SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: General Science	**Length of Course:** Full Year
Grade Level(s): 8	**Periods Per Cycle:** 6
Units of Credit: N/A	**Length of Period:** 48 Minutes
Classification: Required	**Total Instructional Time:** 144 Hours

Course Description

The 8th grade General Science course is based off the PA STEELS Standards. As a general science class, the course is designed for students to learn science topics in the branches of Physical Science and Earth and Space Science.

Instructional Strategies, Learning Practices, Activities, and Experiences

Science and Engineering Practices	Crosscutting Concepts	Instructional Strategies
1. Asking questions and defining problems 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in arguments from evidence 8. Obtaining, evaluating, and communicating information	1. Patterns 2. Cause and effect 3. Scale proportion and quantity 4. Systems and system models 5. Energy and matter: Flows, cycles, and conservation 6. Structure and function 7. Stability and change	Driving question boards Students conducting investigations and solving problems Data collection Reading from multiple sources for research and information Modeling Students writing of journals, reports, posters, and media presentations that explain and argue Students discussing open ended questions that focus on the strength of evidence used to generate claims

Assessments

Performance Assessments Journals Scientific Writing	Tests and Quizzes Lab Investigation Write Ups Projects	Rubrics Evaluation of Knowledge and Practices (Summative and Formative)

Materials/Resources

Internet Resources Laboratory Equipment and Supplies CK-12 Online Textbook	CK Science 8 Computer Simulations Science Models and Kits	Student Journals Resource Books

Adopted: 4/20/88

Revised: 9/3/91; 8/19/98; 11/15/01; 8/20/07; 5/19/14; 5/22/23

Structure and Properties of Matter	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Particle Theory Properties of Matter States of Matter Conservation of Matter	<u>Objectives</u> Students will be able to: 1. Understand that matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. 2. Understand that all substances are made from some 100 different types of atoms, which combine with one another in various ways. 3. Understand that atoms form molecules that range in size from two to thousands of atoms. Pure substances are made from a single type of atom or molecule; each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. 4. Understand that the substructure of atoms determines how they combine and rearrange to form all of the world's substances. 5. Understand that within matter, particles are constantly moving about relative to each other. In a liquid, the molecules are constantly in contact with each other; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and vibrate in position but do not change relative locations. <u>Standards</u> 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.

Chemical Reactions	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Pure Substances Physical Properties Chemical Properties Chemical Process Reactants	<u>Objectives</u> Students will be able to: 1. Understand that substances react chemically in characteristic ways. 2. Understand that in a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. 3. Understand that the total number of each type of atom is conserved, and thus the mass does not change. 4. Understand that some chemical reactions release energy, others store energy. <u>Standards</u> 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.

Forces and Motion	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Force Newton's Laws of Motion Motion Sum of Forces Mass vs Force	<u>Objectives</u> Students will be able to: 1. Understand that in any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first but in the opposite direction (Newton's third law). 2. Understand that the motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. 3. Understand that the greater the mass of the object, the greater the force needed to achieve the same change in motion. 4. Understand that for any given object, a larger force causes a larger change in motion. Forces on an object can also change its shape or orientation. 5. Understand that all positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame. <u>Standards</u> 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.

Types of Interactions	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Electric Forces Magnetic Forces Electromagnetic Forces Attraction Repulsion Charge Current Magnetic Strength Gravitational Forces Magnetic, Electrical, and Gravitational Fields	<u>Objectives</u> Students will be able to: 1. Understand that electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. 2. Understand that gravitational forces are always attractive. 3. Understand that there is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—for example, earth and the sun. 4. Understand that long-range gravitational interactions govern the evolution and maintenance of large-scale systems in space, such as galaxies or the solar system, and determine the patterns of motion within those structures. 5. Understand that forces that act at a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively). <u>Standards</u> 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.

Definitions of Energy	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Motion Energy Kinetic Energy Potential Energy Polarity Conservation of Mass Conservation of Energy	<u>Objectives</u> Students will be able to: 1. Understand that motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. 2. Understand that a system of objects may also contain stored (potential) energy, depending on their relative positions. 3. Understand that energy is also stored in the electric fields between charged particles and the magnetic fields between magnets, and it changes when these objects are moved relative to one another. 4. Understand that stored energy is decreased in some chemical reactions and increased in others. <u>Standards</u> 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.

