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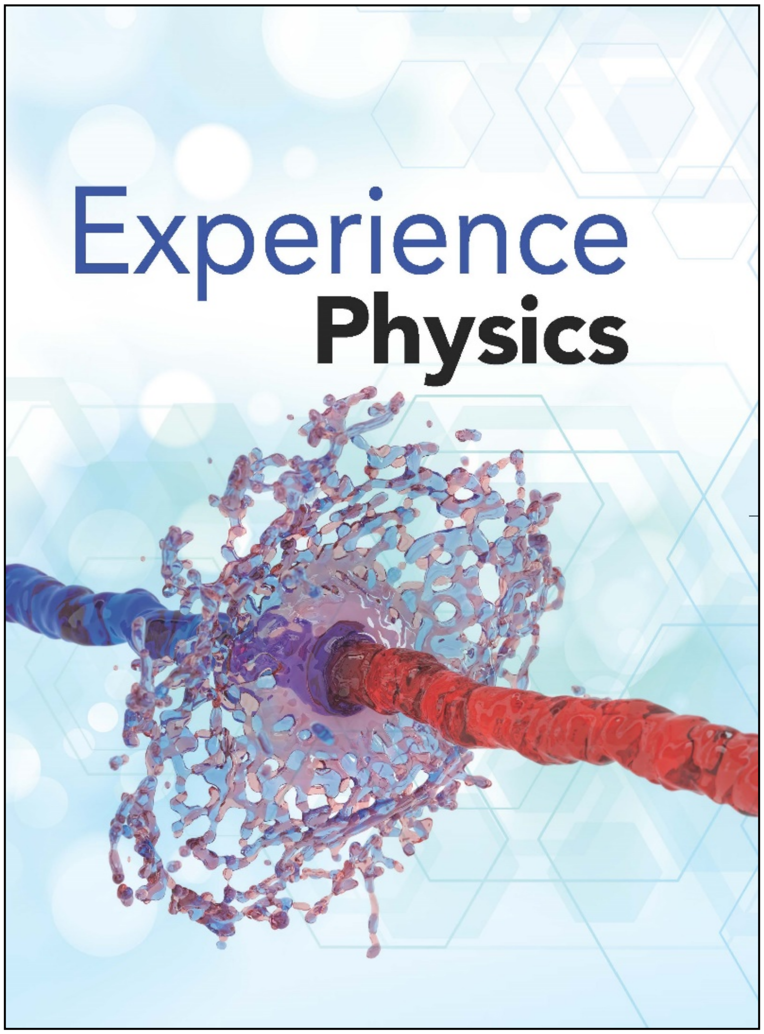

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To the

Minnesota
Academic Standards in Science 2019
High School Physics

A Correlation of Experience Physics ©2022 to the Minnesota Academic Standards in Science 2019 High School Physics

Introduction

This document demonstrates how ***Experience Physics* ©2022** supports Minnesota Academic Standards in Science 2019 for High School Physics. Correlation references include the Experience Notebook, Teacher Guide, and online digital assets.

Savvas Learning Company is excited to introduce ***Experience Physics***!

Students best learn science when they *do* science! Therefore ***Experience Physics*** puts the focus on the student experience. This modern program implements a learning model that organizes learning around phenomena giving students an authentic, real-world experience. ***Experience Physics*** includes a variety of hands-on and digital activities designed to reach every learner, and partners with Flinn Scientific to deliver high-quality inquiry labs, engineering workbenches, and performance assessments.

Phenomenal Experiences Begin with a relevant and engaging phenomenon. Learning is organized around learning around phenomena, giving students an authentic, real-world experience. ***Experience Physics*** includes a variety of hands-on and digital activities designed to reach every learner, encouraging students to ask and answer questions, gather evidence, and organize their reasoning as they experience the concepts of physics firsthand.

Flinn Scientific Partnership Labs, Engineering Workbenches, dataset activities, and performance tasks enhance the student experience and encourage your class to do more science! Hands-on inquiry labs are available in open-ended, guided, shortened, and advanced versions, perfect for meeting the needs of every student.

Personalize Instruction The Teacher Guide allows instructors to personalize their course by selecting from our activities or embedding their own. Enhance instructional plan with Got More Time? Activities, or substitute with Related Phenomena when you want to make a change! Additionally, storyline and Investigation Planners use the 5E model to streamline your prep time.

Build Mathematical Fluency Stepped-out examples in the Experience Handbook break down sample problems for clarity and process guidance, while math tutorial videos reinforce mathematical processes. The Physics and Math Skills Workbook includes four pages of review and practice problems for every learning experience. These activities and more guide students as they become more proficient with math and physics concepts.

Savvas Realize™ Award-Winning Digital Platform Access all your digital content, virtual labs, simulations, assessments, and student data in ONE location. Savvas Realize has offline accessibility, so students can study from anywhere.

