

Topic	Chapters/Pages
I. Structure of Matter (20%)	Chapters 2-3, 7-13, 15, 19, 21, 23-24
A. Atomic theory and atomic structure	39-47, 76-77, 84, 277-313, 329-349, 385, 997-1000
1. Evidence for the atomic theory	39-46
2. Atomic masses; determination by chemical and physical means	10-11, 76-77, 84
3. Atomic number and mass number; isotopes	46-47, 84
4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals	277-313
5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states	329-349, 385, 997-1000
B. Chemical bonding	371-400, 415-445, 469-478, 488-495, 522-524, 694-698, 941-942, 1007-1011, 1029-1030
1. Binding forces	371-400, 415, 425-426, 469-478, 488-495, 941-942
a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces)	371-400, 469-475, 493, 941-942
b. Relationships to states, structure, and properties of matter	381-383, 415, 469-478, 488-495
c. Polarity of bonds, electronegativities	382-385, 425-426
2. Molecular models	380-400, 415-423, 431-445
a. Lewis structures	380-400
b. Valence bond: hybridization of orbitals, resonance, sigma and pi bonds	392-394, 431-445
c. VSEPR	415-423
3. Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; relation of properties to structure	415-430, 469-478, 522-524, 694-698, 1007-1011, 1029-1030

C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications	42-43, 588-589, 865-893
II. States of Matter (20%)	Chapters 1, 4-5, 6, 9, 11-12, 16
A. Gases	178-207, 210-213
1. Laws of ideal gases	178-193, 195-201
a. Equation of state for an ideal gas	178-193
b. Partial pressures	195-201
2. Kinetic molecular theory	183-195, 202-207, 210-213
a. Interpretation of ideal gas laws on the basis of this theory	203-204
b. Avogadro's hypothesis and the mole concept	183-195
c. Dependence of kinetic energy of molecules on temperature	202-207
d. Deviations from ideal gas laws	210-213
B. Liquids and solids	9-10, 261, 374-379, 468-469, 478-507
1. Liquids and solids from the kinetic-molecular viewpoint	9-10, 468-469
2. Phase diagrams of one-component systems	505-507
3. Changes of state, including critical points and triple points	9-10, 495-506
4. Structure of solids; lattice energies	261, 374-379, 478-495
C. Solutions	119-123, 145-149, 197-198, 521-548, 753-757
1. Types of solutions and factors affecting solubility	119-123, 521-524, 529-533, 753-757
2. Methods of expressing concentration (use of normalities is not tested)	145-149, 197-198, 524-528
3. Raoult's law and colligative properties (nonvolatile solutes); osmosis	534-548
4. Nonideal behavior (qualitative aspects)	536-537, 546
III. Reactions (35-40%)	Chapters 2-6, 8-9, 11, 13-18
A. Reaction types	121-143, 151-155, 359-361, 385, 669-670, 704-710, 758-763, 815-834, 843-850
1. Acid-base reactions; concepts of Arrhenius, Brønsted-Lowry and Lewis; coordination complexes; amphoterism	126-132, 151-154, 359-361, 669-670, 704-710, 758-763
2. Precipitation reactions	121-126

3. Oxidation-reduction reactions	132-144, 155, 385, 815-834, 843-850
a. Oxidation number	135-144, 385, 815
b. The role of the electron in oxidation-reduction	132-143, 155, 815-820
c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; Nernst equation; prediction of the direction of redox reactions	815-834, 843-850
B. Stoichiometry	50-65, 77-90, 90-104, 121-143, 193-195, 815-818
1. Ionic and molecular species present in chemical systems: net ionic equations	50-65, 121-143
2. Balancing of equations, including those for redox reactions	90-95, 815-818
3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants	53-54, 77-90, 95-104, 193-195
C. Equilibrium	121, 496-497, 501-502, 624-656, 670-694, 698-706, 723-741, 744-757, 763-765
1. Concept of dynamic equilibrium, physical and chemical; Le Chatelier's principle; equilibrium constants	121, 496-497, 501-502, 624-656
2. Quantitative treatment	627-632, 670-694, 698-706, 723-741, 744-757, 763-765
a. Equilibrium constants for gaseous reactions: K_p , K_c	627-632
b. Equilibrium constants for reactions in solution	670-694, 698-706, 723-741, 744-757, 763-765
(1) Constants for acids and bases; pK ; pH	670-694
(2) Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds	744-757, 763-765
(3) Common ion effect; buffers; hydrolysis	698-706, 723-741, 753-755
D. Kinetics	565-609
1. Concept of rate of reaction	565-573
2. Use of experimental data and	573-589

graphical analysis to determine reactant order, rate constants and reaction rate laws	
3. Effect of temperature change on rates	590-595
4. Energy of activation; the role of catalysts	590-595, 601-609
5. The relationship between the rate-determining step and a mechanism	596-601
E. Thermodynamics	234-262, 400-404, 497-505, 778-804, 826-829
1. State functions	234-238
2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; calorimetry	234-262, 400-404, 497-505
3. Second law: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes	779-798, 802-804
4. Relationship of change in free energy to equilibrium constants and electrode potentials	798-802, 826-829
IV. Descriptive Chemistry (10-15%)	Chapters 2, 4, 8, 20-24
1. Chemical reactivity and products of chemical reactions	121-143, 350-361, 918-921, 935-938, 944-951, 959-991, 1018
2. Relationships in the periodic table: horizontal, vertical and diagonal with examples from alkali metals, alkaline earth metals, halogens and the first series of transition elements	48-50, 349-361, 943-953, 959-991, 997-1002
3. Introduction to organic chemistry: hydrocarbons and functional groups (structure, nomenclature, chemical properties)	65-66, 1028-1033, 1035-1037, 1039-1042, 1044-1049