

SPRING 2007: Natural Science 261 - Physical Science

Location: Northrop Hall 114
Time: TR 8-10:30 AM
Instructor: Matt Nyman
Office: Northrop Hall 126
Office hours: Wednesday 1:00-3:00 PM, Friday 10:00-12:00 AM and **by appointment**
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Required Text: Conceptual Physical Science, 3rd Edition by Hewitt, Suchocki and Hewitt

Course Design and Goals

This course is designed to provide students a well grounded and fundamental understanding of concepts in physics, astronomy and earth science. The process of science ("how science is done" or "the scientific method") is also a major focus of the course and will be a common thread throughout the semester. The course is not designed to produce amateur scientists; similarly passing a course in American government does not make you an amateur lawyer. Instead, at the end of this course you will have developed a meaningful, robust, and valid set of ideas about the world around you and how these ideas form interconnections that help us to understand the natural world. From this course you will also gain and/or improve on important skills such as asking valid and testable questions, how to collect, examine and evaluate scientific data, writing, and assembling a portfolio. Last, students should develop the attitude that learning is a lifelong and exciting necessity.

Instructional Methods

First of all, this is not a class where you will learn how to teach science to your future students. That topic will be covered in your science methods class offered through the College of Education. Although this is not a science methods class, I/we will be teaching/learning the basics of physical science using effective pedagogy. This means that I will attempt to model effective instructional strategies that you will be able to use in your future classes. Specifically this means:

1. Instructional methods will include lab activities, guided inquiry projects, student presentations and lectures. Many activities will be scalable for use at a variety of grade levels.
2. Students will be required to examine their prior knowledge of the subject matter. Identifying and reviewing prior knowledge and dislodging any misconceptions are fundamental requirements for learning new concepts.
3. Students will have the opportunity to organize ideas and make connections to prior work in the class. Developing a "web of understanding" instead of disparate and disconnected scientific factoids is "real" learning.
4. Students will frequently work in groups; this is a requirement for the course. Both doing science and learning occur in an active, social environment.
5. Writing will be a major component of this course and you will be asked to write several summative essays that provide a narrative of your learning and learning experiences.
6. Some basic math skills are required for this course. This includes graphing, calculating the slope of a line, changing units, basic arithmetic, and some algebra.

Course Administration

In order to remove any ambiguity concerning the requirements for the class, the following items will be strictly enforced.

Class Attendance

Research and experience show that regular and consistent attendance correlates with learning and good grades. The integrated nature of the class and importance of group work means that absences may be very detrimental to your performance. Therefore, attendance is required for this

course. More than 4 absences will result in expulsion from the course. You are responsible for all work missed due to the absence

Late Work

Each student will be allowed one late assignment for the semester. The grade of late work will be reduced 10% for each class period that it is late. Other than the single late assignment, no late work will be accepted.

Weekly and Unit Quizzes

There will be no make-up quizzes.

Electronics

Please turn off all electronic gadgetry before coming to class including iPods and (especially) cell phones. If you chose to use your cell phone, text message, or play games on your phone during class I will email you and request that you do not continue this activity. If you continue this practice, I will ask you to leave and receive a 10% penalty on your next quiz. If you have an emergency situation please inform me at the beginning of the class period.

Work for Other Classes

Please do not plan on completing work for other classes during our class time.

Assessment

Your grade will be based on 1) a portfolio; 2) quizzes; 3) homework and labs; 4) final portfolio and essay. Final grades will be assigned using the following scale:

A+	> 99%	B+	87-89%	C+	77-79%	D+	67-69%	F	< 60%
A	95-98%	B	83-86%	C	73-76%	D	63-66%		
A-	90-94	B-	80-82%	C-	70-72%	D-	60-62%		

1- Quizzes (25%): There will be quizzes throughout the semester, usually when we start a new section or set of concepts. These will be short quizzes that focus on textbook reading.

2- Homework and Lab Exercises (30%): Throughout the semester we will do a variety of lab exercises that you will pass in for credit. Some of these will involve work outside of class or preparation of class presentations.

3- Portfolio (40%): There will be no major exams or final exam for this course. Rather, you will produce a portfolio that will be used to assess your learning throughout the semester. See the portfolio section of the syllabus for more details.

