Shelby County Curriculum Guide
Essential Content and Skills
Physics

Textbook – Physics: Principles and Problems (Glencoe 2005)

Standard	Essential Content and Skills			Textbook Section	Suggested Teaching Time
	Reinforce	**Mastery (Priority)**	**Introduce**		
Quantity Basics	Identify and use SI units and prefixes. Review basic algebra and trigonometry. Practice unit conversions.	Use significant digits, scientific notation, and SI units of measure. Solve and manipulate equations, including proper calculator operation. Convert between units in the SI system (dimensional analysis).	This is for review only.	1.1, 1.2, 1.3	Week 1
1. Explain linear, uniform circular, and projectile motions using one- and two-dimensional vectors. Explaining the significance of slope and area under a curve when graphing distance-time or velocity-time data Example: slope and area of a velocity-time curve giving acceleration and distance traveled Describing forces that act on an object Example: drawing a free-body diagram showing all forces acting on an object and resultant effects of friction, gravity, and normal force on an object sliding down an inclined plane	Review trig identities. Review vectors from geometry. Review Newton's Laws of Motion from Physical Science.	Differentiate between velocity and speed. Differentiate between vector and scalar quantities. Predict velocity and acceleration using slope on distance-time or velocity-time graphs. Calculate velocity and acceleration using kinematic equations. Explain meaning of positive and negative quantities. Describe the significance of gravity in vertical motion. Determine displacement in two dimensions using vector analysis. Describe and calculate projectile motion. Describe relative motion. Differentiate between Newton's three laws. Use free body diagrams to describe forces on an object. Identify and calculate forces that act in two dimensions. Describe and calculate frictional forces.	Recognize variables commonly used in physics equations. Calculate motion using kinematic equations. Describe forces: gravity, normal force, friction. Draw force vectors.	Chapter 2, sections 1-4. Chapter 3, sections 1-3. Chapter 4, sections 1-3. Chapter 5, sections 1-3. Chapter 6, sections 1 and 3.	Weeks 2-13

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4. Describe quantitative relationships for velocity, acceleration, force, work, power, potential energy, and kinetic energy.	Differentiate between work and power. Describe types of energy (potential, kinetic, mechanical).	Identify requirements that must be met for work to be done. Use net force to determine net work done. Relate work and power. Calculate kinetic and potential energy. Using the concept of mechanical, determine energy transformed between kinetic and potential. .	Relate force and displacement to work done. Utilize work to determine power generated. Apply concepts of energy transformations.	Chapter 10, section 1 Chapter 11, sections 1 and 2	Weeks 14-15
2. Define the law of conservation of momentum. Calculating the momentum of a single object Calculating momenta of two objects before and after collision in one-dimensional motion	Define momentum.	Explain conservation of momentum. Relate impulse to change in momentum. Determine momentum change of individual particles in two-particle collisions in one dimension.	Utilize the impulse-momentum theorem to determine change in momentum. Calculate momentum in one-dimensional collisions.	Chapter 9, sections 2 and 3	Weeks 16 and 17
1. Explain linear, <u>uniform circular</u>, and projectile motions using one- and two-dimensional vectors. *****Describing forces that act on an object **3. Explain planetary motion and navigation in space in terms of Kepler's and Newton's laws.**	Review force vectors and Newton's second law.	Define uniform circular motion. Describe forces acting on an object in uniform circular motion. Calculate centripetal force, centripetal acceleration. Relate gravitational attraction between objects using Newton's law of universal gravitation. Explain the significance of Kepler's 3 laws. Determine period of planetary motion using Kepler's third law. Relate projectile motion to satellite motion.	Calculate centripetal force and centripetal acceleration. Use Newton's law of universal gravitation. .Calculate satellite motion using Kepler's laws and the concepts of projectile motion.	**6.2, 8.1, 7.1, 7.2**	**Weeks 19-21**

