**Objectives by Chapter**:

Chapter 1:

* Evaluate answers using dimensional analysis
* Perform arithmetic operations using scientific notation.
* Graph the relationships.
* Interpret graphs.
* Understand and use the metric system.

Chapter 2:

* Draw motion diagrams to represent motion.
* Develop a particle model to represent a moving object
* Develop position-time graphs
* Use position-time graphs to interpret an objects position or displacement.

Chapter 3:

* Define acceleration
* Relate velocity and acceleration to the motion of an object.
* Create velocity-time graphs
* Interpret position-time graphs with constant acceleration
* Determine mathematical relationships among position, velocity, acceleration and time.
* Apply graphical and mathematical relationships to solve problems related to constant acceleration.

Chapter 4:

* Define force
* Apply Newton’s second law to solve problems
* Explain the meaning of Newton’s first law.
* Describe relationship between weight and mass.
* Difference between actual and apparent weight.
* Define Newton’s third law
* Define normal force
* Determine values mathematically using force concepts.

Chapter 5:

* Evaluate the sum of two or more vectors in two dimensions
* Determine the components of vectors.
* Solve for the sum of two or more vectors algebraically.
* Determine the force that produces equilibrium when three forces act on an object.
* Analyze the motion of an object on an inclined plane.

Chapter 6:

* Recognize that vertical and horizontal motions of a projectile are independent.
* Relate the height, time in the air, and initial vertical velocity of a projectile using its vertical motion, and then determine the range using the horizontal motion.
* Explain why and object moving in a circle at a constant speed is accelerating.
* Describe how centripetal acceleration depends upon the object’s speed and the radius of the circle.
* Bonus relativity. Solve relativity problems

Chapter 7:

* Describe universal law of gravitation.
* Relate Kepler’s laws to gravitation.
* Calculate orbital speeds and periods.
* Solve orbital motion problems
* Relate weightlessness to freefall
* Calculate gravitational fields.

Chapter 8:

* Describe angular displacement
* Calculate angular velocity
* Calculate angular acceleration
* Solve rotational motion problems
* Describe torque
* Calculate torque
* Calculate the moment of inertia
* Define center of mass
* Explain how the location of center of mass affects stability
* Define the conditions for equilibrium
* Describe how rotating frames of reference give rise to apparent forces

Chapter 9:

* Define momentum of an object
* Determine impulse of an object
* Define angular momentum of an object
* Relate Newton’s third law to conservation of momentum
* Solve conservation of momentum problems.

Chapter 10:

* Describe the relationship between work and energy.
* Calculate work and power used.
* Differentiate between real and ideal machines in terms of efficiency.
* Calculate efficiencies for simple and compound machines.

Chapter 11:

* Use a model to relate work and energy
* Calculate kinetic energy
* Determine the gravitation potential energy of an object
* Solve problems using the law of conservation of energy
* Analyze collisions to find the change in kinetic energy.

Chapter 12:

* Describe thermal energy
* Distinguish temperature from thermal energy
* Define specific heat and calculate heat transfer
* Define heats of fusion and vaporization
* State the first and second laws of thermodynamics
* Distinguish between heat and work
* Define entropy

Chapter 13:

* Describe how fluids create pressure
* Calculate pressure, volume, and number of moles of a gas.
* Relate the properties of solids to their structures
* Explain why solids expand and contract when the temperature changes

Chapter 14:

* Describe the force in an elastic spring
* Determine the energy stored in an elastic spring
* Calculate pendulum motion.
* Identify how waves transfer energy
* Contrast wave types
* Relate wave speed, wavelength, and frequency
* Relate waves speed to medium
* Describe reflection and refraction of waves

Chapter 15:

* Demonstrate the properties of sound
* Identify applications of Doppler effect
* Relate physical properties to sound perception
* Describe origin of sound
* Explain why there are variations in sound among instruments and voices.

Chapter 16:

* Develop ray model of light
* Predict effect of distance on illumination
* Solve speed of light problems
* Predict effects of combining colors of light and mixing pigments
* Describe how diffraction demonstrates light is a wave.
* Explain polarization and Doppler effect