Northern York County School District

Curriculum Overview

Course: 8th Grade Physical Science	
Grade Level: 8	
Development/Revision Date: January 2025	**Length of Time:** 180 Days

Course Description:

This course is designed to explore fundamental concepts in physical science, focusing on atomic structure, chemical reactions, energy transfer, and forces. Students will develop models to describe the atomic composition of molecules, examine changes in particle motion and temperature during phase transitions, and investigate how synthetic materials are derived from natural resources and impact society. Through hands-on experiments and data analysis, learners will interpret the properties of substances before and after chemical interactions to determine if a reaction has occurred, and study how mass is conserved in chemical processes.

Additionally, students will apply Newton's Third Law to solve real-world problems involving motion and forces, explore the relationship between kinetic energy and the mass and speed of objects, and analyze wave behavior as it interacts with different materials. The course also emphasizes the use of scientific principles in designing and testing devices for thermal energy transfer, while encouraging the exploration of electric, magnetic, and gravitational forces. By integrating both qualitative and quantitative information, students will develop a deep understanding of energy, matter, and the physical laws that govern them.

Course Objectives:

- Develop and use models to explain the atomic structure of molecules and extended structures.
- Predict and describe changes in particle motion, temperature, and states of matter when thermal energy is added or removed.
- Understand how synthetic materials are made from natural resources and analyze their societal impacts.
- Analyze data on the properties of substances before and after interactions to determine if a chemical reaction has occurred.
- Use models to demonstrate how atoms are conserved in chemical reactions and how mass is preserved.
- Design, test, and modify devices that either release or absorb thermal energy through chemical processes.
- Apply Newton's Third Law to design solutions involving the motion of colliding objects.
- Plan and carry out investigations to show how forces and mass affect an object's motion.
- Explore the factors that influence electric and magnetic forces through data analysis.
- Construct arguments based on evidence to explain gravitational interactions between objects.
- Investigate and evaluate the existence of force fields between objects that are not in contact.
- Graph and interpret data to describe the relationship between kinetic energy, mass, and speed.
- Design and test devices to optimize thermal energy transfer.

- Investigate the relationship between energy transfer, particle motion, and temperature changes in different substances.
- Support claims about energy transfer during changes in kinetic energy.
- Develop models to explain how potential energy is stored in systems of interacting objects.
- Use mathematical models to describe the relationship between wave amplitude and energy.
- Develop models to explain how waves are reflected, absorbed, or transmitted through different materials.
- Compare and contrast digitized signals and analog signals and explain why digital signals are more reliable for transmitting information.

Related Standards:

Pennsylvania STEELS Standards:

- **3.2.6-8.A** Develop models to describe the atomic composition of simple molecules and extended structures.
- **3.2.6-8.B** Develop a model that predicts and describes changes in the particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- **3.2.6-8.C** Gather and make sense of information to describe how synthetic materials come from natural resources and impact society.
- **3.2.6-8.D** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- **3.2.6-8.E** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- **3.2.6-8.F** Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
- **3.2.6-8.G** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- **3.2.6-8.H** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- **3.2.6-8.I** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- **3.2.6-8.J** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- **3.2.6-8.K** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- **3.2.6-8.L** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass and speed of an object.
- **3.2.6-8.M** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **3.2.6-8.N** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- **3.2.6-8.O** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- **3.2.6-8.P** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- **3.2.6-8.Q** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- **3.2.6-8.R** Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.

- **3.2.6-8.S** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Units:

- Phases of Matter
- Forces and Motion
- Atomic Structure
- Atoms and Molecules
- Periodic Table
- Energy Forms
- Electromagnetism

Competencies:

- Observe time, space, and energy phenomena at various scales and utilize models to study systems that are either too large or too small for direct observation.
- Demonstrate the ability to use cause-and-effect relationships to predict outcomes in both natural and engineered systems.
- Design structures that serve specific functions by understanding and applying the properties of various materials and how they can be shaped and utilized.
- Analyze how engineering advancements have driven discoveries in scientific fields, and conversely, how scientific breakthroughs have led to the creation of new industries and engineered systems.
- Evaluate how the use and limitations of technologies are influenced by individual or societal needs, values, and desires, as well as by scientific research findings and varying factors such as climate, natural resources, and economic conditions.
- Explore the relationships between macroscopic patterns and the nature of microscopic and atomic-level structures.
- Explain the principle of matter conservation, demonstrating an understanding that atoms are conserved in both physical and chemical processes.
- Track the transfer of energy as it flows through both designed and natural systems.
- Utilize models to represent systems and their interactions, including inputs, processes, outputs, and the flow of energy and matter within those systems.
- Construct explanations of stability and change in natural or designed systems by examining changes over time and analyzing forces at different scales.
- Analyze proportional relationships among different quantities, such as speed as the ratio of distance traveled to time taken, to gain insights into the magnitude of properties and processes.
- Identify and describe the various forms of energy, including energy in fields, thermal energy, and kinetic energy.
- Use graphs and charts to identify patterns in data and draw conclusions from their analyses.
- Assess how advances in technology have influenced scientific progress and how scientific developments have contributed to technological innovations.
- Demonstrate how technologies extend the measurement, exploration, modeling, and computational capacities of scientific investigations.

Concepts:	**Learning Activities:**
• **STRUCTURE AND PROPERTIES OF MATTER -** Substances are composed of atoms that form molecules in various ways, creating solids, liquids, or gases with unique	• Ask questions and define problems • Plan and carry out investigations • Engage in argument from evidence • Develop and use models

properties, and can undergo chemical reactions to produce new materials with different properties. • **CHEMICAL REACTIONS -** Chemical reactions rearrange atoms into new substances with different properties, keeping the same mass, and designs using these reactions can be improved by testing and adjusting for better energy use and performance. • **FORCES AND INTERACTIONS** - Forces between objects are equal and opposite, object motion depends on total forces applied, and forces like gravity, electricity, and magnetism work over distances. • **ENERGY** - Kinetic energy depends on mass and speed, temperature shows particles' average energy, energy flows from hot to cold, and designs improve by testing and refining. • **WAVES AND ELECTROMAGNETIC RADIATION** - Waves have patterns with specific features, sound needs a medium, light travels in space, and digital wave signals are reliable for communication.	• Analyze and interpret data • Construct explanations and design solutions • Obtain, evaluate, and communicate information • Use math and computational thinking
Performance Tasks: • Formative lesson assessments such as student discussion, questioning, peer collaborative activities, reflections • Summative unit assessments and projects	
Other Assessment Measures: 8th Grade STEELS PSSA.	
Textbook/Primary Resource: Amplify Education, Inc. (2022). *Amplify Science: Physical Science*. Amplify Education, Inc.	
Supplemental Resource Materials: Gizmos, iXL, BrainPop, Nearpod, EdPuzzle, Canva	