CHEM-UA 127 Advanced General Chemistry I

Semester: Fall, 2016

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Syllabus

Week 1: September 7
Introduction and origins of atoms and molecules

Week 2: September 12, 14
Chapter 1: The nature and conceptual basis of modern chemistry.
Chapter 2: Chemical formulae, algebraic balancing and reaction yields.
Problem set 1 given out on 9/14.
Quiz 1 given at recitation.

Week 3: September 19, 21
Chapter 3: The classical theory of chemical bonding – energetics and bond classification
Problem set 1 due on 9/21.
Problem set 2 given out on 9/21.
Quiz 2 given at recitation.

Week 4: September 26, 28
Chapter 3: The Lewis model.
Chapter 4: Introduction to quantum theory – failures of classical physics.
Problem set 2 due on 9/28.
Problem set 3 given out on 9/28.
Quiz 3 given at recitation.

Week 5: October 3, 5
Chapter 4: Introduction to quantum theory – the Schrödinger equation and its interpretation; particle-in-a-box model.
Problem set 3 due on 10/5
Problem set 4 given out on 10/5.
Quiz 4 given at recitation.
Week 6: October 12 (no class on Monday, October 10)

Chapter 5: Quantum theory of atomic structure – the hydrogen atom.
Problem set 4 due on 10/12
Problem set 5 given out on 10/12.
Quiz 5 given at recitation.

Week 7: October 17, 19

Chapter 5: Quantum theory of atomic structure – hydrogenic orbitals; approximations for multi-electron atoms.
Chapter 6: Quantum theory of molecular structure – the Born-Oppenheimer approximation; exact solution for \( \text{H}_2^+ \)
Problem set 5 due on 10/17
Midterm 1 on 10/21.

Week 8: October 24, 26

Chapter 6: Quantum theory of molecular structure – linear combination of atomic orbitals; bonding in homo- and heteronuclear diatomics.
Problem set 6 given out on 10/24
Quiz 6 given at recitation.

Week 9: October 31, November 2

Chapter 6: Quantum theory of molecular structure – valence bond theory and orbital hybridization for bonding in polyatomic molecules; predicting molecular geometry.
Problem set 6 due on 11/2,
Problem set 7 given out on 11/2.
Quiz 7 given at recitation.

Week 10: November 7, 9

Chapter 7: Bonding in organic molecules – alkanes, alkenes, alkynes; long-chain hydrocarbons; HOMOs and LUMOs; predicting reaction mechanisms.
Problem set 7 due on 11/9,
Problem set 8 given out on 11/9.
Quiz 8 given at recitation.

Week 11: November 14, 16

Chapter 20: Molecular spectroscopy – Introduction and experimental methods.
Problem set 8 due on 11/14.
Midterm 2 given on 11/18

Week 12: November 21 (no class on November 23)
Chapter 20: Molecular spectroscopy – Rotational, vibrational, NMR, electronic.
Problem set 9 given out on 11/21.

Week 13: November 28, 30

Chapter 21: Structure and bonding in solids – Crystal symmetry and unit cells; crystal structure and space groups, crystals in pharmaceuticals, energetics, and explosives; predicting crystal structures.
Problem set 9 due on 11/30.
Problem set 10 given out on 11/30.
Quiz 9 given at recitation.

Week 14: December 5, 7

Chapter 23: Polymeric materials and soft condensed matter – polymeric materials and their uses as energy materials; liquid crystals; natural polymers.
Problem set 10 due on 12/7.
Problem set 11 given out on 12/7.
Quiz 10 given at recitation.

Week 15: December 12, 14

Chapter 19: Nuclear chemistry – mass-energy relations; radioactive decay; applications to medicine, biology, and energy.
Problem set 11 due on 12/14.
Quiz 11 given at recitation.

Week 16: December 20, 23

Lab final on 12/20 at 12:00 pm.
Final exam on 12/23 at 8:00 am.