How Fast

- **Rates** measures changes that occur within intervals of time.

- For example, if you traveled to St. George (300 miles) in 5 hours, your rate of travel would be 60 **Miles per hour**. (300 miles/5 hours).

- Instead of units of length (miles) and time (hour), reaction rates are expressed using chemical **Units** (moles, grams) and time.

- Thus a small sheet of metal containing 1 mole of iron might rust at a rate of .5 **moles of iron per year.**

- We can also measure **Relative** rates by timing how long it takes for a change to occur.

- And now……The Collision Theory

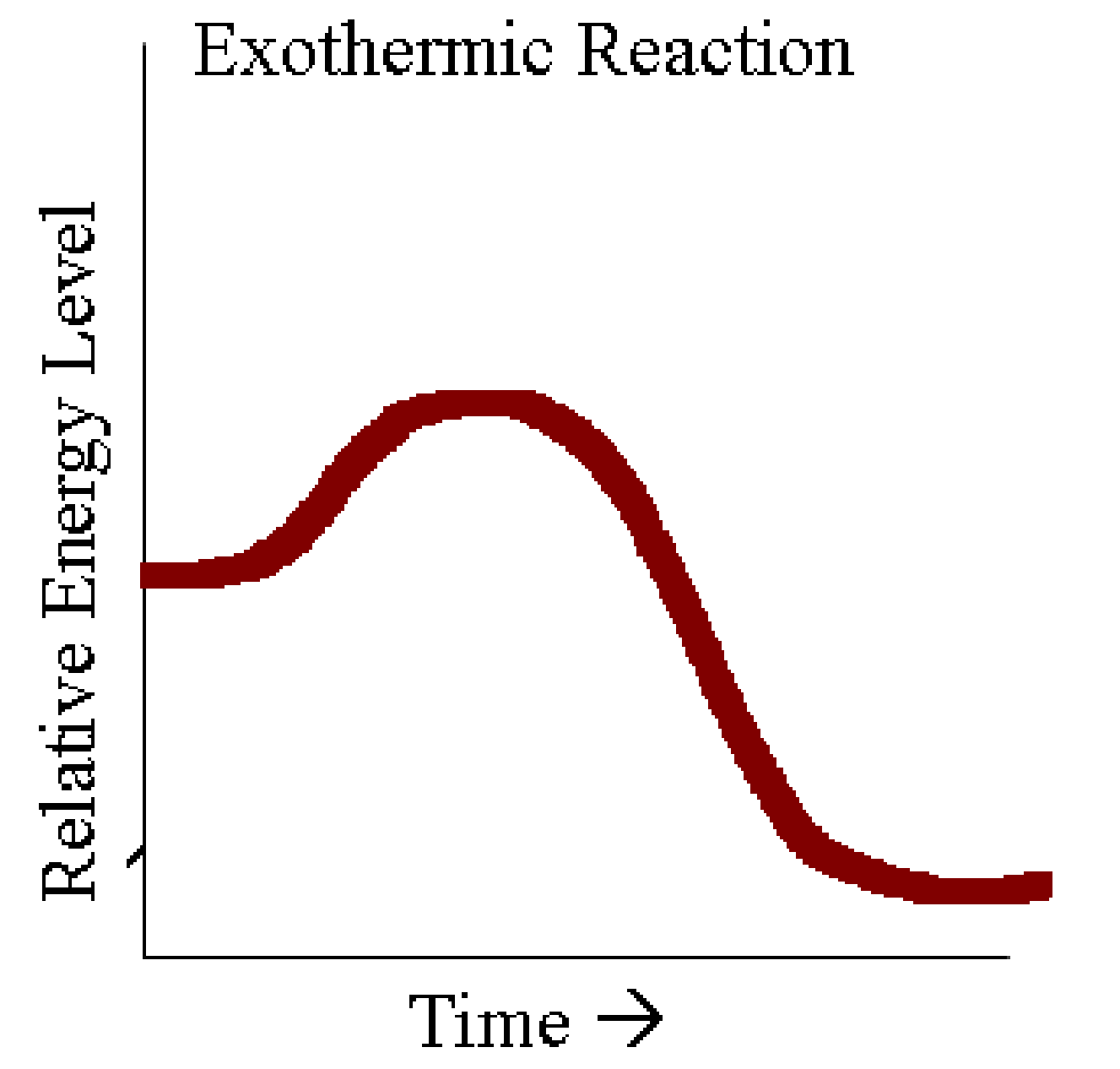
- The **collision** Theory is based on the Kinetic Theory and says that atoms, ions and molecules can form a chemical bond when they collide, provided the particles have enough **Kinetic energy**.

