Unit 2: Pressure, Energy, Magnetism

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **40 days**
Status: **Published**

Summary

Introduction: In this unit, students will work to explore the connection between pressure, energy, and magnetism while utilizing the scientific method and problem solving. Students will explore hydraulics, forms and uses of energy, and the magnetosphere. Students will explore laboratory fundamentals while highlighting the concepts of Gas Laws, the relationship between kinetic and potential energy, and the interaction of molecules to create magnetic poles. Students will gain experience in communicating results, scientific writing, and data representation and analysis through a unit project.

Revision Date: July, 2020

CS.6-8.DA	Data & Analysis
CS.6-8.ED	Engineering Design
LA.W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.W.8.1.A	Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.8.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
LA.W.8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
LA.W.8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
LA.W.8.2.B	Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
LA.W.8.2.C	Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
LA.W.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
LA.W.8.2.E	Establish and maintain a formal style/academic style, approach, and form.
LA.W.8.2.F	Provide a concluding statement or section that follows from and supports the information or explanation presented.
LA.W.8.4	Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
LA.W.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.
LA.W.8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.

LA.RI.8.1	Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RI.8.7	Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.
LA.RI.8.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
MA.8.F.A.1	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.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.
MA.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
MA.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
MA.8.G.A	Understand congruence and similarity using physical models, transparencies, or geometry software.
MA.8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations:
MA.8.EE.A	Work with radicals and integer exponents.
MA.8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, 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.
MA.8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
MA.8.EE.C.7	Solve linear equations in one variable.
MA.8.SP.A	Investigate patterns of association in bivariate data.
MA.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
MA.8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the

	data points to the line.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
SCI.MS.PS1.A	Structure and Properties of Matter
SCI.MS.PS2.B	Types of Interactions
SCI.MS.PS2.B	Types of Interactions
SCI.MS.PS3.A	Definitions of Energy
SCI.MS.PS3.B	Conservation of Energy and Energy Transfer
SCI.MS.PS3.C	Relationship Between Energy and Forces
SCI.6-8.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.
SCI.6-8.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
SCI.6-8.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.
SCI.6-8.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.
SCI.6-8.MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
SCI.6-8.MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

SCI.6-8.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.
SCI.6-8.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.
SCI.6-8.MS-PS1-4.2	Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
SCI.6-8.MS-PS3-2.2.1	Develop a model to describe unobservable mechanisms.
SCI.6-8.MS-PS4-2.2.1	Develop and use a model to describe phenomena.
SCI.6-8.MS-PS1-5.2.1	Develop a model to describe unobservable mechanisms.
SCI.6-8.MS-PS1-4.2.1	Cause and effect relationships may be used to predict phenomena in natural or designed systems.
SCI.6-8.MS-PS3-4.3	Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
SCI.6-8.MS-PS2-5.3	Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
SCI.6-8.MS-PS3-4.3.1	Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
SCI.6-8.MS-PS3-4.3.1	Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.
SCI.6-8.MS-PS3-2.4.1	Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.
SCI.6-8.MS-PS1-2.4.1	Analyze and interpret data to determine similarities and differences in findings.
SCI.6-8.MS-PS2-1.4.1	Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.
SCI.6-8.MS-PS2-4.4.1	Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.
SCI.6-8.MS-PS4-1.5	Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
SCI.6-8.MS-PS1-6.5.1	The transfer of energy can be tracked as energy flows through a designed or natural system.
SCI.6-8.MS-PS3-3.5.1	The transfer of energy can be tracked as energy flows through a designed or natural system.
SCI.6-8.MS-PS4-1.5.1	Use mathematical representations to describe and/or support scientific conclusions and design solutions.
SCI.6-8.MS-PS3-5.5.1	Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).
SCI.6-8.MS-PS2-1.6	Constructing Explanations and Designing Solutions
SCI.6-8.MS-PS3-3.6	Constructing Explanations and Designing Solutions
SCI.6-8.MS-PS2-1.6.1	Apply scientific ideas or principles to design an object, tool, process or system.
SCI.6-8.MS-PS3-3.6.1	Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system.

SCI.6-8.MS-PS2-4.7	Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.
SCI.6-8.MS-PS2-4.7.1	Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
SCI.6-8.MS-PS3-5.7.1	Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon.
SCI.6-8.MS-PS4-3.8	Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods.
SCI.6-8.MS-PS4-3.8.1	Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.
SCI.6-8.MS-PS1-4.PS1.A.1	Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
SCI.6-8.MS-PS1-4.PS1.A.2	In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.
SCI.6-8.MS-PS1-4.PS1.A.3	The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.
SCI.6-8.MS-PS2-1.PS2.A.1	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).
SCI.6-8.MS-PS2-3.PS2.B.1	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.
SCI.6-8.MS-PS1-4.PS3.A.1	The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.
SCI.6-8.MS-PS3-2.PS3.A.1	A system of objects may also contain stored (potential) energy, depending on their relative positions.
SCI.6-8.MS-PS3-4.PS3.A.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.
SCI.6-8.MS-PS3-1.PS3.A.1	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.
SCI.6-8.MS-PS3-3.PS3.A.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.
SCI.6-8.MS-PS3-5.PS3.B.1	When the motion energy of an object changes, there is inevitably some other change in energy at the same time.
SCI.6-8.MS-PS3-3.PS3.B.1	Energy is spontaneously transferred out of hotter regions or objects and into colder ones.
SCI.6-8.MS-PS3-2.PS3.C.1	When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.
SCI.6-8.MS-PS3-3.ETS1.A	Defining and Delimiting an Engineering Problem
SCI.6-8.MS-PS3-3.ETS1.A.1	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.

