

Atoms, Molecules, and Materials - Introduction to Nanomaterials **CHEM 1620 / 2620 - Fall 2018**

Meetings: M, W, F - 1-1:50, Chevron 132
Office Hours - TBD, Eberly 316

Overview: This course is designed to enable senior-level undergraduates and graduate level students to understand the scope, tools, and scientific principles of nanoscience and nanotechnology.

Readings:

There are no required texts for this course – any required materials will be provided throughout the semester on CourseWeb, in class, or both.

- Introduction to Nanoscience by Hornyak, Dutta, Tibbals, and Rao
- Nanostructures and Nanomaterials by Cao and Wang - available online:
<http://site.ebrary.com/lib/pitt/Top?id=10088361>
- Principles of Colloid and Surface Chemistry by Hiemenz and Rajagopalan
- Nanochemistry by Cademartiri and Ozin
- Surfaces by Attard and Barnes (cheap, good)

Grading:

Homework & In-Class Exercises:	100 pts
Piazza / Participation:	100 pts
Exams: (3 total - 100 pts each)	300 pts
Wiki Project:	100 pts

N. B. Additional graduate student requirement:
Final Proposal and Oral Presentation: 100 pts.

Participation: Class participation entails both engagement in the class in the form of questions and also performance on in-class exercises. In-class discussion and questions are strongly encouraged. We will use a discussion forum on piazza.com for pre-class quiz/polls, questions, answers, sharing articles, etc.

Homework: We will have a series of take-home problems throughout the course. These assignments are designed to stimulate critical thinking about facts and concepts covered in class. *Your work will be evaluated on effort in addition to accuracy.* Here, effort is characterized by thorough and thoughtful answers to each question, clear presentation, and acknowledgement of co-workers should you work in a group.

Exams: Exam 1, October 4. Exam 2, Nov. 1. Exam 3: Dec. 8. Exam dates are tentative.

Academic Integrity: Students in the course are expected to comply with the University of Pittsburgh's Policy on Academic Integrity. If you are not aware of the specifics, you may obtain these guidelines from the CAS Dean's Office or on the web at www.cfo.pitt.edu/policies/policy/02/02-03-02.html Violations of these guidelines can result in a zero for the assignment or failure of the course.

Disability Resources: If you have a disability for which you are or may be requesting an accommodation, please contact the Office of Disability Resources and Services, 216 William Pitt Union (412-624-7890) as early as possible in the term.

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Date	Likely Topic
Week 1	27-Aug Introduction - What are Materials, What is "Nano?"
	29-Aug Solids - Unit Cells and Lattices
	31-Aug Solids - Lattices Part 2 - Beyond the Cube
Week 2	3-Sep <i>No Class - Labor Day</i>
	5-Sep Solids - Electronic Structure, Orbitals, Bands, Defects and More
	7-Sep Surfaces - Miller Planes and Flatland
Week 3	10-Sep <i>No Class</i>
	12-Sep Surface Energy and Stability
	14-Sep Nucleation and Growth - Colloids and Nanoparticles
Week 4	17-Sep 0D Metallic Nanoparticles
	19-Sep 0D Semiconductor Nanoparticles - Quantum Dots
	21-Sep 1D Nanomaterials
Week 5	24-Sep Carbon
	26-Sep 2D Nanomaterials - Graphene and Beyond
	28-Sep Top-Down Fabrication (Photolithography, Silicon and Relatives)
Week 6	1-Oct Review / Catch-up
	3-Oct Exam 1
	5-Oct Bottom-Up - Adsorption and Self Assembly
Week 7	9-Oct TUESDAY - Adsorption and Self Assembly Part 2
	10-Oct Soft Materials - Polymers, Liquid Crystals, Biomaterials
	12-Oct Conjugated Polymers
Week 8	15-Oct Characterization - Electron Beam
	17-Oct Characterization - Electron Beam, Part 2
	19-Oct Scanning Probe - STM
Week 9	22-Oct Scanning Probe - AFM & Friends
	24-Oct Characterization - Photons = Spectroscopy
	26-Oct Characterization - Photons, Part 2
Week 10	29-Oct Review / Catch-up
	31-Oct Exam 2
	2-Nov Electronic Materials - Semiconductors, Dielectrics, Superconductors
Week 11	5-Nov Electronic Materials - Part 2

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Date	Likely Topic
	7-Nov Energy - Photovoltaics, Thermoelectrics, Conversion, Transduction, etc.
	9-Nov <i>No Class</i>
Week 12	12-Nov Magnetic - Spins, Ferro and otherwise
	14-Nov Photonics - Refraction, Metamaterials
	16-Nov Applications - Nanomedicine
Week 13	19-Nov Applications - TBD (e.g., Nanotox)
	21-Nov No Class - Thanksgiving Break
	23-Nov No Class - Thanksgiving Break
Week 14	26-Nov Wiki Fun
	28-Nov Wiki Fun
	30-Nov Wiki Fun
Week 15	3-Dec Presentations
	5-Dec Presentations
	7-Dec Exam 3