Madison County Schools
Physics Pacing Guide

UNIT TOPIC	OBJECTIVE COVERED	TIME LENGTH
1st Nine Weeks		
Math Review • **Significant figures** • **Metric conversions** • **Graphical analysis** • **Problem solving**	PHY.1 Students will investigate and understand how to analyze and interpret data.	1 block
One Dimensional Kinematics • **Displacement** • **Velocity** • **Acceleration**	PHY.1.1 Investigate and analyze evidence gained through observation or experimental design regarding the one-dimensional motion of objects. Design and construct experiments to generate and interpret graphical evidence of distance, velocity, and acceleration through motion. PHY.1.2 Interpret and predict. 1-D motion based on displacement vs. time, velocity vs. time, or acceleration vs. time graphs (e.g., free-falling objects) PHY.1.3 Use mathematical and computational analysis to solve problems using kinematic equations. PHY.1.4 Use graphical analysis to derive kinematic equations. PHY.1.5 Differentiate and give examples of motion concepts such as distance-displacement, speed-velocity, and acceleration. PHY.1.6 Design and mathematically/graphically analyze quantitative data to explore displacement, velocity, and acceleration of various objects. Use probe systems, video analysis, graphical analysis software, digital spreadsheets, an/or online simulations.	6-8 blocks

	PHY.1.7 Design different scenarios, and predict graph shapes for distance/time, velocity/time, and acceleration/time graphs. PHY.1.8 Given a 1D motion graph students should replicate the motion predicted by the graph.	
Two-Dimensional Kinematics • **Vector addition** • **Projectiles**	PHY.2.1 Identify forces acting on a system by applying Newton's laws mathematically and graphically (e.g. vector and scalar quantities). PHY.2.2 Use models such as free-body diagrams to explain and predict the motion of an object from simple to complex motions, including circular motion. PHY.2.3 Use mathematical and graphical techniques to solve vector problems and find net forces acting on a body using free-body diagrams and/or online simulations PHY.2.4 Use mathematical and computational analysis to derive simple equations of motion for various systems using Newton's second law (e.g. projectile motion).	4-6 blocks
Newton's Laws/Force • **Inertia** • **F=ma** • **Action/reaction** • **Types of forces**	PHY.2 Students will develop an understanding of concepts related to Newtonian dynamics. PHY.2.1 Identify forces acting on a system by applying Newton's laws mathematically and graphically (e.g. vector and scalar quantities). PHY.2.2 Use models such as free-body diagrams to explain and predict the motion of an object from simple to complex motions, including circular motion. PHY.2.4 Use mathematical and computational analysis to derive simple equations of motion for various systems using Newton's second law (e.g. projectile motion).	4-6 blocks

	PHY.2.5 Use mathematical and computational analysis to derive simple equations of motion for various systems using Newton's second law (e.g. net force equations) PHY.2.6 Use mathematical and computational analysis to explore forces (e.g. friction, force applied, normal, and tension) PHY.2.7 Analyze real-world applications to draw conclusions about Newton's 3 laws of motion PHY.2.8 Design an experiment to determine the forces acting on a stationary object on an incline plane. Test your conclusions. PHY.2.9 Draw diagrams of forces applied to an object and predict the angle of incline that will result in unbalanced forces acting on the object.	
2nd Nine Weeks		
Work, Energy, and Power • **Work/energy theorem** • **Conservation of mechanical energy** • **Power** • **Kinetic energy** • **Potential energy** • **Heat energy**	PHY.3 Students will develop an understanding of concepts related to work and energy. PHY.3.1 Use mathematical and computational analysis to qualitatively and quantitatively analyze the concept of work, energy, and power to explain and apply the conservation of energy. PHY.3.3 Through real-world applications, draw conclusions about mechanical potential energy and kinetic energy using online simulations and/or laboratory experiences. PHY.3.5 Investigate, collect data, and summarize the principles of thermodynamics by exploring how hear energy is transferred from higher temperature to lower temperature until equilibrium is reached.	4-6 blocks
Momentum • **Impulse/momentum theorem** • **Conservation of momentum**	PHY.3.2 Use mathematical and computational analysis to explore conservation of momentum and impulse.	4-6 blocks

