Overview of Year '16 - '17

8th Grade Concept Physics Curriculum

SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
Energy of Matter		Energy of Motion & Forces		Astronomy		Energy of Light and Sound		Energy of Life	

Unit 1: Energy of Matter

Transfer Goal:

Pt. 1: Create a model to explain why a ball can't fit through a metal ring until after the ring is heated based on knowledge of physical properties.

Pt. 2: Students will be able to create evidence arguments (tenacity, think purposefully and advocate) explaining how matter can be transformed by matter.

Students will be able to use both engineering and science skills, practices and content to create a door that is resistant to changes in energy levels (thinking purposefully).

Essential question

Why won't my door shut in the winter / why can't I open my window in the summer?

Why are there so many different kinds of matter? (What makes one material different from another)

Standards:

3.1a Substances have characteristic properties. Some of these properties include color, odor, phase at room temperature, density, solubility, heat and electrical conductivity, hardness, and boiling and freezing points.

3.1c The motion of particles helps to explain the phases (states) of matter as well as changes from one phase to another. The phase in which matter exists depends on the attractive forces among its particles.

Temperature is a direct measurement of the average kinetic energy of the particles in a sample of material. It should be noted that temperature is not a measurement of heat.

3.1d Gases have neither a determined shape nor a definite volume. Gases assume the shape and volume of a closed container.
3.1e A liquid has a definite volume, but takes the shape of a container.
3.1f A solid has a definite shape and volume. Particles resist a change in position.
3.1h Density can be described as the amount of matter that is in a given amount of space. If two objects have equal volume, but one has more mass, the one with more mass is denser.

Understanding:

All things are made out of particles which have energy. This is called matter.

Matter can be transformed by energy. This is often reflected in differences in density.

Properties of a material are determined by the energy of its particles.

Models can be used to explain changes in states of matter.

Elements/matter can be organized based on similar properties and this organizational scheme is the Periodic Table.

Engineering practices help solve problems and to every engineering solution has its pros and cons that need to be considered before taking action.

3.2a During a physical change a substance keeps its chemical composition and properties. Examples of physical changes include freezing, melting, condensation, boiling, evaporation, tearing, and crushing. 3.3a All matter is made up of atoms. Atoms are far too small to see with a light microscope. 3.3b Atoms and molecules are perpetually in motion. The greater the temperature, the greater the motion. 3.3c Atoms may join together in well-defined molecules or may be arranged in regular geometric patterns. 3.3d Interactions among atoms and/or molecules result in chemical reactions. 3.3e The atoms of any one element are different from the atoms of other elements. 3.3f There are more than 100 elements. Elements combine in a multitude of ways to produce compounds that account for all living and nonliving substances. Few elements are found in their pure form. 3.3g The periodic table is one useful model for classifying elements. The periodic table can be used to predict properties of elements (metals, nonmetals, noble gases).	
Performance Task: Pt. 1: Create a written/drawn model that demonstrates how the properties of a metal ring's particles change when heated. Pt. 2. The curriculum embedded task for this unit has students construct large- evidence based explanations (Thompson et al., 2009) based on their answer to the question "Why won't my door just stay shut?! What is matter and how is it transformed by energy?" This large scale explanation will serve as an engineering proposal (combining both engineering and science practices and content) for a door most resistant to changes in energy. Students will receive different material and weigh both the engineering and scientific pros and cons of the material for making the ideal door that won't "get stuck" in the summer. Following these proposals students will pick one material that they determine to be "best" from the class (in terms of both engineering and science) and design a proposal to send the material to the International Space Station to allow NASA astronauts to perform student designed experiments on the	**Criteria for performance task:** -Definition of matter & the states of matter -Explanation of how matter is organized on P.T. -Create particle diagram for each state of matter. -Definition of density. -Properties of metals, nonmetals, and gases. -Distinguish between elements, compounds, and molecules. For a specific compound/element: -Identify family/group of element(s). -Describe following properties: Density, color, luster, boiling/freezing points, insulation, conduction, state at room temp, malleability, expansion/contraction, atomic number & mass, properties unique to material. -Create atomic model including protons, neutrons, & electrons in appropriate locations with appropriate charges. -Calculate mass based on density and volume.

material to see if it behaves the same when in the presences of varying energy in zero gravity.	-Calculate cost. Makes claim citing appropriate evidence with key vocabulary. -include pros and cons of both unseen and seen properties of both materials.

