

Review for First Exam:

Chapter 12

Solids, liquids, gases; condensed phase; fluid phase
Forces of interaction in pure substances – ion-ion; dipole-dipole (including hydrogen bonding); dispersion forces
Relationship between interaction forces and boiling point
General trends in boiling points for pure substances
Vapor pressure (definition); enthalpy of vaporization
Clausius-Clapeyron equation and its use
Types of solids – crystalline and amorphous
Types of phase transitions – fusion (melting); vaporization; sublimation
Enthalpy change for a phase transition
Phase diagram for a pure substance – Identifying the regions where solid, liquid, or gas are most stable; normal phase transition points; triple point and its significance; critical point and its significance

Chapter 13

Definition of solution; solvent, solute; kinds of solutions
Solubility in mass solute per mass solvent; molar solubility
Soluble and insoluble; miscible and immiscible
Thermodynamics of solution formation
 Entropy (S) and disorder; how entropy favors solution formation
 Enthalpy of solution (ΔH_{soln}); how this depends on interparticle attractive forces
 Origin of the observation "like dissolves like"
Unsaturated solution, saturated solution, supersaturated solution
Effect of temperature on the solubility of a solid in a liquid
Solubility of gases in liquids; Henry's law and its use
Dependence of gas solubility on temperature
Concentration units - molarity, molality, mole fraction, mass percent, ppm by mass and so forth
Calculation of concentration in different units; converting from one unit to another unit
Solutions of volatile liquids; Raoult's law and its use in calculations
Raoult's law and ideal solution behavior; ideal behavior as $X_A \rightarrow 1$ for all solvents
Vapor pressure vs mole fraction plots for ideal and nonideal solutions; finding vapor pressure for pure liquids from the plot of vapor pressure vs mole fraction
Colligative properties; general characteristics
 Vapor pressure lowering
 Boiling point elevation and freezing point depression; phase diagram
 Osmotic pressure; semipermeable membranes
van't Hoff factor; definition, relationship to ionization or dissociation of a solute
Simple calculations using colligative properties
Molecular mass by colligative properties
Reverse osmosis; osmosis and cell shape
Colloids; definition and simple examples

Chapter 14

Review of thermodynamics - work, heat, internal energy, enthalpy
Sign conventions; state functions
First law of thermodynamics
Spontaneous processes; the need for a second law for thermodynamics
Entropy (S), properties and interpretation of entropy
 ΔS_{sys} , ΔS_{surr} , ΔS_{univ}
The second law of thermodynamics and its meaning
Finding ΔS_{sys} , ΔS_{surr} , ΔS_{univ} for chemical reactions

Entropy for solids, liquids, and gases

Qualitative prediction of ΔS_{sys} for chemical reactions

Trends in entropy based on size of molecules, dissolving substances in solvents

The third law of thermodynamics

Free energy (G); definition of free energy

Relationship between ΔG and spontaneous processes (for T, p constant)

Method for calculating ΔG_{rxn}

Find T_{eq} for processes; finding the range of temperatures for which processes are spontaneous