



Western Technical College

## 10806154 General Physics 1

### Course Outcome Summary

#### Course Information

<b>Description</b>	Presents the applications and theory of basic physics principles. This course emphasizes problem-solving, laboratory investigation, and applications. Topics include unit conversion and analysis, vectors, translational and rotational kinematics, translational and rotational dynamics, heat and temperature, and harmonic motion and waves.
<b>Instructional Level</b>	Associate Degree Courses
<b>Total Credits</b>	4
<b>Total Hours</b>	90

#### Pre/Corequisites

Prerequisite 10804113 College Technical Math 1A

#### Textbooks

No textbook required.

#### Learner Supplies

Safety Glasses with side eye protection, ANSI Z87.1, Pyramex Venture II or Pyramex OTS. **Vendor:** Campus Shop. Required.

Scientific calculator – TI-36X Pro. **Vendor:** Campus Shop. Required.

#### Success Abilities

1. Cultivate Passion: Expand a Growth-Mindset

2. Live Responsibly: Embrace Sustainability
3. Live Responsibly: Foster Accountability
4. Refine Professionalism: Act Ethically
5. Refine Professionalism: Improve Critical Thinking
6. Refine Professionalism: Participate Collaboratively
7. Refine Professionalism: Practice Effective Communication

## Course Competencies

### 1. Solve problems involving unit conversion and unit analysis.

#### Assessment Strategies

- 1.1. quizzes/exams
- 1.2. lab activities

#### Criteria

*You will know you are successful when*

- 1.1. you use the conversion factor method to make correct conversions.
- 1.2. you show the steps used to solve the problem.
- 1.3. you include correct units of measure in your answer.

#### Learning Objectives

- 1.a. Apply International System and US Conventional System base units of measure.
- 1.b. Construct SI derived units.
- 1.c. Use scientific notation to write numbers.
- 1.d. Apply rules regarding significant figures.
- 1.e. Express numeric answers to correct number of significant figures.
- 1.f. Investigate measurement concepts and practices.

### 2. Perform vector analysis.

#### Assessment Strategies

- 2.1. quizzes/exams
- 2.2. lab activities

#### Criteria

*You will know you are successful when*

- 2.1. you add and subtract vectors using component method.
- 2.2. you convert between rectangular and polar form.
- 2.3. you show the steps used to solve the problem.
- 2.4. you include correct units of measure in your answer.

#### Learning Objectives

- 2.a. Distinguish between scalar and vector quantities.
- 2.b. Resolve vectors into rectangular coordinates.
- 2.c. Calculate the magnitude and direction of a vector given its rectangular components.
- 2.d. Add vectors graphically.
- 2.e. Add vectors analytically.

### 3. Apply the laws of translational kinematics.

#### Assessment Strategies

- 3.1. quizzes/exams
- 3.2. lab activities

#### Criteria

*You will know you are successful when*

- 3.1. you solve problems involving displacement, velocity, acceleration, and time.

- 3.2. you show the steps used to solve the problem.
- 3.3. you include correct units of measure in your answer.

#### **Learning Objectives**

- 3.a. Calculate distance and average speed.
- 3.b. Calculate displacement and velocity.
- 3.c. Calculate average acceleration.
- 3.d. Solve various one-dimensional kinematics problems.
- 3.e. Solve problems involving free fall kinematics.
- 3.f. Interpret two-dimensional kinematics equations.
- 3.g. Examine curvilinear motion in two dimensions (constant acceleration in one direction of motion).
- 3.h. Calculate position and velocity of an object in projectile motion.

### **4. Apply the laws of translational dynamics.**

#### **Assessment Strategies**

- 4.1. quizzes/exams
- 4.2. lab activities

#### **Criteria**

*You will know you are successful when*

- 4.1. you draw an accurate freebody or motion diagram representing the problem.
- 4.2. you use the freebody diagram to solve for unknowns.
- 4.3. you correctly solve uniform circular motion problems .
- 4.4. you show the steps used to solve the problem.
- 4.5. you include correct units of measure in your answer.

#### **Learning Objectives**

- 4.a. Interpret Newton's first law of motion.
- 4.b. Interpret Newton's second law of motion in one dimension.
- 4.c. Interpret Newton's third law of motion.
- 4.d. Apply Newton's second law of motion to dynamic systems in one dimension.
- 4.e. Draw free-body diagrams for each object in a dynamic or static system.
- 4.f. Apply Newton's second law of motion to dynamic systems in two dimensions.
- 4.g. Apply Newton's second law of motion to systems in one- and two-dimensional translational equilibrium.
- 4.h. Apply the properties of friction.

### **5. Solve problems using concepts of work, energy, and power.**

#### **Assessment Strategies**

- 5.1. quizzes/exams
- 5.2. lab activities

#### **Criteria**

*You will know you are successful when*

- 5.1. you accurately calculate work.
- 5.2. you accurately calculate power.
- 5.3. you accurately calculate kinetic energy.
- 5.4. you accurately calculate potential energy.
- 5.5. you solve problems using the law of conservation of energy.
- 5.6. you show the steps used to solve the problem.
- 5.7. you include correct units of measure in your answer.

#### **Learning Objectives**

- 5.a. Apply the definition of work.
- 5.b. Examine kinetic energy of a mechanical system.
- 5.c. Examine the potential energy of a mechanical system.
- 5.d. Apply the law of conservation of energy.
- 5.e. Apply the definition of power.

