AP Chemistry Unit 2 Outline: Chemical Bonding and Organic Chemistry

Chapter 7: Quantum Theory and the Electronic Structure of Atoms

Classes	Topics	Suggested Reading	✓	Assignments	✓
1	Electromagnetic Radiation, Wavelength, Frequency, $c = \lambda\nu$ Plank's Quantum Theory and Planck's Constant, $\Delta E = h\nu$, Photons, Photoelectric Effect, $E = mc^2$, Duality of Light, Quantized Energy	7.1 From Classical Physics to Quantum Theory (pg. 276 – 279) 7.2 Photoelectric Effect (pg. 280 – 282)		pg. 312 − 313 #2, 4, 8, 10, 12 pg. 313 #14 to 22 (even)	
2	Diffraction, Emission and Absorption Spectrums, $E_n = \frac{-2.178\times10^{-18}\,\text{J}}{n^2}$, Duality of Matter ($p = m\upsilon$), de Broglie's Wavelength $\left(\lambda = \frac{h}{m\upsilon}\right)$	7.3 The Atomic Spectrum of Hydrogen (pg. 282 – 287) 7.4 The Dual Nature of the Electron (pg. 288 – 291)		pg. 313 − 314 #23, 24 to 34 (even) pg. 314 #36 to 42 (even)	
3	Heisenberg Uncertainty Principle, Standing Waves, Schrödinger's Wave Function $\left(\hat{H}\psi = E\psi\right)$, Probability Distribution, Atomic Orbital, Radial Probability Distributions, Quantum (Wave) Mechanical Model, Quantum Numbers, Principal Quantum Number (n), Angular Momentum Quantum Number (l), Magnetic Quantum Number (m_l), Electron Spin, Electron Spin Quantum Number (m_s), Orbital Shapes, Nodal Surfaces or Nodes, Subshells (s, p, d, f, and g orbitals), Orbital Energies of a Hydrogen Atom, Polyelectronic Atom, Electrons Correction Problem (Degeneration), Pauli Exclusion Principle, Penetration (Tunneling) Effect, Aufbau (Building-Up) Principle, Orbital Diagrams, Hund's Rule, Electron Configurations and Exceptions, Valence vs. Shielding (Core) Electrons	7.5 Quantum Mechanics (pg. 293 – 294) 7.6 & 7.7 Quantum Numbers & Atomic Orbitals (pg. 294 – 300) 7.8 & 7.9 Electron Configuration & The Building-Up Principle (pg. 300 – 311)		pg. 314 #43 to 47 pg. 314 − 315 #48 to 70 (even) pg. 315 #72 to 78 (even) pg. 315 #82 to 90 (even), 91, 92	

Chapter 8: Periodic Relationships Among the Elements

Classes	Topics	Suggested Reading	✓	Assignments	✓
4	Dmitri Mendeleev, Main Group or Representative Elements (s and p orbitals), Transition Metals (d orbitals), Lanthanide and Actinide Series (f orbitals), Ground and Excited States, Electron Configurations, Electron Configurations of Ions (Representative Elements and Transition Metals), Shielding Effect, Effective Nuclear Charge (Z_{eff}), Periodic Trends of Atomic and Ionic Radii, Isoelectronic Ions,	8.1 Development of the Periodic Table (pg. 324 – 326) 8.2 Periodic Classification of the Elements (pg. 326 – 330) 8.3 Periodic Variations in Physical Properties (pg. 330 – 336)		pg. 356 − 357 #1 to 4 pg. 357 − 358 #11, 13, 15 to 20, 22, 23, 24 to 32 (even) pg. 358 #34 to 44 (even), 45 to 48	
5	Ionization Energy, First and Second Ionization Energies (I_1 and I_2), Periodic Trend in Ionization Energies, Electron Affinity, Periodic Trend of Electron Affinities	8.4 & 8.5 Ionization Energy & Electron Affinity (pg. 337 − 354)		pg. 358 #49 to 52, 54, 56 pg. 358 − 359 #59 to 64	
6	**Lab #2: Quantitative Spectroscopy of Hydrogen Emission Spectrum (September 21, Wednesday)**	Lab #2 Handout		**Lab #2 Report Due (October 5, Wednesday)**	
	Chapter 7 & 8 Take-Home Quiz (Assigned on September 27, Tuesday)	**Chapter 7 & 8 Homework Due (September 26, Monday)**		**Chapter 7 & 8 Take-Home Quiz (Due: September 29, Thursday)**	

