East Penn School District
Curriculum and Instruction

Curriculum for: Meteorology

Course(s): Meteorology

Grades: 10-12

Department: Science

Length of Period (average minutes): 42

Periods per cycle: 6

Length of Course (yrs): 0.5

Type of offering: elective

Credit(s) awarded: 0.5 4.0/4.0

Developed by: Michael Mihalik

ADOPTED: 2018

Enduring Understandings	Essential Questions	Knowledge	Skills	Standards
• Understanding the past is critical towards our efforts to better predict the future. • Climate is what we expect, but weather is what we get. • Life on Earth depends on weather and climate.	• How does the weather affect me? • What connections are there between the changing Earth, evolution of life, and our changing atmosphere?	• Earth's current atmospheric composition and how it has changed greatly since Earth's creation. • Weather affects many aspects of life on Earth. • How the human body changes with changes in the atmosphere. • Properties of air change with changes in elevation. • Weather and climate share the basic elements (temperature, humidity, cloudiness, precipitation, air pressure, winds), but differ in scale. • Ozone's role/function and threats.	• Creating a vertical profile of the atmosphere • Identifying various events on Earth's timeline that had worldwide climatic effects • Conducting a weather analysis comparing weather forecasters • Recognizing various weather/climate effects on daily life • Distinguishing between weather and climate and name the basic elements of weather and climate	NGSS Standards: • HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
• The water cycle is essential to all forms of life on Earth. • The carbon cycle is a natural cycle disrupted recently by human activities.	• How does water move? • How does carbon move? • How do cycles and Earth systems affect all forms of life?	• The different phases of water, why changes happen, and places it can be within the water cycle • Ways that humidity is represented and changes (absolute	• Modeling the movement of water and carbon in their respective cycles • Calculating dew point temperatures and relative	NGSS Standards: • HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere,

		humidity, relative humidity, and dew point) ● When air expands, it cools. The rate at which it cools is dependant upon the air being dry or wet. ● Various mechanisms of lifting (orographic lifting, localized convective lifting, convergence, and front wedging create rising air currents) ● Locations in the Earth that are reservoirs for carbon and water	humidity ● Calculating temperature changes according to dry adiabatic and wet adiabatic lapse rates ● Plan and conduct a precipitation analysis comparing locations throughout the U.S. ● Using a psychrometer to investigate dry- and wet-bulb temperatures to calculate relative humidity	and biosphere. ● HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. ● HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
● Energy transfers from the sun and aspects of Earth's surface determine climate and local temperatures.	● Why/how do seasons and temperatures change? ● What would the world be like without heat transfers?	● Resulting changes from the changing angle of incoming light ● Differences and importance of latent and sensible heat ● Solar budget, including the albedo of surface and atmospheric materials ● Characteristics of the materials absorbing the energy such as color, texture,	● Modeling changes in incoming light to surface temperature changes ● Identifying the 3 types of heat transfer based on solid/gas/liquid ● Correlating approximate hours of daylight for various locations on Earth to sun angle	NGSS Standards: ● HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

		transparency, state of matter, and specific heat. ● A location's climate is influenced by latitude, proximity to water, ocean currents, prevailing winds, vegetative cover, elevation, and mountain ranges.	● Determining sun's direct ray, noon sun angle, and solar intensity ● Converting temperature from Fahrenheit to Celsius ● Calculating temperature changes with changes in elevation	
● Climate is regulated by complex interactions among different factors in various Earth systems.	● What effect do I have on the climate? ● What effect does the climate have on us? ● Why is the climate changing?	● The Greenhouse Effect is a natural phenomena that makes Earth habitable, but also linked to global warming. ● Oxygen isotope ratios in ice core data tell us about past climates ● More than half of the carbon released by humans is absorbed by new plant matter or dissolved in the oceans. 45% remains in the atmosphere for decades. ● Earth has experienced natural changes in the climate and human-induced	● Calculating their own carbon footprint ● Differentiating and calculating the differences between natural and anthropogenic carbon ● Discussing hypotheses that relate to natural causes of climate change ● Analyzing ice core data and climatic changes ● Contrasting positive- and negative-feedback mechanisms ● Identifying their	NGSS Standard: ● HS-ESS3-5. Analyze geoscience data and the results from global climate change models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. ● HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