### **6. Solve problems based on the principle of conservation of momentum.**

#### **Assessment Strategies**

- 6.1. quizzes/exams
- 6.2. lab activities

### Criteria

*You will know you are successful when*

- 6.1. you accurately calculate momentum.
- 6.2. you solve problems using the law of conservation of momentum.
- 6.3. you show the steps used to solve the problem.
- 6.4. you include correct units of measure in your answer.

### Learning Objectives

- 6.a. Apply the concept of momentum of a particle and the relation between the resultant force on a particle and the time rate of change of its momentum.
- 6.b. Apply conservation of momentum to one-dimensional motion.
- 6.c. Distinguish the two types of collisions that can occur between two particles, namely elastic and inelastic collisions.
- 6.d. Apply conservation of momentum to two-dimensional motion.

## 7. Apply the laws of rotational kinematics.

### Assessment Strategies

- 7.1. quizzes/exams
- 7.2. lab activities

### Criteria

*You will know you are successful when*

- 7.1. you solve problems involving angular displacement, angular velocity, angular acceleration, and time.
- 7.2. you show the steps used to solve the problem.
- 7.3. you include correct units of measure in your answer.

### Learning Objectives

- 7.a. Examine angular displacement and arc length.
- 7.b. Examine angular velocity and tangential velocity.
- 7.c. Examine the properties of centripetal acceleration and centripetal force.
- 7.d. Calculate angular acceleration.
- 7.e. Apply Newton's universal law of gravity.

## 8. Apply the laws of rotational dynamics.

### Assessment Strategies

- 8.1. quizzes/exams
- 8.2. lab activities

### Criteria

*You will know you are successful when*

- 8.1. you draw an accurate freebody or motion diagram representing the problem.
- 8.2. you use the freebody diagram to solve for unknowns.
- 8.3. you accurately calculate moment of inertia.
- 8.4. you accurately calculate rotational kinetic energy.
- 8.5. you accurately calculate work.
- 8.6. you accurately calculate power.
- 8.7. you solve problems using the law of conservation of energy.
- 8.8. you show the steps used to solve the problem.
- 8.9. you include correct units of measure in your answer.

### Learning Objectives

- 8.a. Examine the properties of an object that is rolling without slipping.
- 8.b. Investigate the properties of torque.
- 8.c. Investigate Newton's second law of motion for a system of particles rotating about a specific axis.
- 8.d. Investigate mechanical systems in rotational and translational equilibrium.
- 8.e. Examine rotational work, kinetic energy, and power.
- 8.f. Examine conservation of angular momentum.

## 9. Solve problems involving properties of solids and fluids.

### Assessment Strategies

- 9.1. quizzes/exams
- 9.2. lab activities

### Criteria

*You will know you are successful when*

- 9.1. you accurately calculate pressure.
- 9.2. you apply Archimedes' Principle.
- 9.3. you solve problems in fluid dynamics.
- 9.4. you solve problems involving the deformation of solids.

### Learning Objectives

- 9.a. Investigate the relationship between stress, strain, and Young's modulus.
- 9.b. Examine fluid pressure.
- 9.c. Examine Pascal's principle.
- 9.d. Calculate buoyant force using Archimedes' principle.
- 9.e. Analyze flow speed using the continuity equation.
- 9.f. Explore the principles of ideal fluid dynamics and Bernoulli's equation.

## 10. Solve problems involving heat and temperature.

### Assessment Strategies

- 10.1. quizzes/exams
- 10.2. lab activities

### Criteria

*You will know you are successful when*

- 10.1. you convert temperatures.
- 10.2. you solve problems related to specific heat and latent heat.
- 10.3. you solve problems related to heat transfer.
- 10.4. you solve problems related to the gas laws.
- 10.5. you solve problems related to thermal expansion.
- 10.6. you solve problems involving the First Law of Thermodynamics.

### Learning Objectives

- 10.a. Differentiate between temperature and heat.
- 10.b. Identify degrees Celsius and Rankine as temperature scales.
- 10.c. Investigate the ideal gas law.
- 10.d. Apply linear thermal expansion of solids.
- 10.e. Investigate various units of heat, e.g. joules, British thermal units (Btu), and calories.
- 10.f. Calculate heat loss or heat gain of matter in a single phase due to temperature change and specific heat.
- 10.g. Calculate the heat causing a phase change of a material using latent heat.
- 10.h. Examine the three types of heat transfer (conduction, convection, and radiation).

## 11. Solve problems involving simple harmonic motion and waves.

### Assessment Strategies

- 11.1. quizzes/exams
- 11.2. lab activities

### Criteria

*You will know you are successful when*

- 11.1. you solve problems related to simple harmonic motion.
- 11.2. you solve problems involving frequency, amplitude, wavelengths, and wave speed.
- 11.3. you describe interference and resonance.
- 11.4. you solve problems involving sound intensity levels.
- 11.5. you solve problems using the Doppler effect.

### Learning Objectives

- 11.a. Examine the equations of motion for simple harmonic motion.
- 11.b. Apply the equations of motion for simple harmonic motion to wave motion.
- 11.c. Define the two types of mechanical waves (transverse and longitudinal).
- 11.d. Examine wave phenomena (reflection, refraction, diffraction, and dispersion).
- 11.e. Investigate fundamental frequency, harmonic frequencies, and resonance.
- 11.f. Calculate the speed of sound in solids, liquids, and air.