5/20/20

Rate

$R = \frac{\Delta[\ ]}{\Delta t}$ (average)

$R = k[\ ][\ ]\ldots\ldots$

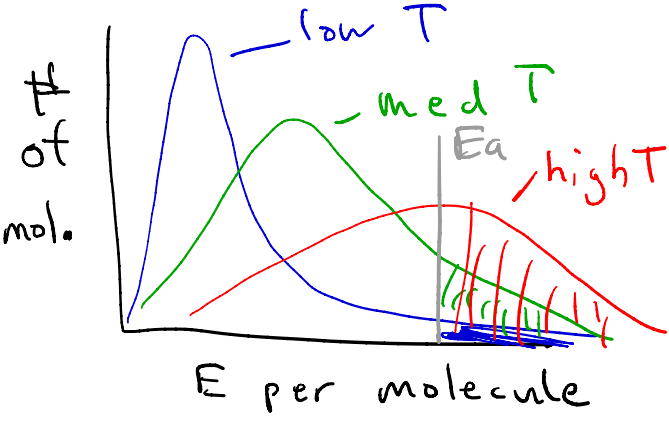
rate constant

reagents that participate in the rate-limiting step

Arrhenius expression

$k = Ae^{-Ea/RT}$

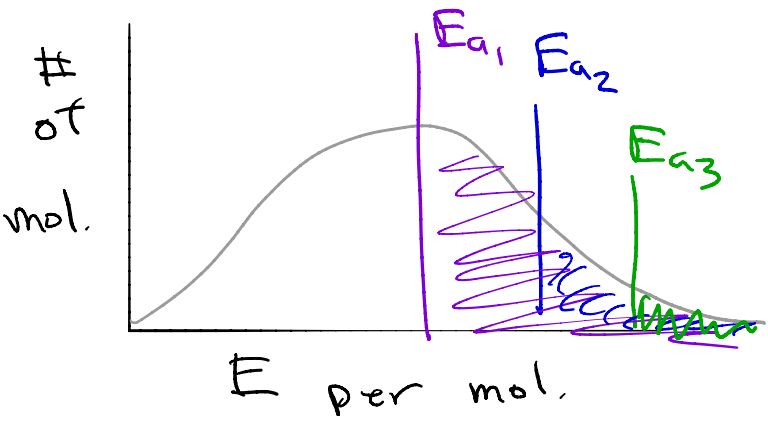
- k: rate constant
- A: steric factor
- Ea: activation energy
- R: constant
- T: temperature



As temperature increases, the number of molecules with enough E to react also increases,

→ rate increases

$k \propto e^{-1/T}$ $T\uparrow$ $\frac{1}{T}\downarrow$ $-\frac{1}{T}\uparrow$ $e^{-1/T}\uparrow$ $k\uparrow$



Graph of one reagent making three different products

At the same temperature, all other factors being equal, the higher the activation energy, the fewer the molecules with enough energy to react, → slower reaction

$k \propto e^{-E_a}$ $\quad E_a \uparrow -E_a \downarrow e^{-E_a} \downarrow k \downarrow$

In this reaction, both molecules participate that the same time

→ bimolecular

$R = k[CH_3Br]^{1}[OH^-]^{1} = 2$

3

Both reagents participate in the one rxn step, so both reagent concentrations affect rxn rate.

first-order → linear relation (first-power) between concentration and rate

In this rxn, the rate is first-order in CH_3Br and first-order in OH^-.

The reaction overall is second-order

order ↑ math

molecularity ↓ chemistry

3 = termolecular

In this rxn, the RLS is unimolecular in CH_3Br and unimolecular in OH^-.

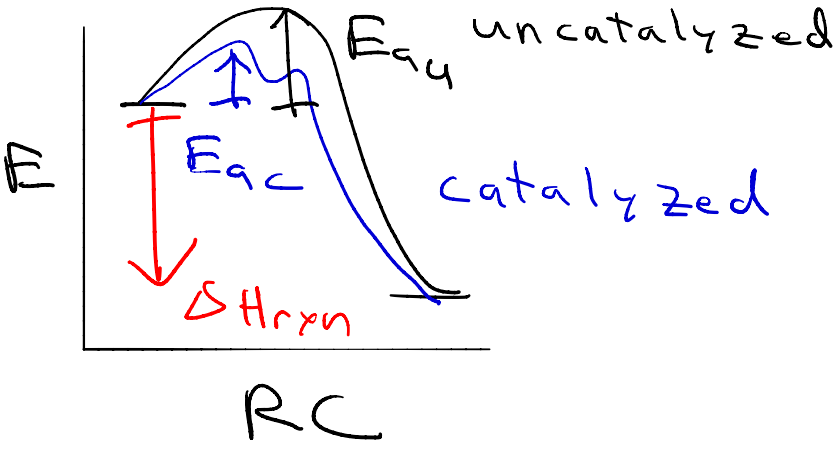
The reaction overall is bimolecular.

$H\cdot + \cdot H \rightarrow H_2$

What if this rxn occurs in only one step?

$R = k[H\cdot][H\cdot] = k[H\cdot]^2$

bimolecular second-order



A catalyst is a substance that speeds up a reaction by creating a new reaction pathway that has a lower activation energy.

A catalyst only changes <u>how</u> a reaction occurs, it does not change the identities of the reactants or products. → A catalyst has no effect on an equilibrium constant.