8^{th} Grade Science

COURSE OUTLINE		
Unit One	*Earth's place in the universe*	*9 weeks*
Unit Two	*Forces and Interactions*	*8 weeks*
Unit Three	*Waves and their application*	*7 weeks*
Unit Four	*Energy transformations*	*9 weeks*
Unit Five	*Electricity and magnetism*	*3 weeks*
Unit Six	*Alternative energy sources*	*3 weeks*
Unit Seven	*Space systems*	*3 weeks*

School-wide Academic Expectations Taught In This Course

- Communication
- Collaboration
- **Analysis**
- Literacy

School-wide Social and Civic Expectations Taught in This Course

- Demonstrate Honesty
- Demonstrate Responsibility
- Demonstrate Respect
- Demonstrate Safety

Performance Expectations Taught in This Course		
1	MS-ESS1	MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases
		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.
		ESS1-4. 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.
2	MS-PS2	MS-PS 2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects
		MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object
		MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
		MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects
		MS-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.

3	MS-PS4	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.
4	MS-PS3	MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object
		MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system
		MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
		MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample
		MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
5	MS-PS2	MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
		MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects
		MS-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.
6	MS-PS3	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.
		HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
7	HS-ESS1	HS-ESS1-1.Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation.

Unit 1: Earth's Place In The Universe

Introduction: Students learn to see Earth from different frames of reference and establish the relative sizes and distances of the Earth, Moon, and Sun. From there they explore how Earth's rotation creates the pattern of day and night we experience and methods we have created for keeping track of the passage of time. Images of the sun and temperature and daylight patterns around the world are examined to generated evidence as to why the seasons occur. Modeling plays a major role in the explanation of the seasons as well as the understanding of the phases of the moon and eclipses. Students then expand their frame of reference to looking at all planets in the solar system and what factors (gravity, mass and distance from the sun) influence the orbit of a planet. Index fossils are used to justify scientists' relative dating process of geologic time.

Next Generation Science Standard:
MS-ESS1-1-4

Science & Engineering Practices:

Developing and Using Models
Analyzing and Interpreting Data
Constructing and Explanations and Designing Solutions

Crosscutting Concepts:
Patterns
Scale, Proportion and Quantity
Systems and Systems Models

Common Core Standard(s):
ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-ESS1-1),(MS-ESS1-2)*

Mathematics -

MP.2 Reason abstractly and quantitatively. (MS-ESS1-3)

MP.4 Model with mathematics. *(MS-ESS1-1),(MS-ESS1-2)*

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *(MS-ESS1-1),(MS-ESS1-2)*,(MS-ESS1-3)

7.RP.A.2 Recognize and represent proportional relationships between quantities. *(MS-ESS1-1),(MS-ESS1-2)*,(MS-ESS1-3)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.*(MS-ESS1-2),(MS-ESS1-4)*

7.EE.B.6 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. *(MS-ESS1-2)*

Essential Question(s):

How does the position of the Earth in the solar system affect conditions on our planet?
Why do we experience moon phases here on Earth?
What factors influence a planet's orbit and how?
Why are index fossils useful in relatively dating Earth's history? What are some limitations of index fossils?

Key Terms/Concepts:
Orbit, revolve, year, period, rotate, hemisphere, season, phase, new moon, satellite, solar eclipse, lunar eclipse, gravity, gravitational acceleration, index fossil, correlation, geologic time scale

LEARNING PLAN

Performance Expectation	Disciplinary Core Ideas (DCI):	**INSTRUCTIONAL STRATEGIES**	**ASSESMENT EVIDENCE**
		Phenomena: To scale: The Solar System youTube video	
MS-ESS1-1 **Developing and using models** **Patterns**	1. ESS1.B: Earth and the Solar System • This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in 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.	• Whole group physical model of Earth, Moon and Sun • Explain everything presentation • Temperatures around the world lab • Day length around the world lab • Seasons webquest • Angle of insolation lab	Frame of reference drawing Webquest Explain everything rubric

