

Topic: Reaction Rates

It's useful to be able to predict whether an action will affect the rate at which a chemical reaction proceeds. There are several factors that can influence the rate of a chemical reaction. In general, a factor that increases the number of collisions between particles will increase the reaction rate and a factor that decreases the number of collisions between particles will decrease the chemical reaction rate.

Concentration and pressure

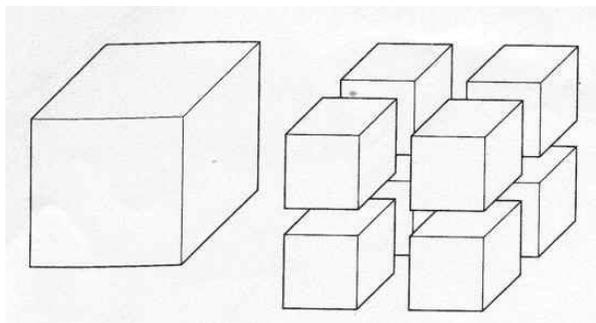
If the concentration or pressure of a chemical increases, there will be more particles within a given space this will lead to more effective collisions per unit time, which leads to an increasing reaction rate. Similarly, a higher concentration of products tends to be associated with a lower reaction rate.

Temperature

Usually, an increase in temperature is accompanied by an increase in the reaction rate. Temperature is a measure of the kinetic energy of a system, so higher temperature implies higher average kinetic energy of molecules and more collisions per unit time. A general rule of thumb for most (not all) chemical reactions is that the rate at which the reaction proceeds will approximately double for each 10°C increase in temperature. Once the temperature reaches a certain point, some of the chemical substances may be altered (e.g., denaturing of proteins) and the chemical reaction will slow or stop.

Physical State

The rate of a chemical reaction depends on the medium in which the reaction occurs. It may make a difference whether a medium is aqueous, liquid, solid, or gaseous. If particles are in the same phase (liquid/liquid) or (gas/gas), then it is very easy for them to mix with each other. This gives particles the maximum opportunity to collide.



BUT, if one of the reactants is a solid, then the reaction can only take place on the surface of the solid.

The smaller the size of the solid particles, the greater the area that the reaction can take place in.

So finely divided powder reacts more quickly than the same stuff in a great big lump!

Presence of Catalysts

Catalysts (e.g., enzymes) lower the activation energy of a chemical reaction and increase the rate of a chemical reaction without being consumed in the process. Catalysts work by increasing the frequency of collisions between reactants, altering the orientation of reactants so that more collisions are effective and reducing intramolecular bonding within reactant molecules. Aside from catalysts, other chemical substances can affect a reaction ie pH, presence of competitors or inhibitors, all these have the effect of reducing the activation energy. The quantity of hydrogen ions (the pH of aqueous solutions) can alter a reaction rate. Other chemical species may compete for a reactant or alter orientation, bonding, electron density, etc., thereby decreasing the rate of a reaction.