Unit 2: Energy of Motion and Forces

Transfer Goal: Determine if there is a speeding problem on a nearby street by investigating distance traveled over time. Determine the purpose of safety equipment in a car based on understanding of Newton's laws (advocate for self and other and thinking purposefully)	**Essential question:** How can we represent the motion of an object? How do we know how/where something will move?
Standards: 5.1b The motion of an object can be described by its position, direction of motion, and speed (rate of change). · 5.1c An object's motion is the result of the combined effect of all forces acting on the object. · A moving object that is not subjected to a force will continue to move at a constant speed in a straight line. An object at rest will remain at rest. · 5.1e For every action there is an equal and opposite reaction. · Mass is the amount of matter ("stuff") that an object is made of. Weight is the force felt by an object due to gravity 5.1d Force is directly related to an object's mass and acceleration. The greater the force, the greater the change in motion. 5.2a Every object exerts gravitational force on every other object depending on its mass and how far apart they are. 5.2c Friction is a force that opposes motion.	**Understanding:** Energy and matter interact through forces that result in changes in motion. The motion of an object can be represented and predicted by its position and speed. Speed is the rate of change. -Newton's First law is the law of inertia. An object at rest or in motion will remain that way unless a force acts upon it · Newton's second law says that when an object fells an unbalanced net force its motion changes· Newton's third law state that for every applied force there is an equal and opposite force. An object's kinetic energy is determined by its mass and speed. Potential energy is energy "stored" based on an object's position.
Performance Task: Students will create and conduct an investigation to determine whether there is a speeding problem on a nearby street by measuring the distance traveled over time of passing cars. Create a Piktochart that demonstrates how each one of Newton's laws are involved in engineering design of car safety	**Criteria for performance task:** -Design a method for determining the speed of a car. Accurately measure the distance traveled over time of ___ cars and calculate the speed of each car. Create a visual representation of data (graph, table, etc). Make a claim based on evidence regarding speeding problem. -Piktochart includes an explanation for each of Newton's laws and how they apply to the activity. A free body diagram is included and

	referenced in each case that accurately demonstrates the forces involved.

Unit 3: Astronomy

Transfer Goal:	**Essential question:**
The goal of this unit is to investigate energy, its impact on astronomical events and how these astronomical events impact us. This unit will culminate in students demonstrating understanding of both astronomical motions and the way energy impacts these motions through a debate where students consider the pros and cons of developing technology to deflect near earth asteroids into orbit with Earth. This will include students considering the energy transfer that would occur if the asteroids were to actually enter our atmosphere and collide with Earth. Students will be able to create evidence arguments explaining should near Earth asteroids be deflected and what the potential engineering, scientific and human consequences (both positive and negative) this decision could make for Rochester, NY (Thinking purposefully, advocating for self and others).	What's "out there" (in outer space), what's it doing, and how do we know? Can we sustain life on Earth? Should energy be used to deflect near Earth asteroids.

Standards:	**Understanding:**
1.1d Gravity is the force that keeps planets in orbit around the Sun and the Moon in orbit around the Earth. 1.1e Most objects in the solar system have a regular and predictable motion. These motions explain such phenomena as a day, a year, phases of the Moon, eclipses, tides, meteor showers, and comets. 1.1a Earth's Sun is an average-sized star. The Sun is more than a million times greater in volume than Earth. 1.1b Other stars are like the Sun but are so far away that they look like points of light. Distances between stars are vast compared to distances within our solar system. 1.1c The Sun and the planets that revolve around it are the major bodies in the solar system. Other members include comets, moons, and asteroids. Earth's orbit is nearly circular. 1.1g Moons are seen by reflected light. Our Moon orbits Earth, while Earth orbits the Sun. The Moon's phases as observed from Earth are the result of seeing different portions of the lighted area of the Moon's surface. The phases repeat in a cyclic pattern in about one month. 1.1h The apparent motions of the Sun, Moon, planets, and stars across the sky can be explained by Earth's rotation and revolution. Earth's rotation causes the length of one day to be approximately 24 hours. This rotation also causes the Sun and Moon to appear to rise	Celestial objects move in predictable and cyclical ways that impact Earth and Rochester more specifically. The sun is the main source of energy for the Earth and Rochester changes throughout the year based on the tilt of the Earth and its predictable motion around the Sun. The night sky in Rochester, NY changes over time based on the moon's predictable and cyclical motion around Earth. The rotation of Earth around its axis changes Rochester, NY throughout the day. The motion of asteroids in our solar system are cyclical and predictable. Altering these orbits for our benefit can change Rochester, NY in the future/forever.

along the eastern horizon and to set along the western horizon. Earth's revolution around the Sun defines the length of the year as 365 1/4 days. 1.1i The tilt of Earth's axis of rotation and the revolution of Earth around the Sun cause seasons on Earth. The length of daylight varies depending on latitude and season. 1.1j The shape of Earth, the other planets, and stars is nearly spherical. 4.1a The sun is the major source of energy for earth. 5.2a Every object exerts gravitational force on every other object. Gravitational force depends on how much mass the objects have and how far apart they are. Gravity is one of the forces acting on orbiting objects and projectiles.	