MS- ESS1-2 **Developing and using models** **Systems and system models**	2. ESS1.A: The universe and Its Stars • Patterns of the motion of the sun, moon and stars can be observed, predicated and modeled • Earth and its solar system are part of the Milky Way galaxy. One of many galaxies in the universe	• Creation of scale models of the planets in the solar system • Model of relative spatial scales of galaxies • Juno: Jupiter's gravity	Evaluation of model (In ISN) pHet simulator: gravity and orbits

MS-ESS1-3 **Analyzing and Interpreting Data** **Scale, Proportion, and Quantity**	3. ESS1.B: • The solar system contains many objects, all in which are held in orbit around the sun by its gravitational pull	• Solar system size and scale • Water Balloon Orbital Lab • SNAP Lab: Solar system trends	Farmer's Market Solar System
MS-ESS1-4 **Constructing Explanations and Designing Solutions** **Scale, Proportion, and Quantity**	4. ESS1.C: • The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and fossil record provide only relative dates, not absolute scale.	• SNAP lab: Index Fossils	End of lab assessment questions

Suggested Resources and Texts:

Suggested Technology:

Unit 2: Forces and Motion

Introduction: The inextricable link between mathematics and science makes itself apparent in this unit. Design, data collection, and graphing also play a central role in this unit as students explore and understand ideas related to why some objects will keep moving, why objects fall to the ground and why some materials are attracted to each other while others are not. Students will be able to apply Newton's Third Law of Motion to relate forces to explain the motion of objects. In particular, students will develop understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are also able to apply an engineering practice and concept to solve a problem caused when objects collide.

Desired Outcome(s): By the end of this student, students will be able to use their knowledge of speed, velocity and acceleration and apply them to an engineering task relating to Newton's third law of motion. Students also apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel.

Next Generation Science Standard:
MS-PS2-1-5

Science & Engineering Practices:

Asking questions and defining problems
Planning and carrying out investigations
Constructing explanations and designing solutions
Engaging in argument from evidence

Crosscutting Concepts:

Cause and effect
Systems and systems models
Stability and change

Common Core Standard(s):
ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(MS-PS2-1),(MS-PS2-3)*
RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. *(MS-PS2-1),(MS-PS2-2),(MS-PS2-5)*
WHST.6-8.1	Write arguments focused on *discipline-specific content*. (MS-PS2-4)
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. *(MS-PS2-1)*,(MS-PS2-2),*(MS-PS2-5)*

Mathematics -

MP.2	Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3)
6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS2-1)

6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. *(MS-PS2-1),(MS-PS2-2)*

7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *(MS-PS2-1),(MS-PS2-2)*

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. *(MS-PS2-1),(MS-PS2-2)*

Essential Question(s):

- Does a change in an object's motion depend on the sum of the forces on the object and the mass of that object?
- What factors affect the strength of electric and magnetic forces?
- Do fields exist between objects that are exerting forces on each other, although they are not in contact?

Key Terms/Concepts: speed, velocity, acceleration, gravity, friction, Newton's laws of motion, force, vector/scalar, momentum/conservation of momentum.

LEARNING PLAN

Performance Expectation	Disciplinary Core Ideas (DCI):	**INSTRUCTIONAL STRATEGIES**	**ASSESMENT EVIDENCE**
MS-PS2-2 **Planning and Carrying Out Investigations** **Stability and Change**	PS2.A: Force and motion • All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)	• Phenomena: Bus speeding towards barrier • pHET modeling forces • Vector vs scalar quantities	Claim/evidence section of pHet activity Vector exit slip
	• The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The	• Acceleration lab ; Jason • Calculating speed lab; Jason	Calculating speed exit slip Lab conclusion questions

	greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)		
MS-PS2-1 **Constructing Explanations and Designing Solutions** **Systems and System Models**	PS2. A • For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1)	• Calculating momentum lab • Egg drop lab	Conclusion questions Helmet prototype activity
MS-PS2-3 **Asking Questions and Defining Problems** **Cause and Effect**	PS2.B • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)	Wards: Forces and interactions activity	Conclusion question responses
MS-PS2-4 **Engaging in Argument from Evidence** **Systems and System Models**	PS2.B • Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)	Wards: Forces and interactions activity	

Suggested Resources and Texts:

Suggested Technology:

Unit 3: Waves and Their Applications

Introduction: Students will learn to describe and identify basic properties of both mechanical and light waves. Through this understanding, students are able to describe and predict characteristic properties and behaviors of waves when the waves interact with matter. Students can apply an understanding of waves as a means to send digital information.