4- Group Work (5%): This class requires considerable group work, both in and out of class. Therefore, your ability to work within the group and your contributions to the group will be included as part of your grade. The final grade will consist of an evaluation based on my observations and an assessment from your partners in the group.

Learning Objectives

The following is a list of learning objectives for the semester.

Process of Science

- Understand the nature and process of science.
- Understand units of measure and convert numerical quantities from one system to another.

Physics

- Describe the various concepts and units used to describe motion.
- State and apply Newton's Laws of Motion.
- Understand concepts and solve problems related to impulse, momentum and the Conservation of Momentum.
- Understand the concepts related to energy, power, work and Conservation of Energy.
- Understand the concept of gravity, the relation between gravity and tides and application to simple problems.
- Describe the motion of a projectile and apply to satellite motion.
- Distinguish between temperature and heat.
- Identify and apply the process of heat transfer.
- Describe and construct simple electrical circuits.
- Understand the concept of electromagnetic induction.
- Describe the affects of magnetic fields.
- Describe the properties of waves and the commonality of wave phenomena

Earth Science

- Know the components of the Earth System.
- Know the structure and models for formation of the Earth.
- Understand the different types of plate boundaries and the relationship between volcanic activity, earthquakes, mountain building and plate motion.
- Understand the relationship between volcanic activity, earthquakes, mountain building and plate motion.

Astronomy

- Know the details of the earth-moon-sun system.
- Know the order to the planets in the solar system and some details about each planet.
- Know models for the formation of the solar system.

Schedule

Week	Class	Date	Topic	Reading
1	1	T 1/16	Introduction, observations and inferences	Harwood (2004)
1	2	R 1/18	Measurement, data and density	HSH Prologue
2	3	T 1/23	Quiz #1 - Scientific process and inquiry Finish density, scientific process and inquiry	
2	4	R 1/25	Earth Observation Day – Part I	
2	X	F 1/26	<i>Last day to add class or change sections</i>	
3	5	T 1/30	Earth Observation Day - Part II	HSH Chapter 1
3	6	R 2/1	Quiz #2 - Speed, velocity, acceleration Speed, velocity, acceleration	
4	7	T 2/6	Speed, velocity, acceleration	
4	8	R 2/8	Quiz #3 – Acceleration Due to Gravity Acceleration Due to Gravity	HSH Chapter 2
4	X	F 2/9	<i>Last day to change grade option</i>	
5	9	T 2/13	Newton's Laws of Motion I <i>Draft essay, concept map and standards on speed, velocity and acceleration due</i>	
5	10	R 2/15	Newton's Laws of Motion II	HSH Chapter 3 p. 65-74
6	11	T 2/20	Quiz #4 - Momentum Momentum	HSH Chapter 3 P. 75-87
6	12	R 2/22	Energy	HSH Chapter 4
7	13	T 2/27	Quiz #5 - Gravity Gravity	HSH Chapter 5
7	14	R 3/1	Projectile Motion WORK ON MIDTERM PORTFOLIO DUE 3/8	HSH Chapter 33 p.794-800
8	15	T 3/6	Earth, Moon and Sun	HSH Chapter 33 p.800-811
8	16	R 3/8	MIDTERM PORTFOLIO DUE Quiz #6 - Moon phases and eclipses Work on Solar System Presentations	
X	X	T 3/13 & R 3/15	NO CLASS – SPRING BREAK	
9	17	T 3/20	Solar System Presentations and "Earth as a Peppercorn"	

Week	Class	Date	Topic	Reading
9	18	R 3/22	Solar System	
10	19	T 3/27	Solar System Presentations and "Earth as a Peppercorn"	HSH Chapter 27
10	20	R 3/29	Discovering Plate Boundaries Processes Associated with Plate Tectonics I	
11	21	T 4/3	Processes Associated with Plate Tectonics II	
11	22	R 4/5	Processes Associated with Plate Tectonics III	
12	23	T 4/10	Earthquakes from the Ground Up I	
12	24	R 4/12	Earthquakes from the Ground Up II	
12	X	F 4/13	<i>Last day to drop w/o dean's approval</i>	
13	25	T 4/17	Earthquakes from the Ground Up III	
13	26	R 4/19	Earthquakes from the Ground Up IV	HSH Chapter 7
14	27	T 4/24	Quiz #7 – Thermodynamics Thermodynamics I	HSH Chapter 8
14	28	R 4/26	Thermodynamics II	HSH Chapter 9
15	29	T 5/1	Quiz #8 – Electricity Electricity	HSH Chapter 10
15	30	R 5/3	Magnetism and EM Induction	
15	X	F 5/4	<i>Last day to drop w/ dean's permission</i>	
16	X	R 5/10	Final Portfolio Due	

