EAST PENN SCHOOL DISTRICT

Grade 8 Science

DATE OF APPROVAL

Grade 8 Science : Unit 1 - Weather, Climate, and Water Cycling

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

3.2.6-8.B - Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

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.J - Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

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

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, "Why does a lot of hail, rain, or snow fall at some times and not others?"

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ All forms of matter exist as a result of the combination or rearrangement of atoms.
- ☐ Water's presence and properties impact Earth's ecosystems and surface features.
- ☐ Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do particles combine to form the variety of matter one observes?
- ☐ How do the properties and movements of water shape Earth's surface and affect its systems?
- ☐ What regulates weather and climate?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ PS1.A. Structures and Properties of Matter In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter
- ☐ PS3.A. The temperature of a system is proportional to the average internal kinetic

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop initial models that describe changes and mechanisms at both observable and particle levels to explain phenomena like hail falling
- ☐ Analyze and interpret data to identify patterns indicating that air temperature decreases with altitude, regardless of geographical location or time of year.
- ☐ Develop a model that shows the relationship between the motion and energy of air molecules to explain these observed temperature changes at various altitudes.
- ☐ Analyze and interpret data from investigations to understand how the addition or removal of

	energy and potential energy per molecule (whichever is the appropriate building block for the system's material). When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time. ☐ ESS2.C. The Role of Water in Earth's Processes Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity. 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. Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. ☐ ESS2.D. Weather and Climate Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can only be predicted probabilistically. 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.	thermal energy affects the density and motion of air. ☐ Develop a model explaining that warmed air becomes less dense and rises, while cooled air becomes more dense and sinks. ☐ Construct an explanation of how the upward and downward movement of air parcels (via conduction and convection) causes air movement in clouds. ☐ Carry out investigations to collect data on the appearance and growth of water droplets in cooled, humid air. ☐ Use mathematical thinking and construct explanations to predict patterns in the relationship between the relative strength of two opposing forces on objects (like water droplets or ice crystals) and their resulting motion. ☐ Develop and use a model to explain the unobservable mechanisms driving matter cycling and energy flow that cause some storms to produce large hail and others not. ☐ Apply their understanding to explain a new phenomenon, such as a hurricane ☐ Develop a model to illustrate how warm and cold air masses interact at frontal boundaries, using this model to explain associated weather changes (like precipitation and temperature) and air movement at these boundaries. ☐ Analyze relative humidity data to determine conditions that cause water vapor to condense. ☐ Use graphical displays of global climate datasets (including sunlight, ocean temperature, and water and wind movement) to identify relationships between energy transfer and matter cycling. ☐ Apply this understanding to explain the location and climate of rainforests around the globe.

Grade 8 Science : Unit 2 - Natural Hazards

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

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.

3.4.6-8.G - Obtain and communicate information to describe how best resource management practices and environmental laws are designed to achieve environmental sustainability.

3.4.6-8.H - Design a solution to an environmental issue in which individuals and societies can engage as stewards of the environment.

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.

3.4.6-8.C - Develop a model to describe how watersheds and wetlands function as systems,

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, “Where do natural hazards happen and how do we prepare for them?”

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ Natural processes can cause sudden or gradual changes to Earth’s systems, some of which may adversely affect humans.
- ☐ Best management practices and data driven resource management, as well as environmental laws and policies, encourage environmental sustainability
- ☐ Environmental stewardship practices are essential to improving environmental quality, sustainability, and community well-being.
- ☐ Human cultures and societies experience and interact with the environment in various ways.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do natural hazards affect individuals and societies?
- ☐ How do actions and regulations support the equitable availability of resources for current and future generations?
- ☐ How can human actions improve environmental quality, sustainability, and community well-being?
- ☐ How do human cultures and societies experience, interact, and value local, regional, and/or global environments?
- ☐ How do various human cultures express their beliefs about nature and the environment?
- ☐ How are natural resources managed by people from various cultures and communities?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ ESS3.B. Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.
- ☐ ETS1.A. The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant

Students will be skilled at...

Science and Engineering Practices

- ☐ Integrate quantitative and qualitative scientific information to connect cause-and-effect relationships to predict communities at risk for future tsunami occurrence.
- ☐ Analyze and interpret data from different wave models to identify patterns in how the tsunami wave forms and moves toward shore, changing height (amplitude) as it interacts with the ocean floor.
- ☐ Evaluate the limitations and benefits of different wave models for explaining how tsunamis form from a movement in the ocean floor (cause), and

