

1) Collision Theory

Monday, September 11, 2017 2:17 PM

"Reaction" → The study of reactions and the factors which affect their rates. → speed of the reaction

Kinetics - Unit 1

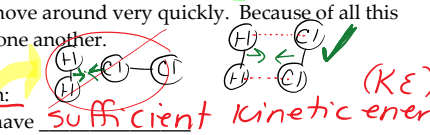
In a chemical reaction, what actually occurs at the particle level in order for reactants to make products? Reactant particles collide with one another, the collision may cause reactant bonds to break, and new product bonds to form.

This process is called 'collision theory'

Particles are always moving as they always have kinetic energy (KE). Solids only vibrate as they have a low amount of KE. Liquid molecules have a medium amount of KE and slide past one another. Gases have a large amount of KE and move around very quickly. Because of all this movement, molecules are always colliding with one another.

Two things can happen as the result of a collision:

- 1) The reactant particles collide but either don't have sufficient kinetic energy or don't have correct collision geometry to cause reactant bonds to break. Therefore, they bounce off one another and no reaction occurs.
- 2) The reactant molecules collide with the correct geometry and with sufficient kinetic energy to cause reactant bonds to break and product bonds to form. This is called an "effective collision".



When a collision has enough kinetic energy to cause reactant bonds to break, it is said to have reached the threshold energy. => minimum energy required

Though it varies for each different reaction, a general rule in chemistry is that only a small percentage of collisions are effective (make products). Why do you think this is the case? Think of the blindfolded walkers' analogy to help.

- 16 ppl - empty classroom
 - some walk fast - all blindfolded
 - some will run slow
 How many collisions? lots
 How many would fail? very few

In most rxns it is difficult to achieve BOTH
 - sufficient energy
 - correct geometry.
 < 20% of collisions are effective.

What could you say about a reaction that has many effective collisions per second?

FAST reaction = high reaction rate

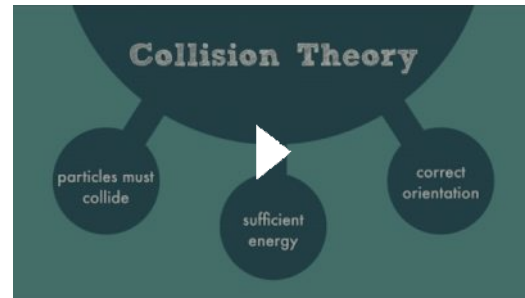
What could you say about a reaction that has few effective collisions per second?

Slower reaction = slower/low reaction rate

What could you say about a reaction that has no effective collisions per second?

no reaction. or possibly "no spontaneous reaction"

The speed of the reaction, otherwise stated as the reaction rate, depends on the amount of effective collisions per unit time. Effective collisions are what produce product particles.



↳ maybe we can:- add heat
 - catalyst
 - ↑ [conc.]
 - ↑ surface area