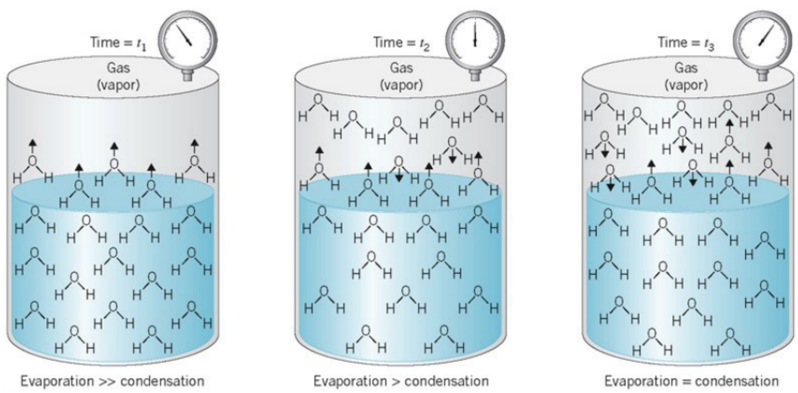
Final Review

March 12, 2022

This is a checklist based on the lecture and textbook materials. It is not expected to be an all encompassing study guide and provides a guideline for your studies.

Phase Equilibria

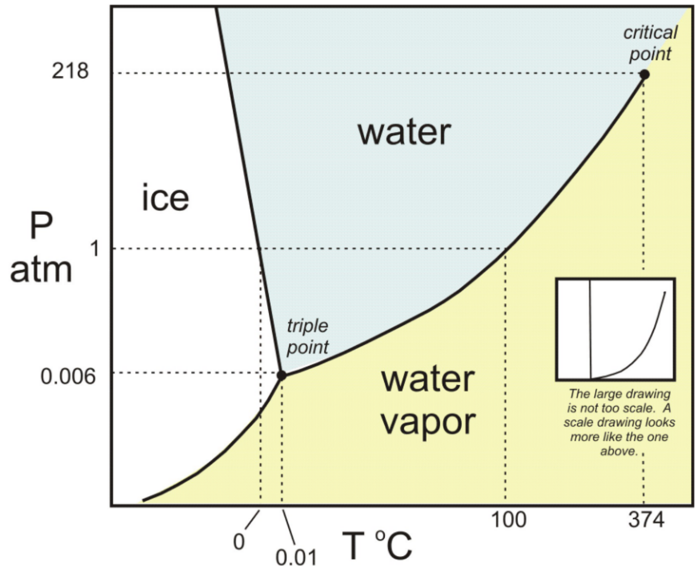


- Vapor pressure and boiling points
- Trouton's rule ($\Delta S_{\text{vap}} = 85$ J/(mol K))
- Clausius-Clapeyron equation

$$P_f = P_i e^{-\frac{\Delta H_{\text{vap}}}{R}(\frac{1}{T_f} - \frac{1}{T_i})}$$

Phase Diagram

- Gibbs Phase Rule $F = C - P + 2$
- Triple Point and Critical Point



- Kinetics of Phase Changes
- Real Gases and the Van der Waals Equation

$$(P + \frac{a}{v^2})(v - b) = RT$$

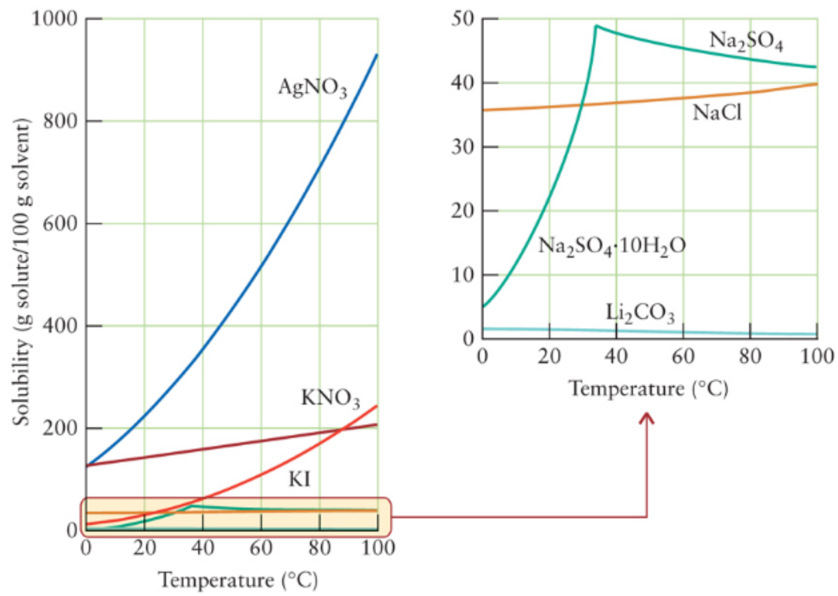
- Microscopic interpretation of constants a and b

