Subject: Conceptual Physics Grade: 8th Unit #: 1 Title: Energy of Matter

UNIT OVERVIEW

<table>
<tr><th colspan="3">STAGE ONE: Identify Desired Results</th></tr>
<tr><td rowspan="4">Established Goals/ Standards

Standards found within P.I. 1.1 “Earth and the Solar System” from the NYS Intermediate Level Science Standards.</td><td colspan="2">Long-Term Transfer Goal</td></tr>
<tr><td colspan="2">At the end of this unit, scholars will use what they have learned to independently…
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.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>Enduring Understandings
Students will understand that…

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.</td><td>Essential Questions
Students will consider such questions as…
● What is out there and how do we know?
● How can we predict the movement of celestial objects in space? How do we investigate these things so far away from Rochester, NY? What type of energy and forces are involved in these motions?
● Where does all our energy originate in Rochester, NY?
● How does the revolution of the Earth around the Sun cause the energy in Rochester, NY to change throughout the year?
● How does the movement of the moon around Earth cause the night sky in Rochester, NY to change over time? (Citing forces and energy).
● How does the movement of Earth on its axis cause relative energy reaching Rochester, NY to change throughout the day?
● Can we sustain life on Earth? Should energy be used to deflect near Earth asteroids into Earth’s orbit for resources</td></tr>
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		and a “way out”?
	Acquisition	
	What knowledge will students learn as part of this unit? ● Gravity is the force that keeps planets in orbit around the Sun and the Moon in orbit around the Earth. ● 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. ● Earth’s Sun is an average-sized star. The Sun is more than a million times greater in volume than Earth. ● 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. ● 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. ● 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. ● 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	*What skills will students learn as part of this unit?* ● Create models of celestial bodies. ● Utilize models to explain complex and abstract astronomical motions. ● Use real data from astronomers to make informed decisions ● Craft scientific evidence-based explanations based on department rubric. ● Using evidence to craft and utilize evidence in scientific argumentation in a debate. ● A use of engineering processes in decision making.

	and Moon to appear to rise 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. ● 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. ● The shape of Earth, the other planets, and stars is nearly spherical. ● The sun is the major source of energy for earth. ● 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.	

STAGE TWO: Determine Acceptable Evidence	
	Assessment Evidence
Criteria to assess understanding: *(This is used to build the scoring tool.)* -Definition of gravity and energy involved with celestial motions.	**Performance Task focused on Transfer:** 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.
-Identification of various celestial bodies in the solar system and how they impact Rochester, NY. -Description of how astronomical motions currently impact the energy	**Other Assessment Evidence:** Unit ILST style quiz Daily Bridge Daily Summary/Closure Questions Daily Extended learning Activities Investigations & writeups Teacher observations

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.	

T, M, A *(Code for Transfer, Meaning Making and Acquisition)*	**STAGE THREE: Plan Learning Experiences**
A: Acquisition M: Meaning Making T: Transfer	Daily Evidence of learning: *(formative assessment)* Summary + Closure at end of each lesson utilizing the "Workshop Model". Investigation reports if applicable.
1. A, M 2. A, M 3. A, M 4. A,M 5. A,M 6. A,M, T 7. A,M 8. A,M,T 9. M,T 10. M,T 11. M,T 12. M,T 13. A, M, T 14. T	Learning Events: **Day 1) Geologic Time:** Students will work in groups of two and will play a "game". Students will be required to create a visual representation of the geologic time scale from big bang to present using several checkpoints. Students will be told that they have a fifteen minute time period to complete the entire timescale and answer questions. Each time limit will correspond to a certain period of time. Students will need to come up with a way to represent each time period. Students are introduced to the project. **Day 2-3) What is out there and how do we know? How can we predict the movement of celestial objects in space? How do we investigate these things so far away from Rochester, NY? What type of energy and forces are involved in these motions? Students will now change their focus to outer space and look at how what is "out there" causes Rochester, NY to change over time.** Students will rotate through 7 stations that help understand what is out there and how we know about it. This ranges from the SETI program to the development of the heliocentric model and telescope. This will introduce them to the various celestial bodies. **Day 4: Where does all our energy originate in Rochester, NY?** Investigating the Sun through a station activity. **Day 5) Apparent Motion How does the movement of Earth on its axis cause relative energy reaching Rochester, NY to change throughout the day?** The mini-lesson aims to have students "experience" a sunrise. As a group we will recreate the sunrise by having each student spin at various intervals. The meaning of rotation will also be covered. Use of a map is modeled. Students use a map with timezones and their experience in the mini-lesson to answer questions. They will apply their knowledge in the mini-lesson to solve problems. **Day 6) Revolution: How does the revolution of the Earth around the Sun cause the energy in Rochester, NY to change throughout the year?** Students work in groups to "discover" how the revolving earth causes the seasons. They will do this by utilizing a earth, sun, moon model. As groups students will come up with their theory for how the revolving earth causes the seasons. This will include the first practice transfer activity to answer the overarching transfer goal.

	Day 7) Celestial Body: Moon How does the movement of the moon around Earth cause the night sky in Rochester, NY to change over time? (Citing forces and energy): The mini-lesson goes over the formation of the moon and recaps how the moon revolves around the earth. The way the sun revolves around the Earth is modeled for the whole class in the front of the room with a student's head serving as Earth a light serving as the sun and a ball serving as the moon. I will show different phases. Students rotate through several stations, each focusing on different phases of the moon, eclipses and tides. They will construct a theory for the phases of the moon by the end of the lesson. **Day 8) Transfer Students read a passage from Carl Sagan's a Pale Blue Dot and use other resources on the computer to prepare for a debate on whether developing technology to deflect near Earth Asteroids is ethically "OKAY" or too dangerous if it gets into the wrong hands.** **Day 9, 10) Transfer: Can we sustain life on Earth? Should energy be used to deflect near Earth asteroids into Earth's orbit for resources and a "way out"?** Students independently construct a large scale evidence based explanation utilizing criteria and rubric addressing the performance assessment and curriculum embedded assessment. **Day 11) Debate Preparation:** Students "pick" sides and prepare/are scaffolded for the debate on deflecting near-Earth Asteroids. **Day 12) Transfer task:** Debate on defecting near-Earth Asteroids. **Day 13)** Review for formal exam utilizing a metacognitive review technique dealing with diagram deconstruction. **Day 14) Exam based on past NYS assessments.**