Conservation of Energy and Energy Transfer	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Thermal Energy Kinetic Energy Energy Transfer	<u>Objectives</u> Students will be able to: 1. Understand that when the motion energy of an object changes, there is inevitably some other change in energy at the same time. 2. Understand that the amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. 3. Understand that energy is transferred out of hotter regions or objects and into colder ones by the processes of conduction, convection, and radiation. <u>Standards</u> 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.

Relationship Between Energy and Forces	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Stored (Potential) Energy Object Interaction Exertion of Force Energy Transfer	<u>Objectives</u> Students will be able to: 1. Understand that when two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. 2. Understand that energy is released as the object falls; the mechanism of this release is the gravitational force. 3. Understand that two magnetic and electrically charged objects interacting at a distance exert forces on each other that can transfer energy between the interacting objects. <u>Standards</u> 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.

Wave Properties	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Repeating Pattern Wavelength Frequency Amplitude	<u>Objectives</u> Students will be able to: 1. Understand that a simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. 2. Understand that a sound wave needs a medium through which it is transmitted. <u>Standards</u> 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.

Electromagnetic Radiation	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Light Reflection Light Absorption Light Transmission Frequency (Color) Light Path	<u>Objectives</u> Students will be able to: 1. Understand that when light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. 2. Understand that the path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. 3. Understand that lenses and prisms are applications of this effect. 4. Understand that a wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media (prisms). However, because light can travel through space, it cannot be a matter wave, like sound or water waves. <u>Standards</u> 3.2.6-8.R Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials. .

Information Technologies and Instrumentation	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Digitized Signals (Wave Pulses) Encode Transmit	<u>Objectives</u> Students will be able to: 1. Understand that appropriately designed technologies (e.g., radio, television, cell phones, wired and wireless computer networks) make it possible to detect and interpret many types of signals that cannot be sensed directly. 2. Understand that many modern communication devices use digitized signals (sent as wave pulses) as a more reliable way to encode and transmit information. <u>Standards</u> 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.

The Universe and Its Stars	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Lunar Phases Eclipse Seasons Tides	<u>Objectives</u> Students will be able to: 1. Understand that patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. 2. Understand that the universe began with a period of extreme and rapid expansion known as the big bang. 3. Understand that earth and its solar system are part of the milky way galaxy, which is one of many galaxies in the universe. <u>Standards</u> 3.3.6-8.A Develop and use a model of the Earth Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. 3.3.6-8.B Develop and use a model to describe the role of gravity in the motion within galaxies and the solar system.

Earth and the Solar System	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Sun Earth Planets Scale Patterns	<u>Objectives</u> Students will be able to: 1. Understand that the solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. 2. Create a model of the solar system to explain tides, eclipses of the sun and the moon, and the motion of the planets in the sky relative to the stars. 3. Explain that the seasons are a result of the tilt of the earth and are caused by the differential intensity of sunlight on different areas of earth across the year. <u>Standards</u> 3.3.6-8.C Analyze and interpret data to determine scale properties of objects in the solar system.

The History of Planet Earth	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Geologic Time Fossil Record	<u>Objectives</u> Students will be able to: 1. Understand that the geological time scale interpreted from rock strata provides a way to organize Earth's history. 2. Understand that major historical events include the formation of mountain chains and ocean basins, the evolution and extinction of particular living organisms, volcanic eruptions, periods of massive glaciation, and development of watersheds and rivers through glaciation and water erosion. 3. Understand that analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. <u>Standards</u> 3.3.6-8.D Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year old history.

Earth Materials and Systems	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Earth's Systems Geosphere, Hydrosphere, Atmosphere, and Biosphere Earth's Interior Energy Cycling	<u>Objectives</u> Students will be able to: 1. Understand that all Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. 2. Understand that energy is derived from the sun and Earth's hot interior. 3. Understand that energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. 4. Understand that the planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. 5. Understand that changes to Earth's environments can have different impacts (negative and positive) for different living things. <u>Standards</u> 3.3.6-8.E Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. 3.3.6-8.F Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. 3.4.6-8.A Develop a model to describe how agricultural and food systems function, including the sustainable use of natural resources and the production, processing, and management of food, fiber, and energy.