PORTFOLIO ASSIGNMENT

Introduction to the Portfolio Assignment

40% of your grade for this class will be determined by evaluation of a portfolio that you will create. In the portfolio you will have the opportunity to clearly demonstrate your mastery of the class objectives. You should devote a considerable amount of time to the portfolio, possibly adding some flair and color to the documents that may include drawings and photographs. However, these items should enhance, not replace, substance. By the end of the semester the portfolio will provide a narrative of your learning throughout the semester and be useful for your future teaching efforts.

Composition and Grading of Portfolio

The portfolio will consist of two parts: 1) a midterm assessment and 2) a final portfolio that will include items from throughout the semester and a summative essay. The portfolio assessment are your "exams", so it is important that you spend a considerable amount of time carefully organizing your work, correcting mistakes on labs, developing a sound concept map(s) and writing a great essay. **DO NOT WAIT UNTIL BEFORE THE PORTFOLIO IS DONE TO START YOUR REFLECTIVE WRITING!**

Midterm Portfolio Assessment (15%)

The midterm assessment part of the portfolio will consist of the following items. The grade criteria for each item are presented in *italics*.

1. A summary of the *class* objectives. **(5 pts)**
 - 5 pts - All goals and objectives are presented*
 - 3 pts - Missing goals or objectives*
 - 1 pt - Inadequate*
2. Concept map(s) **(20 pts)**
 - 20 pts - All concepts are presented, well-defined. Branching is imaginative and thoughtful and indicates integration and cross-linking. Use of bridging words is clear with good use of active verbs. Neatly presented. Easily used by other people.*
 - 10 pts - Some concepts missing or incorrectly defined. Branching may be correct but could be more thoroughly developed. Connecting words are partial or weak in areas. Presentation is not entirely clear; ease of use is compromised.*
 - 0 pts - Incorrect or numerous missing concepts. Branching is vague and poorly defined. Use of connecting words is incorrect or missing. Sloppy presentation.*
3. Lab activities, description of demonstrations, or writing assignments completed during the unit. For the lab activities: I will have already graded these assignments and you will need to make corrections to these labs when you include them with the unit analysis. **THE LAB CORRECTIONS MUST BE MADE VERY CLEAR. IF I HAVE TO SEARCH FOR THEM, YOU WILL NOT RECEIVE CREDIT FOR YOUR WORK. (15 pts)**
 - 10 pts - All work is included and all corrections made*
 - 5 pts - Some labs or other work is missing. Up to three labs are not corrected.*
 - 0 pts - Many missing labs; no corrections made.*
4. A sampling of New Mexico Science Education Standards applicable to the concepts covered in this unit. **(5 pts)**
 - 5 pts - Several standards for each concept*
 - 3 pts - Some concepts are missing standards or insufficient effort at identifying standards.*
 - 1 pt - Inadequate. Few standards included.*

5. A 3-5 page self-reflection essay that provides the reader of the unit analysis information about: **(50 pts)**

- a) Your previous ideas or experiences with the concepts including misconceptions;
- b) How you came to learn the concepts and what helped you to learn them;
- c) What difficulties you had (and may still have) with the concepts;
- d) Your confidence level with understanding the concepts;
- e) You confidence level with teaching the concepts to your future students;
- e) Questions you may still have about the concepts.

You should be very clear in all parts of this essay and refer to actual exercises, lab assignments, and concept maps to support your essay.

50 pts - All of the items are included. Writing content indicates careful reflection with considerable attention to detail. Reference made to lab activities.

40 pts - At least one of the items are not included or not thoroughly discussed in enough detail. Little connection to classroom activities is presented.

30 pts - Two to three items are not included. Insufficient detail on several item.

