Grade 8 Science Units:

Energy and Waves (FOSS)

By middle school, students have heard about waves but likely have had little science instruction on the topic. This is developmentally appropriate, because the fundamental characteristics that describe wave behavior and properties are described in terms of mathematical relationships and graphical models that are best suited for students in middle school.

This puts teachers of **FOSS Waves** in an exciting position, with the opportunity to delve into new content and challenge students to think about concepts they have never considered before. And the content of FOSS Waves is equally exciting to students as they manipulate springs and lasers to determine properties that eventually will be used to explain how their cell phones work. The classroom will be abuzz with excitement throughout this course.

The course proceeds from the most concrete observations, those of physical properties of mechanical waves, to the most abstract concepts, by which students develop a model of electromagnetic waves. Students will also delve into engineering applications and real-life connections along the way. Students leave this course with a greater appreciation and understanding of modern communications technology and a solid foundation for high school and college physics. The driving question for the course is how is energy transferred through waves?

- **MS-PS4-1. 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.**
- **MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.**
- **MS-PS4-3. 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.**
- **MS-PS2-5. 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.**

Weather and Water/Evolution (FOSS)

The **FOSS Weather and Water** unit focuses on Earth's atmosphere, weather, and water. A good understanding of meteorology as an earth science isn't complete without an introduction to the physics and chemistry that drive weather. Understanding weather is more than reading a thermometer and recording air-pressure measurements. The course consists of nine investigations. Students first learn about atoms and molecules, changes of state, and heat transfer. Then they investigate the water cycle, air masses, and fronts, winds and severe weather.

- **MS-ESS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.**
- **MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.**
- **MS-ESS2-6. 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.**
- **MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.**
- **MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.**

- **MS-LS4-5. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.**
- **MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.**

Human Impact

The Human Impact unit helps students formulate an answer to questions such as: "How is the availability of needed natural resources related to naturally occurring processes, How can natural hazards be predicted, How do human activities affect Earth systems, How do we know our global climate is changing?" The ESS3 Disciplinary Core Idea from the NRC Framework is broken down into four sub-ideas: natural resources, natural hazards, human impact on Earth systems, and global climate change. Students understand the ways that human activities impacts Earth's other systems. Students use many different practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of their development. The crosscutting concepts of patterns, cause and effect, and stability and change are called out as organizing concepts for these disciplinary core ideas. In the ESS3 performance expectations, students are expected to demonstrate proficiency in asking questions, developing and using models, analyzing and interpreting data, constructing explanations and designing solutions and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

- **MS-ESS3-1. 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.**
- **MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.**
- **MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**
- **MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.**
- **MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.**

Astronomy/Planetary Science (FOSS)

The **FOSS Planetary Science** unit focuses on the anchor phenomenon of Earth as an object in space. The driving question for the course is what is my cosmic address? Astronomy is the study of everything we can observe and imagine beyond Earth—the Moon, the Sun, the solar system, the Milky Way, and the vastness of the cosmos. Astronomers ask fundamental questions: When and where did the universe start? Why is it expanding? What is its destiny? Astronomers endeavor to answer these questions by determining the kinds and numbers of objects in the cosmos, their composition, their motions, and their interactions with one another. Because Earth is part of this ultimate system, the science of astronomy includes the study of our own planet.

Astronomers are the pioneers who travel back in time along paths of light reaching out to Earth from stars millions of light-years away. These celestial census takers and cartographers are creating an increasingly coherent picture of a universe abuzz with stars, many hosting families of orbiting planets.

And here we now stand on a small, rocky planet orbiting a typical star, in a typical galaxy, peering into the night sky with a sense of anticipation. There is a growing sense that we are probably not alone. Will we detect life in the universe in our lifetimes? When it does happen, those who share in the discovery will witness the opening of the next chapter in the amazing story of life.

- **MS-ESS1-1. 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.**
- **MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.**
- **MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.**