Plate Tectonics and Large-Scale System Interactions	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Rock Cycle Layers of the Earth Types of Plate Movements Volcanoes Glaciers Subduction, Convection, Transform Boundaries Evidence for Pangea or Other Past Plate Movements Landforms	<u>Objectives</u> Students will be able to: 1. Understand that plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust. 2. Use maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. <u>Standards</u> 3.3.6-8.G Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.

The Roles of Water in Earth's Surface Processes	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Water Cycle Transpiration Evaporation Condensation Crystallization Precipitation Downhill Flow	<u>Objectives</u> Students will be able to: 1. Understand that water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation as well as downhill flows on land. 2. Understand that the complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. 3. Understand that global movements of water and its changes in form are propelled by sunlight and gravity. 4. Understand that variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. 5. Understand that water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. <u>Standards</u> 3.3.6-8.H Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. 3.3.6-8.I Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Weather and Climate	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Differences Between Weather and Climate Convection Currents Probability Conservation of Energy (Light to Heat) Thermal Equilibrium Greenhouse Gasses (Types and How They Are Produced) Global Warming Climate Change	<u>Objectives</u> Students will be able to: 1. Understand that weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. 2. Understand that these interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. 3. Understand that because these patterns are so complex, weather can be predicted only probabilistically. 4. Understand that the ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. 5. Understand that greenhouse gasses in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating earth's average surface temperature and keeping it habitable. <u>Standards</u> 3.3.6-8.J Collect data to provide evidence for how the motion and complex interactions of air masses result in changes in weather conditions. 3.3.6-8.O Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Natural Resources	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Limited Resources (Minerals, Fresh Water and Biosphere Resources) Geologic Processes	<u>Objectives:</u> Students will be able to: 1. Understand that humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. 2. Understand that minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. 3. Understand that these resources are distributed unevenly around the planet as a result of past geological processes (link to ESS2.B). Renewable energy resources, and the technologies to exploit them, are being rapidly developed. <u>Standards</u> 3.3.6-8.K Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. 3.4.6-8.B Analyze and interpret data about how different societies (economic and social systems) and cultures use and manage natural resources differently.

Natural Hazards	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Mapping of Natural Hazards Geologic Forces	<u>Objectives</u> Students will be able to: 1. Understand that some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions. 2. Understand that others, such as earthquakes, occur suddenly and with no notice, and thus they are not yet predictable. 3. Understand that mapping the history of natural hazards in a region, combined with an understanding of related geological forces can help forecast the locations and likelihoods of future events. <u>Standards</u> 3.3.6-8.L Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Human Impact on Earth Systems - Watersheds and Wetlands	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Natural Habitats Extinction Stream Order Ecosystems Populations	<u>Objectives</u> Students will be able to: 1. Understand that human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. 2. Understand that changes to earth's environments can have different impacts (negative and positive) for different living things. <u>Standards</u> 3.3.6-8.M Apply scientific principles to design a method for monitoring and minimizing human impact on the environment. 3.3.6-8.N Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems. 3.4.6-8.C Develop a model to describe how watersheds and wetlands function as systems, including the roles and functions they serve.

Human Impact on Earth Systems - Watersheds and Wetlands Continued	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Natural Habitats Stream Order Ecosystems Populations	<u>Objectives</u> Students will be able to: 1. Plan and implement a habitat project in the local community. <u>Standards:</u> 3.4.6-8.D Gather, read, and synthesize information from multiple sources to investigate how Pennsylvania environmental issues affect Pennsylvania's human and natural systems. 3.4.6-8.E Collect, analyze, and interpret environmental data to describe a local environment. 3.4.9-12.G Analyze and evaluate how best resource management practices and environmental laws achieve sustainability of natural resources. 3.4.6-8.H Design a solution to an environmental issue in which individuals and societies can engage as stewards of the environment. National Academies of Sciences, Engineering, and Medicine. 2012. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press. https://doi.org/10.17226/13165.