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Types of Reactions

- Classify by R/P
  - Decomposition
  - Combination
  - Displacement and Double Displacement
- Classify by what happens to reactants
  - Acid-base
  - Oxidation-reduction
  - others

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Oxidation-Reduction (Redox) Reactions

OIL RIG

Oxidation- is loss of electrons

Reduction- is gain of electrons

In a redox rxn, must have pair

$Al + HCl \rightarrow AlCl_3 + H_2\ (g)$

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Oxidation-Reduction Reactions

1. Elemental atoms have oxidation state of 0.
2. Main group elements have oxidation state expected from octet rule.
3. Calculate oxidation state of transition metals
4. Polyatomic ions - oxidation state of ions.

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Oxidation-Reduction Definitions

Oxidizing agent-

Reducing agent-

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Sample Test Question

In the following equation, identify the (a) oxidizing agent (b) reducing agent (c) oxidized atom and (d) reduced atom.

$2\ FeBr_{3(aq)} + 3\ Cl_{2(g)} \rightarrow 2\ FeCl_{3(aq)} + 3\ Br_{2(l)}$

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Oxidation-Reduction Reactions

$CH_4 + O_2 \rightarrow CO_2 + H_2O$

Oxidation	Reduction
gain O	lose O
lose H	gain H

In a redox rxn, must have pair

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Why Does a Reaction Happen?

Because molecules collide with each other. . .
in correct orientation. . .
with sufficient energy. . .

1. Change in energy.
2. Change in entropy.

Entropy- a measure of disorder in a system.

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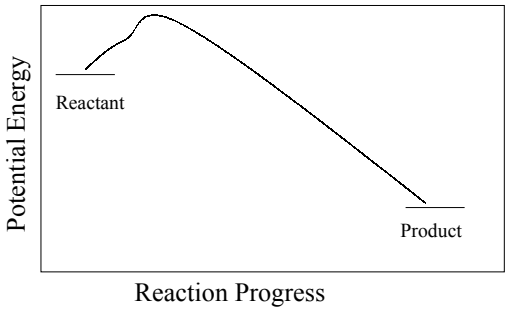
Activation Energy (E_{act})- "energy required to get a reaction to go."



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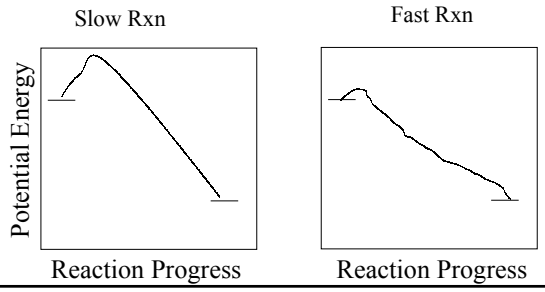
Rapid Reactions are Characterized by A Small E_{act}



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Three Main Ways to Control Reaction Rate

1. Temperature
2. Concentration
3. Add a *catalyst* to speed the rxn up

Catalyst- is not a product or reactant. It only *lowers* the activation energy. A catalyst is not changed in the reaction.

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Reaction Equilibrium

Not all reactions go from A to B, very often some B is converted back to A.

In theory, all reactions are reversible.

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Equilibrium Constant, Keq

$$aA + bB \rightleftharpoons cC + dD$$

$$Keq = \frac{[Products]}{[Reactants]} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

Keq big, $\rightarrow$

Keq small, $\leftarrow$

LeChatlier's principle

LeChatlier's principle- a reaction is shifted from equilibrium by addition of more product or reactant.

The shift is in the direction to relieve stress and is temporary.