
HONORS 227

Scientific Thought and Processes I

■ Instructor

- Dr. Geller
- Classroom Meetings
- Tuesdays/Thursdays 3:00 to 4:15 PM
- Robinson B 201

■ Mandatory Laboratory Meetings (Ms. Clark)

- Mondays/Tuesdays 4:30 PM - 7:10PM in Robinson A410
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Synopsis

- This course explores and integrates the principles of physics, astronomy, chemistry, geology, biology and environmental sciences. The intent is to present many of the dominant theories and laws that underlie how the natural world operates, with a focus on the scientific methodology used for the discovery process. Subsequently, we explore how the theories and laws have relevance in every day life. The labs for the course include computer simulations and hands-on experiments to demonstrate cardinal features of natural systems, including the (i) scientific methods, (ii) concepts of physics and astronomy, (iii) concepts of chemistry and geology, and (iv) concepts of biology.

Course Objectives

- Describe the scientific method and philosophy of science
 - Explain how Newton's Laws of motion and gravity predict the behavior of objects on earth and in space
 - Describe physical laws that govern the interaction of matter, energy, time, and space in the cosmos
 - Comprehend the different forms of energy and their interchangeability
 - Appreciate the magnitude of the scientific problem of the search for extraterrestrial life in the Universe
 - Explore biochemical and molecular properties of living systems
 - Explore the intricacies of the living cell
 - Understand the theory of evolution of life on earth
 - Comprehend the chemistry of matter
 - Understand the geology of the earth and other earth-like planets
 - Comprehend the electromagnetic spectrum and the nature of light
 - Appreciate how cells operate at the molecular and genomic level and how genetic engineering is a viable tool for addressing diseases
 - Understand the genetics of inheritance and why you exhibit the attributes (physical and physiological) that you do
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Major Topics to be Addressed

- Scientific method
 - Origins of the universe
 - Origins of our solar system and planets
 - Physics of light, gravity, matter, magnetism, radioactivity, nuclear energy, and relativity
 - Geology of volcanism, plate tectonics, and erosion
 - Birth and death of stars and galaxies
 - Big Bang theory of universal creation, pulsars, neutron stars, and black holes
 - Origin of life on Earth
 - Biochemical and molecular attributes of all living systems
 - Evolution of life on Earth and the interplay of genetics and ecology
 - Principles of genetics, role in evolution, and the nanoscale aspects of molecular biology
 - Biotechnology, genetic engineering and your future
 - Revolutions in the sciences: how they evolve
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General Information – Part I

(also available online)

■ **Instructors' Web Site:**

- <http://physics.gmu.edu/~hgeller/HONORS227/>
- (website for lecture notes, labs, etc.)

■ **Honors' Web Site:**

- <http://www.honors.gmu/hnrs227/f2004/index.html>
- (website for syllabus and general information only)

■ **Textbook:** Tillery B.W., E.D. Enger and F.R.Ross. 2006. *Integrated Science*. 3rd Edition, McGraw Hill, Boston, MA.

■ **Grading Policy**

- There will be four in-class examinations and one comprehensive final examination. The in-class examinations will be worth a total of 40% (10% each) of your final grade. The final examination will be worth 25% of your final grade and will be comprehensive in nature. The laboratory reports will be due weekly and graded by your lab instructor. The in-class iClicker questions will be counted as 10% of your grade.

General Information – Part II

- **Quizzes/exercises can NOT be done except at the class period in which they are given.**

■ <u>Number</u>	<u>Activity</u>	<u>Per Cent Grade</u>
■ 4	In-Class Examinations	40%
■ 1	Comprehensive Final Exam	25%
■ 10	Laboratory Reports	25%
■ 200+	In-Class Questions	10%
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■		100% Total
■	Mid-term grades f (examination to that point)	

Course Format – Part I

- **Course Format – Lectures**

- Lectures will consist of various forms of presentation materials, including videos, computer displays, demonstrations and Power Point. Questions are acceptable and encouraged at any time during the lecture. Students should be alert during the lecture and prepared to answer queries posed as they arise. The lecture notes, in Power Point format, will be posted on the web site for the course. Students are expected to have command of the lecture material and the text information.

- **Course Format – Text**

- The text covers the breadth of the natural sciences and provides a systematic and well-illustrated survey. In addition, it does an excellent job of integrating the sciences and provides a host of examples to help you understand the information and its application to life. Finally, at the end of each chapter is a well developed list of questions (short answer and discussion) that are an excellent study aid for the quizzes and examinations. You are encouraged to view the text as a parallel reference to the lectures, and each (lecture and text) are viewed as being equally of value as a reference.

Course Format – Part II

- **Course Format – Laboratory Sessions**
 - Labs are a collaborative effort of 2-4 students working as a team. Each student will hand in her/his own laboratory report for each week's exercise. The labs will consist of computer simulations and hands-on experiments. Laboratory reports will be turned in at the close of that week's lab unless your lab instructor has requested a different submission date. There will be 10 lab exercises. Information from the labs will be part of the questions in-class, in-class examinations, and the final examination.
 - Laboratories are NOT an optional part of the course. Because of the effort involved in setting up each lab, it is impossible to provide opportunities for make-up labs. Labs begin at the stated time and being late is disruptive and not acceptable. In the event that you are unable to attend laboratory for a legitimate reason (to be determined by Dr. Geller), you need to notify Dr. Geller in writing. In the event of an absence (legitimate or otherwise), you are still responsible for the information.
 - An absence from any lab carries an automatic zero for that lab unless you have cleared the absence with Dr. Geller.
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Course Format – Part III

- **Course Format – In-Class iClicker questions**
 - During the semester in lecture there will be intermittent iClicker questions. Absences from the iClicker questions cannot be made up.
 - **Course Format – Examinations**
 - The four examinations will include short answer (multiple choice, fill in the blank) and problem solving questions. As a study guide, you should work through the questions at the end of each chapter. Examinations can **NOT** be made up unless Dr. Geller provides a variance; variances are only granted for legitimate excuses. Any make-up exam will not be the same as that given in class.
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Additional Notes

- Web site information (with syllabus)
 - <http://physics.gmu.edu/~hgeller/HONORS227/>
 - Accessibility of instructors
 - Open door policy
 - Best by appointment
 - Laboratory instructor (Ms. Sara Clark)
 - Problems, discussion and resolution
 - Grading
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Notes about Lecture Sessions

- Rationale for lecture and text
 - Lecture notes on web site
 - Lateness to lectures and politeness during lectures
 - Questions during lecture
 - Traditional lectures plus discussion format
 - In-class questioning
 - Missing and make-up...not an option
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Notes about Laboratory Sessions

- Integral part of course (not optional)
 - Nature of labs (e.g., computer, hands-on, modeling)
 - Multiple purposes and objectives (e.g., scientific method, data visualization)
 - Role of the lab instructor
 - Lateness to lab; missing lab (excuse) and make-up
 - Weekly “reports” and grading
 - Working in teams plus working on your own
 - Behavior and decorum in lab
 - Lateness of lab report (2 pt/day)
 - Lab material fair game for tests
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Notes on Examinations

- Form of the exams (N=4)
 - Short answers (multiple choice, fill in the blank)
 - Problem solving
 - Fair game: lecture, text, lab
 - Final examination in December
 - Comprehensive
 - Same format as above
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Grading Summary Table

<u>Activity</u>	<u>Number</u>	<u>Percentage</u>
In-Class Exams	4	40
Laboratory Reports	~10	25
In-Class Questions	200+	10
Final Exam	1	25

Questions?

Anxiety?