• **1-D collisions**	PHY.3.4 Design and conduct investigations to compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions using probe systems, online simulations, and/or laboratory experiences.	
Circular Motion and Gravity • **Centripetal force** • **Satellite motion and weightlessness** • **Universal gravitation** • **Kepler's laws**	PHY.2.2 Use models such as free body diagram to explain and predict the motion of an object from simple to complex motions, including circular motion. PHY.2.10 Apply the effects of the universal gravitation to generate a digital/physical graph, and interpret the forces between two masses, acceleration due to gravity, and planetary motion. PHY.2.11 Explain centripetal acceleration while undergoing uniform circular motion to explore Kepler's third law using online simulations, models, and/or probe systems.	4-6 blocks
3rd Nine Weeks		
Static Electricity • **Electric force** • **Electric fields** • **Electric potential**	PHY.5.2 Explore the characteristics of static charge and how a static charge is generated using simulations. PHY.5.3 Use mathematical and computational analysis to analyze problems dealing with electric field and electric potential.	4-6 blocks
Current Electricity • **Electric current** • **Resistance** • **Ohm's law** • **Simple circuits** • **Complex circuits**	PHY.5.3 Use mathematical and computational analysis to analyze problems dealing with current, voltage, and resistance as related to Ohm's law. PHY.5.4 Develop and use models to explain how electric circuits work by tracing the path of electrons, including concepts of energy transformation, transfer, conservation of energy, electric charge, and resistance using online simulations, probe systems, and/or laboratory experiences. PHY.5.6 Use schematic diagrams to analyze the current flow in series and parallel electric circuits, given the component resistances and the imposed electric potential.	4-6 blocks
Magnetism • **Magnetic fields**	PHY.5.1 Analyze and explain electricity and the relationship between electricity and magnetism.	4-6 blocks

• **Electromagnets** • **Electromagnetic induction**	PHY.5.5 Design and conduct an investigation of magnetic poles, magnetic flux and magnetic field using online simulations, probe systems, and/or laboratory experiences. PHY.5.7 Analyze and communicate the relationship between magnetic fields and electrical current by induction, generators, and electric motors (e.g., microphones, speakers, generators, and motors) using Ampere's and Faraday's laws.	
4th Nine Weeks		
Mechanical Waves • **Harmonic motion** • **Wave properties** • **Standing waves** • **Doppler effect**	PHY.4 Students will investigate and explore wave properties. PHY.4.1 Analyze the characteristics and properties of simple harmonic motions, sound, and light. PHY.4.2 Describe and model through digital or physical means the characteristics and properties of mechanical waves by simulating and investigating properties of simple harmonic motion. PHY.4.3 Use mathematical and computational analysis to explore wave characteristics (e.g., velocity, period, frequency, amplitude, phase, and wavelength). PHY.4.4 Investigate and communicate the relationship between the energy of a wave in terms of amplitude and frequency using probe systems, online simulations, and/or laboratory experiences. PHY.4.5 Design, investigate, and collect data on standing waves and waves in specific media using online simulations, probe systems, and/or laboratory experiences. PHY.4.6 Explore and explain the Doppler effect as it relates to a moving source and to a moving observer using online simulations, probe systems, and/or real-world experiences.	4-6 blocks

Electromagnetic Waves • **Electromagnetic spectrum** • **Reflection** • **Refraction** • **Lenses**	PHY.4.4 Investigate and communicate the relationship between the energy of a wave in terms of amplitude and frequency using probe systems, online simulations, and/or laboratory experiences. PHY.4.7 Explain the laws of reflection and refraction, and apply Snell's law to describe the relationship between the angles of incidence and refraction. PHY.4.8 Use ray diagrams and the thin lens equations to solve real-world problems involving object distance from lenses, using a lens bench, online simulations, and/or laboratory experiences. PHY.4.9 Research and defend conclusions among the different bands of electromagnetic radiation, including characteristics, properties, and similarities/differences, using examples of uses of each, including radio waves, microwaves, infrared, visible light, ultraviolet, and gamma rays.	4-6 blocks
Nuclear Energy • **Types of decay** • **Nuclear decay equations** • **Half-life**	PHY.6 Students will demonstrate an understanding of the basic principles of nuclear energy. PHY.6.1 Analyze and explain the concepts of nuclear physics. PHY.6.2 Explore the mass number and atomic number of the nucleus of an isotope of a given chemical element. PHY.6.3 Investigate the conservation of mass and the conservation of charge by writing and balancing nuclear decay equations for alpha and beta decay.	4-6 blocks

	PHY.6.4 Simulate the process of nuclear decay using online simulations and/or laboratory experiences and using mathematical computations determine the half-life of radioactive isotopes.	