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Calculate the magnitude of torque on an object. Define conditions for equilibrium.	Review force vectors.	Determine net torque on an object. Determine force on an object in rotational equilibrium.	Torque is not on the COS, but is a necessary component of a rigorous physics course (essential background for college and AP courses).	**8.2, 8.3**	**Weeks 22-23**
Determine the magnitude of the buoyant force on a floating or submerged object. Calculate fluid pressure. Apply Bernoulli's equation and Pascal's law.	Review free body diagrams. Review the concept of weight. Determine density of an object. Calculate pressure of an object.	Describe the buoyant force. Relate Newton's second law to calculate of the buoyant force. Show how calculation of pressure is applied in Pascal's law. Describe the significance and uses of Pascal's principle. Determine pressure on an object due to a fluid. Describe Bernoulli's principle. Apply the continuity equation in calculating fluid flow. Apply Bernoulli's principle in calculation of fluid flow.	Hydrostatics and fluid mechanics are not on the COS but are necessary components of a rigorous college-prep physics program.	**13.1, 13.3**	**Weeks 24-25**
8. Summarize similarities in the calculation of electrical, magnetic, and gravitational forces between objects. **Determining the force on charged particles using Coulomb's law**	Compare electric and magnetic forces to universal gravitation.	Determine electric force using Coulomb's law.	Demonstrate electric force of attraction using van de Graaff generator.	**20.1, 20.2, 24.1**	**Weeks 26**
9. **Describe quantitative relationships among charge, current, electrical potential energy, potential difference, resistance, and electrical power for simple series, parallel, or combination direct current (DC) circuits.**	Compare series and parallel circuits.	Define electric charge. Describe and calculate current. Differentiate between electric potential energy and potential difference. Describe factors affecting resistance. Apply Ohm's law. Relate voltage, current, and resistance to electrical power in DC circuits.	Perform circuit analysis for simple and complex circuits. Briefly introduce electromagnetic induction. Describe the significance of alternating current.	**22.1, 22.2, 23.1, 23.2**	**Weeks 27-29**

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6. Describe wave behavior in terms of reflection, refraction, diffraction, constructive and destructive wave interference, and Doppler effect. Explaining reasons for differences in speed, frequency, and wavelength of a propagating wave in varying materials Describing uses of different components of the electromagnetic spectrum, including radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X rays, and gamma radiation Demonstrating particle and wave duality using Einstein's theory for explaining the photoelectric effect **Describing change of wave speed in different media**	Describe types of waves. Describe properties of waves. Relate speed, wavelength and frequency.	Define and differentiate between reflection, refraction, and diffraction. Describe types and effects of wave interference. Calculate speed of a wave. Determine wave period in a mass-spring system and of a period. Compare mass-spring systems to pendulum motion. Relate period and frequency. Compare speed of waves in different media. Describe significance of resonance. Calculate frequency shift in the Doppler effect with sound. Discuss the significance of Doppler shift in sound and light. Describe the importance of the various types of light in the electromagnetic spectrum.	Describe the significance of standing waves. Discuss particle nature of light in the photoelectric effect. Explain the significance of interference in wave diffraction.	**14.1, 14.2, 14.3, 15.1, 15.2** **27.1, 27.2**	**Weeks 30-33**
7. Describe properties of reflection, refraction, and diffraction. Examples: tracing the path of a reflected light ray, predicting the formation of reflected images through tracing of rays Demonstrating the path of light through mirrors, lenses, and prisms Example: tracing the path of a refracted light ray through prisms using Snell's law **Describing the effect of filters and polarization on the transmission of light**	Define reflection, refraction, and diffraction.	Compare/contrast types of mirrors and images. Determine image and object distances using the mirror equation. Compare/contrast types of lenses and note similarities to types of mirrors. Determine image and object distances using the lens equation. Calculate refracted angles using Snell's law. Explain practical applications of Total Internal Reflection, and determine critical angles. Explain the significance of dispersion.	Draw ray diagrams for convex and concave mirrors Trace the path of refracted light. Describe the significance of atmospheric refraction in formation of mirages..	**16.1, 16.2, 17.1, 17.2, 18.1, 18.2, 18.3, 19.1, 19.2**	**Weeks 34-35**

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5. Explain the concept of entropy as it relates to heating and cooling, using the laws of thermodynamics. • Using qualitative and quantitative methods to show the relationship between changes in heat energy and changes in temperature	Describe conduction, convection, and radiation. Convert between temperature scales.	Explain the first two laws of thermodynamics. Describe change of phase. Calculate heat transfer using $mc\Delta T$. Calculate heat required for phase changes. Identify types of thermodynamic processes from P-V diagrams. Interpret work done using P-V diagrams. Calculate internal energy change using the first law of thermodynamics.	Describe uses of calorimetry. Define entropy.	**12.1, 12.2**	**Week 36**