Chemistry

Final Examination Chapter Summaries

FIRST SEMESTER

Chapter 2: Matter

matter
physical states: solid, liquid, gas
physical & chemical properties
physical & chemical changes
elements
compounds
atoms
molecules
pure substances
homogenous and heterogenous mixtures
solutions
separation of mixtures

Chapter 3: Elements, Atoms, and Ions

element symbols
atomic theory
law of constant composition
elements
atoms & molecules
compounds
chemical formulas
Rutherford's experiment
structure of atom
  nucleus
protons, electrons, neutrons
atomic number
mass number
isotopes
nuclear symbol
periods & groups
regions of the Periodic Table: main groups, transition metals, inner transition metals
noble gases, halogens, alkali metals, alkaline earth metals
metals, nonmetals, metalloids
ionic & covalent compounds
diatomic molecules
ions
formulas for ionic compounds

Chapter 4: Nomenclature

naming ionic compounds
  Type I (no roman numeral)
  Type II (roman numeral)
naming binary covalent compounds
polyatomic ions
naming acids
writing formulas from names

Chapter 5: Measurements and Calculations

scientific notation
metric units: gram, liter, meter
metric prefixes: nano, micro, milli, centi, kilo
measuring devices: balance, graduated cylinder
significant figures
  counting and in arithmetic
accuracy & precision
percent accuracy error
problem solving using conversion factors (dimensional analysis)
temperature conversions
density

Chapter 6: Chemical Composition

atomic mass
mole
Avogadro's number
molar mass
calculations: # particles $\leftrightarrow$ moles $\leftrightarrow$ mass
percent composition (mass percent)
empirical formula
molecular formula
percent composition $\leftrightarrow$ empirical formula
finding molecular formula from empirical formula and molar mass
empirical formula from experimental data

Chapter 7: Introduction to Chemical Reactions

chemical reactions
chemical equations
reactants, products
coefficients
writing and balancing chemical equations

Chapter 8: Reactions in Aqueous Solutions

predicting whether a reaction will occur
precipitation reactions
strong electrolytes
using a solubility table
predicting whether a precipitate occurs
writing equations for precipitation reactions
molecular equations
net ionic equations
acids, bases
acid-base reactions
common strong acids
common strong bases
double displacement reactions
  precipitation reactions
  acid-base reactions
oxidation-reduction reactions
  synthesis (combination)
  decomposition
  combustion reactions
  single replacement reactions

Chapter 9: Chemical Quantities

interpreting balanced chemical equations
stoichiometric calculations:
mole and mass relationships between reactants and products
limiting reactant and excess reactant
theoretical yield
experimental yield
calculating percent yield

Chapter 10: Energy

Potential and Kinetic Energy
Law of conservation of energy
1st and 2nd Laws of Thermodynamics
Temperature
endothermic, exothermic
heat content diagrams
specific heat
calorimetry: calculation of heat change from temperature change
  $Q = s \times m \times \Delta T$
Heat content = enthalpy
change in heat content (ΔH)
thermochemical equations
ΔH/mole conversions
Hess' Law
Fossil fuels
Entropy

Chapter 11: Modern Atomic Theory

wavelength, frequency and energy
atomic spectra
Bohr model of the hydrogen atom
ground state, excited states
quantum mechanics
electron clouds
orbitals
principle energy levels (n)
sublevels (s, p, d, f): electron capacity and relative energies
ground state electron configuration of atoms
electron configuration & the Periodic Table
abbreviated electron configurations
outer electron configuration
valence electrons
orbital diagrams
atomic radius
ionization energy

SECOND SEMESTER

Chapter 12: Chemical Bonding

chemical bonds
ionic bonds
covalent bonds
polar and nonpolar covalent bonds
electronegativity
bond polarity
dipole moment
electron configurations of ions
ion size
Lewis structures of atoms
Lewis structures of molecules
octet rule
lone pairs
resonance
VSEPR Model

Chapter 20: Organic Chemistry

properties of organic compounds
saturated and unsaturated hydrocarbons
alkanes
name alkanes
    prefixes for 1-10 carbons
draw structures
isomers
petroleum
alkenes, alkynes
reactions of alkanes and alkenes
aromatic hydrocarbons
    benzene
functional groups
    alkyl, phenyl, alcohols, carboxylic acids, esters,
    amines, amides
formic acid & acetic acid
common names and formation of esters
addition polymers
condensation polymers
    polyesters and polyamides
draw monomer from polymer and vice versa

