

Warren County Schools



PHYSICAL SCIENCE PACING GUIDE 2017 – 2018 (Semester)

Philosophical approach to the process of teaching and learning science in the Warren County School District (WCS).

In WCS there is an emphasis on both traditional and innovative teaching methodologies of science curriculum. Whereas traditional laboratory experiences provide opportunities to demonstrate how science is constant, historic, probabilistic, and replicable; intuitive-practical solutions to scientific problem solving are encouraged. Even though there are no fixed steps that all scientists follow, scientific investigations usually involve collections of relevant evidence, the use of logical reasoning, the application of imagination to devise hypotheses, and explanations to make sense of collected evidence. Student engagement in scientific investigation provides background for understanding the nature of scientific inquiry. In addition, the science process skills necessary for inquiry are acquired through active experience. The process skills support development of reasoning and problem-solving ability and are the core of scientific methodologies.

Suggested Time Frame (Weeks)	Topic/Standard	Essential Questions/Learning Intentions	Key Vocabulary	Unit Assessments and NCFE
UNIT 1 Motion, Speed, and Velocity				
Weeks (1-2)	<p>PSc.1.1.1 Explain motion in terms of frame of reference, distance and displacement.</p> <p>PSc.1.1.2 Compare speed, velocity, acceleration, and momentum using investigations, graphing, scalar quantities and vector quantities.</p>	<ul style="list-style-type: none"> Describe velocity as a relationship between displacement and time. Understand that all motion is relative (requires a frame of reference). Describe motion as a change in position. Utilize graphs to determine speed and velocity. 	Motion Average Speed Velocity Frame of Reference Distance Displacement Uniform Motion Slope	<i>TBD by Site Administration</i>
UNIT 2; Acceleration and Forces				
Weeks (3-4)	<p>PSc.1.1.2 Compare speed, velocity, acceleration, and momentum using investigations, graphing, scalar quantities and vector quantities.</p> <p>PSc.1.2.1 Explain how gravitational force affects the weight of an object and the velocity of an object in free fall.</p> <p>PSc.1.2.2 Classify frictional forces into one of four types: static, sliding, rolling, and fluid.</p> <p>PSc.1.2.3 Explain Newton's three laws of motion.</p>	<ul style="list-style-type: none"> Describe acceleration as a relationship between velocity and time. Analyze graphical data to determine velocity and acceleration. Investigate the acceleration due to gravity as an example of uniformly changing velocity (where $g=9.8 \text{ m/s}^2$). Distinguish between the mass and weight of an object with weight as the relationship between the acceleration due to gravity 	Acceleration Inertia Force Net Force Balanced Forces Newton's First Law of Motion Newton's Second Law of Motion Newton's Third Law of Motion Action-Reaction Pairs Mass Weight Friction Gravity $F=ma$	<i>TBD by Site Administration</i>

		<p>and the mass of the object.</p> <ul style="list-style-type: none"> Investigate friction as a force that opposes the motion of an object. Analyze the motion of an object in free fall. 		
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UNIT 3: Energy and Work				
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Weeks (5-6)	<p>PSc.3.1.1 Understand types of Energy, conservation of Energy, and Energy Transfer.</p> <p>PSc.3.1.2 Explain the Law of Conservation of Energy in a mechanical system in terms of Kinetic energy, Potential energy, and Heat.</p> <p>PSc.3.1.3 Explain Work in terms of the relationship among the force applied to an object, the resulting displacement of an object, and the energy transferred to an object.</p> <p>PSc.3.1.4 Explain the relationship among work, power, and simple machines both qualitatively and quantitatively.</p>	<ul style="list-style-type: none"> Analyze and investigate different forms of potential energy: elastic, gravitational, chemical, electrical, and nuclear. Differentiate between kinetic and potential energy. Calculate potential and kinetic energy mathematically. Calculate work as the product of force multiplied by distance. Investigate the scientific meaning of “work” in terms of movement and forces. Explain the relationship between work and power. Distinguish between each of the six types of simple machines. 	<p>Kinetic Energy Potential Energy Gravitational Potential Energy Chemical Energy Elastic Potential Energy Electrical Energy Thermal Energy Nuclear Energy Mechanical Energy Work Power Joule The Law of Conservation of Energy Simple Machine Mechanical Advantage Lever Wedge Inclined Plane Screw Wheel & Axle Pulley</p>	<i>TBD by Site Administration</i>
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		<ul style="list-style-type: none"> Explain mechanical advantage in terms of how machines make doing work easier. 		
UNIT 4: Thermal Energy and Heat				
Week (7)	<p>PSc.3.1.1 Understand types of Energy, conservation of Energy, and Energy Transfer.</p> <p>PSc.3.1.2 Explain the Law of Conservation of Energy in a mechanical system in terms of Kinetic energy, Potential energy, and Heat.</p>	<ul style="list-style-type: none"> Identify the characteristics of a substance that affect its ability to absorb or release thermal energy. Explain thermal energy and how it is transferred. Explain the direction of heat flow (from warmer to cooler objects). Differentiate between heat and temperature. Differentiate between conduction, convection, and radiation as types of heat transfer. 	Thermal Energy Heat Temperature Conduction Convection Radiation Specific Heat	<i>TBD by Site Administration</i>
UNIT 5: Electricity and Magnetism				
Week (8)	<p>PSc.3.3.1 Summarize static and current electricity.</p> <p>PSc.3.3.2 Explain simple series and parallel DC circuits in terms of Ohm's law.</p> <p>PSc.3.3.3 Explain how current is affected by changes in composition, length, temperature, and diameter of wire.</p>	<ul style="list-style-type: none"> Compare/contrast the relationship between like and opposite charges. Explain the differences/similarities between the three methods of charging and give examples. Distinguish between series and parallel circuits. 	Static Electricity Current Electricity Circuit Open Circuit Closed Circuit Electric Power Series Circuit Parallel Circuit Ohm's Law Resistor Switch Voltage	<i>TBD by Site Administration</i>