including the roles and functions they serve.	knowledge that are likely to limit possible solutions. ☐ ETS1.B. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. ☐ PS4.C. Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	how they move and change as they approach the shore (effect). ☐ Apply scientific ideas to construct an explanation for how sudden changes in the ocean floor during an earthquake lead to the formation of a tsunami, and construct an explanation that includes qualitative relationships between variables (distance to epicenter, shoreline topography) that predicts which communities are most at risk for damage as a result of a sudden change. ☐ Make an argument based on a systematic evaluation process using relevant scientific principles to support or refute the ability of different existing solutions (structure) to mitigate the effects of tsunamis and meet the needs of at-risk communities (function). ☐ Use digital tools and/or mathematical concepts to integrate and synthesize information to compare the reliability of emergency communication systems. ☐ Construct a system model to represent the interactions of subsystems designed to detect, warn communities, and reduce damage from a tsunami hazard. ☐ Interpret and analyze patterns in large data sets (maps) of the history of natural hazards in regions and use this information to forecast future risk; ☐ Communicate scientific and technical information about a system designed to meet the criteria and constraints for communicating with identified stakeholder groups about a natural hazard

Grade 8 Science : Unit 3 - Plate Tectonic and Rock Cycling

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

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.

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.

3.3.6-8.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.G - Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, "What causes Earth's surface to change?"

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ We can infer Earth's planetary history by features we observe today.
- ☐ Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and biosphere).
- ☐ Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and biosphere).
- ☐ Plate tectonics explains the past and current movements and features of the rocks at Earth's surface.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do people reconstruct and date events in Earth's planetary history?
- ☐ How and why is Earth constantly changing?
- ☐ How do Earth's major systems interact?
- ☐ Why do the continents move, and what causes earthquakes and volcanoes?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ ESS1.C. The History of Planet Earth The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analysis of rock strata and the fossil record provide only relative dates, not an absolute scale.
- ☐ ESS2.A. Earth's Materials and Systems All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop a model showing what is happening at a scale larger than we can see (patterns) to help explain what happened to the different mountains to (cause) them to change (in elevation and/or location).
- ☐ Construct and defend an argument that earthquakes either caused or are correlated to the elevation and location changes of mountains.
- ☐ Develop and use models to describe the structure, composition, and temperature of materials below the surface of Earth, and some of the processes (pressure and heat) that cause changes to those earth materials.

	energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. ☐ 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. These interactions have shaped Earth's history and will determine its future. ☐ ESS2.C. The Roles of Water in Earth's Surface Processes Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. ☐ ESS1.C. The History of Planet Earth Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. ☐ ESS2.B. Plate Tectonics and Large-Scale System Interactions 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.	☐ Develop a profile model across the North American plate to explain the changes seen in bedrock after an earthquake by showing what is found at and below the observable surface. ☐ Analyze a graphical display of a large data set of plate movement in order to determine whether a causal or correlational relationship exists between plate movement and mountain movement. ☐ Construct an argument supporting a model of how plate interactions could cause mountains and earthquakes. ☐ Apply scientific ideas and evidence to construct an explanation for the processes that cause some of the large scale interactions of Earth's plates that result in the effects (volcanoes) of those interactions. ☐ Construct an explanation using representations on the Causal Chain of Events poster to explain how the causal (not correlational) events lead to a mountain changing in elevation or location. ☐ Construct an explanation of changes in the global position of land masses over time including reasoning that shows how rock strata and fossil evidence adequately supports a map of where Earth's land masses (parts of plates that were not created or destroyed as plates were moving) were located millions of years ago. ☐ Construct an explanation based upon prior investigations and evidence that gradual changes have caused marine fossils to become exposed on mountains due to erosion (accumulating) over time, and those gradual changes will lead to the destruction of the marine fossils due to erosional processes over time. ☐ Explain a complex phenomenon (marine fossils on Mt. Everest) by integrating concepts of tectonic uplift, erosion rates, and the idea of gradual changes over long periods leading to observable effects

Grade 8 Science : Unit 4 - Earth's Resources and Human Impact

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

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.

3.3.6-8.M - Apply scientific principles to design a method for monitoring and minimizing a 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.

3.3.6-8.O - Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

3.4.6-8.E - Collect, analyze, and interpret environmental data to describe a local environment.

3.4.6-8.I - Construct an explanation that describes regional environmental conditions and their implications on environmental justice and

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, "How do changes in Earth's system impact our communities and what can we do about it?"

