

Exit Competencies for a “Concepts in Physics” Course Draft

All general education science courses offer opportunities for teaching the nature of science. A single-semester “concepts in physics” course provides undergraduate students with an understanding of the fundamental laws of physics, practice in reasoning and application of the concepts. Students learn how the discipline of physics operates and how the different branches interact.

The use of a physics course for teaching the nature and process of science necessitates teaching some common basic physics concepts, but it does not require specific subtopics within physics to be learned. However, certain characteristics are essential to an undergraduate “concepts in physics” course that fulfills the general education requirement. Such physics courses are suffused with the following:

- A) Scientific thinking and processes
- B) Force and change
- C) Conservation of energy
- D) Historical richness
- E) Application to modern living
- F) Investigations of current open questions

With the diversity of potential topics for teaching physics, the goals of the course are achieved using at least two of the following broad subtopics, and the connections between those topics:

- 1) Dynamics
 - a) Relationship between velocity, acceleration, and force -- including their vector nature
 - b) Inertia and momentum
 - c) Diversity of forces, for example friction, gravitational, elastic
 - d) Forms of mechanical energy and conservation laws
- 2) Thermodynamics
 - a) Work and energy
 - b) Conservation of energy
 - c) Mechanical energy and heat
 - d) Heat transfer and applications
 - e) Laws of Thermodynamics
- 3) Electricity & Magnetism
 - a) Charge and electric current
 - b) Electric field and magnetic field
 - c) Motors and generators
 - d) Electromagnetic waves

- 4) Waves & Optics
 - a) Types and properties of waves
 - b) Interference and diffraction
 - c) Geometric optics

- 5) Modern Physics
 - a) Failure of classical physics
 - b) Relativity
 - c) Quantum behavior
 - d) Atomic models
 - e) Fission and fusion

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