Reaction rate and Reversible reaction.

Reaction rate

* The rate of a reaction is a measure of how quickly a reactant is used up, or a product is formed.
* Different chemical reactions occur at different rates. Some examples are illustrated in Table.

|  |  |  |
| --- | --- | --- |
| Type of reaction | Fast reaction | Slow reaction |
| Reaction involving liberation of a gas | Bubbles of carbon dioxide gas liberate rapidly when sodium carbonate powder reacts with dilute hydrochloric acid.  Na2CO3 (s) + 2HCl(aq) → 2NaCl(aq) + CO2 (g) + H2O(l) | In photosynthesis, carbon dioxide reacts with water very slowly in the presence of sunlight and chlorophyll to produce glucose and oxygen gas. 6CO2(g) + 6H2O(l) → C6H12O6 (s) + 6O2 (g) |
| Precipitation reaction | When silver nitrate solution is added to sodium chloride solution, a white precipitate of silver chloride is formed immediately. AgNO3 (aq) + NaCl(aq) → AgCl(s) + NaNO3 (aq) | When dilute hydrochloric acid is added to sodium thiosulphate solution, a yellow precipitate of sulphur appears only after a few seconds. Na2SO4 (aq) + 2HCl(aq) → 2NaCl(aq) + S(s) + SO2 (g) + H2O(l) |
| Heating a metal in air | When a small piece of potassium is heated in air, it burns rapidly to form a white solid of potassium oxide. 4K(s) + O2 (g) → 2K2O(s) | When a small piece of copper is heated in air, it reacts slowly with oxygen in the air to form a black solid of copper (II) oxide. 2Cu(s) + O2 (g) → 2CuO(s) |

Measuring reaction rate

This is done by observing either the amount of reactants consumed or the amount of products formed per unit time. Some of the measurable visible changes in a chemical reaction are;

* Volume of gas liberated.
* Change in mass during a reaction.
* Colour changes.

Examples to illustrate how the rate of reaction is measured.

Reaction between magnesium and dilute sulphuric acid

Mg(s) + H2SO4 (aq) → MgSO4 (aq) + H2 (g)

* In the reaction between dilute sulphuric acid and a magnesium ribbon, the following two changes are observed:
  + The mass of magnesium (the reactant) decreases with time.
  + The volume of hydrogen gas (the product) increases with time.
* Hence, the rate of reaction between dilute sulphuric acid and magnesium can be determined by measuring the *change in the mass of magnesium* or the *volume of hydrogen gas* per unit time.

Collision theory and activation energy

* For particles to react, they have to collide with sufficient energy. (that means if they collide with less energy nothing happens)
* This sufficient energy is called **activation energy**.
* *The activation energy is the minimum amount of energy needed for a collision to be successful.*
* A collision that produces a reaction is called a **successful collision**.
* The greater the number of 'successful' collisions, the faster the rate of a reaction. This is called the **'collision theory'**.

The diagram below show activation energy for a reaction

