

2H2O2 → 2H2O + O2

In this reaction, hydrogen peroxide (H2O2) decomposes into water (H2O) and oxygen gas (O2).

In both cases, the decomposition reactions break down a compound into simpler substances as represented by the balanced chemical equations.

**e. What is the type of chemical reaction occurring inside the test tube shown in the given figure? Write the balanced chemical equation of that reaction. (Reaction of cupper sulphate with iron)**

Answer: Based on the given information, the type of chemical reaction occurring inside the test tube is a single displacement (single replacement) reaction. In this reaction, iron (Fe) displaces copper (Cu) from copper sulfate (CuSO4) to form iron sulfate (FeSO4) and copper metal (Cu).

The balanced chemical equation for the reaction is as follows:

Fe + CuSO4 → FeSO4 + Cu

In this reaction, the iron nail (Fe) is displacing copper from copper sulfate solution, leading to the formation of iron sulfate (FeSO4) and solid copper metal (Cu). This type of reaction is commonly observed when a more reactive metal displaces a less reactive metal from its compound.

**f. Four students A, B, C, and D are allowed to carry out decomposition reactions in the laboratory. All of them perform it differently as given below.**

Answer:

**i. Student A burnt magnesium(Mg) ribbon**

Ans:

The balanced chemical reaction for the decomposition of magnesium (Mg) through burning is as follows:

2Mg + O2 → 2MgO

In this reaction, magnesium (Mg) reacts with oxygen gas (O2) during the burning process to form magnesium oxide (MgO).

The other procedures described by Students B, C, and D are not decomposition reactions but involve different types of chemical reactions:

**ii. Student B mixed Zn in FeSO solution**

Ans: Student B mixed Zn in FeSO4 solution, which is an example of a single displacement (single replacement) reaction:

Zn + FeSO4 → ZnSO4 + Fe

**iii. Student C heated KCIO in a hard glass test tube**

Ans:

Student C heated KCIO3 in a hard glass test tube, which is an example of a decomposition reaction:

2KCIO3 → 2KCl + 3O2

**iv. Student D mixed Zn and HCI solution**

Ans:

Student D mixed Zn and HCl solution, which is an example of a single displacement (single replacement) reaction:

Zn + 2HCl → ZnCl2 + H2

**Which student followed the correct procedure? Write the balanced chemical reaction of that process.**

Ans:

The correct procedure was followed by Student A, who burnt magnesium (Mg) ribbon.

Only Student A performed the correct decomposition reaction by burning magnesium (Mg) ribbon to produce magnesium oxide (MgO).

**g. Samir burns a magnesium ribbon which is like a small strip or a ribbon. It burns brightly and forms white ash'A'. Write the name of substance Write a balanced chemical reaction of the process.**

Answer: The substance formed as a white ash 'A' when Samir burns the magnesium ribbon is magnesium oxide (MgO).

The balanced chemical reaction for the burning of magnesium (Mg) to form magnesium oxide (MgO) is as follows:

2Mg + O2 → 2MgO

In this reaction, magnesium (Mg) reacts with oxygen gas (O2) from the air during the burning process to produce magnesium oxide (MgO) as a white ash. The bright burning observed during the reaction is due to the exothermic nature of the combustion reaction.