**Reaction Rates:**

Reactions can occur very slowly to very quickly.

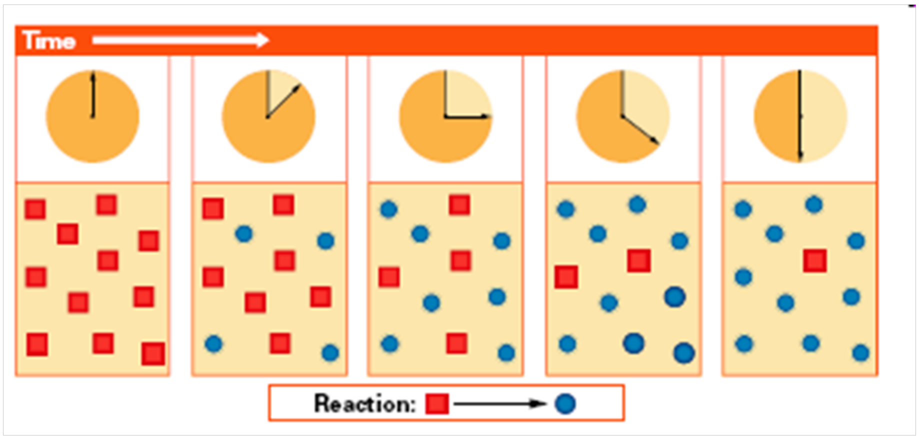
Examples:

Slow: dead plants turning into coal

Fast: firecracker, dynamite

Rate:

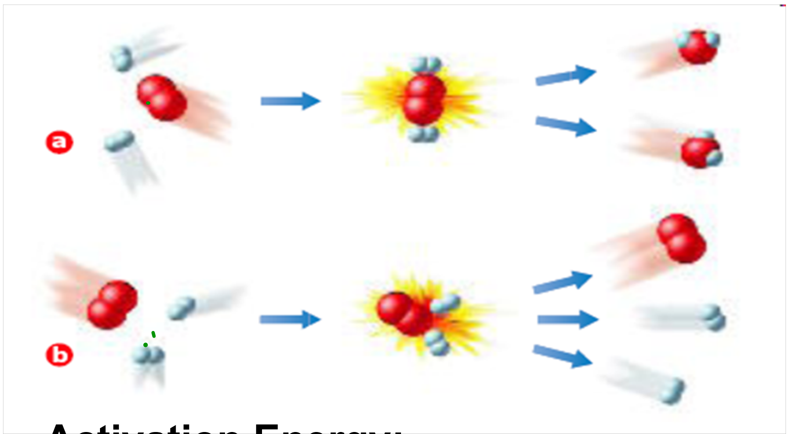
Amount of reactant changing per unit time.



**Collision Theory:**
**Key Idea:** Particles must collide to react.

Only some collisions = reactions...why?

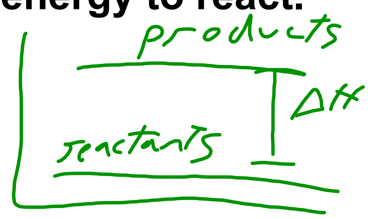
1. Particles need the necessary kinetic energy to react. If they are lacking in kinetic energy, they will just bounce apart unchanged.
2. Particles need to collide in the proper orientation