Performance Task: Students will be able to create evidence arguments explaining should near Earth asteroids be deflected and what the potential engineering, scientific and human consequences (both positive and negative) this decision could make for Rochester, NY.	**Criteria for performance task:** -Definition of gravity and energy involved with celestial motions. -Identification of various celestial bodies in the solar system and how they impact Rochester, NY. -Description of how astronomical motions currently impact the energy received by Rochester, NY throughout different time lengths (year, month and day). -Transfer of how humans changing predictable motions of celestial bodies can impact both Rochester currently and in the future.

Unit 4: Energy of Life (Ecology)

Transfer Goal: Create a model demonstrating how energy is transferred to an owl in its ecosystem based on its pellets and how this relates to overall energy transfer in Rochester, NY. Explain how the actions of humans have directly and indirectly affected the flow of energy in an ecosystem and what we can do going forward in making ecological and environmental decisions (think purposefully, be tenacious and advocate for self and others).	**Essential question:** Why do we need energy and where does our energy come from?

Standards: 5.1c All organisms require energy to survive. 5.1d. The methods for obtaining nutrients vary among organisms. Producers, such as green plants, use light energy to make their food. Consumers, such as animals, take in energy-rich foods.	**Understanding:** Energy and matter flow from one organism to another. Energy enters ecosystems as sunlight, and is eventually lost from the community to the environment, mostly as heat.

5.1e Herbivores obtain energy from plants. Carnivores obtain energy from animals. Omnivores obtain energy from both plants and animals. Decomposers, such as bacteria and fungi, obtain energy by consuming wastes and/or dead organisms. 6.1a Energy flows through ecosystems in one direction, usually from the sun, through producers to consumers and then to decomposers. This process may be visualized with food chains or energy pyramids. 6.1b Food webs identify feeding relationships among producers, consumers, and decomposers in an ecosystem. 6.2a Photosynthesis is carried on by green plants and other organisms containing chlorophyll. In this process, the Sun's energy is converted into and stored as chemical energy in the form of a sugar. 6.2c Green plants are the producers of food which is used directly or indirectly by consumers. 7.1e The environment may contain dangerous levels of substances (pollutants) that are harmful to organisms. Therefore, the good health of environments and individuals requires the monitoring of soil, air, and water, and taking steps to keep them safe. 4.1c Most activities in everyday life involve one form of energy being transformed into another. For example, the chemical energy in gasoline is transformed into mechanical energy in an automobile engine. Energy, in the form of heat, is almost always one of the products of energy transformations.	Energy cannot be created or destroyed, but only changed from one form to another. Some energy is always converted into heat in a transformation process.
Performance Task: Create a model demonstrating how energy is transferred to an owl in its ecosystem based on its pellets. Use this understanding as a platform for overall energy transfer in Rochester, NY and relate this to the environmental issue of dumping waste into our waterways. Students advocate for their community based on their understanding of ecosystems and energy transfer.	**Criteria for performance task:** Create an accurate food chain model that demonstrates how energy moves through the ecosystem to the owl, beginning with a producer and ending with the owl. Students create a model demonstrating how energy is transferred through their local ecosystem, including its original source (sun) and eventual form (heat). Based on the model, students explain how our actions have directly and indirectly affected the flow of energy in the ecosystem.

Unit 5: Energy of Sound and Light (Waves)	
Transfer Goal: Relate and describe the perception of a wave (observable characteristics) to its properties (frequency, amplitude) and how this impacts their ability to hear the songs they love (think purposefully, advocate for self and others).	**Essential question:** How does sound/light get from one place to another (instrument to ear/lamp to eyeball)?
Standards: 4.4a Different forms of electromagnetic energy have different wavelengths. Some examples of electromagnetic energy are microwaves, infrared light, visible light, ultraviolet	**Understanding:** Observe and describe the properties of sound and light

light, X-rays, and gamma rays. 4.4b Light passes through some materials, sometimes refracting in the process. Materials absorb and reflect light, and may transmit light. To see an object, light from that object, emitted by or reflected from it, must enter the eye. 4.4c Vibrations in materials set up wave-like disturbances that spread away from the source. Sound waves are an example. Vibrational waves move at different speeds in different materials. Sound cannot travel in a vacuum.	A wave is a disturbance that travels through space and transfers energy Waves transfer energy. Frequency changes observed characteristics. Motion relative to a wave source affects perception of wave. *Doppler shift can tell us if something is getting closer and further away (even celestial objects)*

Performance Task: Relate frequency of sound wave to color. Scholars listen to a segment of music, represent the sound waves in that segment with related colors from EM spectrum.	**Criteria for performance task:** Identify higher pitch -> greater frequency -> move up color spectrum Higher volume -> greater amplitude