

Factors Affecting the Rate of Chemical Reactions - Notes

What is Rate of Reaction and How Does it Apply to Chemical Reactions?

In a chemical reaction, how quickly or slowly reactants turn into products is called the **rate of reaction**. A reaction that takes a long time has a low reaction rate. A reaction that occurs quickly has a high reaction rate. A *rate* describes how quickly or slowly a change occurs. Every chemical reaction proceeds at a definite rate. However, you can speed up or slow down the rate of a chemical reaction.

What Factors Affect the Rate of a Chemical Reaction?

The four main factors that affect the rate of chemical reactions are temperature, concentration, surface area, and the presence of a catalyst.

1. Increasing the **temperature** cause the particles (atoms or molecules) of the reactants to move more quickly so that they collide with each other more frequently and with more energy. Thus, the higher the temperature, the greater the rate of reaction. If you decrease the temperature, the opposite effect occurs. The particle move more slowly, colliding less frequently and with less energy. In this case, the rate of reaction decreases.
2. **Concentration** refers to how much solute is dissolved in a solution. If a greater concentration of reactant atoms and molecules is present, there is a greater chance that collisions will occur among them. More collisions mean a higher reaction rate. Thus, increasing the concentration of the reactants usually results in a higher reaction rate. At lower concentration, there is less chance for collisions between particles. This means that decreasing the concentrations of the reactants results in a lower reaction rate.
3. **Surface area** is the measure of how much area of an object is exposed. For the same mass, many small particles have a greater total surface area than one large particle. For example, steel wool has a larger surface area than a block of steel of the same mass. This allows oxygen molecules to collide with many more iron atoms per unit of time. The more surface contact between reactants, the higher the rate of reaction. The less surface contact, the lower the reaction rate. Surface area can also be important if a reaction occurs between tow liquids that do not mix. In this case, the reaction occurs only at the boundary where the two liquids meet. It is also important to note that not all reactions depend on surface area. If both reactants are gases or liquids that mix together then there is no surface, and surface area is not a factor.
4. A **catalyst** is a substance that speeds up the rate of a chemical reaction with out being used up in the reaction itself. Catalysts reduce the amount of energy required to break and form bonds during a chemical reaction . When catalysts are used, a reaction can proceed although less energy is added during the reaction. For example, enzymes are catalysts that allow chemical reactions to occur at relatively low temperatures within the body.