

Course and Lecture Outline

Weeks 1-3 (Aug. 29 – Sept. 19)

Topic 1: Bonding, Acids and Bases, and Intermolecular Forces

Readings: Part 1; Sections 1.1, 1.2; pg. 5-63

Lewis Dot structures; Acids and Bases; Bonding; electronegativities; dipole moments; intermolecular forces of attraction

Topic 2: Quantum Chemistry - Atomic and Molecular Orbitals

Readings: Part 1; Sections 2.1-2.5; pg. 67-147

Quantum Mechanics; particle-in-a-box; rigid rotor; Hydrogen Atom; H_2^+ ; Variation method for solving diatomic molecules; hybridization; Heterodiatomics; HOMO/LUMOs

Weeks 4-8 (Sept. 24 – Oct. 27)

Topic 3: Quantum Chemistry Applied

Readings: Part 1; Sections 2.6-2.10; pg. 151-229

Conjugation and pi-systems; Hückel Molecular Orbital Theory; Metallic Bonding/semiconductors; Conducting Polymers

Topic 4: Organic Chemistry - Reactions and Polymers

Readings: Part 2; Sections 3.1-3.5; pg. 5-89

Organic Chemistry Introduction; nomenclature; Basic reaction classes; nucleophilic substitutions; Electrophilic additions to alkenes; Carbonyl Chemistry; Polymer Synthesis and retrosynthesis; Polymer Properties; Photoresists

Weeks 9-13 (Oct. 29 – Nov. 26)

Topic 5: Chemistry of Glasses

Readings: Part 2; Sections 4.1, 4.2; pg. 93-137

Introduction to Glasses; glass formation; Synthesis of Glasses (sol-gel); Biosilification

Topic 6: Chemistry of Color

Readings: Part 2; Sections 5.1-5.3; pg. 141-166

Crystal Field Theory; Ligand Field Theory; fluorescence; phosphorescence; absorption; emission; Organic LEDs; quantum dots; plasmon resonance

Topic 7: Electrochemistry and Corrosion

Readings: Part 2; Sections 6.1-6.3; pg. 169-234

Review of Electrochemistry; Reduction and Oxidation; electrochemical cells; Fuel Cells; electrolysis; electroplating; corrosion; Pourbaix Diagrams

Week 14 (Dec. 1 – Dec. 5)

Topic 8: Surfaces and Interfaces

Readings: Part 2; Sections 7.1-7.3; pg. 237-262

Surfaces and Interfaces; Adhesion; Surface functionalization; Synthesis of nanoparticles

MSE 301 Academic Integrity Policy Statement

(adapted from Prof. Thompson's Policy for MSE 303)

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity (as clarified below). Any work submitted by a student in this course for academic credit will be the student's own work. For this course, the generic University policy is clarified/modified as:

Discussion among students, the professor, TA, former students, and/or any colleagues is permitted and encouraged. You are free to seek help through all avenues. *All final work submitted must be almost exclusively your own work. Copying work from any source (a classmate's homework, previous year's solutions, a website, etc.) is a violation of this policy.*

Violations

Because establishing violations of this policy is difficult, the penalties are sufficiently extreme to discourage the attempt. As such, in this class the following penalties will be assessed for violations:

First violation: A one grade letter drop in final course grade

Second violation: An F for the course.

What does this practically mean for collaborations?

It is not the intent of this policy to discourage students teaching and learning from one another. Quite the contrary, I strongly encourage working together to teach one another. It is only to ensure that you do in fact make the effort to learn the material for yourself. If you work on problem sets together, you still must write the solutions for yourself. If you look over someone else's solution, you need to then go and work the problem out for yourself and put it in your own words and style.

How are violations discerned?

While it is often difficult to find violations, sometimes they are so flagrant that they cannot be missed. We read all of the problem sets and exams, we will notice copied phrases, line-by-line identical solutions, blatant errors that are perpetuated through copying, or material copied directly from websites such as Wikipedia.

Multiple students turning in a problem approached in the same way (correct or incorrect) does not constitute a violation.