Chapter 13: Gases

Kinetic-molecular theory
    pressure
        barometer, manometer
        1 atm = 760 mmHg = 760 torr
    temperature
absolute zero temperature
    T(K) = T(°C) + 273
relationship between pressure, volume, temperature
    Boyle's Law
    Charles' Law
    Avogadro's Law
Ideal Gas Law
    R = 0.0821 L atm/mol K
partial pressure
molar volume
STP
molar volume @ STP = 22.4 L
gas stoichiometry
molar mass and density of a gas

formulas:

$P_{total} = P_x + P_y + \ldots$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$PV = nRT$; R = 0.0821 L atm/mol K

$d = \frac{mm}{mV}$

$P_1 = \left(\frac{n_1}{n_T}\right)P_T$

Chapter 14: Liquids and Solids

Differences between gas, liquid, solid
heating/cooling curve
sublimation
intramolecular forces and intermolecular forces
Intermolecular forces:
- London dispersion forces, dipole forces, hydrogen bonds

Relationship between interparticle forces and melting pt, boiling pt, vapor pressure
vapor pressure
equilibrium vapor pressure of water as f(T)
relative humidity
dew point
boiling point
Properties of the following types of solids (nature of particles, electrical conductivity, melting points, solubility, examples): molecular, network covalent, ionic, metallic

Chapter 19: Radioactivity and Nuclear Energy

what makes elements radioactive
alpha emission
beta emission
gamma emission
nuclear equations
band of stability
half-life (rate of decay)
nuclear fission
- nuclear equation
- production of radioactive waste
- chain reaction

nuclear fusion

Chapter 15: Solutions

solution
solute
solvent
molecular and ionic solutes
like dissolves like
- nonpolar vs. polar solutes and solvents

Saturated, supersaturated and unsaturated solutions
Using graph of solubility and temperature
solubility and temperature
solution composition
- mass percent
- molarity

dilution: $V_1 \times M_1 = V_2 \times M_2$
electrolytes and nonelectrolytes
solution stoichiometry
- volume x molarity = moles

neutralization reactions
electrolytes & nonelectrolytes
colligative properties
- vapor pressure lowering
- boiling point elevation
- freezing point depression

calculate number of moles, concentration or molar mass from freezing point
- $\Delta T_f = 1.86 \times$ moles solute/kg water

Chapter 17: Equilibrium

factors affecting rate (and why)
- concentrations of reactants, temperature, surface area, catalysts

activation energy
- relation to rate

energy diagrams

catalysis

definition of equilibrium

factors affecting equilibrium: temperature

equilibrium constant, K
- expression for K from equation
- only gases and aqueous
- relate to extent of reaction

calculation of K from concentrations at equilibrium and vice versa

LeChatelier's Principle
- statement of principle
- effect of adding or removing product or reactant
- effect of changing volume or pressure
- effect of changing temperature

relationship between temperature and K for endothermic and exothermic reactions

K_{sp}
- expression for K_{sp}
- calculations of equilibrium concentrations from K_{sp} and vice versa
- relationship to extent of solubility

Chapter 16: Acids and Bases

properties of acids and bases

Arrhenius definition of acids and bases

Bronsted-Lowry model of acids and bases
- conjugate acid/base pairs

strong and weak acids

the acid dissociation constant, K_a
- definition
- relationship to acid strength

amphoteric substances

K_w: relationship between $[H^+]$ and $[OH^-]$

definitions of pH and pOH

defining acids and bases in terms of pH, $[H^+]$, pOH, and $[OH^-]$

find pH from $[H^+]$ and $[OH^-]$

ionization (dissociation) equations for acids

acid-base equations

buffers

Chapter 18: Oxidation-Reduction Reactions & Electrochemistry

definitions
- oxidation and reduction
- oxidizing and reducing agents
- oxidation state (number)
- oxidation-reduction reactions

balancing oxidation-reduction reactions

voltaic cells
- anode and cathode
- direction of electron and ion flow
- porous barrier/salt bridge

electrolytic cells