Huntsville City Schools 2017-2018 Pacing Guide

Course: Physics Grades: 11-12

All 9 weeks are planned for 20 days of instruction – this can vary slightly based on dates/exams

** All PhET simulations can be found on the mastering physics website, in the student study area. They are organized by chapter.

1st Nine Weeks			
Standards	**Topic and Statements**	**Resources**	**Pacing**
Physics as Inquiry ACOS: SCIENCE Scientific and Engineering Practices QualityCore A.1. Scientific Inquiry A.2. Mathematics and Measurement in Science A.3. Science in Practice	**Scientific Inquiry** • identify research questions and design experiments with controlled variables and appropriate numbers of trials. • collect, organize, and analyze data using appropriate procedures and technology. • interpret results and make conclusions from data, revising hypotheses as necessary. • write and speak to effectively present my findings and results using appropriate terms and visuals. • safely use laboratory equipment to conduct investigations. • routinely make predictions and estimations. **Mathematics and Measurement in Science** • distinguish between precision and accuracy. • use appropriate SI units for measurements. • calculate slope and explain its physical significance. • use significant figures to calculate and estimate the uncertainty of experimental results and use these to evaluate the results. • express numbers in scientific notation. • solve for unknown quantities by manipulating variables. • use graphical, mathematical and statistical models to express patterns and relationships amongst data. • **Science in Practice** • understand the fundamental assumptions of science • explain and apply criteria to validate scientific claims and theories • explain why experimental and observational data, peer review and ethical procedures are essential in science • use multiple sources and cite those sources properly	**Walker** *Pearson Physics, 1e.* Chapter 1 Mastering Physics Pearson Platform and Khan Academy LTF "Foundation Lesson I: The Scientific Method" LTF "Foundation Lesson II: Numbers in Science: PhET "Estimation"	**3 days +** application and practice throughout the course

Speed, Velocity and Acceleration ACOS: SCIENCE 1 Motion and Stability: Forces and Interactions	**Speed, Velocity and Acceleration** • write equations for displacement and velocity over time. • recognize and/or draw graphs of an object's displacement and velocity versus time. • solve problems in kinematics using the equation $v_{avg} = (s - s_0)t$ • solve problems in kinematics using the equations $v = v_0 + at$, and $x = x_0 + v_0t + (1/2)at^2$ • construct the two graphs not given, when given a linear motion graph of displacement, velocity, or acceleration versus time.	**Walker** *Pearson Physics, 1e.* Chapters 2 and 3 Mastering Physics Pearson Platform and Khan Academy LTF "Graph Match" LTF "Graphing Motion" LTF "Ticker Tape Timer" LTF "Falling Washers" LTF "Carts and Ramps" PhET "The Moving Man" PhET "Forces in 1 Dimension" PhET "Calculus Grapher"	**7 days**
One- and Two-Dimensional Motion ACOS: SCIENCE 1 Motion and Stability: Forces and Interactions	**One- and Two-Dimensional Motion** • determine the sum of vector components by graphical and mathematical means. • resolve a vector into mutually perpendicular components. • write the equations for the horizontal and vertical components of a projectile's displacement over time, as well as its velocity over time. • calculate the displacement, velocity and altitude over time for a projectile that is launched at a given initial velocity from a launch site at a given altitude above the horizontal plane.	**Walker** *Pearson Physics, 1e.* Chapter 4 Mastering Physics Pearson Platform and Khan Academy PhET "Vector Addition" PhET "Maze Game" PhET "Projectile Motion" LTF "Kinematics" LTF "Vector Scavenger Hunt" LTF "Sizzle and Slice" LTF "Projectile Motion"	**5 days**
Momentum ACOS: SCIENCE 3 Motion and Stability: Forces and Interactions	**Momentum** • define momentum and impulse. • calculate total linear momentum of an isolated system of moving masses. • calculate the time-average force acting on a body when an impulsive force is exerted on the body. • identify and explain the situations where linear momentum is conserved, using Newton's second and third laws. • solve problems using the conservation of linear momentum, including those involving two bodies following paths that intersect at arbitrary angles.	**Walker** *Pearson Physics, 1e.* Chapter 7 Mastering Physics Pearson Platform and Khan Academy LTF "Conservation of Momentum" LTF "Crumple Zone" PhET "Collision Lab" Video Tutor Demonstrations "Water Rocket"	**5 days**