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ All materials, energy, and fuels that humans use are derived from natural sources, some of which are renewable over time and others are not.
- ☐ Human activities in agriculture, industry, and everyday life have an impact on the land, rivers, ocean, and air.
- ☐ Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.
- ☐ Environmental justice plays an important role in providing equitable protection from environmental hazards or concerns for all people.
- ☐ The environment provides multi-faceted opportunities to develop and apply interdisciplinary literacy skills to investigate complex issues at various scales.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do Earth's surface processes and human activities affect each other?
- ☐ How do humans depend on Earth's resources?
- ☐ How do humans change the planet?
- ☐ What regulates weather and climate?
- ☐ How can conducting local field investigations lead to identifying, understanding, and addressing environmental issues in my community?
- ☐ How do human actions impact environmental justice issues for individuals and communities?
- ☐ How do human actions impact the equitable access, use, and disposal of natural resources?
- ☐ How do investigations of local environmental issues expand understanding and facilitate potential solutions to other local, regional, and/or global environmental issues?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ ESS3.A. Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop a model to explain what could cause an increase in temperatures that are linked to an increase in floods and droughts.
- ☐ Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal patterns in temperature, total

social equity. 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.C Develop a model to describe how watersheds and wetlands function as systems, including the roles and functions they serve*	the planet as a result of past geologic processes. ☐ ESS3.C. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. ☐ ESS3.C. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered otherwise. ☐ ESS3.D. Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding human behavior and applying that knowledge wisely in decisions and activities. ☐ ETS1.B. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	precipitation, and seasonal precipitation in the local community and at case sites. ☐ integrate scientific information with media and graphical displays of data to clarify how a small change in temperature affects components of Earth's water system. ☐ Construct a scientific explanation based on evidence for how rising temperatures affect the water cycle and components of the water system in a chosen community. ☐ Develop and use a model to describe how greenhouse gas molecules respond to energy transfer from Earth to the atmosphere and cause the temperatures to rise. ☐ Analyze and interpret data on graphs of carbon dioxide levels collected from ice cores to collect evidence of whether the changes in these levels are cyclical in nature and a normal occurrence or are changing at an non-normal rate. ☐ Integrate qualitative and quantitative scientific information in written text with digital tools to analyze trends of atmospheric CO2 levels, energy consumption, and human population over time to determine a correlation between human activities and CO2 emissions. ☐ Apply mathematical concepts to quantify the carbon imbalance caused by human activities, particularly fossil fuel combustion, against natural carbon removal processes.. ☐ Construct an argument supported by science ideas to refute and clarify claims through an explanation of the causal chain of events between the changing climate and water resources. ☐ Apply scientific principles to design a process/system that the school can undertake to reduce the vulnerability to climate change impacts (e.g., high heat, changing water resources) in the short-term and contribute to rebalancing carbon in the long-term

Grade 8 Science : Unit 5 - Earth in Space

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

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.R - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

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 motions within galaxies and the solar system.

3.3.6-8.C - Analyze and interpret data to determine scale properties of objects in the solar system.

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, "How are we connected to the patterns we see in the sky and space?"

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ All forces between objects, regardless of size or direction, arise from only a few types of interactions.
- ☐ Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave pattern of changing electric and magnetic fields that interact with matter.
- ☐ We can infer information about stars based on observations we make from Earth.
- ☐ Observations of the sky can be explained by predictable patterns of the movement of Earth, moon, sun and planets.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ What underlying forces explain the variety of interactions observed?
- ☐ What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?
- ☐ What is the universe, and what is Earth's place in it?
- ☐ What are the predictable patterns caused by Earth's movement in the solar system?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ ESS1.A. The Universe and Its Stars Patterns of the apparent motion of the Sun, the Moon, and stars in the sky can be observed, described, predicted, and explained with models. Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.
- ☐ ESS1.B. Earth and the Solar System 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. This model of the solar system can explain eclipses of the Sun and the Moon. Earth's spin axis is fixed in

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop an initial model of systems in space to describe patterns we observe in the sky.
- ☐ Develop and use models of the Earth-Sun system to explain the cause-and-effect relationships between Earth's tilt, solar elevation, and sunlight energy on Earth's surface to explain seasonal temperature differences.
- ☐ Develop and use a model of the Earth-Sun-Moon system to explain and predict patterns we observe in the way the apparent shape of the Moon changes over time.
- ☐ Develop and use a model of the Earth-Sun-Moon system to explain why and when we can see a solar eclipse.

	direction over the short-term but tilted relative to its orbit around the Sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. ☐	☐ Evaluate the limitations of our system model predicting what we would see during a lunar eclipse. ☐ Develop and use a model of light in the Earth-Sun-Moon system to describe why the Moon changes color during a lunar eclipse. ☐ Analyze and interpret data to identify patterns in and between different scale properties for planets and some of their moons in our solar system (including relative size, orbital distance from the Sun, surface features, if any, and atmosphere). ☐ Use a simulation of a two-object system to produce data that can be analyzed to identify patterns to determine how changes in the mass or distance between the objects in the system affects the strength of gravitational forces between those objects in space. ☐ Develop and map evidence from written and media sources to support the claim that the solar system formed from a disk of gas and dust, drawn together by gravity that was once chaotic but has become more stable over time. ☐ Develop a model of the universe that shows how gravity forces cause the patterns of motion and organization of objects in space systems at multiple scales.