

## Correlation to Arkansas Science Curriculum Framework: Physical Systems Curriculum Resource Guide

Standard #: Strand	Grades	Content Standard	Student Learning Expectation	Investigation Level A	Investigation Level B	Investigation Level C
PS.1.01 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Understand that science is a process based on the scientific method which leads to a deeper understanding of real world situations.	<b><i>Car and Ramp</i></b> A-2 Investigations and Experiments <b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster	<b><i>Car and Ramp</i></b> B-2 Investigating Speed	
PS.1.02 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Follow procedures for a scientific inquiry using step-by-step instructions, mathematical formulas, flow diagrams, and/or sketches.	<b><i>Car and Ramp</i></b> A-2 Investigations and Experiments A-3 Speed <b><i>Gravity Drop</i></b> A-1 Introduction to the Gravity Drop A-3 Falling Motion <b><i>Light and Optics</i></b> A-3 Rules of Reflection <b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance <b><i>Pendulum</i></b> A-2 Making a Clock <b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster A-2 Height on the Roller Coaster	<b><i>Air Rocket</i></b> B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion <b><i>Car and Ramp</i></b> B-2 Investigating Speed <b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall <b><i>Pendulum</i></b> B-1 Harmonic Motion <b><i>Rollercoaster</i></b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion <b><i>Ropes and Pulleys</i></b> B-3 Efficiency	<b><i>Air Rocket</i></b> C-3 Acceleration and G-forces <b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction <b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall <b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum

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PS.1.03 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Develop and implement a workable scientific inquiry independently and with a group using standard safety procedures.	<p><b><i>Car and Ramp</i></b> A-2 Investigations and Experiments</p> <p><b><i>Electric Circuits</i></b> A-3 Current and Voltage</p> <p><b><i>Gravity Drop</i></b> A-1 Introduction to the Gravity Drop A-3 Falling Motion</p> <p><b><i>Light and Optics</i></b> A-3 Rules of Reflection</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Pendulum</i></b> A-1 The Pendulum A-2 Making a Clock</p> <p><b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys</p>	<p><b><i>Air Rocket</i></b> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Car and Ramp</i></b> B-2 Investigating Speed B-7 Weight, Gravity, and Friction</p> <p><b><i>Electric Circuits</i></b> B-1 Voltage B-2 Current</p> <p><b><i>Gravity Drop</i></b> B-2 Speed, Acceleration, and Free Fall</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range</p> <p><b><i>Pendulum</i></b> B-1 Harmonic Motion</p> <p><b><i>Rollercoaster</i></b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion</p> <p><b><i>Ropes and Pulleys</i></b> B-1 Forces in Machines B-3 Efficiency</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-2 Newton's Second Law and Friction</p> <p><b><i>Electric Circuits</i></b> C-1 Series Circuits C-2 Parallel Circuits C-3 Compound Circuits</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation</p> <p><b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum</p> <p><b><i>Rollercoaster</i></b> C-1 Motion on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> C-1 Simple and Complex Pulley Systems</p>

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PS.1.04 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Evaluate the process that scientists use to construct and validate scientific theory, such as data collection, prediction, experimentation (controls and variables), bias elimination, and replication.	<p><b><i>Car and Ramp</i></b> A-1 Time and Distance A-2 Investigations and Experiments A-3 Speed A-4 Describing Motion</p> <p><b><i>Electric Circuits</i></b> A-3 Current and Voltage</p> <p><b><i>Gears and Levers</i></b> A-1 The Lever A-2 Gears</p> <p><b><i>Gravity Drop</i></b> A-2 Speed and the Gravity Drop A-3 Falling Motion</p> <p><b><i>Light and Optics</i></b> A-1 Introduction to Light A-2 Color A-3 Rules of Reflection</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Pendulum</i></b> A-1 The Pendulum</p> <p><b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster A-2 Height on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys A-2 What is Work?</p> <p><b><i>Sound and Waves</i></b> A-1 Sound</p>	<p><b><i>Air Rocket</i></b> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Car and Ramp</i></b> B-1 Time and Distance B-2 Investigating Speed B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-6 Force, Mass, and Acceleration</p> <p><b><i>Electric Circuits</i></b> B-1 Voltage B-2 Current B-3 Ohm's Law</p> <p><b><i>Gears and Levers</i></b> B-1 Levers, Torque and Mechanical Advantage B-2 Gears and Rotating Motion B-4 Machines with Gears and Levers</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall B-3 Newton's Second Law</p> <p><b><i>Light and Optics</i></b> B-1 Seeing an Image B-2 Polarization B-4 Ratios</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction C-3 The Physics of the Inclined Plane</p> <p><b><i>Electric Circuits</i></b> C-3 Compound Circuits</p> <p><b><i>Electric Motor</i></b> C-2 Optimizing Performance</p> <p><b><i>Gears and Levers</i></b> C-2 The Center of Gravity and Equilibrium</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall C-2 Measuring Gravity C-3 Interpreting Graphs of Accelerated Motion</p> <p><b><i>Light and Optics</i></b> C-1 Light and Color C-5 Geometric Optics C-6 The Thin Lens Equation</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation</p> <p><b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum C-3 The Physical Pendulum</p> <p><b><i>Rollercoaster</i></b></p>

