FEB 15

>>> LE CHÂTELIER'S PRINCIPLE CONT'D

~~RXN RATES~~

(1)

When gases are involved in equbm:

- Increasing the pressure (or decreasing volume) will favor the side w/ the less moles of gas.
- decreasing pressure (increase volume) favor the side w/ the More Moles of gas.

$\underbrace{2A\,(g)}_{\text{more moles}} \rightleftharpoons \underbrace{B\,(g)}_{\text{less moles}}$

A) ⟶

B) Increase P ⇒ decrease moles ⇒ RXN moves towards products.

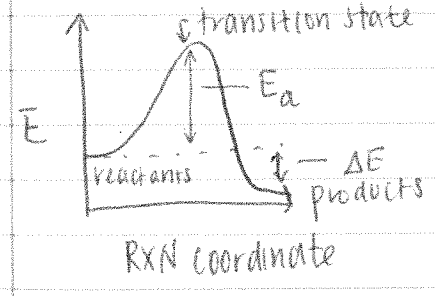
C) Decrease P ⇒ Increase moles ⇒ RXN moves towards reactants.

- Effect of Temp:
  - Endothermic: heat acts like reactant, adding heat drives a RXN towards products (heat + A ⇌ B)
  - Exothermic: heat acts like a product, adding heat drives a RXN towards reactant. (A ⇌ B + heat)

>>> CHEMICAL KINETICS (CH 14)

(study of rates of RXN)

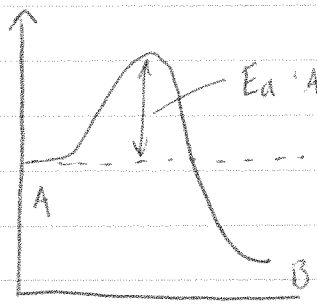
ex/ Why don't things rust immediately?



- CHEMICAL RXN occur slowly if there is a large 'barrier' to RXN.

(EXOTHERMIC)

Exothermic RXN



RXN coordinate

$\Delta E < 0$, $K > 1$, favors products

$\Delta E > 0$, $K < 1$, favors reactants

K > 1 favors products.

- ΔE determines position of equilibrium.
- E_a determines rate of RXN
- greater Ea, slower RXN

(*) Chemical Kinetics tell us: time it takes to get to equibm, the path the RXN follows, and the rates of RXN

$NO_{(g)} + O_{2\,(g)} \longrightarrow NO_{2\,(g)} + O_{2\,(g)}$

How do rxns happen?
- effective collisions in the right orientation.

(*)(*) Factors that Affect RXN rates

- Physical state of reactants (solids slower)
- reactant concentration (high concentration, more collisions)
- reaction temperature (heat causes faster motions, so more collisions)
- Presence of catalyst
  - Do not appear in overall rxn
  - can affect collision geometry → Accelerates rate
  - Class demo: $2H_2O_2 \rightleftharpoons 2H_2O + O_2$
    NI

What is a rate?

(*) rate = $\frac{\text{distance}}{\text{time}} = \frac{\Delta x}{\Delta t}$ (*)

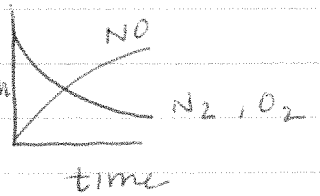
ex/ Jane drives from Waterville to Brunswick (40 miles) in 40 minutes.

$$\text{Rate} = \frac{\Delta x}{\Delta t} = \frac{40\ \text{mi}}{40\ \text{min}} = 1\ \text{mile per minute}$$

$$\times \frac{60\ \text{min}}{1\ \text{hr}} = 60\ \text{mi/hr}$$

ex/ $N_2(g) + O_2(g) \rightarrow 2\,NO(g)$ (see table 13.1)

- As eqbm is reached RXN slows down. Amount of reactants decreases, so less collisions.



$$\text{Rate}_{NO} = +\frac{\Delta[NO]}{\Delta t}$$

$$= \frac{(14.8\,\mu M - 7.8\,\mu M)}{10\,\mu s - 5\,\mu s}$$

$$= \boxed{1.4\,\mu M \text{ per second}}$$

Rate - change in concentration with time

$$R = \frac{\Delta[\ ]}{\Delta t}$$