Science & Engineering Practices:
Developing and Using Models
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Crosscutting Concepts:
Patterns
Structure and Function

Common Core Standard(s):

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)
RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. *(MS-PS4-3)*
RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)
WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-PS4-1),(MS-PS4-2)*

Mathematics -

MP.2	Reason abstractly and quantitatively. (MS-PS4-1)
MP.4	Model with mathematics. (MS-PS4-1)
6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1)
6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1)
7.RP.A.2	Recognize and represent proportional relationships between quantities. (MS-PS4-1)
8.F.A.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *(MS-PS4-1)*

Essential Question(s):
What the characteristics of a simple wave?
How do wave model properties correspond to physical observations?
What is light and how can one explain the varied effects that involve light?
How are instruments that transmit and detect waves used to extend human senses?

Key Terms/Concepts: Wavelength, crest, trough, frequency, amplitude, , electromagnetic radiation, reflection, refraction, Digitized signal, Analog signal , Information (Transmission, Encoding), Information technology (e.g. fiber optic, wifi devices, binary signal)

LEARNING PLAN

Performance Expectation	Disciplinary Core Ideas (DCI):	INSTRUCTIONAL STRATEGIES	ASSESEMENT EVIDENCE
MS-PS4-1 **Using Mathematics and Computational Thinking** **Patterns**	PS4.A: Wave Properties • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) • A sound wave needs a medium through which it is transmitted. (MS-PS4-2)	• What makes a wave? • Discovery station learning • Bell in a Jar Video • Graphing different waves • pHet waves on a string • Lecture notes	Laboratory responses Graphing waves quiz
MS-PS4-2 **Developing and Using Models** **Structure and Function**	PS4.B: Electromagnetic Radiation • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2) • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2) • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2) • However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)	• SNAP lab: Bending light • SNAP lab: Wave behaviors	Laboratory responses
MS-PS4-3 **Obtaining, Evaluating, and Communicating Information** **Structure and Function**	PS4.C: Information Technologies and Instrumentation • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)	• Station models: Digital vs analog • SNAP lab: Digital vs analog	Laboratory responses

Suggested Resources and Texts:

Suggested Technology:

Unit 4: Energy Transformation

Introduction: Energy is all around us! Students develop their understanding of important qualitative ideas about energy including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students will also come to know the difference between energy and temperature, and begin to develop an understanding of the relationship between force and energy. Students are also able to apply an understanding of design to the process of energy transfer. (A Framework for a Science Education, 2012)

Science & Engineering Practices:
Developing and Using Models
Planning and Carrying Out Investigations
Analyzing and Interpreting Data
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence

Crosscutting Concepts:
Scale, Proportion, and Quantity
Systems and System Models
Energy and Matter

Common Core Standard(s):

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(MS-PS3-1),(MS-PS3-5)*
RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. *(MS-PS3-3)*,(MS-PS3-4)
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)
WHST.6-8.1	Write arguments focused on discipline content. *(MS-PS3-5)*
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3),*(MS-PS3-4)*
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-PS3-2)*

Mathematics -

MP.2	Reason abstractly and quantitatively. (MS-PS3-1),(MS-PS3-4),(MS-PS3-5)
6.RP.A.1	Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),*(MS-PS3-5)*
6.RP.A.2	Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. *(MS-PS3-1)*
7.RP.A.2	Recognize and represent proportional relationships between quantities. (MS-PS3-1),*(MS-PS3-5)*
8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)
8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. *(MS-PS3-1)*
8.F.A.3	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1),*(MS-PS3-5)*
6.SP.B.5	Summarize numerical data sets in relation to their context. *(MS-PS3-4)*

Essential Question(s):

- How is energy transferred and conserved?
- How is energy transferred between objects or systems?
- How are forces related to energy?