2nd Nine Weeks			
Standards	**Topic and Statements**	**Resources**	**Pacing**
Newton's Laws ACOS: SCIENCE 2 Motion and Stability: Forces and Interactions	**Newton's Laws** • describe the condition under which a body under the influence of several forces will remain at rest or in a state of unaccelerated motion. • compare and contrast mass and weight. • calculate the net change in velocity of a body initially moving in a straight line, which will result when a constant net force is applied for a given amount of time. • create a free body diagram, as well as write the vector equation for a body using Newton's second law. • write the equation that describes the relationship between a frictional force on a body and a normal force exerted on the surface of the body, as well as explain the meaning of the coefficient of friction. • use Newton's third law to name action-reaction pairs; for each pair, identify the body on which the reaction force acts and vector quantity of the reaction force.	**Walker** *Pearson Physics, 1e.* Chapter 5 Mastering Physics Pearson Platform and Khan Academy **LTF "Newton's Second Law"** LTF "Forces on Objects" LTF "Vector Addition of Forces" LTF "The Atwood Machine" PhET "Force and Motion: Basics" PhET "Forces in 1 dimension" PhET "Ramp: Forces and Motion"	**5 days**
Kepler's Laws ACOS: SCIENCE 4 Motion and Stability: Forces and Interactions	**Rotational Motion** • relate the magnitude of centripetal acceleration to the speed or rate of revolution and to the radius of orbit for a particle undergoing uniform circular motion. • describe the direction of the velocity and acceleration vectors for a particle undergoing uniform circular motion at any given position in orbit.	**Walker** *Pearson Physics, 1e.* Chapter 8 Mastering Physics Pearson Platform and Khan Academy LTF "Centripetal Force" PhET "Motion in 2D" PhET "Ladybug Motion 2D" PhET "Ladybug Revolution" PhET "My Solar System" PhET "Gravity and Orbits"	**5 days**
Gravity ACOS: SCIENCE 2 Motion and Stability: Forces and Interactions	**Gravity** • explain the dependence of the gravitation field (gravitational acceleration) on mass and distance, using proportions. • calculate the strength of a gravitational field of a spherical mass at a given point outside of the mass.	**Walker** *Pearson Physics, 1e.* Chapter 9 (skip 9.4 if low on time) Mastering Physics Pearson Platform and Khan Academy LTF "Newton's Second Law"	**5 days**

		PhET “Gravity Force Lab” PhET “Gravity and Orbits” PhET “My Solar System”	
Work and Energy **A**COS: SCIENCE 5 Energy ACOS: SCIENCE 6 Energy	**Work and Energy** • describe the relationship between work and energy. • describe the difference between kinetic and potential energy. • discuss the relationship of work and kinetic energy as well as work and gravitational potential energy using Newton’s Second Law. • calculate the amount of work done by a given force on a body that is constrained to move along a plane. • calculate the change in energy (kinetic, gravitational potential, and elastic potential) that results from performing a specified amount of work on a body. • solve problems involving elastic and inelastic collisions. • write the equation for force exerted by an ideal spring, compressed or stretched, as well as an equation for the potential energy stored by the spring. • identify and explain times when mechanical energy is conserved, and vice versa. • relate power to work and solve problems involving force, distance, time and acceleration.	**Walker** *Pearson Physics, 1e.* Chapter 6 Mastering Physics Pearson Platform and Khan Academy LTF “Running the Stairs” LTF “Rollercoaster!” PhET “Energy Skate Park”	**5 days**