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					B-2 Launch Speed and Range B-3 Relating Launch Speed and Range <b>Pendulum</b> B-1 Harmonic Motion B-2 The Five Second Pendulum <b>Rollercoaster</b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion <b>Ropes and Pulleys</b> B-1 Forces in Machines B-2 Work and Energy B-3 Efficiency	C-1 Motion on the Roller Coaster C-2 Rotational Kinetic Energy C-3 Mass, Motion, and Energy <b>Ropes and Pulleys</b> C-1 Simple and Complex Pulley Systems C-2 Compound Pulley System <b>Sound and Waves</b> C-1 Standing Waves

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PS.1.05 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Make objective observations and perform error analysis on collected data.	<p><b><i>Car and Ramp</i></b> A-1 Time and Distance A-3 Speed A-4 Describing Motion A-5 Gravity</p> <p><b><i>Gravity Drop</i></b> A-3 Falling Motion</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Rollercoaster</i></b> A-2 Height on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys A-2 What is Work?</p>	<p><b><i>Air Rocket</i></b> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Car and Ramp</i></b> B-1 Time and Distance B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-5 Acceleration B-7 Weight, Gravity, and Friction</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-3 Newton's Second Law</p> <p><b><i>Light and Optics</i></b> B-1 Seeing an Image</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range B-2 Launch Speed and Range</p> <p><b><i>Rollercoaster</i></b> B-1 Energy and the Rollercoaster</p> <p><b><i>Ropes and Pulleys</i></b> B-1 Forces in Machines B-2 Work and Energy B-3 Efficiency</p> <p><b><i>Sound and Waves</i></b> B-1 Sound</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction</p> <p><b><i>Gravity Drop</i></b> C-2 Measuring Gravity</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-3 Accuracy, Precision, and Error</p> <p><b><i>Rollercoaster</i></b> C-1 Motion on the Roller Coaster C-3 Mass, Motion, and Energy</p> <p><b><i>Ropes and Pulleys</i></b> C-1 Simple and Complex Pulley Systems C-2 Compound Pulley System</p>

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PS.1.06 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Formulate valid conclusions.	<p><b><i>Car and Ramp</i></b> A-4 Describing Motion A-5 Gravity</p> <p><b><i>Light and Optics</i></b> A-1 Introduction to Light</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Rollercoaster</i></b> A-2 Height on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys A-2 What is Work?</p>	<p><b><i>Car and Ramp</i></b> B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-5 Acceleration</p> <p><b><i>Electric Circuits</i></b> B-3 Ohm's Law</p> <p><b><i>Light and Optics</i></b> B-2 Polarization</p> <p><b><i>Rollercoaster</i></b> B-3 Mass and Motion</p> <p><b><i>Ropes and Pulleys</i></b> B-1 Forces in Machines B-2 Work and Energy</p> <p><b><i>Sound and Waves</i></b> B-1 Sound</p>	<p><b><i>Light and Optics</i></b> C-1 Light and Color</p> <p><b><i>Marble Launcher</i></b> C-2 Improving the Range Equation</p> <p><b><i>Rollercoaster</i></b> C-1 Motion on the Roller Coaster C-3 Mass, Motion, and Energy</p> <p><b><i>Ropes and Pulleys</i></b> C-1 Simple and Complex Pulley Systems</p>
PS.1.07 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Communicate and defend in writing a scientific argument.		<p><b><i>Air Rocket</i></b> B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Electric Circuits</i></b> B-2 Current</p>	

