

Physics Honors

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

Grades: 11-12

Prerequisite: Minimum grade of 80 in both Algebra II Honors and the last Honors-level science course taken (or a minimum grade of 90 in the Level I course of either).

To develop a genuine understanding of the physical laws basic to all sciences and the interrelationships and effects the laws have on the development of society in general, a multi-activity/laboratory-based approach, including video demonstrations, computer and non-computer-assisted laboratories, and interactive computer simulations, is to be used. Advanced skills in mathematics are developed when needed and combined with appropriate technology and problem solving skills to explore concepts in detail. The concepts of motion and force, work and energy, and electricity and magnetism are among those examined.

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 and two-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 two 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, in two dimensions.

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 and Kirchhoff's laws to direct current circuits.
- Demonstrate an understanding of the relationships between electric power, electric potential difference, current, and resistance.

MAGNETISM

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

ELECTROMAGNETIC INTERACTION

1. Demonstrate an understanding that electromagnetic radiation, light, is a physical manifestation of the interaction of electricity and magnetism.
2. 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 .
3. Demonstrate an ability to describe and apply the characteristics and properties of waves to light and other everyday phenomena.
4. Demonstrate an understanding that the photoelectric effect requires the adoption of the photon model of light.

NUCLEAR PROCESSES

1. Demonstrate an understanding of the basic nuclear processes of fission and fusion and the implications of their use.
2. Demonstrate an understanding of the types and properties of elementary and other subatomic particles
3. 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