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1.0: Exploring phenomena or engineering problems	
1.1: Asking questions and defining problems	
1.1.1: Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	
Waves and their Applications	
9P.1.1.1.1: Evaluate questions about the advantages and disadvantages of using digital transmission and storage of information.* ** (P: 1, CC: 7, CI: PS4, ETS1) Emphasis is on the tradeoffs involved in the transmission and storage of data elements. Examples of advantages may include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Examples of disadvantages may include issues of easy deletion, security, and theft.	**Student Experience Notebook:** Storing Pictures in Digital Code, 543 Storing Sounds in Digital Code, 544 Computer Memory, 545 Advantages and Disadvantages of Digital Information, 547 SEP Ask Questions, 547 Investigative Phenomenon, 548 **Teacher Guide:** **Inquiry Lab:** Binary Logic **Digital Activity:** Music Storage for Home Recording **Performance-Based Assessment:** Send Messages with a Telegraph
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Phys: Energy	
9P.1.2.1.1: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution among the components in the system. (P: 3, CC: 3, CI: PS3) Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually may include mixing liquids at different initial temperatures or adding objects at different temperatures to water.	**Student Experience Notebook:** SEP Plan an Investigation, 365 The Second Law of Thermodynamics, 384-385 SEP Design a Solution, 393 SEP Construct an Explanation, 393 **Teacher Guide:** **Inquiry Lab:** Heat Transfer **Digital Activity:** Thermal Equilibrium and Heat Flow; Meltdown at the Pool **Engineering Workbench:** Build an Efficient Travel Mug
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2.1.1: Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	
Phys: Motion and Stability: Forces and Interactions	
9P.2.1.1.1: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. (P: 4, CC: 2, PS: 2) Examples of data (including data from student investigations) may include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object sliding down a ramp, or a moving object being pulled by a constant force.	**Student Experience Notebook:** Force Causes an Acceleration, 54 Sample Problem: Mowing the Lawn, 55 Modeling Force, 60-61 Writing Force-Acceleration Equations, 61 SEP Analyze and Interpret Data, 64 SEP Analyze and Interpret Data, 66 SEP Use Mathematics, 72 **Teacher Guide:** **Inquiry Lab:** Forces and Motion **Digital Activities:** Force, Mass, and Acceleration; Sliding Down **Performance-Based Assessment:** Force, Mass, and Acceleration

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2.2: Mathematics and Computational Thinking	
2.2.1: Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	
9P.2.2.1.1: Apply mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. (P: 5, CC: 4, CI: PS2) Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle. Examples may include investigating changes in momentum before and after collisions in closed systems.	**Student Experience Notebook:** Conserving Momentum, 331 SEP Argue from Evidence, 331 Sample Problem: Conserving Momentum in Space, 332 Conserving Angular Momentum, 333 SEP Use Models, 333 Impulse-Momentum Theorem, 336-337 Impulse and Momentum in Collisions, 338 Types of Collisions, 342-343 SEP Use Mathematics, 343 Sample Problem: A Ballistic Pendulum, 344-345 Sample Problem: Inelastic Collision, 346 **Teacher Guide:** **Inquiry Labs:** Momentum and Impulse During Collisions; Elastic and Inelastic Collisions **Digital Activity:** Minimizing Car Crash Injuries
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9P.2.2.1.3: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in or out of the system are known.** (P: 5, CC: 4, CI: PS3) Emphasis is on explaining the meaning of mathematical expressions used in the model for systems of two or three components. Forms of energy may include thermal energy, kinetic energy, and elastic potential energy. Computational models may include the creation or use of a simulation or the analysis of a data set.	**Student Experience Notebook:** Mechanical Energy Bar Charts, 303 Sample Problem: Bowling Ball Bounce, 304–305 Modeling Systems, 311 SEP Use Math, 311 Sample Problem: Roller Coaster Energy, 314–315 SEP Use Mathematics, 318 **Teacher Guide:** **Performance-Based Assessment:** Energy Conversion **Digital Activity:** Rocket Launch
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9P.3.1.1.1: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). (P: 2, CC: 5, CI: PS3) Examples of phenomena at the macroscopic scale may include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above Earth, and the energy stored between two electrically-charged plates. Examples of models may include diagrams, drawings, descriptions, and computer simulations.	**Student Experience Notebook:** SEP Develop and Use a Model, 178 SEP Develop a Model, 182 CCC Energy and Matter, 301 SEP Develop a Model, 312 SEP Develop a Model, 313 SEP Use Mathematics, 318 SEP Use Models, 372 SEP Develop a Model, 385 SEP Develop a Model, 411 **Teacher Guide:** **Inquiry Lab:** The Impact of Position on Energy; Kinetic Energy **Digital Activity:** Mechanical Energy; Temperature; Rocket Launch **Performance-Based Assessment:** Energy Conversion; Heating Curve of Water