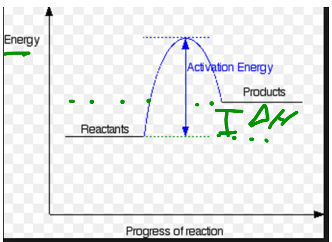


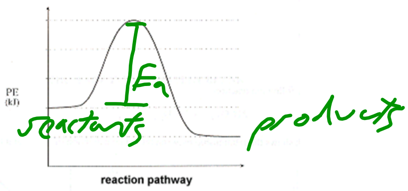

**Activation Energy:**
**Minimum energy needed to react.**

**Collisions must equal or exceed the activation energy to react.**

old potential energy diagrams



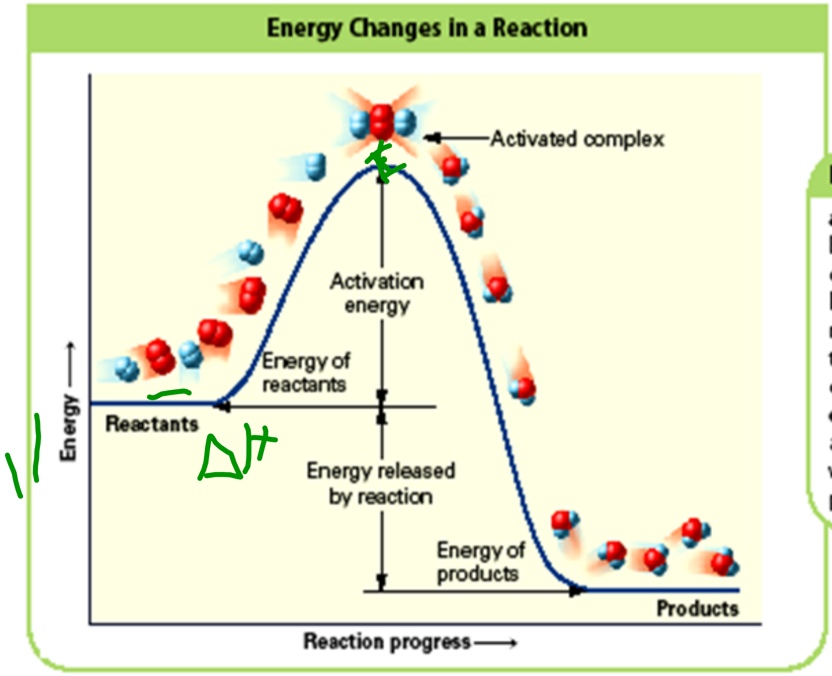




# Activated Complex or Transition State

-Unstable arrangement at the peak of the energy barrier lasting about $10^{-13}$seconds

