Week 1	Team Building through Physics and Scientific Inquiry
	Focus: Build class community through collaborative problem-solving and inquiry-based physics challenges while introducing foundational measurement and mathematical skills. **Standards (introduced contextually):** **CCSS Mathematics Integration** – Develop measurement skills, unit analysis, and basic equation manipulation through hands-on challenges and scientific inquiry practices. **Skills Developed:** Team communication, basic measurement techniques, unit conversion, hypothesis generation, collaborative problem-solving, introduction to scientific method **Activities:** **Paper Tower Challenge**: Using only paper and tape, teams build the tallest free-standing structure. Introduces measurement, units, and design thinking while building team dynamics. **Marshmallow Catapult Design**: Teams use plastic spoons, rubber bands, and cups to launch marshmallows at targets. Introduces variables, measurement precision, and collaborative engineering. **Measurement Scavenger Hunt**: Teams measure classroom objects using different units and tools, practicing unit conversion and measurement accuracy. **Lab Team Contract**: Establish team roles, expectations, and safety procedures for virtual and hands-on activities. **Formative Assessments:** Team collaboration rubric, measurement accuracy checks, unit conversion practice problems **Summative Assessments:** Group presentation on challenge results including measurements, unit conversions, and design reasoning

Weeks 2–5	**Unit 1 - Introduction to Physics**
	## Focus: Develop mathematical foundations for physics while introducing energy concepts through modeling and hands-on exploration. ## Standards: **HSN-Q.1-3**: Use units and quantitative reasoning **HSA-CED.1-4**: Create and solve equations **HS-PS3-2**: Develop and use models to illustrate energy at macroscopic scale ## Skills Developed: Unit analysis and conversion, equation manipulation, significant figures, scientific notation, energy identification and modeling, basic data analysis ## Activities: ● **PhET Energy Skate Park Virtual Lab**: Model kinetic and potential energy transformations using online simulation, tracking energy changes quantitatively. ● **Pendulum Investigation**: Use string and washers to explore energy conservation, measuring period and analyzing energy transformations (safe classroom setup). ● **Unit Conversion Olympics**: Competitive team activities converting between metric units, scientific notation practice, and measurement precision challenges. ● **Energy Detective**: Identify and categorize energy forms in everyday classroom objects and situations, creating simple particle motion models. ● **Formula Manipulation Practice**: Rearrange energy equations (KE = ½mv², PE = mgh) to solve for different variables. ## Formative Assessments: Daily unit conversion practice, energy identification exit tickets, equation manipulation worksheets with peer checking ## Summative Assessments:

	Skills test covering unit analysis, scientific notation, and equation solving; Virtual lab report analyzing energy transformations in pendulum motion with mathematical calculations
Weeks 6–9	**Unit 2 - Motion**
	## Focus: Analyze motion using mathematical representations and graphical analysis while applying Newton's Second Law. ## Standards: **MS-PS3-1**: Construct and interpret graphical displays of data **HS-PS2-1**: Analyze data to support Newton's second law ## Skills Developed: Graph construction and interpretation, kinematic calculations, data analysis, applying F=ma relationships ## Activities: ● **PhET Moving Man Simulation**: Create and interpret position-time and velocity-time graphs using virtual motion scenarios. ● **Walking Motion Graphs**: Students walk in patterns to match given motion graphs, then create graphs of their own motion patterns. ● **Toy Car Ramp Investigation**: Use toy cars on classroom ramps with different masses, measuring time and distance to analyze acceleration (safe, simple setup). ● **Video Analysis Project**: Analyze motion in online videos (bouncing balls, falling objects) using free video analysis software to create motion graphs. ● **Newton's Second Law Calculator**: Use virtual simulations to test F=ma relationships with different masses and forces. ## Formative Assessments: Graph matching activities, motion prediction challenges, F=ma calculation practice with immediate feedback ## Summative Assessments:

	Written test including graph interpretation and kinematic calculations; Motion analysis project using video or simulation data to demonstrate Newton's Second Law
Weeks 10–13	**Unit 3 - Forces**
	## Focus: Investigate force interactions, momentum conservation, and engineering applications of force principles. ## Standards: **5-PS2-1**: Support arguments about gravitational interactions **HS-PS2-1**: Analyze data to support Newton's second law **HS-PS2-2**: Use mathematical representations for momentum conservation **HS-PS2-3**: Design device to minimize collision forces **HS-PS2-4**: Use mathematical representations of gravitational and electrostatic forces ## Skills Developed: Force analysis, free body diagrams, momentum calculations, collision analysis, gravitational force calculations ## Activities: ● **PhET Forces and Motion Simulation**: Explore how forces affect motion using virtual force scenarios and free body diagram construction. ● **Balloon Rocket Investigation**: Use balloons, string, and straws to demonstrate Newton's Third Law and momentum conservation (safe classroom activity). ● **Paper Collision Design Challenge**: Design paper structures to protect raw eggs during controlled drops, analyzing force reduction strategies. ● **Gravitational Force Modeling**: Use online calculators and simulations to explore how mass and distance affect gravitational attraction. ● **Momentum Conservation with Marbles**: Use marbles or ball bearings on smooth surfaces to demonstrate momentum conservation in collisions. ## Formative Assessments:

