

## Physics Principles

5 credits - Level: II (This course fulfills the graduation requirements for physics.)

Grades: 11-12

Prerequisite: None

Physics Principles will introduce and develop the fundamental concepts and laws of physics as they apply to everyday applications and experiences through a hands-on, laboratory, and multi-media approach. Necessary mathematical concepts are developed within the course and reinforced with practical applications. Less emphasis is placed on teacher-directed learning and more on teacher-assisted learning.

### **KINEMATICS**

- Demonstrate an understanding of the relationships between time, displacement, and velocity through applications of these relationships to problems in everyday one-dimensional situations.
- Demonstrate an understanding of the relationships between time, velocity, displacement, and acceleration through applications of these relationships to calculations in common situations.
- Apply the principles learned in kinematics to situations of objects in free fall including non-zero initial vertical velocities.
- Demonstrate an ability to use vector analysis to solve problems in determining velocities, displacement, and time of travel of objects in one-dimensional situations.

### **DYNAMICS**

- Apply Newton's laws of motion to explain inertia; the relationships among force, mass, and acceleration; and the interaction of forces between two objects.
- Analyze forces acting on an object utilizing free body diagrams to identify the net force.
- Apply the concepts of dynamics to analyze one-dimensional situations.
- Demonstrate an ability to describe and apply the concept of friction to everyday situations and determine the factors that affect it.
- Demonstrate an ability to describe and apply the concepts of momentum and impulse to everyday examples of collisions or explosions.

### **GRAVITY**

- Demonstrate an ability to explain qualitatively Kepler's three laws as a vehicle to describe planetary motion.
- Demonstrate an understanding of the nature of gravitational attraction between masses.
- Recognize that when a scientific model fails to account for certain phenomena, the theory upon which it is based has to be revised or discarded in favor of more suitable theories.

### **ENERGY**

- Demonstrate an understanding of the relationship between work, force and displacement.
- Demonstrate an understanding of the relationship between work and the different forms of energy.
- Demonstrate an understanding of the law of conservation of energy and the relationships among work, kinetic energy, potential energy, and thermal energy, including the loss of energy due to heat, sound and/or light.
- Demonstrate an ability to describe and apply the concepts of power and efficiency to everyday situations.

## **ELECTRICITY**

- Demonstrate an understanding of the laws governing electrical interactions are used to explain the behavior of electric charges at rest.
- Apply Coulomb's law to situations involving point charges and demonstrate an understanding of electric fields and their effects on charged objects.
- Apply the concept of electric potential, potential difference and electric potential energy to analyze situations involving point charges.
- Apply Ohm's law to direct current circuits.
- Demonstrate an understanding of the relationships between electric power, electric potential difference, current, and resistance.

## **MAGNETISM**

- Demonstrate an understanding of the nature of magnetic fields and magnetic forces.
- Analyze electromagnetism, with reference to magnetic fields and their effects on moving charges and vice versa.
- Analyze the process of electromagnetic induction.

## **ELECTROMAGNETIC INTERACTION**

- Demonstrate an understanding that electromagnetic radiation, light, is a physical manifestation of the interaction of electricity and magnetism.
- Explain, quantitatively, the characteristics and behaviors of the various constituents of the electromagnetic spectrum, and algebraically solve problems, using the relationship among speed, wavelength and frequency of electromagnetic waves.
- Demonstrate an ability to describe and apply the characteristics and properties of waves to light and other everyday phenomena.
- Demonstrate an understanding of the relationship between energy and the frequency of light.

## **NUCLEAR PROCESSES**

- Demonstrate an understanding of the basic nuclear processes of fission and fusion and the implications of their use.
- Demonstrate an understanding of the types and properties of elementary and other subatomic particles .
- Demonstrate an understanding of the nature of both nuclear forces so they can compare its strength and range with those of the electromagnetic force and gravitational force.