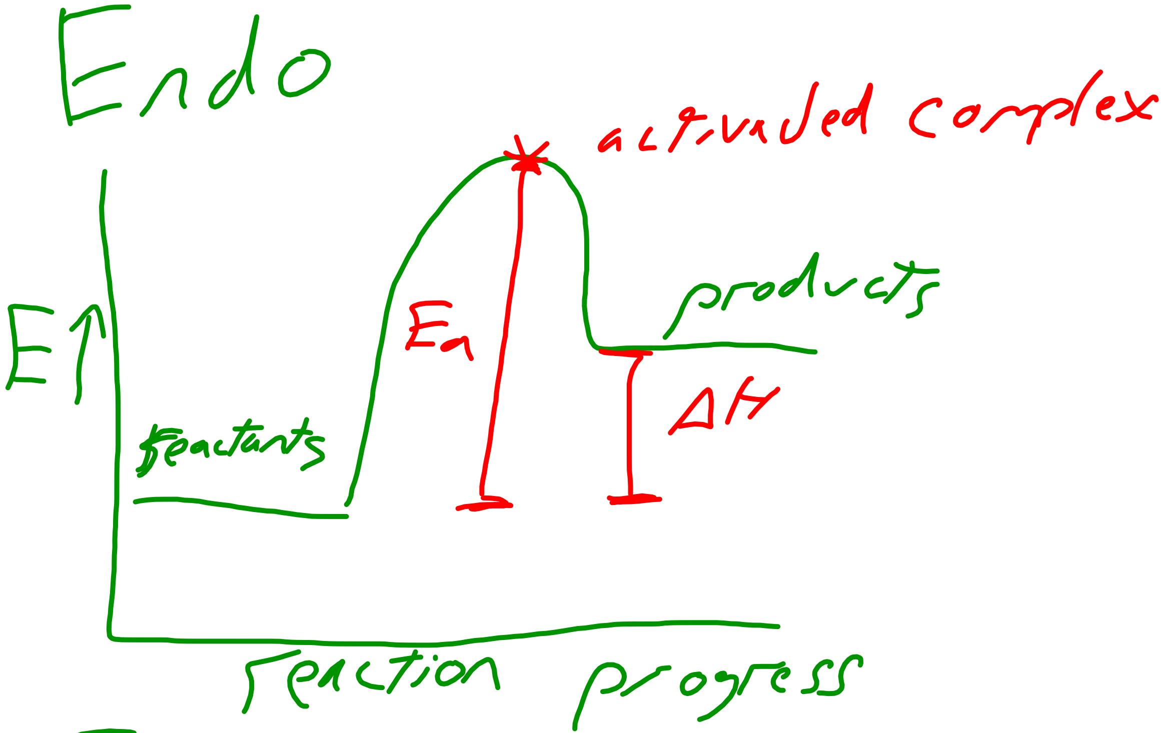
## Figure 18.5 Interpreting Graphs

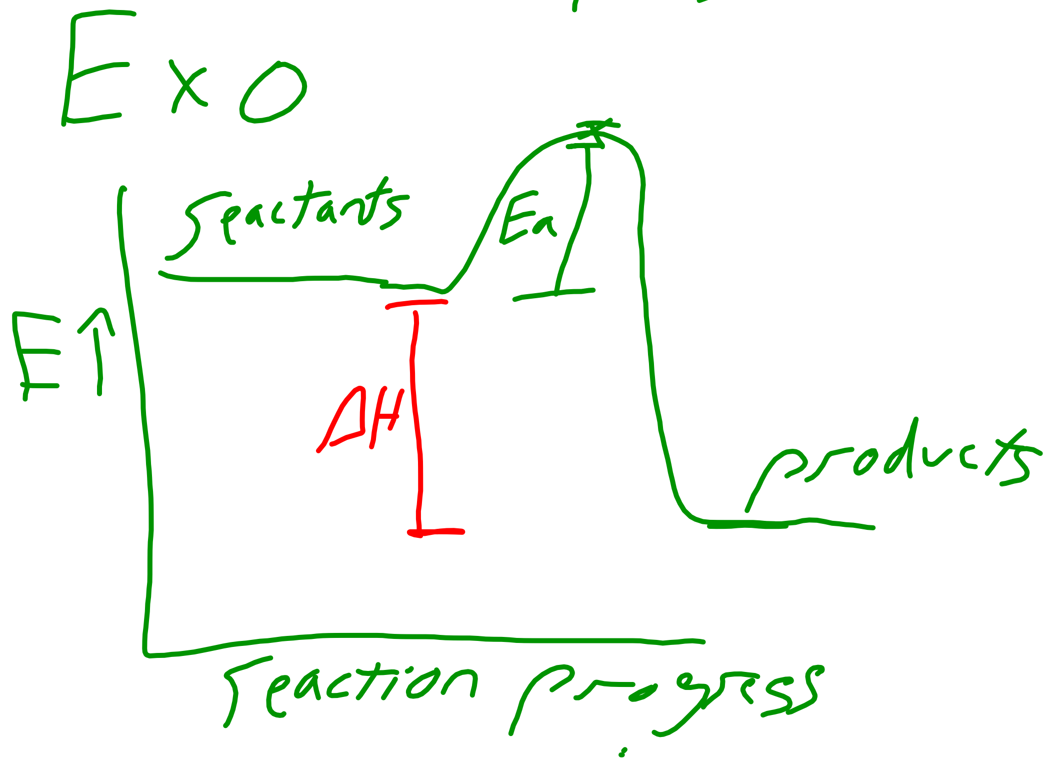



**INTERPRETING GRAPHS**

**a. Navigate** Which are at a higher energy, the reactants or products?
**b. Read** Is energy absorbed or released in progressing from the reactants to the activated complex?
**c. Interpret** Once the activated complex is formed, will it always proceed to form products? Explain.