3rd Nine Weeks			
Standards	**Topic and "I Can" Statements**	**Resources**	**Pacing**
Thermodynamics ACOS: SCIENCE 7 Energy	**Thermodynamics** • I can relate temperature and heat to one another. • I can discuss how energy is exchanged by conduction. • I can calculate specific heat of a substance. • I can relate heat and work. • I can explain the concept of entropy. • I can relate the first law of thermodynamics to energy conservation.	**Walker** *Pearson Physics, 1e.* Chapters 10 (skip 10.4) and 11 Mastering Physics Pearson Platform and Khan Academy LTF "Conduction, Convection, Radiation" LTF "Heat Lost and Heat Gained" PhET States of Matter	**5 Days**
Wave Properties ACOS: SCIENCE 8 Waves and Their Applications in Technologies for Information Transfer	**Wave Properties** • I can use a graph of the displacement of a point in a medium versus time to calculate the frequency, wavelength, and amplitude of a wave. • I can explain how wavelength and frequency are related to velocity. • I can describe the reflection of a wave from a fixed end and free end of a string. • I can state what factors determine the speed of waves on a string. • I can model the standing waves for different modes, as well as determine the wavelength, frequency, and amplitude for each mode of a string fastened and pulled taught. • I can describe constructive and destructive interference. • I can explain the conditions under which a standing wave might be formed by the superposition of multiple waves. • I can calculate wave speed, wavelength and frequency. • I can discuss factors that determine the energy of a wave. • I can compare and contrast transverse and longitudinal waves. • I can explain the refraction of a wave, as it passes through mediums. • I can describe the wave behavior of the Doppler Effect, as well as give examples.	**Walker** *Pearson Physics, 1e.* Chapters 13.3 – 13.4 Mastering Physics Pearson Platform and Khan Academy LTF "Waves in a Spring" LTF "Ripple Tank" PhET "Sound" PhET "Wave on a String" PhET "Wave Interference" PhET "Color Vision"	**3 days**
Periodic Motion ACOS: SCIENCE 8 Waves and Their Applications in	**Periodic Motion** • I can describe the conditions needed to cause a particle to undergo simple harmonic motion (SHM).	**Walker** *Pearson Physics, 1e.* Chapter 13.1	**1 day**

Technologies for Information Transfer	• I can describe the relationship between the frequency of oscillation of a particle undergoing Simple Harmonic Motion and the period of the particle's oscillations.	Mastering Physics Pearson Platform and Khan Academy LTF "The Inertial Balance" LTF "The Pendulum Swings" PhET "Pendulum Lab"	
Sound Waves ACOS: SCIENCE 9 Waves and Their Applications in Technologies for Information Transfer	**Sound Waves** • I can measure intensity and discuss its relationship to the decibel scale. • I can draw standing waves for pipes with different openings, as well as find the frequency and wavelength of each.	**Walker** *Pearson Physics, 1e.* Chapter 14 (all) Mastering Physics Pearson Platform and Khan Academy LTF "Speed of Sound" PhET "Sound" PhET "Wave Interference"	**3 days**
Light Waves ACOS: SCIENCE 10 Waves and Their Applications in Technologies for Information Transfer	**Light Waves** • I can describe how the intensity of light from a point source varies with distance, using proportions. • I can calculate the intensity of light at various distances, and use the results to illustrate the invers square law. • I can discuss the relationship between the intensity of light and the amplitude of light waves. • I can describe the electromagnetic spectrum in relation to energy, frequency, and wavelength, and discuss how our lives are affected by radiation in the various regions of this spectrum. • I can relate the wavelength, speed, and index of refraction of light as it passes from one medium to another. • I can sketch and diagram the directions of reflected and refracted rays when incident light rays approach in a rectangular glass block. • I can use Snell's law to calculate the direction of a refracted ray, when the direction of the incident ray and index of refraction are unknown. • I can trace rays to show the position of an image, object, and focal point or thin lens and determine if the image is real, virtual, upright or inverted. • I can elaborate on the conditions under which total internal reflection will occur. • I can use the thin lens equation to relate the positions of an object, an image and the focal point of a mirror, or thin lens. • I can use image and object distances to determine the lateral magnification, using the mirror equation.	**Walker** *Pearson Physics, 1e.* Chapters 15.2, 16 (all), 17 (skip 17.4), and 18 (all) Mastering Physics Pearson Platform and Khan Academy LTF "Convex Lens and Concave Mirror" LTF "Electromagnetic Waves" LTF "Refraction of Light" LTF "The Science of Light and Color" PhET "Wave Interference" PhET "Color Vision"	**8 days**