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PS.1.08 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Critique and interpret scientific data on charts and graphs.	<p><b><i>Car and Ramp</i></b> A-1 Time and Distance A-4 Describing Motion A-5 Gravity</p> <p><b><i>Gears and Levers</i></b> A-1 The Lever A-2 Gears A-4 Designing Gear Machines</p> <p><b><i>Gravity Drop</i></b> A-3 Falling Motion</p> <p><b><i>Light and Optics</i></b> A-2 Color</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Pendulum</i></b> A-1 The Pendulum</p> <p><b><i>Rollercoaster</i></b> A-2 Height on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys A-2 What is Work?</p> <p><b><i>Sound and Waves</i></b> A-1 Sound</p>	<p><b><i>Air Rocket</i></b> B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Car and Ramp</i></b> B-1 Time and Distance B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-5 Acceleration B-6 Force, Mass, and Acceleration B-7 Weight, Gravity, and Friction</p> <p><b><i>Electric Circuits</i></b> B-3 Ohm's Law</p> <p><b><i>Gears and Levers</i></b> B-1 Levers, Torque and Mechanical Advantage B-2 Gears and Rotating Motion B-4 Machines with Gears and Levers</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall B-3 Newton's Second Law</p> <p><b><i>Light and Optics</i></b> B-4 Ratios</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range B-2 Launch Speed and Range B-3 Relating Launch Speed and Range</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction C-3 The Physics of the Inclined Plane</p> <p><b><i>Electric Circuits</i></b> C-1 Series Circuits</p> <p><b><i>Electric Motor</i></b> C-2 Optimizing Performance</p> <p><b><i>Gears and Levers</i></b> C-2 The Center of Gravity and Equilibrium</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall C-2 Measuring Gravity C-3 Interpreting Graphs of Accelerated Motion</p> <p><b><i>Light and Optics</i></b> C-6 The Thin Lens Equation</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation C-3 Accuracy, Precision, and Error</p> <p><b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum C-2 Newton's Second Law and the Pendulum C-3 The Physical Pendulum</p>

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					<p><b>Pendulum</b> B-1 Harmonic Motion B-2 The Five Second Pendulum</p> <p><b>Rollercoaster</b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion</p> <p><b>Ropes and Pulleys</b> B-1 Forces in Machines B-2 Work and Energy</p> <p><b>Sound and Waves</b> B-1 Sound</p>	<p><b>Rollercoaster</b> C-1 Motion on the Roller Coaster C-2 Rotational Kinetic Energy C-3 Mass, Motion, and Energy</p> <p><b>Ropes and Pulleys</b> C-1 Simple and Complex Pulley Systems C-2 Compound Pulley System</p> <p><b>Sound and Waves</b> C-1 Standing Waves C-3 Natural Frequency and Resonance C-4 Sound</p>
PS.1.09 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Recognize that theories are models and may be revised when new data is introduced.	<p><b>Car and Ramp</b> A-2 Investigations and Experiments</p>	<p><b>Car and Ramp</b> B-2 Investigating Speed</p> <p><b>Marble Launcher</b> B-3 Relating Launch Speed and Range</p> <p><b>Rollercoaster</b> B-3 Mass and Motion</p>	<p><b>Car and Ramp</b> C-3 The Physics of the Inclined Plane</p> <p><b>Light and Optics</b> C-1 Light and Color</p> <p><b>Marble Launcher</b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation</p>
PS.1.10 Physical Systems	9-12	Students will demonstrate an understanding of physical systems as a process of inquiry.	Understand the criteria for the formation of scientific theory and a scientific law.		<p><b>Marble Launcher</b> B-3 Relating Launch Speed and Range</p> <p><b>Rollercoaster</b> B-3 Mass and Motion</p>	<p><b>Car and Ramp</b> C-3 The Physics of the Inclined Plane</p> <p><b>Light and Optics</b> C-1 Light and Color</p> <p><b>Marble Launcher</b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation</p>