	<p>PSc.3.3.4 Explain magnetism in terms of domains, interactions of poles, and magnetic fields.</p> <p>PSc.3.3.5 Explain the practical application of Magnetism.</p>	<ul style="list-style-type: none"> • Describe simple series and parallel DC circuits in terms of Ohm's Law. • Describe how properties such as wire composition, wire length, temperature, and diameter affect the flow of electricity. • Investigate open versus closed circuits. • Solve simple Ohm's Law and Power equations for DC circuits. • Describe the behavior of magnetic domains. • Investigate the attraction of unlike poles and the repulsion of like poles. • Explain why a nail can be temporarily magnetized in terms of magnetic domains. 	<p>Ampere Induction Conduction Magnetism Magnetic Domain The Law of Magnetic Attraction Pole Electromagnet Permanent Magnet Electric Motor Generator</p>	
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UNIT 6: Mechanical/Electromagnetic Waves

	<p>PSc.3.2.1 Understand the nature of waves.</p> <p>Explain the relationships among wave frequency, wave period, wave velocity, amplitude, and wavelength through calculation and investigation.</p> <p>PSc.3.2.2</p>	<ul style="list-style-type: none"> • Explore the differences between mechanical and compressional waves. • Identify the basic characteristics of a transverse wave: trough, crest, amplitude, and wavelength. • Identify the basic 	<p>Mechanical Wave Transverse Wave Compressional Wave Electromagnetic Wave Electromagnetic Spectrum Radiation Microwaves Infrared Waves Visible Light</p>	
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<p>Week (9)</p>	<p>Compare waves (mechanical, electromagnetic, and surface) uses their characteristics.</p> <p>PSc.3.2.3 Classify waves as transverse or compressional</p> <p>PSc.3.2.4 Illustrate the wave interactions of reflection, refraction, diffraction, and interference.</p>	<p>characteristics of a compressional wave: amplitude, rarefaction, and compression.</p> <ul style="list-style-type: none"> Analyze the relationship between frequency and period. Utilize the relationship between velocity, frequency, and wavelength to solve wave problems. Investigate the various types of wave interactions: reflection, refraction, diffraction, and interference. 	<p>Ultraviolet Waves X-Rays Gamma Rays Reflection Refraction Diffraction Interference Crest Trough Amplitude Wavelength Frequency Period Sonar Echolocation Ultrasound Decibels</p>	<p><i>TBD by Site Administration</i></p>
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Unit 7 Properties of Matter

