Physics in the Classroom II: Energy in Motion

SCI 5332/PHYS5V46

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Course Objectives: The physics and chemistry content topics covered in this course will parallel those of part of first year introductory college physics and chemistry courses, but with several important differences. Much of the class will be done workshop style, with hands-on materials available in local districts or demonstrations and experiments that can be done with inexpensive or common materials. Students will also be expected to think critically about both the science content and how topics discussed in the course can relate to their own classrooms.

The primary goals of this course are to:

- Deepen participants' content knowledge of the physical science concepts involving the properties of matter, behavior of fluids, mechanical waves including sound, heat and temperature, and the structure of the atom. This course will aid students in developing a conceptual understanding of how the behavior of matter on small scales relates to the behavior of matter on everyday scales explored in our summer institute.
- Increase students familiarity with hands-on activities, equipment including but not limited to CPO, and demonstrations that can be used with pre-college students,
- Provide students with a mathematical tool kit that can be applied in their own teaching of physical science,
- Increase students' awareness of physics and chemistry in the everyday world.

The overarching goal is to increase the comfort level of students in their own teaching of physical science.

Text: *Physics* by James S. Walker, 2nd addition, is an excellent college physics text and will be provided to grant participants. *Conceptual Physics* by Paul Hewitt is a less mathematically-based high school physics text and the teacher edition will be available for purchase at cost. The primary purpose of the textbook is to serve as a reference and resource during and after the course.

Required Equipment:

- A scientific calculator will be useful in most, if not all class meetings. Please bring yours to each class session.

- Access to a computer and the Internet outside of class. Some course materials will be posted on WebCT.

Recommended Software:

- Microsoft Word (UTD has a special license agreement with Microsoft. Microsoft Office, which includes MS Word, is available at the technology store next to campus bookstore or the HiEd's (http://www.hied.com/ut/) off campus office for approximately $6 per disk.

The schedule for the summer program is approximate. We will take more or less time on listed activities as is necessary.

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Schedule of Topics:

Some topics may take only a portion of a class meeting, and others may require more than one session to complete. The schedule below is therefore subject to modification.

1. States of matter, density
2. Fluids part 1 (pressure, static equilibrium and buoyancy)
3. Fluids part 2 (fluid flow, Bernoulli's equation, viscosity and surface tension)
4. Oscillations and waves
5. Sound
6. Temperature and heat (temperature scales, thermal expansion and contraction, heat capacity, heat transfer)
7. Heat and matter (heat in fluids, heat in solids, phases changes)
8. Thermodynamics
9. The nature of the atom

Grading Policy:
Your final letter grade will be determined by your percentage (90% and above for an A, 80-89% for a B, etc.). Grades will not be curved; you are not in competition with your classmates for a good grade.

- **Class Participation** (10%): Much of the class will be done in the style of an educator workshop. You will be expected to participate in all activities and in discussions and to be an active learner. Your class participation grade will reflect your attendance as well as your interactions with the other students and the instructor. This grade includes your group activity reports.
- **Reflective Journaling** (10%): You will be asked to write journal entries based on your experiences in this course. This grade includes your pre-instructional journaling.
- **Understanding of Material in Post-InstructionalJournaling (**20%): This grade will reflect how well you understand a concept *post instruction.*
- **Quiz Questions** (40%): Every class meeting, one or more thought questions or simple problems will be asked of the class to probe each student's understanding of the topics discussed. Answers to the journal questions must be in your own words, and when mathematical, you must show your work. Questions may take home or given in class. All quizzes will be graded on a 4 point scale:

  4 point: Excellent. Little or no corrections are necessary.

  3 points: Good. Minor problems with the answer.

  2 points: Fair. Requires at least one major correction or revision. Consider redoing the quiz.

  1 point: Poor. Serious flaws in the answer. Turning in a redo of the quiz is strongly recommended.

  0 points: Did not address the question asked**.** Please try again.
- **Small Projects** (20%): A small project is a catchall term for mini-papers, out-of-class experiments, and homework assignments. Examples of small projects:
  - Brief reports on home experiments.
  - Exploring physics in special settings, such as using handheld spectrometers to observe "neon" signs in front of stores.
  - Presenting brief reports of physics in the news.
  - Exploration of applicable physics Web sites.

- **Revisions:** Whenever reasonable, you may redo most take home quiz questions and small projects to earn back up to half of your missed points. Such revisions must be submitted in a timely manner, and will be held to the same standards as the original assignment. Turning in a revision does not additional points will be earned. We will discuss journal questions in class. Revisions must demonstrate an individual's understanding of the material rather than a summary of the class discussion.
- **Unit and Presentation**: At the end of the **Spring** semester program participants will be expected to create unit of 4 to 6 complete lesson plans on a physical science topic related to the topics discussed in class and do a short presentation on the unit. This unit will constitute a major portion of your grade in your spring course. Each lesson plan must be created in a format that can easily be used by other teachers, and must be a cohesive unit. The lessons must be your original work, but you may incorporate existing hands-on activities and demonstrations. *The distinction between your work and the creative work of another must be clear. You will not receive credit for plagiarized lessons/activities. (All students at UT Dallas, are expected to adhere to the University policies regarding academic dishonesty which are available online at* http://www.utdallas.edu/student/slife/dishonesty.html.) Your lesson plans, which are more than simple activites, should reflect accurate science as well as good pedagogy, and should be easily usable by another teacher at the same grade level.

A complete lesson plan should include:

- Target grade level(s) or age group
- Learning goals for the lesson
- Appropriate TEKS (non-science TEKS may also be included).
- Materials needed, if any
- Background information for the teacher
- Complete instructions for any activities/demonstations
- Recommended modifications to pre-existing activities used in the lesson
- Instructions for introducing and following up the lesson
- Suggestions for assessing student understanding
- A list of references cited and/or activity/demo sources
- You are also encouraged to include information of additional resources.

In addition, you should include an introduction to your unit, with the target grade level(s), learning goals, topics covered, and equipment required.

Approved *peer teaching may substitute for a final unit grade. Such peer teaching must demonstrate mastery of the subject matter as well as good pedagogy.*

Note: Students taking the physics section of this course must complete a research proposal this semester and a final project consisting of a physics research project and presentation in the Spring.

Important: All assignments must be completed in a timely manner and with a quality of work that reflects the level of this course. Accepting late assignments is at the instructor's discretion. **You are encouraged to discuss class work with your classmates. However, all assignments submitted for credit must be the work of the students submitting the assignments. Plagiarized assignments will *not* be accepted for credit.** Weekly quizzes provide the best method of gauging an individual students understanding of the physics concepts covered in this course. A final exam may be required for students who have three or more weekly quiz grades of 50% or less. (The 50% cutoff does not include any additional points earned due to subsequent revisions.) The final exam grade will replace the quiz grades in the calculation of the final grade in the class.