4th Nine Weeks			
Standards	**Topic and "I Can" Statements**	**Resources**	**Pacing**
Electrical Charges and Coulomb's Law ACOS: SCIENCE 11 Waves and Their Applications in Technologies for Information Transfer	**Electrical Charges and Coulomb's Law** • I can distinguish between Coulomb's law and Newton's universal law of gravitation, and explain how each variable affects the forces. • I can calculate Coulomb force exerted on a specific point charge by one or many point charges. • I can give a qualitative description of electrical charging by conduction and induction.	**Walker** *Pearson Physics, 1e.* Chapter 19.1 – 19.2 Mastering Physics Pearson Platform and Khan Academy LTF "Introduction to Electricity" LTF "Electrostatics" PhET "John Travoltage" PhET "Balloons and Static Electricity"	**4 days**
Electrical Potential and Electric Fields ACOS: SCIENCE 11 Waves and Their Applications in Technologies for Information Transfer	**Electrical Potential and Electric Fields** • I can qualitatively describe electric fields produced by a point charge. • I can use lines of force to represent the electrical fields associated with various symmetrical charge distributions, and describe these fields. • I can use vector addition to combine electric fields of two or more point charges and to determine the strength of the resultant electric field at a given location in space. • I can find the magnitude and direction of the electrical force exerted by an electric field on a positive and negative charges. • I can describe the motion of a particle of a given charge and mass in a uniform electric field. • I can calculate the electrical work done on a positive or negative charge that moves in a uniform electric field. • I can calculate the work done on a charged particle by an electric field that moves through a uniform electric field. • I can relate the intensity of an electric field between two points in space to the differences in electrical potential between the two points as well as to the difference between the two points. • I can calculate the potential difference between two points in a uniform electric field, and determine which point is at the higher potential.	**Walker** *Pearson Physics, 1e.* Chapter 20.1 – 20.2 Mastering Physics Pearson Platform and Khan Academy LTF "Equipotential Lines and Electric Fields" LTF "What is a Capacitor?" PhET "Charges and Fields" PhET "Electric Field Hockey"	**4 days**

Electrical Circuits ACOS: SCIENCE 12 Waves and Their Applications in Technologies for Information Transfer	**Electrical Circuits** • I can describe the relationship between current flowing through a resistor and the voltage across a resistor. • I can calculate the magnitude and determine the direction of the electrical current in a conducting wire. • I can distinguish between direct current (DC) and alternating current (AC). • I can describe the relationship between the resistance of a resistor and the length, composition, and cross-sectional area of the resistor. • I can describe the effect of temperature on the resistance of a resistor. • I can use Ohm's Law to calculate the voltage across, the current through, or the resistance of a circuit element in a direct current circuit. • I can identify the elements in a circuit that are in parallel or series. • I can calculate the ratio of voltages across two resistors connected in series. • I can calculate the ratio of currents through 2 resistors connected in parallel. • I can calculate the equivalent resistance for a network of resistors • I can calculate, for any resistor connected to a single power source, as well as the voltage, current and amount of power dissipated. • I can design, given a predetermined terminal voltage, a circuit element containing resistors in series and/or parallel such that a predetermined amount of current flows through the element. • I can describe the placement of a voltmeter and an ammeter in an electrical circuit to correctly measure current and voltage.	**Walker** *Pearson Physics, 1e.* Chapter 21.1 – 21.2 Mastering Physics Pearson Platform and Khan Academy LTF "Circuits Worksheet 1" LTF "Circuits Worksheet 2" LTF "Introduction to Electric Circuits" LTF "Series and Parallel Circuit Exercises" LTF "Paths of Resistance" PhET "Battery-Resistor Circuit" PhET "Circuit Construction Kit (AC) and (DC)" PhET "Ohm's Law"	**5 days**
Magnetism ACOS: SCIENCE 11 Waves and Their Applications in Technologies for Information Transfer	**Magnetism** • I can describe the conditions under which magnetic fields are produced. • I can describe the most general path for a charged particle moving in a uniform magnetic field. • I can describe the conditions under which magnetic flux through a current loop will induce an electromagnetic field in the loop. • I can describe how electromagnetic induction applies to the motor and generator.	**Walker** *Pearson Physics, 1e.* Chapters 22.1-22.2 and all of 23 Mastering Physics Pearson Platform and Khan Academy LTF "Magnetic Fields" PhET "Magnet and Compass" PhET "Magnet and Electromagnets" PhET "Faraday's Law"	**7 days**