2006

Honors College, Honors 298: Special Topics, 3 Credits

John Charpie
Southern Connecticut State University, charpiej1@southernct.edu

Michael Shea
Southern Connecticut State University

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Course Description
Students explore the logic of science by examining the language and writing about science, using various thinking-writing exercises to stimulate their research. While hearing lectures about fundamental scientific principles and analyzing knowledge structures of scientific discourse, students write cause-and-effect explanations of a variety of phenomena by building them up from first principles; science essays are developed using standard rhetorical devices of scientific discourse. Small-group exercises include “workshopping” each student’s writing regarding tone, clarity, fluidity, and accuracy. Twenty-three students enroll in this course.

Course Materials
Six Easy Pieces, by Richard Feynman
The Nature of Science, by James Trefil
The Science Book, by Peter Tallack
On Writing Well, by William Zinsser

Syllabus
January 24 Writing and Language
How to actively observe a diagram and write a 500-word guided tour
How to interrogate a quotation, and integrate it into a text
Assign 25 one-page Tallack essays per week as a gentle and pleasant introduction to science

January 26 Kinetic Theory: inter-atomic collisions
Feynman: Chapter 1: “Atoms in Motion”
Trefil: “Kinetic theory” + links
SCIENCE AND WRITING

Cause-and-effect relationships linking gas laws and random atomic motion

January 31 Atomic Theory
Feynman Chapter 2, “Basic physics”
Trefil: “Bohr Model” + links
The Bohr model of the atom; electrons and nucleons; electron orbitals spectroscopy as the experimental basis of atomic theory

February 2 Writing and Language
Textual macrostructures and macropropositions

February 7 Heat
Feynman: Chapter 1: “Atoms in Motion” (review)
Trefil: “Heat” and “Changes of State” + links
Phase transitions; the domino effect, thermal transfer and mammalian thermoregulation: conduction, convection, radiation, and evaporation
Hand in: First 500-word guided tour of a diagram for the first term paper

February 9 Sound
Trefil: “Doppler Effect” + links
Tuning fork experiment introducing resonant energy transfer; the nature of sound, and the domino effect; waves, wavelengths, frequencies, and amplitudes; The Doppler Effect and Doppler medical imaging
Hand in: Five extended definitions + examples for the first term paper (500 words total)

February 14 Hearing
The domino effect in the ear; the lever system of ossicles in the middle ear; the inner ear and resonant energy transfer; cochlear implants

February 16 Writing and Language
Local cohesion and global coherence of texts
How to write extended definitions using examples, analogies, graphics, applications, and generalizations
Hand in: 500-word essay describing two scientific principles fundamental to the first term paper

1 Scientific American Frontiers: http://www.pbs.org/saf/1509/resources/resources-1.htm + links.
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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<tbody>
<tr>
<td>February 21</td>
<td>Electricity and Magnetism</td>
<td>Trefil: “Coulomb’s Law,” “Magnetism,” “Electrical Properties” + links</td>
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<td>Coulomb’s Law; the electron, magnetism, magnetic and electric fields</td>
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<td>Faraday’s Principle applied to alternative energy production</td>
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<td>Hand in: Second 500-word guided tour of the first term-paper diagram</td>
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<td>February 23</td>
<td>Chemistry</td>
<td>Feynman Chapter 3: “The relation of physics to other sciences”</td>
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<td>Trefil: “Chemical Bonds” + links</td>
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<td>Chemical bonding and the Periodic Table; covalent / ionic bonds</td>
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<td>February 28</td>
<td>Writing and Language</td>
<td>Identifying fundamentals principles of scientific topics (axiomatics)</td>
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<td>Hand in: Three rewrites of previous assignments—of (1) a guided tour, (2) the definitions, and (3) the fundamental principles</td>
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<td>March 2</td>
<td>Chemical Bonding</td>
<td>Polar molecules, van der Waals bonds, detergents, and dietary physics</td>
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<td>Hand in: macrostructures of the first term paper + transitional sentences</td>
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<td>March 7</td>
<td>In-class midterm; the take-home writing component due today</td>
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<td>March 9</td>
<td>Writing and Language</td>
<td>Rhetorical structures in scientific writing, e.g., analogy, logical deduction, semantic parallelism, experimental testing, generalizations and induction</td>
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<td>The nature of science in the nature of scientific rhetoric</td>
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<td>March 14</td>
<td>Science analogies</td>
<td>Exercises on analogies and how to develop them for term papers: the Bohr Model and the planetary system; the Domino effect, sound, and heat transfer; tuning forks and the vibrating inner-ear membrane; ATP as the currency of living things</td>
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<td>March 16</td>
<td>Neurons and Nerve Impulses</td>
<td>Trefil: “Nerve Signals” + links</td>
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<td>Bio-electricity, neurons, action potentials, nerve impulses,</td>
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<td>Hand in: First term paper</td>
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<td>March 21</td>
<td>Spring Break</td>
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<td>March 23</td>
<td>Spring Break</td>
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2006
March 28  Writing and Language
Interactive and interactional metadiscourse and its function in scientific writing; How to anticipate and accommodate readers' needs

March 30  Weather
Trefil: "Archimedes' Principle" and "Water Cycle" + links
Archimedes' Principle and global weather patterns; rain formation;
Hand in: 500-word guided tour of a diagram for the second term-paper

April 4  Grand Processes and Principles of Science
Feynman Chapter 4: “Conservation of Energy”

April 6  DNA and large molecules
Trefil: “Molecules of life,” “Proteins,” “Mendel's Laws” + links

April 11 Writing and Language
Varieties and uses of quantitative graphics
Small-group decision making / critical reasoning using quantitative graphs
Hand in: Five extended definitions + illustrative examples (500 words total) for the second term paper

April 13 Writing and Language
How to get the reader's attention—examples from popular science writing
Small-group exercises to explore methods of humanizing science essays

April 18 Light
Trefil: “Electromag. spectrum,” “Spectroscopy,” “Snell’s Law” + links
The visible spectrum; refraction; prisms, and rainbows
Hand in: 500-word guided tour of a quantitative figure for the second term paper

April 20 Vision—Corrective lenses, color vision, laser eye correction, retinal implants

CHARPIE AND SHEA

April 25
Nuclear Structure and Radiation
Trefil: “Nuclear fusion and fission” and “Radioactive decay” + links
Rutherford’s experiment; nuclear structure and stability; E=mc²;
small-group exercises to analyze (quantitative) graphs of atomic properties
Hand in: macrostructures of the second term paper + transitional sentences

April 27
Students discuss science articles that they found in the popular press
Hand in: 500-word essay of analogies relevant to the second term paper

May 2
Astronomy and Cosmology
Feynman Chapter 5: “Theory of Gravitation”
Trefil: “Big Bang,” and both “Newton” entries + links
Gravity, the solar system, stellar evolution, and nucleosynthesis

May 4
Nuclear theory
Trefil: “Correspondence Principle,” “Vital Force” “Determinism” + links
Philosophy of indeterminism, Born’s statistical interpretation in quantum physics; wave-particle duality; Laplacian determinism

May 9
The Limits and Value of Science
Trefil: Selections from the Introduction, + links
Discussion about big issues raised by the Big Bang, origins, and endings; compare and contrast religious faith, scientific faith, and scientific method
Hand in: Second term paper

Grading Policy
Your grade will be based on two tests (20% each) and two term papers (20% each), + homework assignments / class participation (20%).

The author may be contacted at charpiej1@southernct.edu