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PS.2.01 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Evaluate the historical and multi-cultural contributions to the scientific body of knowledge in physical systems (nature of light, falling objects, expanding universe, model of the atom, quantum physics, periodic table). Construct time lines.		<i>Air Rocket</i> B-4 The Rocket and Newton's Laws of Motion  <i>Electric Circuits</i> B-3 Ohm's Law	<i>Light and Optics</i> C-1 Light and Color
PS.2.05 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Use models to show the structure and behavior of matter (includes Rutherford's Gold Foil Experiment, sub-atomic particles, electron energy levels, quantum theory, and organic molecules).	<i>Atom Building Game</i> A-1 Building Atoms A-2 Atomic Challenge A-3 Building Molecules <i>Light and Optics</i> A-1 Introduction to Light <i>Periodic Table Tiles</i> A-1 The Periodic Table A-2 Groups of Elements	<i>Atom Building Game</i> B-1 Comparing Atoms B-2 Nuclear Reactions Game B-3 Bonding and Molecules <i>Periodic Table Tiles</i> B-1 Chemical Formulas B-2 A Tour of the Periodic Table	<i>Atom Building Game</i> C-1 Electrons and the Periodic Table C-2 Photons and Lasers C-3 Valence Electrons and Molecules <i>Light and Optics</i> C-1 Light and Color <i>Periodic Table Tiles</i> C-1 Electrons and the Periodic Table
PS.2.06 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Understand the rationale of the periodic charts.	<i>Periodic Table Tiles</i> A-1 The Periodic Table A-2 Groups of Elements A-3 Chemical Reactions	<i>Periodic Table Tiles</i> B-2 A Tour of the Periodic Table B-3 Chemical Equations	<i>Periodic Table Tiles</i> C-1 Electrons and the Periodic Table

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PS.2.07 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Explain the relationship among mole, chemical bonding, and molecular geometry within chemical compounds.	<i>Atom Building Game</i> A-3 Building Molecules <i>Periodic Table Tiles</i> A-2 Groups of Elements	<i>Atom Building Game</i> B-3 Bonding and Molecules <i>Periodic Table Tiles</i> B-1 Chemical Formulas	<i>Atom Building Game</i> C-1 Electrons and the Periodic Table C-3 Valence Electrons and Molecules <i>Periodic Table Tiles</i> C-1 Electrons and the Periodic Table
PS.2.09 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Understand the representation of and energetics of chemical reactions (equation writing, types of reactions, stoichiometry, reaction rates, equilibria and electrochemistry).	<i>Periodic Table Tiles</i> A-2 Groups of Elements A-3 Chemical Reactions	<i>Periodic Table Tiles</i> B-1 Chemical Formulas B-3 Chemical Equations	<i>Periodic Table Tiles</i> C-1 Electrons and the Periodic Table C-2 Challenging Chemical Equations C-3 Classifying Reactions
PS.2.11 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Define the four fundamental forces in nature (gravitational, electromagnetic, weak nuclear and strong nuclear).	<i>Atom Building Game</i> A-2 Atomic Challenge <i>Car and Ramp</i> A-5 Gravity <i>Gravity Drop</i> A-2 Speed and the Gravity Drop A-3 Falling Motion	<i>Air Rocket</i> B-5 The Acceleration of a Rocket <i>Atom Building Game</i> B-1 Comparing Atoms B-2 Nuclear Reactions Game <i>Car and Ramp</i> B-7 Weight, Gravity, and Friction <i>Gravity Drop</i> B-1 Introduction to the Gravity Drop B-3 Newton's Second Law <i>Marble Launcher</i> B-1 Launch Angle and Range	<i>Car and Ramp</i> C-3 The Physics of the Inclined Plane <i>Gravity Drop</i> C-2 Measuring Gravity C-3 Interpreting Graphs of Accelerated Motion <i>Marble Launcher</i> C-1 Projectile Motion and the Range Equation

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PS.2.12 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Analyze the aspects of motion (frame of reference, speed, velocity, acceleration, relativity, time and displacement), and distinguish between average, constant and instantaneous motion. (demonstrate and evaluate motion graphically.)	<p><b><i>Car and Ramp</i></b> A-3 Speed A-4 Describing Motion A-5 Gravity</p> <p><b><i>Gravity Drop</i></b> A-2 Speed and the Gravity Drop A-3 Falling Motion</p> <p><b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster A-2 Height on the Roller Coaster</p>	<p><b><i>Air Rocket</i></b> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion B-5 The Acceleration of a Rocket</p> <p><b><i>Car and Ramp</i></b> B-2 Investigating Speed B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-5 Acceleration B-6 Force, Mass, and Acceleration</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall B-3 Newton's Second Law</p> <p><b><i>Marble Launcher</i></b> B-2 Launch Speed and Range</p> <p><b><i>Rollercoaster</i></b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces C-5 Conservation of Momentum</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-3 The Physics of the Inclined Plane</p> <p><b><i>Electric Motor</i></b> C-2 Optimizing Performance</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall C-2 Measuring Gravity C-3 Interpreting Graphs of Accelerated Motion</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation C-3 Accuracy, Precision, and Error</p> <p><b><i>Pendulum</i></b> C-2 Newton's Second Law and the Pendulum</p> <p><b><i>Rollercoaster</i></b> C-1 Motion on the Roller Coaster C-2 Rotational Kinetic Energy C-3 Mass, Motion, and Energy</p> <p><b><i>Ropes and Pulleys</i></b> C-2 Compound Pulley System</p> <p><b><i>Sound and Waves</i></b> C-2 The Speed of a Wave Pulse</p>

