

**PHYSICS**  
**Semester One**  
**Benchmark Blueprint**

<b>Strand 1: Inquiry Process</b>		
Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.		
<b>CONCEPT</b>	<b>PERFORMANCE OBJECTIVE</b>	<b>ASSESSMENT</b>
<b>Concept 1: Observations, Questions, and Hypotheses</b> Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.	PO 1. Evaluate scientific information for relevance to a given problem.	
	PO 2. Develop questions from observations that transition into testable hypotheses.	
	PO 3. Formulate a testable hypothesis.	
	PO 4. Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).	
<b>Concept 2: Scientific Testing (Investigating and Modeling)</b> Design and conduct controlled investigations.	PO 1. Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.	
	PO 2. Identify the resources needed to conduct an investigation.	
	PO 3. Design an appropriate protocol (written plan of action) for testing a hypothesis: <ul style="list-style-type: none"> <li>• Identify dependent and independent variables in a controlled investigation.</li> <li>• Determine an appropriate method for data collection (e.g., using balances, thermometers, microscopes, spectrophotometer, using qualitative changes).</li> <li>• Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators).</li> </ul>	

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<b>Concept 2: Scientific Testing (Investigating and Modeling)</b> Design and conduct controlled investigations.	PO 4. Conduct a scientific investigation that is based on a research design.	
	PO 5. Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.	
<b>Concept 3: Analysis, Conclusions, and Refinements</b> Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.	<i>PO 1. Interpret data that show a variety of possible relationships between variables, including:</i> <ul style="list-style-type: none"> <li>• <i>positive relationship</i></li> <li>• <i>negative relationship</i></li> <li>• <i>no relationship</i></li> </ul>	
	PO 2. Evaluate whether investigational data support or do not support the proposed hypothesis.	
	PO 3. Critique reports of scientific studies (e.g., published papers, student reports).	
	PO 4. Evaluate the design of an investigation to identify possible sources of procedural error, including: <ul style="list-style-type: none"> <li>• sample size</li> <li>• trials</li> <li>• controls</li> <li>• analyses</li> </ul>	

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<b>Concept 3: Analysis, Conclusions, and Refinements</b> Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.	PO 5. Design models (conceptual or physical) of the following to represent "real world" scenarios: <ul style="list-style-type: none"> <li>• carbon cycle</li> <li>• water cycle</li> <li>• phase change</li> <li>• collisions</li> </ul>	
	PO 6. Use descriptive statistics to analyze data, including: <ul style="list-style-type: none"> <li>• mean</li> <li>• frequency</li> <li>• range</li> </ul> (See MHS-S2C1-10)	
	PO 7. Propose further investigations based on the findings of a conducted investigation.	
<b>Concept 4: Communication</b> Communicate results of investigations.	PO 1. For a specific investigation, choose an appropriate method for communicating the results.	
	PO 2. Produce graphs that communicate data. (See MHS-S2C1-02)	
	PO 3. Communicate results clearly and logically.	
	PO 4. Support conclusions with logical scientific arguments.	

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**Strand 2: History and Nature of Science**

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
<b>Concept 1: History of Science as a Human Endeavor</b> Identify individual, cultural, and technological contributions to scientific knowledge.	PO 1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.	
	<i>PO 2. Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.</i>	
	PO 3. Analyze how specific changes in science have affected society.	
	PO 4. Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.	
<b>Concept 2: Nature of Scientific Knowledge</b> Understand how science is a process for generating knowledge.		

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<b>Strand 3: Science in Personal and Social Perspectives</b>		
<p>Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.</p>		
<b>CONCEPT</b>	<b>PERFORMANCE OBJECTIVE</b>	<b>ASSESSMENT</b>
<p><b>Concept 1: Changes in Environments</b>            Describe the interactions between human populations, natural hazards, and the environment.</p>		
<p><b>Concept 2: Science and Technology in Society</b>            Develop viable solutions to a need or problem.</p>		
<p><b>Concept 3: Human Population Characteristics</b>            Analyze factors that affect human populations.</p>		

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**Strand 5: Physical Science**

Physical Science affords students the opportunity to increase their understanding of the characteristics of objects and materials they encounter daily. Students gain an understanding of the nature of matter and energy, including their forms, the changes they undergo, and their interactions. By studying objects and the forces that act upon them, students develop an understanding of the fundamental laws of motion, knowledge of the various ways energy is stored in a system, and the processes by which energy is transferred between systems and surroundings.

<b>CONCEPT</b>	<b>PERFORMANCE OBJECTIVE</b>	<b>ASSESSMENT</b>
<b>Concept 2: Motions and Forces</b> Analyze relationships between forces and motion.		
<b>Concept 5: Interactions of Energy and Matter</b> Understand the interactions of energy and matter.		