20 pts- A poor and unacceptable essay.

6. Spelling and Grammar **(5 pts)**

5 pts - Spelling and grammar are correct throughout the essay.

4 pts - Spelling and grammar are mostly correct throughout the essay.

3 pts - Spelling and grammar are moderately correct throughout the essay.

0-1 pts - The number of errors is not acceptable.

Final Portfolio (15% - since midterm; 10% - summative)

The final portfolio will be due on the day of the final. The portfolio should be organized in a 3-ring binder. There will be three sections of the final portfolio: 1- the midterm portfolio materials; 2- materials related to content covered since the midterm and 3- a summative assessment. The specific requirements for the portfolio are:

1. Your midterm portfolio assessment. **(5 pts)**

2. A summary of the class objectives **since the midterm. (5 pts)**

- i. 5 pts - All goals and objectives are presented*
- ii. 3 pts - Missing goals or objectives*
- iii. 1 pt - Inadequate*

3. Concept map(s) based on what you learned **since the midterm. (20 pts)**

- i. 20 pts - All concepts are presented, well-defined. Branching is imaginative and thoughtful and indicates integration and cross-linking. Use of bridging words is clear with good use of active verbs. Neatly presented. Easily used by other people.*
- ii. 10 pts - Some concepts missing or incorrectly defined. Branching may be correct but could be more thoroughly developed. Connecting words are partial or weak in areas. Presentation is not entirely clear; ease of use is compromised.*
- iii. 0 pts - Incorrect or numerous missing concepts. Branching is vague and poorly defined. Use of connecting words is incorrect or missing. Sloppy presentation.*

4. Lab activities, description of demonstrations, or writing assignments completed **since the midterm**. For the lab activities: I will have already graded these assignments and you will need to make corrections to these labs when you include them with the unit analysis. *THE LAB CORRECTIONS MUST BE MADE VERY CLEAR. IF I HAVE TO SEARCH FOR THEM, YOU WILL NOT RECEIVE CREDIT FOR YOUR WORK. (10 pts)*
 - i. 10 pts - All work is included and all corrections made
 - ii. 5 pts - Some labs or other work is missing. Up to three labs are not corrected.
 - iii. 0 pts - Many missing labs; no corrections made.

5. A sampling of New Mexico Science Education Standards applicable to the concepts covered **since the midterm. (5 pts)**
 - i. 5 pts - Several standards for each concept
 - ii. 3 pts- Some concepts are missing standards or insufficient effort at identifying standards.
 - iii. 1 pt - Inadequate. Few standards included.

6. A 3-5 page self-reflection essay about material **since the midterm** that provides the reader information about: **(50 pts)**
 - a) Your previous ideas or experiences with the concepts including misconceptions;
 - b) How you came to learn the concepts and what helped you to learn them;
 - c) What difficulties you had (and may still have) with the concepts;
 - d) Your confidence level with understanding the concepts;
 - e) You confidence level with teaching the concepts to your future students;
 - f) Questions you may still have about the concepts.

You should be very clear in all parts of this essay and refer to actual exercises, lab assignments, and concept maps to support your essay.

 - i. 50 pts - All of the items are included. Writing content indicates careful reflection with considerable attention to detail. Reference made to lab activities.
 - ii. 40 pts - At least one of the items are not included or not thoroughly discussed in enough detail. Little connection to classroom activities is presented.
 - iii. 30 pts - Two to three items are not included. Insufficient detail on several item.
 - iv. 20 pts- A poor and unacceptable essay.

The summative assessment includes:

- 1- A showcase and 1-page written description of:
 - a. Your best work
 - b. Your work where you learned the most
 - c. Your most interesting work

The written description should describe why each particular item is included as you choice **(10 pts each for a total of 30 pts).**

- 2- A 3-5 page summative essay that describes **(30 pts):**
 - a. How you knowledge of physical science has changed over the semester citing specific examples.
 - b. Your evaluation of the portfolio and unit analysis process.
 - c. A personal reflection statement related to the following - "If you could view yourself from a distance over time, seeing yourself during the first week of the semester and

again now, what would you want me to know about how you have changed? What differences do you notice in yourself intellectually, emotionally and/or personally?"