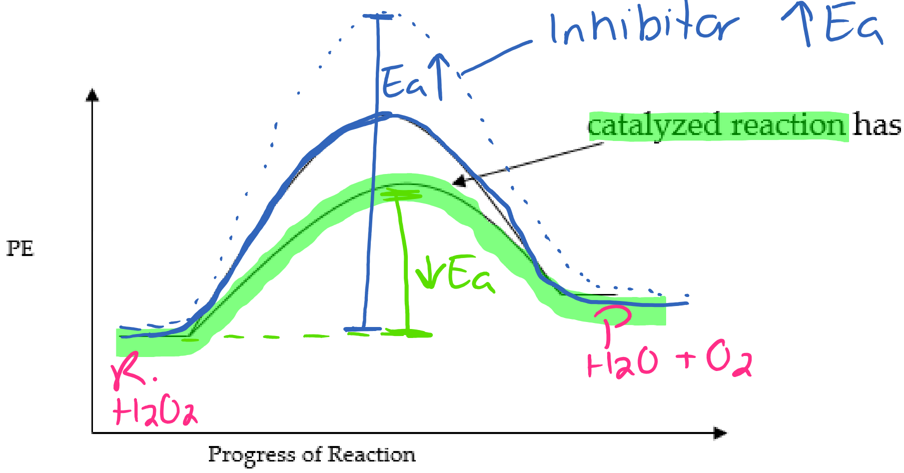
VII) Catalysts and Inhibitors

Monday, September 11, 2017 2:25 PM

Every type of reaction follows a specific and consistent pathway with a unique activated complex. When a catalyst is introduced to the reaction, the pathway changes and a different activated complex is formed with a lower Ea. Because of this lower Ea, a higher % of collisions are effective, thereby increasing the reaction rate.



Catalysts are involved in creating a different, lower energy activated complex, but remain unaltered at the end of the reaction.
An inhibitor forms a new activated complex that has a larger activation energy, thereby decreasing reaction rate.
Catalysts lower the Ea, thereby increasing the rate, but do they alter ΔH for the reaction? (look at the curve on above) NO! Because the catalyst/inhibitor alter the pathway taken; the reactants used + products formed are unaltered ∴ the bond energy is the same.

A catalyst is written above the reaction arrow in a reaction. However, sometimes, it's written as a reactant and a product (as it does not get used up in a reaction).

Example

Uncatalyzed (very slow):

$2H_2O_{2(aq)} \Rightarrow 2H_2O_{(l)} + O_{2(g)}$ + energy

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Catalyzed (fast)

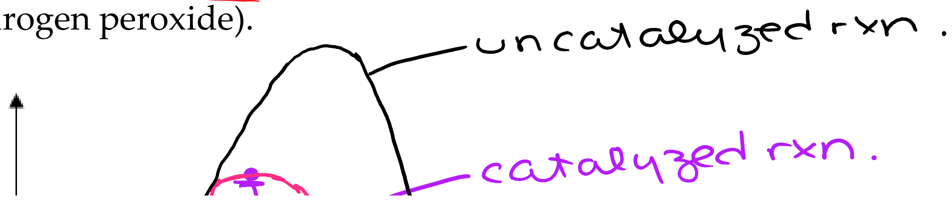
$2H_2O_{2(aq)} \xrightarrow{MnO_{2(s)}} 2H_2O_{(l)} + O_{2(g)}$ + energy OR:

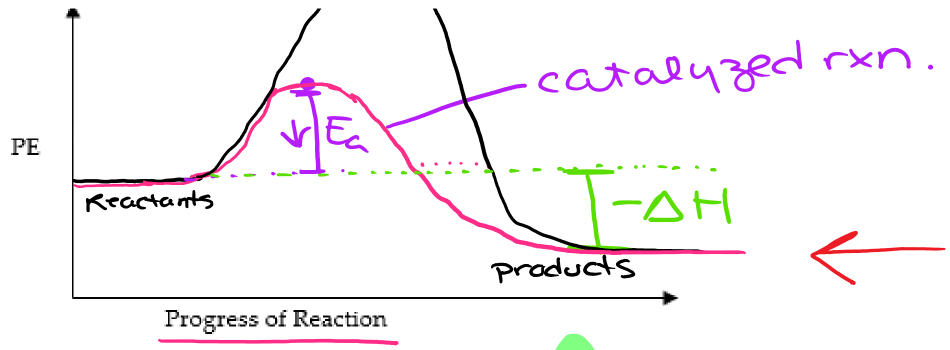
$2H_2O_{2(aq)} + MnO_{2(s)} \Rightarrow 2H_2O_{(l)} + O_{2(g)} + MnO_{2(s)}$ + energy

exothermic

catalyst is unchanged during a rxn.

Draw a PE diagram for the uncatalyzed and catalyzed decomposition of H_2O_2 (hydrogen peroxide).





A heterogeneous catalyst is in a different phase than reactants, and usually adsorbs the reactant (holds it on its surface) to allow better geometry with other reactants. ∴ ↑ effective collisions ∴ ↑ rxn rate

A homogeneous catalyst is in the same phase as reactants, and usually alters the regular reaction pathway to a new, lower energy reaction pathway.