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<b>Concept 3: Analysis, Conclusions, and Refinements</b> Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.		
<b>Concept 4: Communication</b> Communicate results of investigations.		

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
<p><b>Concept 1: History of Science as a Human Endeavor</b>            Identify individual, cultural, and technological contributions to scientific knowledge.</p>		
<p><b>Concept 2: Nature of Scientific Knowledge</b>            Understand how science is a process for generating knowledge.</p>	<p>PO 1. Specify the requirements of a valid, scientific explanation (theory), including that it be:</p> <ul style="list-style-type: none"> <li>• logical</li> <li>• subject to peer review</li> <li>• public</li> <li>• respectful of rules of evidence</li> </ul>	
	PO 2. Explain the process by which accepted ideas are challenged or extended by scientific innovation.	
	PO 3. Distinguish between pure and applied science.	
	PO 4. Describe how scientists continue to investigate and critically analyze aspects of theories.	

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<b>CONCEPT</b>	<b>PERFORMANCE OBJECTIVE</b>	<b>ASSESSMENT</b>
<b>Concept 1: Changes in Environments</b> Describe the interactions between human populations, natural hazards, and the environment.		
<b>Concept 2: Science and Technology in Society</b> Develop viable solutions to a need or problem.	PO 2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.  PO 3. Support a position on a science or technology issue.	
<b>Concept 3: Human Population Characteristics</b> Analyze factors that affect human populations.	PO 3. Predict the effect of a change in a specific factor on a human population.	

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
<b>Concept 2: Motions and Forces</b> Analyze relationships between forces and motion.	PO 1. Determine the rate of change of a quantity (e.g., rate of erosion, rate of reaction, rate of growth, velocity).	
	PO 2. Analyze the relationships among position, velocity, acceleration, and time: <ul style="list-style-type: none"> <li>• graphically</li> <li>• mathematically</li> </ul>	
	PO 3. Explain how Newton's 1 <sup>st</sup> Law applies to objects at rest or moving at constant velocity.	
	PO 4. Using Newton's 2 <sup>nd</sup> Law of Motion, analyze the relationships among the net force acting on a body, the mass of the body, and the resulting acceleration: <ul style="list-style-type: none"> <li>• graphically</li> <li>• mathematically</li> </ul>	
	PO 5. Use Newton's 3 <sup>rd</sup> Law to explain forces as interactions between bodies (e.g., a table pushing up on a vase that is pushing down on it; an athlete pushing on a basketball as the ball pushes back on her).	
	PO 6. Analyze the two-dimensional motion of objects by using vectors and their components.	
	PO 7. Give an example that shows the independence of the horizontal and vertical components of projectile motion.	
	PO 8. Analyze the general relationships among force, acceleration, and motion for an object undergoing uniform circular motion.	
	PO 9. Represent the force conditions required to maintain static equilibrium.	

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<b>CONCEPT</b>	<b>PERFORMANCE OBJECTIVE</b>	<b>ASSESSMENT</b>
<b>Concept 2: Motions and Forces</b> Analyze relationships between forces and motion.	PO 10. Describe the nature and magnitude of frictional forces.	
	PO 11. Using the Law of Universal Gravitation, predict how the gravitational force will change when the distance between two masses changes or the mass of one of them changes.	
	PO 12. Using Coulomb's Law, predict how the electrical force will change when the distance between two point charges changes or the charge of one of them changes.	
	PO 13. Analyze the impulse required to produce a change in momentum.	
	PO 14. Quantify interactions between objects to show that the total momentum is conserved in both collision and recoil situations	

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
<b>Concept 3: Conservation of Energy and Increase in Disorder</b> Understand ways that energy is conserved, stored, and transferred.	PO 1. Describe the following ways in which energy is stored in a system: <ul style="list-style-type: none"> <li>• mechanical</li> <li>• electrical</li> <li>• chemical</li> <li>• nuclear</li> </ul>	
	PO 2. Describe various ways in which energy is transferred from one system to another (e.g., mechanical contact, thermal conduction, electromagnetic radiation.)	
	PO 3. Recognize that energy is conserved in a closed system.	
	PO 4. Calculate quantitative relationships associated with the conservation of energy.	
<b>Concept 5: Interactions of Energy and Matter</b> Understand the interactions of energy and matter	PO 2. Describe the following characteristics of waves: <ul style="list-style-type: none"> <li>• wavelength</li> <li>• frequency</li> <li>• period</li> <li>• amplitude</li> </ul>	
	PO 3. Quantify the relationships among the frequency, wavelength, and the speed of light.	
	PO 8. Describe the relationship among electric potential, current, and resistance in an ohmic system.	
	PO 9. Quantify the relationships among electric potential, current, and resistance in an ohmic system.	