		changes ● Positive-feedback mechanisms reinforce the initial change (melting of sea ice equals decreasing albedo) and negative-feedback mechanisms counteract the initial effect (more clouds blot out more radiation, which leads to cooling) ● In the future, Earth's surface temperature is likely to continue to rise. Sea levels are predicted to rise. Populations are likely to rise. Sea ice cover and permafrost will likely decrease.	own views on climate change and being able to consider natural and human causes	
● Water's ability to move is essential to life. ● There is more to the sky than what is seen by the eye.	● What would the world be like without condensation and/or precipitation? ● Why do we see what we see in the sky?	● Precipitation and condensation are results of various conditions and can be seen on a skew-t log-p diagram ● Form and height are the basis for naming clouds ● The relationships between physical geography and	● Identifying the reasons for different cloud types and associated weather effects ● Describe the conditions necessary for all types of precipitation and condensation	NGSS Standards: ● HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

		precipitation/condensation ● A rain gauge is the standard instrument used to measure rainfall ● Each cloud is associated with certain predictable weather	● Using a prediction chart to know what various clouds mean for forecasting ● Creating a forecast after analyzing and interpreting a skew-T log-P diagram ● Designing and building a rain gauge to accurately measure rainfall	
● Unequal heating of Earth sets the atmosphere into motion.	● How does air move locally and globally? ● How can humans use wind to improve life? ● What is the influence of wind?	● Wind is the horizontal movement of air from difference in air pressure and is also controlled by friction and the Coriolis Effect ● Air pressure is a force exerted by the weight of the air above ● High pressure and low pressure have varying associated weather and ways in which the air moves ● Air pressure affects the human body and performance in many types of objects ● El Nino (ocean warming in the Eastern Pacific and	● Analyzing/coding information from a station model ● Recognizing rising/sinking air masses based on areas of high and low pressure ● Interpreting isobars on weather maps ● Identifying local winds and the way they are formed and why they work ● Recognizing atmospheric pressure effects on the human body and objects	NGSS Standards: ● HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. ● HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

		associated with strong eastward-moving equatorial currents) and La Nina (colder surface temperatures in the Eastern Pacific and associated with strong westward-moving equatorial currents)		
• Observable weather at the surface is a result of atmospheric events we cannot see with the eye	• Why does weather change? • Where do air masses originate and travel to? • How do we see weather patterns and project their path?	• Different weather maps show us air masses and fronts • Day-to-day weather depends on the temperature, stability, and moisture content of an air mass affecting our region • Classification of an air mass depends on latitude and moisture content, which determines observable weather • Fronts are boundary surfaces that separate air masses (warm, cold, stationary, occluded) • The different types of fronts all bring different observable weather	• Identifying air masses and fronts based on different types of data (temperature, dew points, etc...) and associated weather • Forecasting weather based on weather patterns and fronts • Reading, interpreting, and using weather models to create a prediction	NGSS Standards • HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. • HS-ESS3-5. Analyze geoscience data and the results from global climate change models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

● Humans have made severe storms more severe ● Some storms are more predictable than others	● Why do storms occur? ● How will humans deal with storms in the future?	● There are multiple types of thunderstorms including air-mass thunderstorms, severe thunderstorms, and supercells. ● Conditions necessary to sustain thunderstorm, tornado, and hurricane development ● Loss of property, personal injury, and loss of life can be reduced by effective emergency procedures. ● The formation and structure of different storms and what conditions fuel their growth ● Hurricanes are associated with storm surge, torrential rains, and flooding ● Global warming will likely enhance the conditions that promote storm development	● Using atmospheric observations of the sky to recognize different stages of thunderstorm development ● Using weather maps and models to forecast incoming storms ● Building a structure to withstand hurricane-speed winds ● Recognizing land-use strategies and the effects of those decisions with regards to future storms	NGSS Standards: ● HS-ESS3-6. Use a computational representation to illustrate the relationship among Earth systems and how these relationships are being modified due to human activity. ● HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

Materials and Resources: **internet Resources**