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PS.2.13 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Investigate the aspects of two-dimensional motion (circular, rotational and projectile), momentum and impulse.			<i>Air Rocket</i> C-5 Conservation of Momentum
PS.2.14 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Apply the laws of conservation to interactions of matter (momentum, angular momentum, mass/energy, and electric charge).		<i>Periodic Table Tiles</i> B-3 Chemical Equations	<i>Air Rocket</i> C-4 Energy and Power C-5 Conservation of Momentum
PS.2.16 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Recognize the relationships of forces and motion, applying Newton's laws, and diagrams to analyze the forces on a system.	<i>Ropes and Pulleys</i> A-1 Ropes and Pulleys	<i>Air Rocket</i> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion  <i>Car and Ramp</i> B-6 Force, Mass, and Acceleration B-8 Equilibrium, Action, and Reaction  <i>Gravity Drop</i> B-1 Introduction to the Gravity Drop B-3 Newton's Second Law  <i>Ropes and Pulleys</i> B-1 Forces in Machines B-3 Efficiency	<i>Air Rocket</i> C-5 Conservation of Momentum  <i>Car and Ramp</i> C-2 Newton's Second Law and Friction  <i>Gravity Drop</i> C-2 Measuring Gravity  <i>Pendulum</i> C-2 Newton's Second Law and the Pendulum  <i>Ropes and Pulleys</i> C-1 Simple and Complex Pulley Systems

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Standard #: Strand	Grades	Content Standard	Student Learning Expectation	Investigation Level A	Investigation Level B	Investigation Level C
PS.2.17 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Examine the types of waves (transverse, longitudinal, standing, circular, electromagnetic), properties and characteristics of waves (reflection, refraction, diffraction, interference, pitch, frequency, and velocity), and how waves transfer energy.	<b><i>Light and Optics</i></b> A-2 Color <b><i>Sound and Waves</i></b> A-1 Sound A-2 Musical Sounds A-3 Making Waves	<b><i>Light and Optics</i></b> B-2 Polarization <b><i>Sound and Waves</i></b> B-1 Sound B-2 Musical Sounds B-3 Standing Waves on a String B-4 Natural Frequency and Resonance B-5 Resonant Sounds	<b><i>Light and Optics</i></b> C-7 Wave Properties of Light <b><i>Sound and Waves</i></b> C-1 Standing Waves C-2 The Speed of a Wave Pulse C-3 Natural Frequency and Resonance C-5 Interference and Diffraction of Sound
PS.2.18 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Investigate the properties and characteristics of light and different optical systems (lenses, mirrors, polarization filters, fiber optics, and lasers).	<b><i>Light and Optics</i></b> A-2 Color A-3 Rules of Reflection	<b><i>Light and Optics</i></b> B-1 Seeing an Image B-3 Optical Technology B-4 Ratios	<b><i>Air Rocket</i></b> C-3 Acceleration and G-forces <b><i>Light and Optics</i></b> C-1 Light and Color C-2 The Law of Reflection C-3 Refraction and Snell's Law C-4 The Convex Lens C-5 Geometric Optics C-7 Wave Properties of Light
PS.2.20 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Investigate the electromagnetic spectrum and the derivation of emission and absorption spectra.	<b><i>Light and Optics</i></b> A-1 Introduction to Light A-2 Color		<b><i>Atom Building Game</i></b> C-2 Photons and Lasers <b><i>Light and Optics</i></b> C-1 Light and Color C-7 Wave Properties of Light

