Lecture 17
Properties of Solutions

**Liquid Mixtures**

**Colligative Properties**

- Osmosis
- Freezing Point Depression
- Boiling Point Elevation

**Real solutions**

- Composed of molecules for which A-A, A-B, B-B interactions are all different from one another
- Excess functions, \( X \)
- Excess entropy, \( S \)

Excess functions for all state function variables that can be written as extensive properties (i.e., \( V \), \( S \), \( H \), \( U \), \( G \) and \( A \))

- Excess enthalpy example, \( H \)
- Excess molar volume example, \( V \)

**Assumptions**

- Solvents, solutes and entropy
- Solute not volatile, no contribution to vapour pressure
- Solute does not dissolve in solid solute

**FREEZING POINT DEPRESSION**

- \( \Delta T = K_f b \)
- \( K_f \) is the cryoscopic constant
- Same proof as for BP elevation

**BOILING POINT ELEVATION**

- \( \Delta T = K_b \)
- \( K_b \) is the ebullioscopic constant

Work on proof: will aid with exercises; no need to memorize for examinations

**Not covered**

- Activities
- Solubilities
- Solvents, solutes and entropy

**Effects of entropy**

- Solute: \( S > S^* \), \( p_{A}^* < p_A \) because there is a weaker tendency to form a gas

Results in elevation of boiling point (and also depression of freezing point)