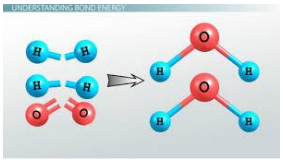
Hemingway Name:_____

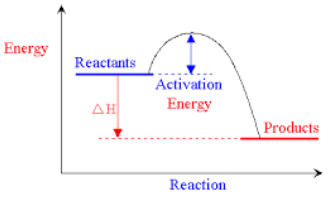
Changes in Energy

Energy and Chemical Reactions



- Chemical Energy – Energy _____ in the chemical bonds of a substance.
- Chemical reactions always involve energy _____.
- For any chemical reaction to occur, the reactants must_____ with enough energy to break the bonds of the reactants.

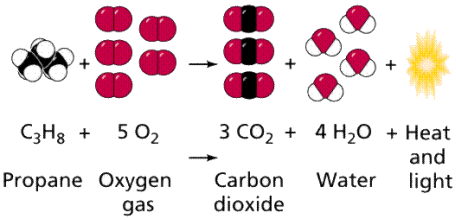
Activation Energy



- The _____ to break the bonds in the reactants for a chemical reaction to occur.

Input of Energy

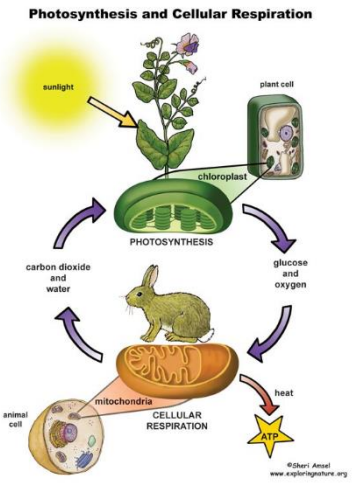
- Many chemical reactions require an initial input of energy
  - Ex: _____
  - Imagine if no activation energy was required, what would happen?



Will the reaction continue?

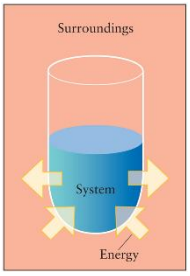
- Once the propane is ignited, the reaction will continue until the energy is extinguished or reactants are _____ (turning off propane)
  - The energy released during the reaction_____ the energy needed to overcome the activation energy

How is Energy Transferred?



- All chemical reactions are accompanied by _____ in energy
- These reactions are crucial to life
  - Photosynthesis and Cellular Respiration

Energy Changes



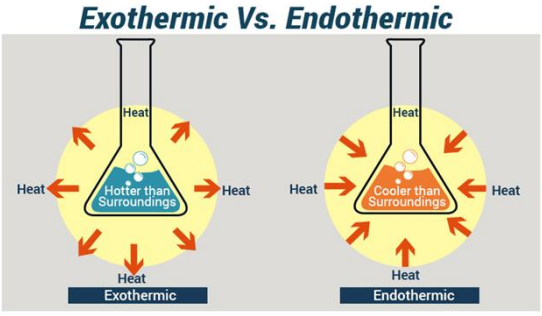
- Transfers between the system and the surroundings
  - _____: materials involved with a chemical reaction
  - _____: everything else in the universe

Hemingway Name:_____

Law of Conservation of Energy

- Total energy of the universe is _____
  - Energy cannot be created or destroyed
  - Energy that leaves the system goes into the surroundings
  - Energy that enters the system is from the surroundings

Endothermic and Exothermic Reactions



- Energy must be absorbed to _____
- Energy is_____ when bonds form
- By comparing the total energy used to break bonds, to the total energy released when bonds form, you can determine what type of chemical reaction has occurred
- **Step 1:** Energy must be_____ to break chemical bonds of reactants:
- **Step 2:** Energy is_____ when new chemical bonds are made in the products:

Classification

- _____: If more energy is **RELEASED** to the surroundings than absorbed by the system
  - More energy released from formation of bonds
- _____: If more energy is **absorbed by the system** than is **RELEASED** to the surroundings
  - More energy required to break bonds

Temperature

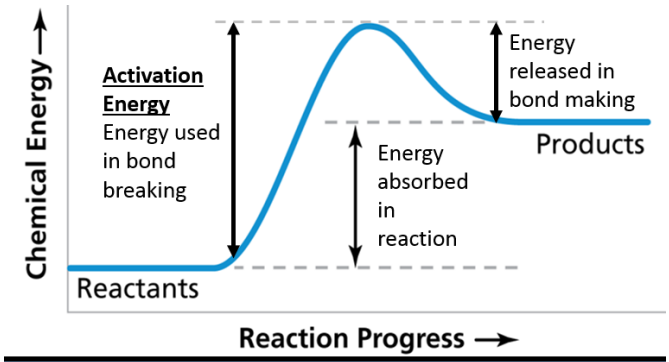
- **Exothermic**: energy is *released*
  - Exo- = _____
    - Ex: Burning of gasoline
- **Endothermic**: energy is *absorbed*
  - Endo- = _____
    - Ex: Cooking of pancakes

Temperature Change

- By monitoring changes in temperature you can determine what type of reaction is occurring

Hemingway Name:_____

- Endothermic Diagram

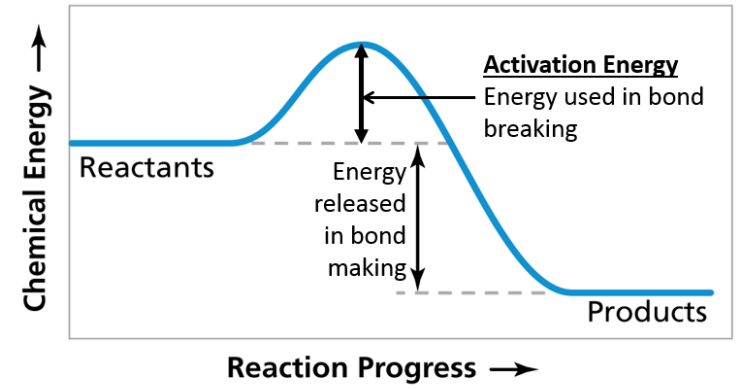


Endothermic – more energy is taken in to break the bonds in the reactants than released by the bonds being formed in the products. Therefore, energy is absorbed.

  - Heat (_____) taken in
  - Temperature of the substance _____
  - Products feel _____

- Exothermic Diagram

- **ENDOTHERMIC OR EXOTHERMIC?**



Exothermic – More energy is released when the products where formed than energy was used to break bonds in the reactants. Therefore, a net release of energy.

- Heat (energy) given off
- Temperature of the substance _____
- Products feel _____

ENDOTHERMIC OR EXOTHERMIC?

$6CO_2 + 6H_2O + Energy \rightarrow C_6H_{12}O_6 + 6O_2$

ENDOTHERMIC!

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + Energy$

EXOTHERMIC!