Miami-Dade Community College

PHY 1004 - Physics with Applications

PHY 1004 3 credits

Course Description PHY 1004, Physics with Applications, is the first semester of a two semester physics without calculus sequence. This class is usually taken by students who are majoring in a program leading toward a degree in occupational therapy or physical therapy assistant. Classical mechanics, wave mechanics, sound and thermodynamics are studied. The pre-requisite for PHY 1004 is college algebra, MAT 1033 or the equivalent.

Pre-requisite: MAT 1033

Course Competencies

Competency 1. The student will demonstrate an ability to apply the equations for uniformly accelerated motion by

a. describing the conditions required for an object to be undergoing uniformly motion.
b. identifying the mathematical formula(s) need to solve the problem.
c. solving word problems concerning the motion of an object which is undergoing uniformly accelerated motion.

Competency 2. The student will demonstrate a comprehension of Galileo's contribution to the scientific method by

a. describing the experiments which he performed which led to his conclusion that all freely falling objects accelerate at the same rate.
b. describing the conditions required for an object to be undergoing uniformly motion.
c. identifying the mathematical formula(s) needed to solve a word problem involving free fall.
d. solving word problems concerning the motion of an object which is undergoing free fall.

Competency 3. The student will demonstrate a comprehension of the equations which describe projectile motion by

a. describing the conditions required for an object to be undergoing projectile motion.
b. identifying the mathematical formula(s) need to solve the problem involving projectile motion..
c. solving problems involving the motion of a projectile in motion near the surface of the earth.

Competency 4. The student will demonstrate a knowledge of vector algebra by

a. producing an accurate two dimensional and to scale drawing of one or more vectors
b. determining the resultant vector for problems involving two vectors using the
1) parallelogram method and
2) trigonometric component method.

Competency 5. The student will demonstrate an application of Newton's three laws of motion by

a. stating each law in the student's own words
b. applying the laws to everyday life experiences.

Competency 6. The student will demonstrate an ability to apply Newton's Laws of Motion by

a. drawing a free body diagram locating the forces acting on each object involved
b. solving word problems related to external forces acting on an object or system of objects in each of the following situations:
1. objects in static equilibrium
2. objects moving at constant velocity
3. objects which are uniformly accelerated

Competency 7. The student will demonstrate a comprehension of Newton's Universal Law of Gravitation by

a. stating Newton's universal law of gravitation in the student's own words
b. calculating the force acting between point objects placed at a given distance from one another.

Competency 8. The student will demonstrate a synthesis of the theories of Newton and Galileo to the problem of objects in free fall by formulating hypotheses on

a) the factors which affect the rates of fall of different objects, e. g. a feather and a coin,
b) how these factors affect the rates of fall of the objects, and
c) how the experimental results can be explained by using Newton's laws of motion and Galileo's law of inertia.

Competency 9. The student will demonstrate an ability to distinguish between kinetic friction and static friction by

a) identifying the type of friction involved in a particular problem
b) solving word problems involving each type of friction.

Competency 10. The student will demonstrate a comprehension of the difference between centripetal and centrifugal force by

a) identifying the object providing the centripetal force and the object receiving the centrifugal force
b) solving word problems involving the centripetal force on an object which is traveling in uniform circular motion.

Competency 11. The student will demonstrate a comprehension of Kepler's Laws by

a) stating each of Kepler's laws and explaining how each law applies to planetary motion.
b) using Kepler's third law to solve word problems related to planetary motion and the motion of satellites.

Competency 12. The student will demonstrate a synthesis of Newton's three laws of motion with his universal law of gravitation by

a) using these laws to derive Kepler's third law.
b) using these laws to determine the orbital velocity and period of motion of satellite undergoing

uniform circular motion.

Competency 13. The student will demonstrate a comprehension of work and energy by

a) stating the scientific definition of each term and distinguishing the scientific definition from the colloquial definition.
b) distinguishing between work, kinetic energy and potential energy.
c) calculating the work done by a force which moves an object through a given distance.
d) applying the principle of the conservation of mechanical energy when solving word problems in which the mechanical energy in a physical system is conserved.

Competency 14. The student will demonstrate an application power by

a) stating the scientific definition of the term power and distinguishing the scientific definition from the colloquial definition.
b) calculating the rate at which work is being done on an object.

Competency 15. The student will demonstrate an application of impulse, momentum, and the law of conservation of momentum by

a) distinguishing between impulse and momentum
b) solving word problems related to impulse and momentum.

Competency 16. The student will demonstrate an application of the law of conservation of momentum by

a) distinguishing between elastic collisions and inelastic collisions
b) stating the conditions required for each type of collision and citing examples of each type of collision.
c) applying the law of conservation of momentum in solving word problems related to elastic and inelastic collisions between two or more objects.