Draw a potential energy diagram for both an endo and exo thermic reaction including labels for the axis, activation energy, products, and reactants. Put a star on the activated complex.



## Factors Affecting Collision Rates:

**Temperature:**

Increase in temperature will increase the rate of reactions

**Concentration:**

Increasing concentration usually increases the rate of reaction

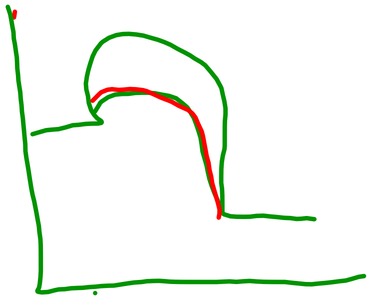
**Particle Size:**

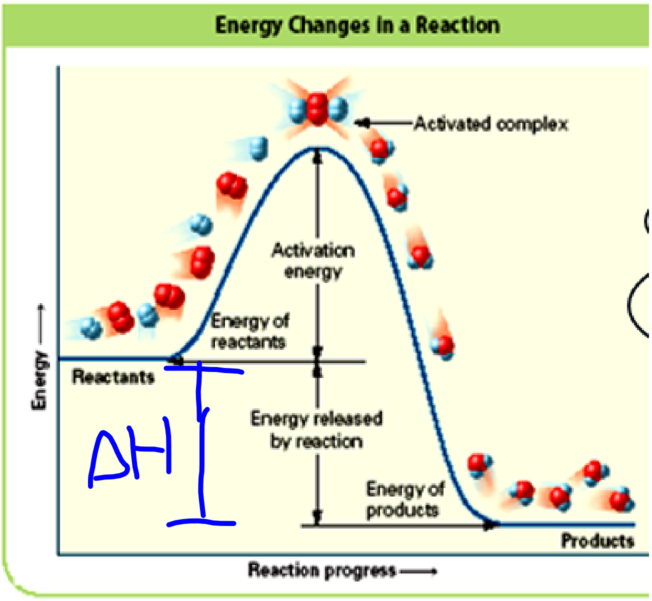
Increasing particle size decreases the surface area for a given mass of particle, decreasing the amount of reactant exposed for reaction.
Increase in particle size will decreasing reaction rate.

**Catalyst:**

A substance that speeds up a reaction, without being consumed itself in the reaction.
Example: enzymes

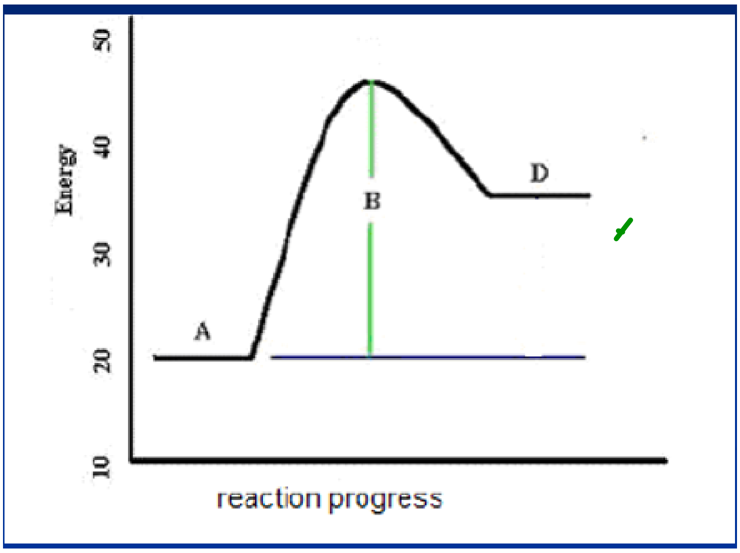
What happens to the a potential energy diagram if we add a catalyst?






Is this reaction endothermic or exothermic? exothermic

Indicate on diagram location of delta H.




Is this reaction endothermic or exothermic? endothermic

Indicate on diagram identify a, b and d.