

Educational Goals for Physics Students & Assessable Learning Outcomes

There are several general goals that students completing a physics course should have. Among these general goals are

- (a) ability to perform a mathematical formulation of a physical system
- (b) ability to discuss (mathematically and linguistically) a physical system drawing upon a well-developed foundation built upon physical fundamentals.
- (c) ability to formulate complex arguments based upon physical foundations and which are testable by experimentation.
- (d) ability to produce technologically enabled students with an understanding of the basis for experimental design.

There are several rather specific goals that students completing a physics course should have. A non-inclusive topical course by course list primary outcomes is shown below.

Phy210

PHY 210 GENERAL PHYSICS I / 3 credits

Newtonian mechanics, sound propagation, heat transfer, and thermodynamics using algebra and trigonometry.
Prerequisite: MTH 110 or permission of instructor.

A non-exhaustive listing of learning outcomes is below

- (a) Ability to convert units
- (b) Ability to work with algebraic vectors.
- (c) Ability to describe 1-dimensional motion in the presence of uniform accelerations.
- (d) Ability to describe 2-dimensional motion in the presence of uniform accelerations.
- (e) Ability to use Newton's laws of motion in algebraic form.
- (f) Ability to construct and use free-body diagrams in problem formulation.
- (g) Ability to apply principles of energy conservation for conservative and non-conservative systems.
- (h) Ability to work with Newton's law of gravitation and gravity in general as an example of a conservative force.
- (i) Ability to provide mathematical analysis necessary to describe systems undergoing uniform circular motion.
- (j) Ability to apply principles of momentum conservation to physical systems.
- (k) Ability to provide mathematical analysis necessary to describe systems undergoing non-uniform circular motion in the presence of uniform external torques.
- (l) Ability to provide mathematical analysis necessary to describe systems undergoing simple harmonic oscillation and the effect of linear restoring forces upon systems.
- (m) Ability to provide mathematical analysis necessary to describe pulses, waves, traveling harmonic waves, transverse and longitudinal oscillations.
- (n) Ability to work with Archimedes' principle and Bernoulli's equation⁴.
- (o) Ability to model the non-leaky ideal gas thermodynamically and to expand this theory to cover systems with more than one degree of freedom.
- (p) Calorimetry and linear expansion.
- (q) Ability to apply the four laws of thermodynamics.
- (r) Ability to apply black body radiation⁶, Newton's law of cooling and the greenhouse effect.