SCI.6-8.MS-PS1-6.ETS1.C.1	Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.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.
SCI.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.
SCI.MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
SCI.MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
SCI.MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
SCI.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.
SCI.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.
SCI.MS-PS1	Matter and its Interactions
SCI.MS-PS2-1	Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.
SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
SCI.MS-PS2	Motion and Stability: Forces and Interactions
SCI.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.
WRK.9.2.8.CAP	Career Awareness and Planning
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and

	synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
TECH.8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
TECH.8.1.8.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.8.D.2	Demonstrate the application of appropriate citations to digital content.
TECH.8.1.8.D.4	Assess the credibility and accuracy of digital content.
TECH.8.1.8.D.CS3	Exhibit leadership for digital citizenship.
TECH.8.1.8.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.8.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.8.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
TECH.8.1.8.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.1.8.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.8.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
TECH.8.2.8.C.3	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
TECH.8.2.8.D.CS1	Apply the design process.
TECH.9.4.8.CI	Creativity and Innovation
TECH.9.4.8.CT	Critical Thinking and Problem-solving
TECH.9.4.8.TL	Technology Literacy
	Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.

Essential Questions/Enduring Understandings

Essential Questions

How do scientists communicate?
How and why is energy transfered?
How is magnetism used to replace fossil fuels?
How do animals use pressure to interact with their environment?

Enduring Understanding

Understand how to carry out proper lab safety techniques, create a testable hypothesis and utilize the scientific method.

Understand that comparing densities of objects allows you too determine whether an object will sink or float.

Understand the concept of conservation and its applications.

Understand that magnetics are used in everyday life.

Objectives

Students will be skilled at explaining how fluids exert pressure.

Students will be skilled at demonstrating how hydraulic systems multiply force.

Students will be skilled at determining the density of a regular and irregular shaped solid.

Students will be skilled at explaining why density is a derived unit.
Students will be skilled at incorporating mass, air resistance, and terminal velocity as factors that determine the rate of falling objects.

Students will be skilled at using the Law of Conservation of Energy to explain how kinetic and potential energy combine to make mechanical energy
Students will be skilled at demonstrating the transfer of energy through motion by calculating work energy.

Students will be skilled at describing how magnetic poles interact.

Learning Plan

Discuss pressure, heat and temperature. Predict their relationship to each other.

Students calculate their own pressure (psi) on the ground as they walk by tracing their foot. Investigate changes in pressure as their shoe changes. (i.e. High heel)

Deduce the relationship between heat and pressure and the relationship between volume and pressure through a series of labs.

Pressure Labs

Define Charles' and Boyle's Laws and kinetic molecular theory.

Discuss the changes in pressure as altitude or depth changes.

Boyle's Law Demo

Compare and contrast heat and temperature.

Conductor and Insulator Lab

Define and discuss convection, conduction and radiation heat.

Discuss how heat and radiation affects the environment. Define and discuss global warming, ozone layer, CFCs, carbon dioxide and greenhouse effect.

Discuss the causes and effects of global warming and suggestions to combat it.

Create an informational tool to educate others about global warming.

Define and discuss Bernoulli's principle.

Paper helicopter Lab

Discuss specific heat and how a calorimeter works

.

Assessment

Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

Formative Assessments:

Worksheets

Exit Tickets

Class Discussion

Quizzes

***Some Suggested Options**:*

Gas Laws, Pascal, Bernoull's Principal, Archemedi's Principal of Buoyancy

Types of Energy

Energy Transformations

Kinetic vs. Potential Energy

Bench Marks:

Formal Lab Reports/Lab Write-ups

Lab Work

***Some Suggested Options**:*

Sink or Spill

Bounce Lab

Helichopter Lab

Versorium Lab

Laboratory Techniques

Summative:

Quizzes

***Some Suggested Options**:*

Gas Laws, Pascal, Bernoull's Principal, Archemedi's Principal of Buoyancy

Types of Energy

Energy Transformations

Kinetic vs. Potential Energy

Unit Tests

Pressure

Energy

Magnetism

Alternative:

Long-Term Projects

Rollercoasters

Skate park design

U.N. Energy Convention

Laboratory Practical

Materials

General lab equipment

General lab kits

General classroom supplies

Safety Equipment

Science Textbook

Physical Science McGraw Hill

Science Explorer Modules Physical Science Prentice Hall

Computer(s)

Smartboard

Access to Internet

Powerpoints

Relevant worksheets/notes

Relevant videos

Relevant virtual activities

Relevant interactive programs

Paper helicopter template

Empty soda cans/bottles

Marshmallows

Plastic eggs

Balloons

Magnets