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<b>Standard #: Strand</b>	<b>Grades</b>	<b>Content Standard</b>	<b>Student Learning Expectation</b>	<b>Investigation Level A</b>	<b>Investigation Level B</b>	<b>Investigation Level C</b>
PS.2.21 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Examine the properties of sound (pitch, frequency, and intensity) and other related aspects (earthquakes, shock waves, SONAR).	<i>Sound and Waves</i> A-1 Sound	<i>Sound and Waves</i> B-1 Sound B-2 Musical Sounds B-3 Standing Waves on a String B-5 Resonant Sounds	<i>Sound and Waves</i> C-4 Sound C-5 Interference and Diffraction of Sound
PS.2.22 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Investigate electric and magnetic interactions and fields (poles, magnetic domains, charges, field lines, potential difference, force and Coulomb's Law).	<i>Electric Motor</i> A-1 Magnets A-2 Magnetic Materials A-3 How a Motor Works A-4 Designing Motors A-5 Measuring Current and Voltage	<i>Electric Motor</i> B-1 Permanent Magnets B-2 Electromagnets B-3 The Electric Motor B-4 Current, Voltage, and Power B-5 Generators	<i>Electric Motor</i> C-1 Introduction to the Electric Motor C-2 Optimizing Performance C-3 Generators and Faraday's Law of Induction
PS.2.23 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Distinguish between direct and alternating current.	<i>Electric Circuits</i> A-3 Current and Voltage	<i>Electric Circuits</i> B-2 Current	

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PS.2.24 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Analyze and evaluate the parameters of circuits applying Ohm's Law and use appropriate data collections and calculations (current, resistance, and voltage).	<i>Electric Circuits</i> A-3 Current and Voltage <i>Electric Motor</i> A-5 Measuring Current and Voltage	<i>Electric Circuits</i> B-1 Voltage B-2 Current B-3 Ohm's Law <i>Electric Motor</i> B-4 Current, Voltage, and Power	<i>Electric Circuits</i> C-1 Series Circuits C-2 Parallel Circuits C-3 Compound Circuits <i>Electric Motor</i> C-1 Introduction to the Electric Motor
PS.2.25 Physical Systems	9-12	Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.	Analyze the interdependent fields of electricity and magnetism (electromagnets, motors, generators, and transformers).	<i>Electric Motor</i> A-3 How a Motor Works A-4 Designing Motors A-5 Measuring Current and Voltage	<i>Electric Motor</i> B-2 Electromagnets B-3 The Electric Motor B-4 Current, Voltage, and Power B-5 Generators	<i>Electric Motor</i> C-1 Introduction to the Electric Motor C-2 Optimizing Performance C-3 Generators and Faraday's Law of Induction
PS.3.01 Physical Systems	9-12	Students will demonstrate an understanding of the connections and applications of physical science.	Analyze the role science plays in everyday life and compare different careers in the physical sciences.		<i>Light and Optics</i> B-2 Polarization	

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PS.3.04 Physical Systems	9-12	Students will demonstrate an understanding of the connections and applications of physical science.	Understand that mathematics is the precise language of communication and problem solving in science (conversions logarithms, inverse square law, ect). (Measure and calculate using SI units.)	<p><b><i>Car and Ramp</i></b> A-1 Time and Distance A-3 Speed A-4 Describing Motion A-5 Gravity</p> <p><b><i>Gears and Levers</i></b> A-1 The Lever A-2 Gears</p> <p><b><i>Gravity Drop</i></b> A-1 Introduction to the Gravity Drop A-3 Falling Motion</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Rollercoaster</i></b> A-2 Height on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys A-2 What is Work?</p>	<p><b><i>Air Rocket</i></b> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion B-5 The Acceleration of a Rocket</p> <p><b><i>Car and Ramp</i></b> B-1 Time and Distance B-3 Using a Scientific Model to Predict Speed B-5 Acceleration B-6 Force, Mass, and Acceleration B-7 Weight, Gravity, and Friction</p> <p><b><i>Gears and Levers</i></b> B-1 Levers, Torque and Mechanical Advantage B-2 Gears and Rotating Motion B-4 Machines with Gears and Levers</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall B-3 Newton's Second Law</p> <p><b><i>Light and Optics</i></b> B-1 Seeing an Image B-4 Ratios</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range B-2 Launch Speed and Range B-3 Relating Launch Speed and Range</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces C-4 Energy and Power</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction C-3 The Physics of the Inclined Plane</p> <p><b><i>Gears and Levers</i></b> C-2 The Center of Gravity and Equilibrium</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall C-2 Measuring Gravity C-3 Interpreting Graphs of Accelerated Motion</p> <p><b><i>Light and Optics</i></b> C-4 The Convex Lens C-6 The Thin Lens Equation C-7 Wave Properties of Light</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation C-3 Accuracy, Precision, and Error</p> <p><b><i>Pendulum</i></b> C-2 Newton's Second Law and the Pendulum C-3 The Physical Pendulum</p> <p><b><i>Rollercoaster</i></b> C-1 Motion on the Roller Coaster</p>

