

Physics 1408, Principles of Physics I Objectives & Assessments

This course is a rapid survey of *first semester Physics* (mechanics, fluids, waves). It is *calculus based* physics. The level of the course is at the standard (nationwide) introductory physics level.

Course Objectives

In this course, students will learn:

1. How to use Newton's laws of motion to solve problems with static and dynamic bodies.
2. How to use conservation of energy and linear and angular momentum to solve problems.
3. How to represent wave motion in mathematical form and how to solve problems about sound propagation.

Course Assessments

In this course, student learning will be assessed by the use of:

1. Certain problems on the homework assignments
2. Certain problems on the exams
3. Certain problems on the final exam.

Specific Learning Outcomes, Physics 1408, Principles of Physics I

After completing this course, students will be able to:

1. Understand: **a)** measurements, units, & estimating; **b)** basic & derived units in the SI system; **c)** significant figures
2. Understand displacement, velocity, & acceleration. Understand the one-dimensional kinematic equations for motion at constant acceleration. Apply these equations to problems with objects in horizontal motion and objects in vertical motion (free fall) in the earth's gravity.
3. Understand vectors & how to add and subtract them using both the graphical and the analytical (trigonometric) methods.
4. Understand projectile motion in the earth's gravity & the basic equations describing it. Apply the basic kinematics equations for projectile motion to problems with objects shot into the air.
5. Understand force and Newton's 3 Laws of Motion. Apply these laws (especially the 2nd Law) to problems with objects subjected to constant forces.
6. Understand frictional forces. Apply Newton's 2nd Law to problems with objects moving in the presence of friction. Understand the basics of inclined plane motion.
7. Understand centripetal acceleration & force. Apply these concepts, along with Newton's 2nd Law, to problems with objects moving in uniform circular motion.

8. Understand Newton's Universal Law of Gravitation. Apply this law, with Newton's 2nd Law, to problems with objects (planets) in circular orbit about larger objects (stars).
9. Understand work by a constant force, kinetic energy, conservative forces, potential energy, & the Work-Energy Principle. Apply these concepts to various problems.
10. Understand the Principle of Conservation of Mechanical Energy (for conservative forces). Apply this law to problems of objects moving under the influence of conservative forces.
11. Understand momentum & impulse. Understand Newton's 2nd Law in terms of momentum. Apply these concepts to problems with colliding objects.
12. Understand the Law of Conservation of Linear Momentum. Apply this law to problems with colliding objects. Understand elastic & inelastic collisions & how to solve problems involving each kind of collision.
13. Understand angular displacement, angular velocity, angular acceleration, & the relations between these & displacement, velocity, & acceleration. Apply these concepts to problems involving rotating rigid bodies.
14. Understand the kinematic equations for rotation with constant angular acceleration. Apply these to problems involving rotating rigid bodies.
15. Understand torque & Newton's 2nd Law for rotational motion. Apply these concepts to problems involving rigid body rotation.
16. Understand rotational kinetic energy & angular momentum. Apply these concepts to problems involving rigid body rotation.
17. Understand the three conditions for static equilibrium. Apply these conditions to problems with objects in equilibrium.
18. Understand density, pressure, & the relation between them in a static fluid. Apply these concepts to simple cases.
19. Understand Archimedes' Principle for the buoyant force on an object submerged in a static fluid. Apply this principle to objects in a fluid (either floating or totally submerged).
20. Understand the constant volume flow rate equation & Bernoulli's Principle (& equation) in a uniformly flowing fluid. Apply these to fluid flow problems.
21. Understand simple harmonic motion & the simple harmonic oscillator. Understand displacement, frequency, & period for simple harmonic motion. Apply these concepts, along with Newton's 2nd Law to simple mass-spring problems.
22. Understand Conservation of Mechanical Energy for simple harmonic motion. Apply this concept to simple mass-spring problems.
23. Understand the basics of wave motion, including transverse & longitudinal waves & the concepts of displacement, wavelength, & frequency and the relations between them. Apply these concepts to simple wave problems.
24. Understand the energy transported by waves & interference & superposition. Apply these concepts to simple wave problems.
25. Understand standing waves & resonance. Apply this to calculate harmonics of vibrating strings.
26. Understand the basics concepts of sound waves. Apply these to simple sound wave problems.