	Free body diagram practice, momentum calculation worksheets, force identification activities using everyday examples **Summative Assessments:** Comprehensive test covering Newton's Laws and momentum; Engineering design project creating and testing a collision-reduction device with force analysis
Weeks 14–17	**Unit 4 - Energy**
	Focus: Quantitatively analyze energy transformations and design energy conversion systems. **Standards:** **HS-PS3-1**: Create computational model for energy changes **HS-PS3-2**: Develop and use models to illustrate energy at macroscopic scale **HS-PS3-3**: Design energy conversion device **Skills Developed:** Energy calculations, system modeling, energy efficiency analysis, computational modeling **Activities:** ● **PhET Energy Forms and Changes Simulation**: Track energy transformations in virtual systems, calculating efficiency and energy losses. ● **Rubber Band Energy Investigation**: Use rubber bands and rulers to explore elastic potential energy and energy conversion (safe classroom setup). ● **Solar Oven Design Challenge**: Design and test simple solar ovens using cardboard, foil, and plastic wrap to convert light energy to thermal energy. ● **Energy Audit Simulation**: Use online tools to analyze energy consumption in virtual homes and propose efficiency improvements.

	● **Simple Machine Energy Analysis**: Use classroom objects (inclined planes, levers, pulleys) to analyze work and energy relationships. **Formative Assessments:** Energy calculation practice problems, efficiency analysis worksheets, energy transformation identification in daily life **Summative Assessments:** Test including energy calculations and conservation problems; Design project creating an energy conversion device with quantitative energy analysis
Weeks 18–20	**Unit 5 - Waves (Light and Sound)**
	Focus: Explore wave properties and their applications in information transmission. **Standards:** **HS-PS4-1**: Use mathematical representations for wave relationships **HS-PS4-3**: Evaluate wave-particle duality claims **Skills Developed:** Wave calculations, frequency and wavelength analysis, wave behavior modeling, technology applications **Activities:** ● **PhET Wave on a String Simulation**: Explore wave properties, reflection, and interference using virtual wave generators. ● **Sound Wave Investigation**: Use tuning forks, rubber bands, and smartphone apps to measure frequency and analyze sound wave properties. ● **Light Wave Demonstration**: Use laser pointers (safely), prisms, and diffraction gratings to explore light wave behaviors. ● **Communication Technology Research**: Investigate how waves are used in cell phones, Wi-Fi, and radio using online resources and simulations.

	● **Wave-Particle Duality Cases**: Analyze scenarios where wave or particle models of light are most useful using online animations and case studies. **Formative Assessments:** Wave property calculations, technology application discussions, wave behavior predictions using simulations **Summative Assessments:** Test covering wave mathematics and concepts; Technology investigation project explaining how waves transmit information in a chosen device
Weeks 21–24	**Unit 6 - Electromagnetism**
	Focus: Investigate electromagnetic phenomena and their technological applications. **Standards:** **HS-PS2-4**: Use mathematical representations of gravitational and electrostatic forces **HS-PS2-5**: Investigate electric current and magnetic fields **HS-PS2-6**: Communicate about molecular structure and materials **HS-PS3-5**: Model electric/magnetic field interactions **Skills Developed:** Electromagnetic calculations, field modeling, material property analysis, circuit understanding **Activities:** ● **PhET Circuit Construction Kit**: Build virtual circuits to explore current, voltage, and resistance relationships. ● **Static Electricity Investigation**: Use balloons, plastic rods, and lightweight objects to explore electrostatic forces and charging (safe classroom activity). ● **Simple Electromagnet Construction**: Use batteries, wire, and nails to create electromagnets and test their strength with paper clips.

	● **Material Conductivity Testing**: Use simple circuits to test conductivity of various classroom materials and relate to molecular structure. ● **Electromagnetic Induction Simulation**: Use online simulations to explore how changing magnetic fields produce electric current. **Formative Assessments:** Electrostatic force calculations, circuit analysis practice, material property identification activities **Summative Assessments:** Test covering electromagnetic principles and calculations; Electromagnetic device project with explanation of underlying physics principles
Weeks 26-28	**Unit 7 - Engineering Design and Problem Solving**
	Focus: Apply engineering design process to complex real-world challenges, integrating physics principles from throughout the course. **Standards:** **HS-ETS1-1:** Analyze global challenges for solution criteria **HS-ETS1-2:** Design solutions to complex problems **HS-ETS1-3:** Evaluate solutions based on constraints **Skills Developed:** Problem analysis, systematic design thinking, constraint evaluation, optimization, physics integration **Activities:** ● Global Challenge Analysis: Research real-world problems (renewable energy, transportation, communication) and identify design criteria and constraints. ● Systematic Problem Breakdown: Use engineering design process tools to break complex problems into manageable components. ● Multi-Physics Design Challenge: Create solutions that integrate multiple physics concepts (forces, energy, waves, electromagnetism) such as alarm systems or transportation devices.

	● Design Optimization Workshop: Use iterative design principles to improve solutions based on testing data and constraint analysis. ● Solution Evaluation Matrix: Develop criteria-based evaluation systems to compare multiple design solutions objectively. **Formative Assessments:** Design process journals, peer feedback on solution proposals, constraint analysis worksheets **Summative Assessments:** Comprehensive design portfolio including problem analysis, solution development, prototype testing, and optimization documentation; Final presentation demonstrating physics integration and design reasoning
	Course Summary:
	Total Duration: 28 weeks **Assessment Strategy:** Balanced formative and summative assessments accommodating diverse learning needs **Technology Integration:** Extensive use of PhET simulations and online tools to replace traditional laboratory equipment **Safety Focus:** All activities designed for classroom implementation without specialized laboratory facilities **Physics Integration:** Each unit builds mathematical and conceptual foundations for subsequent learning