

CORRELATION

ADVANCED PLACEMENT CHEMISTRY TOPICS

SUBJECT: AP Chemistry

TITLE: Chemistry: The Molecular Nature of Matter and Change, 5th Edition

AUTHORS: Martin Silberberg

PUBLISHER: Glencoe/McGraw-Hill

	Page(s) or location(s) where taught
I. Structure of Matter (20%)	
A. Atomic theory and atomic structure	Chapters 2,7, 8
1. Evidence for the atomic theory	47-57
2. Atomic masses; determination by chemical and physical means	53-56
3. Atomic number and mass number; isotopes	52-54
4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals	269-295,303-316
5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states	57-59, 317-333,554-555,561
B. Chemical bonding	Chapters 2,9,10,11,12,15,23
1. Binding forces	
a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces)	60-63,341-371,450-456,556-557
b. Relationships to states, structure, and properties of matter	349-350,355-356,370-371,457-460
c. Polarity of bonds, electronegativities	363-369,399-401

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|--|---------------------------|
| 2. Molecular models | |
| a. Lewis structures | 378-387 |
| b. Valence bond: hybridization of orbitals, resonance, sigma and pi bonds | 381-383,411-421 |
| c. VSEPR | 388-397 |
| 3. Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; relation of properties to structure | 388-401,637-638,1043-1045 |

C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications	Chapter 24 1066-1082,1094-1098
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II. States of Matter (20%)

A. Gases

Chapter 5

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|---|-----------------|
| 1. Laws of ideal gases | |
| a. Equation of state for an ideal gas | 193-205,208-210 |
| b. Partial pressures | 205-208 |
| 2. Kinetic-molecular theory | |
| a. Interpretation of ideal gas laws on the basis of this theory | 210-215 |
| b. Avogadro's hypothesis and the mole concept | 196-197,213 |
| c. Dependence of kinetic energy of molecules on temperature | 213-215 |
| d. Deviations from ideal gas laws | 221-224 |

B. Liquids and solids

Chapters 9,12

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|--|-----------------|
| 1. Liquids and solids from the kinetic-molecular viewpoint | 437-438 |
| 2. Phase diagrams of one-component systems | 448-449 |
| 3. Changes of state, including critical points and triple points | 438-449 |
| 4. Structure of solids; lattice energies | 344-350,463-476 |

C. Solutions

1. Types of solutions and factors affecting solubility
2. Methods of expressing concentration (The use of normalities is not tested.)
3. Raoult's law and colligative properties (nonvolatile solutes); osmosis
4. Non-ideal behavior (qualitative aspects)

Chapters 3,4,13

142-144,503-506,514-522

121-124,522-527

527-538

528,537-538

III. Reactions (35-40%)

A. Reaction types

1. Acid-base reactions; concepts of Arrhenius, Bronsted-Lowry, and Lewis; coordination complexes, amphoterism
2. Precipitation reactions
3. Oxidation-reduction reactions
 - a. Oxidation number
 - b. The role of the electron in oxidation-reduction
 - c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; Nernst equation; prediction of the direction of redox reactions

Chapters 4,18,21

150-157,784-785,793-797,816-820

146-150,158-173

159-162

923-924

923-951, 956-966

B. Stoichiometry

1. Ionic and molecular species present in chemical systems: net ionic equations
2. Balancing of equations including those for redox reactions
3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants

Chapters 3,4,21

104-109, 145-164

104-109,162-164,924-928

90-102,109-128

C. Equilibrium

1. Concept of dynamic equilibrium, physical and chemical; LeChatelier's principle; equilibrium constants
2. Quantitative treatment
 - a. Equilibrium constants for gaseous reactions: K_p , K_c

Chapters 4,17,18,19

173-175,735-747,761-768

748-760

b.	Equilibrium constants for reactions in solution	
(1)	Constants for acids and bases; pK; pH	785-815
(2)	Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds	851-862
(3)	Common ion effect; buffers; hydrolysis	812-816,832-851
D.	Kinetics	Chapter 16
1.	Concept of rate of reaction	685-691
2.	Use of experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws	690-705
3.	Effect of temperature change on rates	705-710
4.	Energy of activation; the role of catalysts	708-713,720-722
5.	The relationship between the rate-determining step and a mechanism	714-719
E.	Thermodynamics	Chapters 6,12,20,21
1.	State functions	236-242
2.	First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; calorimetry	243-255,438-443
3.	Second law: entropy; free energy of formation, free energy of reaction; dependence of change in free energy on enthalpy and entropy changes	881-907
4.	Relationship of change in free energy to equilibrium constants and electrode potentials	991-913,943-945
IV.	Descriptive Chemistry (10-15%)	Chapters 3,4,8,14,15,23
1.	Chemical reactivity and products of chemical reactions	147-152,156-159,170-173,326-327,559,566-616
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	325-327,562-563-618,1025-1030
3.	Introduction to organic chemistry: hydrocarbons and functional groups (structure, nomenclature, chemical properties).	102-104,629-645, 650-662

V. Laboratory (5-10%)

*see laboratory manual to accompany Chemistry: The Molecular Nature of Matter and Change
5th Edition, by Martin Silberberg*

- making observations of chemical reactions and substances
- recording data
- calculating and interpreting results based on the quantitative data obtained
- communicating effectively the results of experimental work