Competency 17. The student will demonstrate an application of angular motion by

a) distinguishing between angular displacement, angular velocity and angular acceleration.
b) solving word problems related to uniformly accelerated angular motion.

Competency 18. The student will demonstrate a comprehension of torque and angular momentum by

a) distinguishing between torque and angular momentum
b) stating the conditions needed for an unbalanced torque to act on an object.
c) solving word problems involving the change in angular momentum produced by an unbalanced torque acting on an object.

Competency 19. The student will demonstrate a comprehension of the law of conservation of angular momentum by

a) citing everyday situations which are applications of this law.
b) solving word problems involving the law of conservation of angular momentum.

Competency 20. The student will demonstrate an application of the conditions required for static equilibrium by

a) stating in the student's own words the two conditions required for static equilibrium.
b) drawing a free body diagram locating the forces acting on an object in static equilibrium.
c) selecting a suitable point in order to determine the magnitude of the torque produced by a given force.
d) applying the conditions in order to solve word problems involving static equilibrium.

Competency 21. The student will demonstrate an application of the three classes of levers by

a) correctly identifying which type of lever is being used in everyday situations.
b) solving word problems involving each type of lever.

Competency 22. The student will demonstrate a comprehension of the terms pressure, density and specific gravity by

a) correctly defining each term in the student's own words.
b) solving word problems related to pressure, density and specific gravity.

Competency 23. The student will demonstrate an application of Archimedes principle by

a) stating Archimedes' principle in the student's own words.
b) deriving Archimedes' principle.
c) solving word problems related to objects which are either floating on a fluid or completely submerged in a fluid.

Competency 24. The student will demonstrate an application of fluid dynamics by

a) describing how the Bernoulli equation can be used to explain vascular flutter, a transient ischemic attack (TIA), curve ball in baseball, slice or hook of a tennis ball or golf ball, and the motion of a sailboat on a windy day.
b) using Bernoulli's equation to solve word problems involving relative motion between an object and its surrounding fluid.

Competency 25. The student will demonstrate an application of simple harmonic oscillation by

a) describing the conditions necessary for simple harmonic motion
b) solving word problems involving the amplitude, frequency, period, and total mechanical energy of a given harmonic oscillator.

Competency 26. The student will demonstrate a comprehension of the nature of wave motion by

a) describing the differences between transverse and longitudinal mechanical waves.
b) drawing a transverse wave noting the crest, trough, amplitude and wavelength of the wave.
c) drawing a longitudinal wave noting the rarefaction, compression and wavelength of the wave.

Competency 27. The student will demonstrate an application of the nature of standing waves in strings and pipes by

a) drawing diagrams which correctly depict the mode of vibration described in the problem.
b) solving word problems involving frequency, wavelength, and mode of vibration in order to produce standing waves in
    1. a string
    2. an open pipe
    3. a closed pipe

Competency 28. The student will demonstrate an application of the expansion and contraction of solid or a liquid with temperature by

a) describing the conditions required for an object to expand or contract with temperature.
a) solving problems related to the changes in length and/or volume of solid or a liquid.

Competency 29. The student will demonstrate a comprehension of the types of heat transfer by

a) distinguishing between the three methods by which heat transfer may occur:
    1. conduction.
    2. convection.
    3. radiation.
b) solving word problems involving heat transfer by conduction and radiation.

Competency 30. The student will demonstrate an application of the universal gas law P V = n R T by

a) using the law to describe the relationship between pressure, temperature and volume occupied by a gas confined to an enclosed container.
b) solve word problems involving the universal gas law.

Competency 31. The student will demonstrate a knowledge of the kinetic theory by

describing the molecular motion of particles in each of the three states of matter, i. e. solid, liquid and gas..

Competency 32. The student will demonstrate a comprehension of the kinetic theory of gases by

using the kinetic theory of gases to describe how changes in each of the following would affect h pressure of a gas:
    1. temperature
    2. volume that the gas occupies
    3. number of molecules in the gas.

Competency 33. The student will demonstrate a synthesis of the gas laws and the kinetic theory of gases to the problem of changing pressure in an enclosed container by

a) formulating a hypothesis on the factors which affect the pressure, and
b) how the experimental results can be explained by using the kinetic theory of gases.

Competency 34. The student will demonstrate a comprehension of the mathematical equations which describe changes of

state by

solving word problems related to heating or cooling of a substance and change of phase from solid o
liquid, from liquid to gas and vice versa.

Competency 35. The student will demonstrate an application of the first law of thermodynamics by

a) using the first law of thermodynamics to explain the operation of a four cycle Carnot engine as well as the operation of a refrigerator or air conditioner
b) using the equations describing heat engines to solve mathematical problems related to the Carnot engine.

Competency 36. The student will demonstrate an understanding of the second law of thermodynamics by

a) explaining in the student's own words the meaning of the term entropy.
b) using examples from everyday life which support the second law of thermodynamics.