

**Franklin Public Schools****Physics  
Grade 12  
Advance Placement**

*Physics AP is a second year course for students who are expressly interested in majoring in the physical sciences or engineering in college/university. Students must have successfully completed Physics Honors and should be enrolled in Pre-Calculus or Calculus.*

**1. Motion and Forces**

*Broad concept: Newton's laws of motion and gravitation describe and predict the motion of most objects.*

- 1.1 Distinguish between vector quantities (velocity, acceleration and force) and scalar quantities (speed and mass).
- 1.2 Illustrate how to represent vectors graphically and be able to add them graphically.
- 1.3 Distinguish between, and solve problems involving, velocity, speed and constant acceleration.
- 1.4 Create and interpret graphs of motion (position vs. time, speed vs. time, velocity vs. time, constant acceleration vs. time).
- 1.5 Explain the relationship between mass and inertia.
- 1.6 Interpret and apply Newton's first law of motion.
- 1.7 Interpret and apply Newton's second law of motion to show how an object's motion will change only when a net force is applied.
- 1.8 Use a free body force diagram with only co-linear forces to show forces acting on an object and determine the net force on it.
- 1.9 Qualitatively distinguish between static and kinetic friction, what they depend on and their effects on the motion of objects.
- 1.10 Interpret and apply Newton's third laws of motion.
- 1.11 Understand conceptually Newton's law of universal gravitation.
- 1.12 Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration and time and explain how they are measured.

**2. Conservation of Energy and Momentum**

*Broad concept: The laws of conservation of energy and momentum provide alternate approaches to predict and describe the movement of objects.*

- 2.1 Interpret and provide examples that illustrate the law of conservation of energy.
- 2.2 Provide examples of how energy can be transformed from kinetic to potential and vice versa.
- 2.3 Apply quantitatively the law of conservation of mechanical energy to simple systems.
- 2.4 Describe the relationship between energy, work and power both conceptually and quantitatively.
- 2.5 Interpret the law of conservation of momentum and provide examples that illustrate it. Calculate the momentum of an object.
- 2.6 Identify appropriate standard international units of measurement for energy, work, power, and momentum.

### 3. Waves

*Broad concept: Waves carry energy from place to place without the transfer of matter.*

- 3.1 Differentiate between wave motion and the motion of objects.
- 3.2 Recognize the measurable properties of waves (e.g., velocity, frequency, wavelength) and explain the relationships between them.
- 3.3 Distinguish between transverse and longitudinal waves.
- 3.4 Distinguish between mechanical and electromagnetic waves.
- 3.5 Interpret and be able to apply the laws of reflection and refraction (qualitatively) to all waves.
- 3.6 Explain the relationship between the speed of a wave (e.g. sound) and the medium it travels through.

### 4. Electromagnetism

*Broad concept: Stationary and moving charge particles result in the phenomenon known as electricity and magnetism.*

- 4.1 Recognize the characteristics of static charge, and explain how a static charge is generated.
- 4.2 Interpret and apply Coulomb's Law.
- 4.3 Explain the difference in concept between electric forces and electric fields.
- 4.4 Develop a qualitative and quantitative understanding of current, voltage, and resistance and the connection between them.
- 4.5 Identify appropriate units of measurement for current, voltage, and resistance explain how they are measured.