Key Terms/Concepts: Kinetic energy, mass of the object (KE ∝ m), Speed of the object (KE ∝ v^2) Proportional, Potential energy, Interacting stationary objects (e.g. Earth and roller coaster cart, magnets, charged objects), Forces (electric, magnetic, or gravitational), Thermal energy transfer (hotter object to colder object), Thermal energy transfer processes (conduction, convection, and radiation), Temperature

LEARNING PLAN

Performance Expectation	Disciplinary Core Ideas (DCI):	**INSTRUCTIONAL STRATEGIES**	**ASSESMENT EVIDENCE**
MS-PS3-1 **Analyzing and interpreting data** **Scale, proportion and quantity**	PS3.A: Definitions of Energy • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1) • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4)	• Kinetic energy station lab • Kinetic energy car worksheet	• Kinetic energy relationship graph exit slip
MS-P3-2 **Developing and using models** **Systems and system models**	PS3.C: Relationship Between Energy and Forces • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2) • A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-	• Rubber band Canons • ABCDE paragraph • Practicing science diagrams • Potentially amazing station lab • Using data as evidence •	• Potential energy diagram exit slip

	PS3-2) •		
MS-P3-3 **Constructing explanations and designing solutions** **Energy and matter**	• Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) ETS1.A: Defining and Delimiting an Engineering Problem • 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 knowledge that is likely to limit possible solutions. *(secondary to MS-PS3-3)* ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. *(secondary to MS-PS3-3)*	• Thermal energy demo • Jason learning types of thermal energy reading • Rube Goldberg energy transfers • Cedar glade thermal energy transfer • Solar Ovens • DIY thermos (science Olympiad event)	• Lab responses •
MS-PS3-4 **Planning and carrying out investigations** **Scale, proportion, and quantity**	• The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	• Boling water lab	• Why water is weird poem
MS-PS3-5 **Engaging in**	PS3.B: Conservation of Energy and Energy Transfer	• SNAP lab: Kinetic energy	• Assessment question

argument from evidence **Energy and matter**	• When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)		responses

Suggested Resources and Texts:

Suggested Technology:

Unit 5: Electricity and Magnetism

Introduction: Electric forces and magnetic forces are different aspects of a single electromagnetic interaction. Such forces can be attractive or repulsive, depending on the relative sign of the electric charges involved, the direction of current flow, and the orientation of magnets. Students will learn that forces' magnitudes depend on the magnitudes of the charges, currents, and magnetic strengths as well as on the distances between the interacting objects during a variety of lab activities.

Science & Engineering Practices:
Planning and Carrying Out Investigations

Crosscutting Concepts:
Cause and Effect

Common Core Standard(s):

ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(MS-PS3-1),(MS-PS3-5)*

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. *(MS-PS3-3)*,(MS-PS3-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)

WHST.6-8.1 Write arguments focused on discipline content. *(MS-PS3-5)*

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3),*(MS-PS3-4)*

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-PS3-2)*

Mathematics -

MP.2 Reason abstractly and quantitatively. (MS-PS3-1),(MS-PS3-4),(MS-PS3-5)

6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),*(MS-PS3-5)*

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. *(MS-PS3-1)*

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-1),*(MS-PS3-5)*

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)

8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. *(MS-PS3-1)*

8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1),*(MS-PS3-5)*

6.SP.B.5 Summarize numerical data sets in relation to their context. *(MS-PS3-4)*

Essential Question(s):

- What underlying forces explain the variety of interactions observed?
- What factors determine the strength of an electric or magnetic field?

Key Terms/Concepts: Electric force
Magnetic force
Attraction and repulsion
Electric charge
Electric current
Magnet
Devices (e.g. electromagnet, electric motor, generator)

LEARNING PLAN

Performance Expectation	**Disciplinary Core Ideas (DCI):**	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
MS-PS2-3	PS2.B: Types of Interactions • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)	• Discovery stations: magnets • Lecture notes	Check-in quizzes
MS-PS2-5	• Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, a magnet, or a ball, respectively). (MS-PS2-5)	• Electromagnetic fishing derby	

Suggested Resources and Texts:

Suggested Technology:

Unit 6: Alternative Energy Sources

Introduction: Students will build on our energy unit to discuss the energy crisis happening right now in our world. Technology is ever improving how electricity can be generated, not just from fossil fuels. Students will spend time investigating these different energy sources and their impacts on the world around us.

