



**Gifted Learning Links Program
Course Syllabus**

**Instructor name: Ken D'Aquila
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Course Title: Nanoscience: What's the "Small" Idea?

Session Date: Monthly Enrollment 2011-2012 Academic Year

Course Description:

An exciting area of current science research, nanoscience is the study of the extremely tiny. Little particles have a huge impact on our daily lives! It is not just physics, chemistry, engineering or biology, but rather an integration of all of these. Through readings, labs and simulations, students discover the importance of nanoscience and the applications of this research in information technology, medicine and other fields.

Outcomes

- a. Students will know:
 - a. Examples of nanomaterials and nanoscale size effects
 - b. Capabilities of electron microscopes and several scanning probe microscopes
 - c. Capabilities of different nanofabrication techniques
 - d. Applications of nanomaterials to a variety of fields
- b. Students will understand:
 - a. Nanoscience is multi-disciplinary
 - b. Different laws of physics dominate the behavior of nanoscale objects
 - c. The potential health risks of nanomaterials
- c. Students will be able to:
 - a. Read and analyze online literature pertaining to nanoscience and nanotechnology

Resources and Materials:

- a. There is no text book required for this class ☺
- b. All learning materials will be provided through the Course Management System Website including: online readings, virtual labs, and other activities
- c. Electronic resources:
 - 1. Computer
 - 2. Broadband internet access
 - 3. Mozilla Firefox Web browser
 - 4. Stable Email account

CTD Statement on Third-Party Web Sites

Instructors are required to thoroughly review any third-party web sites they intend to use in their courses for inappropriate content. However, because web content continuously

changes, CTD disclaims any responsibility for any of the content contained on third-party web sites used in course materials. If you become aware of anything that may be inappropriate, please notify CTD staff immediately.

Suggested Schedule:

	Topic	Things to do this week	Which Discussion Board Forum/Thread ?	What do I need to turn in?
Week 1	Introduction to Nanoscience	Audio Slideshow History of Nanoscience Activity Scale of Things Activity Discussion Board: Respond to a topic AND reply to a post	Briefly introduce yourself in the student lounge	Nothing
Week 2	Survey of Nanomaterials	Audio Slideshow Exploring CNTs (Activity) Au Nanoparticles (Virtual Lab) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread1	Week 1 Assignments
Week 3	Size Effects: Chemical Reactivity	Audio Slideshow Dissolving Speed (Activity) Web Reading Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread2	Week 2 Assignments
Week 4	Size Effects: Optical and Electrical Properties	Audio Slideshow Quantum Dots (Reading) Graphene (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread3	Week 3 Assignments
Week 5	Size Effects: Magnetic Properties	Audio Slideshow Iron Oxide Nanoparticles (Reading) Magnetic Domains (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread4	Week 4 Assignments
Week 6	Scanning Probe Microscopy	Audio Slideshow AFM (Virtual Lab) STM (Virtual Lab) Discussion Board: Respond to a topic AND reply to a post	Forum 2: Thread1	Week 5 Assignments

	Topic	Things to do this week	Which Discussion Board Forum/Thread ?	What do I need to turn in?
Week 7	Electron Microscopy and Others	Audio Slideshow SEM/TEM Imaging Modes (Activity) Atom Probe Tomography (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 2: Thread2	Week 6 Assignments
Week 8	Midterm Exam	Part1: Types of Nanomaterials Part2: Size Effects Part3: Microscopy Techniques	None	Nothing
Week 9	Nano-Lithography	Audio Slideshow Design a Mask (Activity) Discussion Board: Respond to a topic AND reply to a post	Forum 2: Thread3	Week 7 Assignments
Week 10	Self-Assembly	Audio Slideshow Self-Assembled Monolayers (Reading) DNA-templated structures (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 2: Thread4	Week 9 Assignments
Week 11	Nanoscience in Commercial Products	Audio Slideshow Waterproofing Cloth (Activity) Anti-Microbial Ag np's (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread5	Week 10 Assignments
Week 12	Nanoscience in Medicine	Audio Slideshow Advanced Drug Delivery (Reading) Core-Shell Nanoparticles (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread6	Week 11 Assignments
Week 13	Nanoscience in Electronics	Audio Slideshow Anatomy of a Nanowire FET (Activity) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread7	Week 12 Assignments

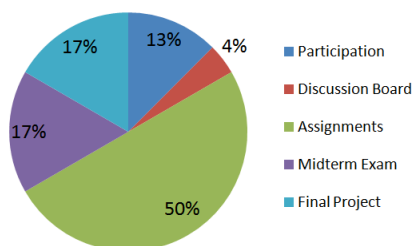
	Topic	Things to do this week	Which Discussion Board Forum/Thread ?	What do I need to turn in?
Week 14	Nanoscience in Energy	Audio Slideshow Photovoltaic Devices (Reading) Supercapacitors/Batteries (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread8	Week 13 Assignments
Week 15	Nanoscience in Structural Applications	Audio Slideshow Strength of a composite (Activity) CNT Composites (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread9	Week 14 Assignments
Week 16	Health Risks of Nanoscience	Audio Slideshow Nanoparticles in the food (Reading) Discussion Board: Respond to a topic AND reply to a post	Forum 1: Thread10	Week 15 Assignments
Week 17	<i>To Be Determined</i>	<i>To Be Determined</i>	None	Nothing
Week 18	Final Project	1. Choose a topic from a list 2. Research the topic 3. Make summary slides	None	Nothing

Student Evaluation and Grading Policies for Credit Courses Only:

a. CTD Grading scale

A+ 97-100	B+ 87-89	C+ 77-79	D+ 67-69	F Below 60
A 93-96	B 83-86	C 73-76	D 63-66	
A- 90-92	B- 80-82	C- 70-72	D- 60-62	

b. Breakdown of final grade:



c. Participation points (13%): Full credit is earned simply by attempting post slide show quizzes.

Discussion board (4%): Points are earned by posting responses to an existing thread and replying to other students' posts. Please refer to the suggested schedule, above, to know when you are expected to use the discussion board.

Extra Credit: will be awarded to students who post additional, meaningful messages to the discussion board beyond the minimum.

Assignments (50%): These will usually follow readings or other activities and consist of short answer questions. Assignments may be attempted twice and the highest grade is kept.

Midterm Exam (17%): The midterm will be an online multiple choice, true/false, and free-response exam covering the first few units of the class. This exam is "open-book", meaning that use of course materials and other websites is encouraged. However, **receiving aid from any human sources (parents, other students, tutors, etc) is not allowed for this exam.** Please be on your honor with this policy. Thank you ☺

Final Project (17%): This will be a literature search in which students will choose from a list of topics covering applications of nanoscience, find information online, and create their own set of summary slides.

Instructor Biography:

Ken D'Aquila is a 4th year Ph.D. candidate in the Department of Material Science and Engineering at Northwestern University. His research project at Argonne National Laboratory is aimed at understanding the link between changes in electrical resistance and microstructure in metal/oxide/metal tri-layer films. He has a strong interest in teaching and has been active as an undergraduate lab teaching assistant.