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Standard #: Strand	Grades	Content Standard	Student Learning Expectation	Investigation Level A	Investigation Level B	Investigation Level C
					<p><b><i>Pendulum</i></b>            B-1 Harmonic Motion            B-2 The Five Second Pendulum</p> <p><b><i>Rollercoaster</i></b>            B-1 Energy and the Rollercoaster            B-2 Conservation of Energy            B-3 Mass and Motion</p> <p><b><i>Ropes and Pulleys</i></b>            B-1 Forces in Machines            B-2 Work and Energy</p>	<p>C-2 Rotational Kinetic Energy            C-3 Mass, Motion, and Energy</p> <p><b><i>Ropes and Pulleys</i></b>            C-1 Simple and Complex Pulley Systems            C-2 Compound Pulley System</p> <p><b><i>Sound and Waves</i></b>            C-1 Standing Waves            C-4 Sound</p>

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PS.3.05 Physical Systems	9-12	Students will demonstrate an understanding of the connections and applications of physical science.	Apply technology as appropriate tools for solving problems (electronic balances, computers, pH meters, spectrophotometers, multimeters, etc).	<p><b><i>Car and Ramp</i></b> A-1 Time and Distance A-2 Investigations and Experiments A-3 Speed A-4 Describing Motion A-5 Gravity</p> <p><b><i>Electric Circuits</i></b> A-3 Current and Voltage</p> <p><b><i>Electric Motor</i></b> A-5 Measuring Current and Voltage</p> <p><b><i>Gravity Drop</i></b> A-2 Speed and the Gravity Drop A-3 Falling Motion</p> <p><b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster A-2 Height on the Roller Coaster</p>	<p><b><i>Air Rocket</i></b> B-1 The Air Rocket B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion B-5 The Acceleration of a Rocket</p> <p><b><i>Car and Ramp</i></b> B-1 Time and Distance B-2 Investigating Speed B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-5 Acceleration B-6 Force, Mass, and Acceleration</p> <p><b><i>Electric Circuits</i></b> B-1 Voltage B-2 Current B-3 Ohm's Law B-4 Current, Voltage, and Power</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall B-3 Newton's Second Law</p> <p><b><i>Marble Launcher</i></b> B-2 Launch Speed and Range</p> <p><b><i>Pendulum</i></b> B-1 Harmonic Motion</p> <p><b><i>Rollercoaster</i></b> B-1 Energy and the Rollercoaster</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction C-3 The Physics of the Inclined Plane</p> <p><b><i>Electric Circuits</i></b> C-1 Series Circuits C-3 Compound Circuits</p> <p><b><i>Electric Motor</i></b> C-1 Introduction to the Electric Motor C-2 Optimizing Performance C-3 Generators and Faraday's Law of Induction</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall C-2 Measuring Gravity</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-3 Accuracy, Precision, and Error</p> <p><b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum C-3 The Physical Pendulum</p> <p><b><i>Rollercoaster</i></b> C-1 Motion on the Roller Coaster C-3 Mass, Motion, and Energy</p> <p><b><i>Ropes and Pulleys</i></b> C-2 Compound Pulley System</p>

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					B-2 Conservation of Energy B-3 Mass and Motion	<i>Sound and Waves</i> C-2 The Speed of a Wave Pulse C-3 Natural Frequency and Resonance
PS.3.06 Physical Systems	9-12	Students will demonstrate an understanding of the connections and applications of physical science.	Assess the connections between pure science and applied science to the world of work by performing labs and activities common to the physical sciences.	<p><b><i>Car and Ramp</i></b> A-2 Investigations and Experiments A-3 Speed</p> <p><b><i>Gravity Drop</i></b> A-1 Introduction to the Gravity Drop A-3 Falling Motion</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance</p> <p><b><i>Pendulum</i></b> A-1 The Pendulum A-2 Making a Clock</p> <p><b><i>Rollercoaster</i></b> A-1 Speed on the Roller Coaster A-2 Height on the Roller Coaster</p>	<p><b><i>Air Rocket</i></b> B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Car and Ramp</i></b> B-2 Investigating Speed B-7 Weight, Gravity, and Friction</p> <p><b><i>Gravity Drop</i></b> B-1 Introduction to the Gravity Drop B-2 Speed, Acceleration, and Free Fall</p> <p><b><i>Light and Optics</i></b> B-2 Polarization B-3 Optical Technology</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range</p> <p><b><i>Pendulum</i></b> B-1 Harmonic Motion</p> <p><b><i>Rollercoaster</i></b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion</p> <p><b><i>Ropes and Pulleys</i></b> B-3 Efficiency</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall</p> <p><b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum</p>