Science & Engineering Practices:

Engaging in Argument from Evidence

Crosscutting Concepts:

Cause and Effect

Common Core Standard(s):

Common Core State Standards Connections:
ELA/Literacy -
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-4)
WHST.6-8.1 Write arguments focused on discipline content. (MS-ESS3-4)
WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-4)
Mathematics -
6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *(MS-ESS3-4)*
7.RP.A.2 Recognize and represent proportional relationships between quantities. *(MS-ESS3-4)*
6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. *(MS-ESS3-4)*
7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. *(MS-ESS3-4)*

Essential Question(s):
What is the effect of technology on the environment?
What factors effect the management of natural resources?
How does an ecosystem sustain biodiversity?

Key Terms/Concepts: Renewable vs nonrenewable, fossil fuel, energy consumption chart, capacity, natural resources, sustainability, biodiversity

LEARNING PLAN

Performance Expectation	Disciplinary Core Ideas (DCI):	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
	•	•	
MS-ESS3	• Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other	• NEED energy article readings • Teach a lesson: Energy experts	Teaching a lesson rubric

	species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. • 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.		
HS-ESS3	ESS3.C: Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.	• JASON learning Energy city online simulation • Solar Cars STEM lab • Hydropower STEM lab	Lab report responses

Suggested Resources and Texts:

Suggested Technology:

Unit 7: Nuclear Fusion

Introduction: The purpose of this unit is to set the stage for 9th grade science. Students will take a look at the brief reasoning of nuclear fusion and the life cycle of our Sun.

Science & Engineering Practices:
Developing and Using Models

Crosscutting Concepts:
Developing and Using Models

Common Core Standard(s):
Common Core State Standards Connections:
ELA/Literacy -

RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. *(HS-ESS1-1)*

Mathematics -

MP.2	Reason abstractly and quantitatively. (HS-ESS1-1)
MP.4	Model with mathematics. (HS-ESS1-1)
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS1-1)
HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-1)
HSN-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS1-1)
HSA-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. *(HS-ESS1-1)*
HSA-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. *(HS-ESS1-1)*
HSA-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *(HS-ESS1-1)*

Essential Question(s):

What are the major steps in the life cycle of the sun?
What will cause the Sun to run out of energy?

Key Terms/Concepts: Nuclear fusion, helium, hydrogen, red star, white dwarf

LEARNING PLAN

Performance Expectation	Disciplinary Core Ideas (DCI):	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
HS-ESS1-1	• ESS1.A: The Universe and Its Stars • The star called the sun is changing and will burn out	• Sun's life narrative	Rubric score

	over a lifespan of approximately 10 billion years. • PS3.D: Energy in Chemical Processes and Everyday Life • Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary)		

Suggested Resources and Texts:

Suggested Technology:

APPENDIXES

Link to NGSS:
https://www.google.com/search?q=next+generation+science+standards&sourceid=ie7&rls=com.microsoft:en-us:ie-searchbox&ie=&oe=&safe=active&ibss=1&gws_rd=ssl

Crosscutting Concepts:

1. **Patterns**.
Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

2. **Cause and Effect: Mechanism and Explanation**.
Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. **Scale, Proportion, and Quantity.**
In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

4. **Systems and System Models**.
Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

5. **Energy and Matter: Flows, Cycles, and Conservation**.
Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

6. **Structure and Function**.
The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

7. **Stability and Change**.
For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Science and Engineering Practices

Asking Questions and Defining Problems

A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.

Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.

Planning and Carrying Out Investigations

Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.

Analyzing and Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.

Using Mathematics and Computational Thinking

In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; statistically analyzing data; and recognizing, expressing, and applying quantitative relationships.

Constructing Explanations and Designing Solutions

The products of science are explanations and the products of engineering are solutions.

Engaging in Argument from Evidence

Argumentation is the process by which explanations and solutions are reached.

Obtaining, Evaluating, and Communicating Information

Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.