Intermolecular Interactions

- Electrostatic, induction, and dispersion
- Affects boiling points and vapor pressures

Solutions

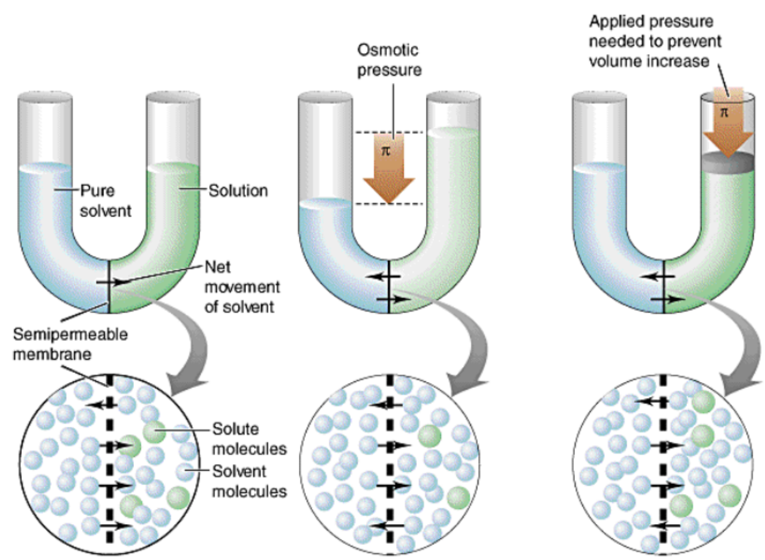
- "Like dissolves like"
- Molarity (mol/L), molality (mol/kg), mass percentage (m(solute)/m(solution)), and mole fraction ($\chi = \frac{n(\text{solute})}{n(\text{solution})}$)
- Solubility rules for ionic compounds
- Henry's law $c(\text{solute}) = k_H P(\text{solute})$
- Temperature dependence of solubility



- Raoult's law

$$\Delta P = P(\text{sol}) - P_0 = -\chi(\text{solute})P_0(\text{solvent})$$

- Boiling point elevation ($\Delta T_{\text{bp}} = k_b b$) and freezing point depression ($\Delta T_{\text{fp}} = -k_f b$)
- Osmotic pressure (Π) satisfies "ideal gas law"



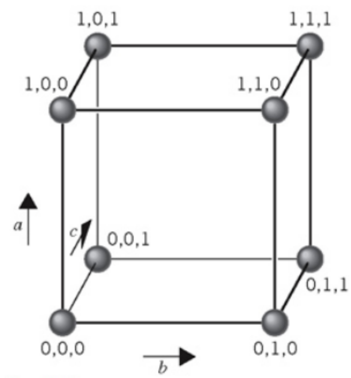
- Van't Hoff factor multipled to freezing point depression and boiling point elevation

$$i = \frac{n(\text{solute species in solution})}{n(\text{undissociated solute})}$$

- Osmotic pressure: $\Pi V = inRT$

Solids

- Unit cell is smallest unit that can be used to construct the lattice by periodic repetition
- Lattice points: Atomic coordinates in basis of lattice vectors **a, b, c**



- N_u - number of atoms per unit cell; V_u unit cell volume
- Density where $m = M/N_A$ is atomic mass

$$\rho = \frac{m_u}{V_u} = \frac{N_u m}{V_u}$$

- Different packings - simple cubic, body-centered cubic, and face-centered cubic