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PS.3.07 Physical Systems	9-12	Students will demonstrate an understanding of the connections and applications of physical science.	Understand broad themes of Project 2061. Such themes include systems, patterns of change, interactions, energy equilibrium, models, and scale (e.g., relative dimensions such as solar system size). (See <a href="http://www.project2061.org/">http://www.project2061.org/</a> )	<p><b><i>Car and Ramp</i></b> A-4 Describing Motion</p> <p><b><i>Gears and Levers</i></b> A-1 The Lever A-2 Gears</p> <p><b><i>Gravity Drop</i></b> A-3 Falling Motion</p> <p><b><i>Marble Launcher</i></b> A-1 Launch Angle and Distance A-2 Launch Speed and Distance</p> <p><b><i>Pendulum</i></b> A-1 The Pendulum</p> <p><b><i>Rollercoaster</i></b> A-2 Height on the Roller Coaster</p> <p><b><i>Ropes and Pulleys</i></b> A-1 Ropes and Pulleys A-2 What is Work?</p> <p><b><i>Sound and Waves</i></b> A-1 Sound</p>	<p><b><i>Air Rocket</i></b> B-2 Motion of the Air Rocket B-3 Pressure and Speed B-4 The Rocket and Newton's Laws of Motion</p> <p><b><i>Car and Ramp</i></b> B-3 Using a Scientific Model to Predict Speed B-4 Position and Time B-5 Acceleration B-6 Force, Mass, and Acceleration B-7 Weight, Gravity, and Friction B-8 Equilibrium, Action, and Reaction</p> <p><b><i>Electric Circuits</i></b> B-3 Ohm's Law</p> <p><b><i>Gears and Levers</i></b> B-1 Levers, Torque and Mechanical Advantage B-2 Gears and Rotating Motion B-4 Machines with Gears and Levers</p> <p><b><i>Gravity Drop</i></b> B-2 Speed, Acceleration, and Free Fall B-3 Newton's Second Law</p> <p><b><i>Light and Optics</i></b> B-2 Polarization B-3 Optical Technology B-4 Ratios</p> <p><b><i>Marble Launcher</i></b> B-1 Launch Angle and Range B-2 Launch Speed and Range</p>	<p><b><i>Air Rocket</i></b> C-3 Acceleration and G-forces</p> <p><b><i>Car and Ramp</i></b> C-1 Uniform Accelerated Motion C-2 Newton's Second Law and Friction C-3 The Physics of the Inclined Plane</p> <p><b><i>Electric Circuits</i></b> C-1 Series Circuits</p> <p><b><i>Electric Motor</i></b> C-2 Optimizing Performance</p> <p><b><i>Gears and Levers</i></b> C-2 The Center of Gravity and Equilibrium</p> <p><b><i>Gravity Drop</i></b> C-1 Speed, Acceleration, and Free Fall C-2 Measuring Gravity C-3 Interpreting Graphs of Accelerated Motion</p> <p><b><i>Light and Optics</i></b> C-2 The Law of Reflection C-5 Geometric Optics C-6 The Thin Lens Equation</p> <p><b><i>Marble Launcher</i></b> C-1 Projectile Motion and the Range Equation C-2 Improving the Range Equation</p> <p><b><i>Pendulum</i></b> C-1 Energy Conservation and the Pendulum C-2 Newton's Second Law and the Pendulum C-3 The Physical Pendulum</p>

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					B-3 Relating Launch Speed and Range <b>Pendulum</b> B-1 Harmonic Motion B-2 The Five Second Pendulum <b>Rollercoaster</b> B-1 Energy and the Rollercoaster B-2 Conservation of Energy B-3 Mass and Motion <b>Ropes and Pulleys</b> B-1 Forces in Machines B-2 Work and Energy <b>Sound and Waves</b> B-1 Sound	<b>Rollercoaster</b> C-1 Motion on the Roller Coaster C-2 Rotational Kinetic Energy C-3 Mass, Motion, and Energy <b>Ropes and Pulleys</b> C-1 Simple and Complex Pulley Systems <b>Sound and Waves</b> C-1 Standing Waves C-3 Natural Frequency and Resonance C-4 Sound