<p>Week (10)</p>	<p>PSc.2.1.1 Classify matter as homogeneous or heterogeneous; pure substance or mixture; element or compound; metals, nonmetals, or metalloids; solution, colloid, or suspension.</p> <p>PSc.2.1.2 Explain the phases of matter and the physical changes that matter undergoes.</p> <p>PSc.2.1.3 Compare general physical and chemical properties of various types of matter.</p>	<ul style="list-style-type: none"> What are the indicators of a physical/chemical change? What constitutes a homogeneous/heterogeneous mixture? Differentiate between an element and compound. Differentiate between chemical/physical changes. Understand that phase changes (changes of state) are physical changes. 	<p>Chemical change Chemical properties Physical change Physical properties Melting point Boiling point Heterogeneous Homogeneous Element Compound Mixture Solution Suspension Colloid Density Conservation of Matter</p>	<p><i>TBD by Site Administration</i></p>
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UNIT 8 : Atomic Structure and Properties

<p>Weeks (11 -12)</p>	<p>PSc.2.1.4 Interpret the data presented in the Bohr model diagrams and dot diagrams for atoms and ions of elements in groups one through eighteen.</p> <p>PSc.2.2.1 Infer valence electrons, oxidation number, and reactivity of an element based on its location in the Periodic Table.</p>	<ul style="list-style-type: none"> • Compare/contrast the physical and chemical properties of metals, nonmetals, and metalloids. • Describe the structure of an atom: including charge, relative mass, and the location of protons, neutrons, and electrons. • Calculate the number of protons, electrons, and neutrons in an atom when given its atomic number and average atomic mass. • Distinguish between period and group. • Explain Bohr's model, showing how electrons fill energy levels. 	<p>Periodic Table Group Period Proton Neutron Electron Metal Nonmetal Transition metal Halogen Noble Gas Isotope Nucleus Electron Cloud Atomic Number Average Atomic Mass Ground state Excited state</p>	<p><i>TBD by Site Administration</i></p>
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UNIT 9 Chemical Bonding

<p>Weeks (13-14)</p>	<p>PSc.2.2.2 Infer type of chemical bond that occurs, whether covalent, ionic, or metallic, in a given substance.</p> <p>PSc.2.2.3 Predict chemical formulas and names for simple compounds based on knowledge of bond formation and naming conventions.</p>	<ul style="list-style-type: none"> • Predict oxidation number based on the element's location on the Periodic Table (excluding transition elements). • Describe how ionic, covalent, and metallic bonds form and provide examples of each. 	<p>Ion Ionic Bond Cation Anion Polyatomic Ion Covalent Bond Metallic Bond Polar Bond Non-polar Bond Oxidation Number Hydrate Lewis Electron Dot</p>	<p><i>TBD by Site Administration</i></p>
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UNIT 10: Chemical Equations/Reactions				
Week (15)	<p>PSc.2.2.4 Exemplify the law of conservation of mass by balancing chemical equations.</p> <p>PSc.2.2.5 Classify types of reactions such as synthesis, decomposition, single replacement, or double replacement</p>	<ul style="list-style-type: none"> How does the law of conservation of mass apply to balancing equations? Identify the reactants and products in a simple chemical equation. Identify the types of reactions (synthesis, decomposition, single replacement, and double replacement). 	Reactant Product Catalyst Inhibitor Law of Conservation of Mass Synthesis Decomposition Single Replacement Double Replacement Exothermic Endothermic	<i>TBD by Site Administration</i>
UNIT 11: Solutions/Acids and Bases				
Week (16)	<p>PSc.2.2.6 Summarize the characteristics and interactions of acids or bases.</p>	<ul style="list-style-type: none"> Identify the solvent and solute in a given solution. Determine the factors which change the solubility of a substance (temperature, stirring, crystal size, etc.). Analyze a solubility curve. Compare/contrast the physical and chemical characteristics of acids, bases, and neutral substances. Identify and describe the use of pH indicators. 	Dissociation Ion Solution Solubility Solute Solvent Solubility Curve pH Scale Acid Base Buffer pH Indicator Neutralization	<i>TBD by Site Administration</i>

UNIT 12 Radioactivity

<p>Week (17)</p>	<p>PSc.2.3.1 Compare nuclear reactions including alpha decay, beta decay, and gamma decay; nuclear fusion and nuclear fission.</p> <p>PSc.2.3.2 Exemplify the radioactive decay of unstable nuclei using the concept of half-life.</p>	<ul style="list-style-type: none"> • Distinguish between fission and fusion. • Differentiate between the three types of nuclear decay (alpha, beta, and gamma). • Calculate the half-life of a radioactive sample. 	<p>Alpha particles Beta particle Gamma ray Half-life Fusion Fission Radiation</p>	<p style="text-align: center;"><i>TBD by Site Administration</i></p>
<p>Week (18)</p>	<p>Review/NC Final Exam</p>			

Physical Science