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9P.3.1.1.2: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between two objects and the changes in energy of the two objects due to the interaction and describe how these forces are present in phenomena. (P: 2, CC: 2, CI: PS3) Examples of models may include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other. Examples of phenomena may include motors, electromagnetic induction, speakers, generators, wireless charging, and induction cooktops.	**Student Experience Notebook:** SEP Systems and System Models, 160 SEP Use Models, 172 SEP Use a Model, 175 SEP Develop and Use a Model, 178 SEP Develop a Model, 212 SEP Develop and Use a Model, 213 SEP Develop and Use a Model, 216 SEP Develop a Model, 217 SEP Develop and Use a Model, 220 SEP Develop a Model, 233 SEP Develop a Model, 238 SEP Develop a Model, 437 SEP Use Models, 439 **Teacher Guide:** **Inquiry Lab:** Electric Charges and Coulomb's Law; Magnetic Force and Separation Distance; Induction of Electrical Current **Digital Activity:** Modeling Electric Fields; Generator Testing; Junkyard Electromagnet **Performance-Based Assessment:** Build and Test an Electroscope; Build a DC Motor
3.2: Constructing explanations and designing solutions	
3.2.2: Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.*	
Phys: Motion and Stability: Forces and Interactions	
9P.3.2.2.1: Develop a computer simulation to demonstrate the impact of a proposed solution that minimizes the force on a macroscopic object during a collision.** (P: 6, CC: 2, CI: PS2, ETS1) Emphasis is on applying science and engineering principles and analyzing the energy conversions. Examples of a device may include a helmet, a parachute, an airbag, and packaging for safe shipping.	**Teacher Guide:** **Digital Activity:** Minimizing Car Crash Injuries **Performance-Based Assessment:** Build Your Own Egg-Transport Vehicle **Engineering Workbench:** Egg Supply Drop

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9P.3.2.2.2: Evaluate a solution to a complex energy-related problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, aesthetics, and maintenance, as well as social, cultural, and environmental impacts.* (P: 6, CC: 2, CI: PS3, ETS1) Examples of energy-related problems may be drawn from alternative energy, manufacturing , and transportation systems.	**Student Experience Notebook:** SEP Design a Solution, 409 SEP Design a Solution, 434 Energy Storage Technologies, 451 Costs and Benefits, 452-453 Costs and Benefits: Oil, Gas, and Coal, 454 Costs and Benefits: Wind, Solar, and Biomass, 455 SEP Argue from Evidence, 455 Costs and Benefits: Nuclear Power, 456 Costs and Benefits: Hydroelectric, Geothermal, Tides, and Waves, 457 Sustainable Energy Future, 458-459 SEP Construct an Argument, 459 SEP Communicate Information, 461 **Teacher Guide:** **Inquiry Lab:** Natural Resource Management **Digital Activities:** Resource Use and Biodiversity Trade-Offs; Energy Resources and Conservation; Energy Choices; Junkyard Electromagnet **Performance-Based Assessment:** Design, Build, and Refine a Wind-Turbine Motor
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4.1: Arguing from evidence	
4.1.1: Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments.	
Phys: Waves and their Applications	
9P.4.1.1.1: Evaluate the claims, evidence, and reasoning behind the argument that electromagnetic radiation can be described using either by a wave model or a particle model, and that for some phenomena one model is more useful than the other. (P: 7, CC: 4, CI: PS4) Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of phenomena may include resonance, interference, diffraction, and photoelectric effect.	**Student Experience Notebook:** Wave Behavior of EM Radiation, 516 Shortcomings of the Wave Theory, 520-521 SEP Evaluate Claims, 521 Photoelectric Effect, 522 Particles of Light, 523 SEP Argue from Evidence, 523 The Dual Nature of Light, 524-525 Sample Problem: Double-Slit Interference Patterns, 526 SEP Use Evidence, 528 **Teacher Guide:** **Inquiry Lab:** Particle Nature of Light **Digital Activities:** Particle-Wave Duality; Particle-Wave Duality of Light

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4.2: Obtaining, evaluating and communicating information	
4.2.1: Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	
9P.4.2.1.1: Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (P: 8, CC: 2, CI: PS4) Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples may include medical imaging technology and communication devices.	**Student Experience Notebook:** Photon Energy Absorption by Matter, 530-531 Damage to Living Cells, 534-535 SEP Evaluate Claims, 535 SEP Argue from Evidence, 536 SEP Evaluate Claims, 536 **Teacher Guide:** **Inquiry Lab:** Electromagnetic Radiation and Matter **Digital Activity:** Sunscreen and UV Protection **Performance-Based Assessment:** Clothing and Sun Protection
9P.4.2.1.2: Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.* (P: 8, CC: 2, CI: PS4) Examples of devices may include medical imaging technologies, cell phones, GPS, Doppler radar or solar cells that capture light and convert it to electricity.	**Student Experience Notebook:** Audio Information, 549 CCC Energy and Matter, 549 Medical Imaging, 552-553 SEP Construct Explanations, 552 Antennas, 554 Wireless Wonders, 555 SEP Construct Explanations (21), 556 SEP Construct Explanations (23), 556 Capturing an EM Wave's Energy, 557-559 Wireless Charging, 561 Cooking, 562 Radiotherapy, 563 SEP Argue from Evidence, 564 **Teacher Guide:** **Inquiry Labs:** Converting Electrical Signals to Sounds; Converting Sunlight to Electricity **Digital Activities:** Antennas; Solar Panels on a Cloudy Day **Performance-Based Assessment:** Send Messages with a Telegraph