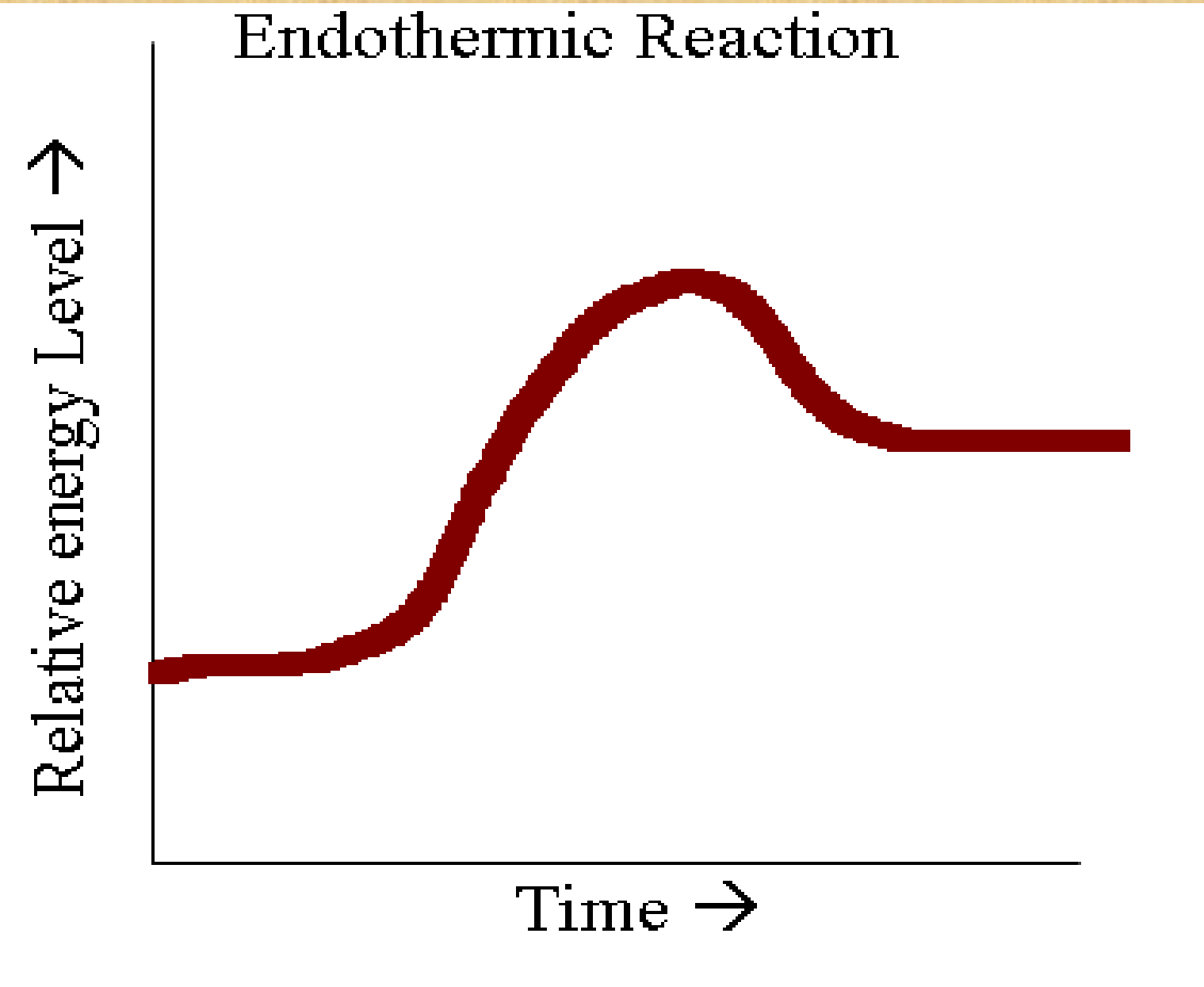
- Think about two cars involved in head-on collisions. If the cars are moving slow (**low** kinetic energy), they will only bounce off each other when they collide. However, if the cars are moving fast enough (high kinetic energy), they will "**bond**" when they collide.

- The minimum energy colliding particles must have when they collide to ensure that a reaction happens is called the **activation** energy. In a sense, the activation energy is a **barrier** that the reactants must cross to be converted to products.

- Graph the relative energy changes in reactant particles as they form a new product in both endothermic and exothermic reactions. Make sure to **label** the following on each graph:

- 1) energy content of reactants, 2) activation energy, 3) energy content of products, and 4) energy released by reaction or energy taken in by reaction. Draw the activated complex on the graphs.


Exothermic Reaction
Relative Energy Level
Time →


Endothermic Reaction
Relative energy Level →
Time →

CATALYSTS

- A reaction can be made to happen **faster** by the presence of a catalyst. A catalyst is a substance that increases the rate of a reaction **without** being used up itself in the reaction.

- The catalyst provides a **surface** where the reaction can occur at **LOWER** activation energies because the reactants are brought in close proximity to each other in a correct molecular alignment that allows bond formation or breaking.

- Are highly **Specific** , catalyzing only **One** particular reaction

- **Lower** the energy needed to activate (start) the reaction

- **Temperature** affects enzyme activity (increase with higher temp, but high temperatures inactivate enzymes)

- Have an optimal **pH** and are active only over a narrow pH range

- Can be **Inhibited** by certain chemical agents