March
April
2020

AIM
- What is equilibrium and how does it relate to Le Châtelier's Principle?

AGENDA
- YOYO
- Equilibrium Notes
- Equilibrium Simulation

YOYO

HOMEWORK
- Follow calendar on website

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Irreversible vs. Reversible Reactions

- In a **irreversible reaction**, the reactants react to form the products, which cannot change back into reactants
- A **reversible reaction** is one in which the conversion of reactants to products and the conversion of products to reactants occur simultaneously (at the same time).

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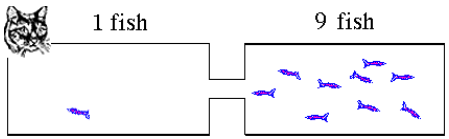
Equilibrium

- Equilibrium occurs when the forward and reverse reactions occur at the **same rate**; the **concentration** of the reactants and products remain **constant**.
- Can only occur in a **closed system**; reactants nor products can leave the system.



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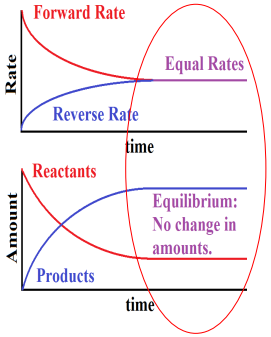
Equilibrium

- The forward reaction will continue to slow as the reverse reaction proceeds until equilibrium is met.
- That is chemical equilibrium.



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Physical/Phase Equilibrium

- The **rate** at which a substance evaporates is **equal** to the **rate** which the substance condenses.
- Example: Rate of melting = rate of freezing

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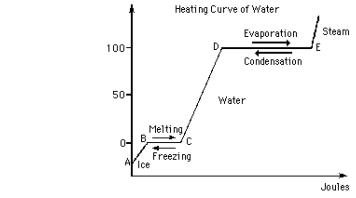

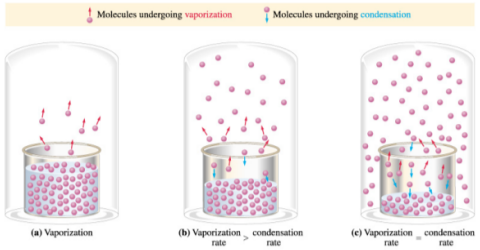

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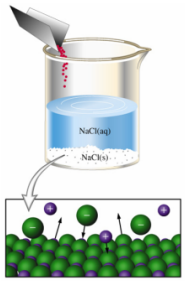
Solution Equilibrium

- A saturated solution is at equilibrium; the rate of **dissolving** equals the rate of **recrystallization**.
- Ex: NaCl(s) → NaCl(aq)



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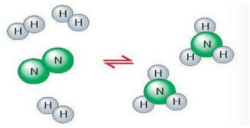
Chemical Equilibrium

- Chemical equilibrium is when the **rates** of the forward and reverse reactions are **equal** in a chemical reaction.

Making ammonia
The Haber process

$N_2 + 3H_2 \rightleftharpoons 2NH_3$



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Le Châtelier's Principle

- Explains how a chemical reaction at equilibrium responds to relieve any stress on that reaction. **STRESS MEANS CHANGE**
- Reaction will counter the stress by shifting to the left to produce more reactant, or shift to the right to produce more product.
- Sources of Stress:
  - Changes in **Concentration** (amount)
  - Changes in **Temperature** (added/subtracted heat)
  - Changes in **Pressure** (only if gases are present)

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Putting It All Together

- **Add to left, shift to right**
- **Add to right, shift to left**
- **Remove from left, shift to left**
- **Remove from right, shift to right**
- **If increase pressure, shift to the side with less gas molecules**
- **The side in which the reaction shifts is the side whose amount increases; and the other side's amount decreases.**
- Catalysts DON'T cause stress. They only speed up the reaction.
- All of this can be boiled down to four letters…AATT
  - ADD AWAY TAKE TOWARD

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