Chapter 9: Chemical Bonding I: Basic Concepts

Classes	Topics	Suggested Reading	✓	Assignments	✓
7	Lewis Structures, Ionic Bonding and Predicting Ionic Compounds, Lattice Energy, Coulomb's Law, Comparing Lattice Energy, Molar Heat of Formation for Ionic Compounds using the Haber-Born Cycle	9.1: Lewis Dot Symbols (pg. 366) 9.2: The Ionic Bond (pg. 367 – 369) 9.3: Lattice Energy and Ionic Compounds (pg. 369 – 374)		pg. 400 #1 and 5 pg. 400 #7, 9, 10, 13, 15, 16, 18, 20 pg. 400 − 401 #21, 22, 24 to 26	
8	Covalent Bonds and Covalent Compounds, Chemical Bonding Model, Single Bonds, Lone Pairs, Bonding Pairs, Structural Formula, Double and Triple Bonds (Coordinate Covalent Bonds – Multiple Bonds), Bond Lengths, Polar Covalent Bond, Electronegativity, Periodic Trends of Electronegativity, Relative Bond Polarity, Writing Lewis Dot Diagrams, Duet Rule, Octet Rule	9.4: The Covalent Bond (pg. 374 – 377) 9.5: Electronegativity (pg. 377 – 380) 9.6: Writing Lewis Structures (pg. 380 − 383)		pg. 401 #30 to 32 pg. 401 #34 to 40 pg. 401 #43 to 48	
9	Exceptions to the Octet Rule (Incomplete Octet and Expanded Octet), Odd-Electron Molecules, Resonance, Resonance Structures, Formal Charge, Bond Energy and Enthalpy	9.9: Exceptions to the Octet Rule (pg. 389 – 394) 9.7 & 9.8: Formal Charges & the Concept of Resonance (pg. 383 − 388) 9.10: Bond Enthalpy (pg. 394 − 398)		pg. 402 #57, 59, 63 to 66 pg. 401 − 402 #42, 51 to 56 pg. 402 #69 to 72	

Chapter 10: Chemical Bonding II: Molecular Geometry and Hybridization of Atomic Orbitals

Classes	Topics	Suggested Reading	✓	Assignments	✓
10	Molecular Geometry, Valence Shell Electron Pair Repulsion (VSEPR) Model, Linear, Trigonal Planar, Tetrahedral, V-Shaped, Trigonal Pyramid, Trigonal Bipyramid, Octahedral and Square Planar Structures, Dipole Moments, Polar and Nonpolar Molecules	10.1: Molecular Geometry (pg. 410 – 419) 10.2: Dipole Moments (pg. 420 − 423)		pg. 453 #2, 4, 5, 8 to 14 pg. 453 − 454 #16, 17, 20 to 24	
11	Valence Bond Theory, Overlapping of Atomic Orbitals, Hybridization, Hybrid Orbitals (sp^3, sp^2, sp, dsp^3, d^2sp^3), Sigma (σ) and Pi (π) Bonds	10.3: Valence Bond Theory (pg. 424 – 427) 10.4 & 10.5: Hybridization of Atomic Orbitals & in Molecules Containing Double and Triple Bonds (pg. 428 − 439)		pg. 454 #26 pg. 454 – 455 #29, 30, 32, 34, 36 to 42	
12	**Lab #3: Analysis of Food Dye in Beverages** (October 6, Thursday)	Lab #3 Handout		**Lab #3 Report Due** **(October 18, Tuesday)**	
	Chapters 9 & 10 Take-Home Quiz **(Assign on October 10, Monday)**	**Chapter 9 & 10 Homework Due** **(October 6, Thursday)**		**Ch 8 & 9 Take-Home Quiz** **(Due: October 13, Thursday)**	

Chapter 24 & 25: Organic Chemistry and Synthetic Organic Polymers

Classes	Topics	Suggested Reading	✓	Assignments	✓
13	Organic Chemistry, Functional Groups, Hydrocarbons, Aliphatic and Aromatic Hydrocarbons, Saturated and Unsaturated Bonds, Alkanes, Normal (Straight Chained or Unbranched) Hydrocarbons, Structural and Stereo Isomerism, Nomenclature of Alkanes, Alkyl Groups, Reactions of Alkanes (Combustion, Substitution, Dehydrogenation), Halogen Derivatives, Cyclic Alkanes, Alkenes, *cis-trans* Isomerism, Alkynes, Addition, Hydrogenation Reactions with Alkenes and Alkynes (Markovikov's Rule), Halogenation	24.1: Classes of Organic Compounds (pg. 1026) 24.2: Aliphatic Hydrocarbons (pg. 1026 –1037)		pg. 1052 #1 and 2 pg. 1052 – 1053 #3 to 8, 11 to 18, 20, 23, 24, 26 to 28	
14	Aromatic Hydrocarbons, Nomenclature of Aromatic Compounds (ortho-, meta-, para-), Properties and Reactions with Aromatic Compounds	24.3: Aromatic Hydrocarbons (pg. 1039 – 1041)		pg. 1053 #29 to 32	
15	Hydrocarbon Derivatives, Properties of Different Functional Groups and Reactions, Alcohols (Primary, Secondary and Tertiary), Ethers, Aldehydes, Ketones, Carboxylic Acids, Esters, Esterification, Amines	24.4: Chemistry of the Functional Groups (pg. 1042 – 1051)		pg. 1053 − 1054 #34 to 42	
16	Polymers, Monomers, Dimers, Free Radical, Homopolymer, Atactic Polypropenes, Isotactic versus Syndiotactic Structures, Addition and Condensation Polymerizations, Copolymer, Polyester, Polyvinyl Chloride (PVC)	25.1 & 25.2: Properties of Polymers & Synthetic Organic Polymers (pg. 1062 – 1067)		pg. 1081 #3, 4, 7 to 12	
17	**Lab Activity: Organic Molecular Models (October 31, Monday)**	Lab Activity: Organic Molecular Models Handout		**(Due with Chapter 24 & 25 HW)**	
18	**Unit 2 Test (covers Chapter 7, Chapter 8, Chapter 9, Sections 10.1 to 10.4, Chapter 24, Sections 25.1 & 25.2)** **(November 7, Monday)**			**Chapter 24 & 25 HW Due (November 7, Monday)**	