



Springfield Public Schools
Springfield, New Jersey 07081

Science
Grade 8

Curriculum Guide

2026

This curriculum may be modified through varying materials, techniques, and strategies as per an individual student's IEP.

Springfield Board of Education
Approved July 27, 2026

Springfield Public Schools

Cultivating compassionate and extraordinary learners!

EXTRACT OF THE MINUTES OF A MEETING OF THE BOARD OF EDUCATION OF THE TOWNSHIP OF SPRINGFIELD COUNTY OF UNION, NEW JERSEY AS RECORDED IN THE OFFICIAL MINUTE BOOK

Resolution: 21

Introduced By: Mrs. Gamarekian

Seconded By: Vice President Rinaldi

Adopted: July 27, 2026

Curriculum Adoption

To approve the following new and revised curriculum and courses for the 2026-2027 school year:

1. High School Courses

- a. AP Cybersecurity (new course)
- b. AP Business with Personal Finance (new course)
- c. AP Biology
- d. AP Chemistry
- e. AP Physics 1
- f. PLTW Robotics and Automation
- g. PLTW Introduction to Engineering Design
- h. PLTW Principles of Engineering
- i. Biology
- j. Biology Honors
- k. Chemistry
- l. Chemistry Honors
- m. Conceptual Physics
- n. Physics
- o. Environmental Science
- p. Forensics
- q. Human Anatomy and Physiology
- r. Oceanography
- s. Science 8
- t. Molecular Biology Research Lab (new course)

2. Middle School Courses

- a. Science 6
- b. Science 7

3. Elementary School Courses

- a. Kindergarten Science
- b. Grade 1 Science
- c. Grade 2 Science

Michelle Calas, School Business Administrator/Board Secretary

(continued)

I, Michelle Calas, School Business Administrator/ Board Secretary of the Springfield Board of Education, hereby certify that the extract from the minutes of a meeting of the Board of Education duly called and held on July 27, 2026 has been compared by me with the original minute book of said Board of Education, and is a true, complete and exact copy thereof, as far as the same relates to the subject matter to on said extract.

In WITNESS THEREOF, I have hereunto set my hand and seal of the Springfield Board of Education, this 28th day of July 2026.

SEAL



Michelle Calas
School Business Administrator/ Board Secretary



**Springfield Public Schools
Springfield, New Jersey**

**Rachel Goldberg
Superintendent of Schools**

**Erica Scudero
Assistant Superintendent of Curriculum and Instruction**

Curriculum Developed By:

Norman Francis ~ Principal of Jonathan Dayton High School

Gregory Salmon ~ STEM Supervisor

Robert Hildebrand ~ Science Teacher



Unit Overview Template

Content Area: Science **Grade Level:** 8 **Unit Title:** Foundations of Science

Unit Summary: During the course of this unit students will utilize the steps of the scientific method to investigate a question. The scientific method will stand as a process used for investigating and acquiring new knowledge, or correcting and integrating prior knowledge. Students will be introduced to the intricate tools scientists use to gather accurate data, learn to accurately map out a science experiment, differentiate between controlled and experimental variables, and understand the importance of proper lab etiquette.

Primary Interdisciplinary Connections: Mathematics

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☐ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy

Unit Rationale: Teaching and constantly reinforcing the importance of proper lab safety ensures that students learn in a safe environment. The importance of making accurate measurements will allow students to gather correct data and arrive at a valid conclusion. Making accurate measurements also enables others to recreate experiments (which is an important part of science). The scientific method provides an objective, a standardized approach to conducting experiments and, in doing so, improves student results. By using a standardized approach in investigating, scientists (students) can feel confident that they will stick to the facts and limit the influence of personal, preconceived notions. Reinforcing proper lab safety ensures that students learn in a safe environment. Accurate measurements lead to accurate data.

Career Readiness (Standard 9):

- 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
- 9.2.8.CAP.19: Relate academic achievement, as represented by high school diplomas, college degrees, and industry credentials, to employability and to potential level
- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a)
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.

Learning Targets

Standards: MS-ETS1, ELA.RI.8, ELA.W.8, ELA.SL.8, ELA.L.8, MATH.A-SSE, MATH.A-CED

Content Statements: Engineering Design, ELA, Algebra

CPI#:

Cumulative Progress Indicator (CPI):

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.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
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.
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.
ELA.RI.8.2	Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.
ELA.RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
ELA.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.
ELA.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.
ELA.W.8.1.D	Establish and maintain a formal style.
ELA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
ELA.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
ELA.W.8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.
ELA.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.
ELA.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
ELA.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
ELA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
ELA.L.8.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
MATH.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain



	properties of the quantity represented by the expression.
MATH.A-SSE.B.3.C	Use the properties of exponents to transform expressions for exponential functions.
MATH.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
8.2.8.ITH.2	Compare how technologies have influenced society over time.
8.2.8.NT.1	Examine a malfunctioning tool, product, or system and propose solutions to the problem.
8.2.8.ETW.2	Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).

Science and Engineering Practices:

Asking Questions and Defining Problems

Asking questions and defining problems in grades 6–8 builds on K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.

- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on 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.

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)



Disciplinary Core Ideas (DICs):

ETS1.A: Defining and Delimiting Engineering Problems

- 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 are likely to limit possible solutions. (MS-ETS1-1)

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. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- 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 those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

Crosscutting Concepts:

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Unit Essential Questions:

- How do we create a safe science environment?
- How is the scientific method used to investigate and solve questions?
- What specific scientific equipment is used in making length, time, temperature, volume, and mass measurement?

Unit Enduring Understandings:

- Utilize all safety precautions and concepts in a lab environment.
- Identify the proper tools scientists use to collect accurate data.



- Convert measurements between various metric units.
- Use inquiry skills to ask and solve scientific questions.
- Utilize the steps of the scientific method to successfully map out the steps of a controlled experiment to investigate a problem, analyze data, and arrive at a conclusion.

Unit Learning Targets:

Students will...

- Identify and use proper safety precautions within a laboratory environment.
- Create an experiment using the steps of the scientific method that incorporates the usage of both controls and variables.



Evidence of Learning

Summative Assessment: Unit Assessment and Labs

Equipment Needed: Student iPads, laboratory materials and supplies, safety equipment, measuring tools, calculators

Teacher Resources: Teacher laptop, textbook, laboratory materials and supplies, safety equipment, measuring tools, calculators

Formative Assessments:

- Exit/Admit cards
- Class discussion/observation
- Self assessing lab activities
- Lab reports/summary questions
- Test/Quiz/Unit Exam
- Online Gizmo questions
- Homework
- Adult/student modeling
- Peer/Self Assessments
- Presentations
- Kinesthetic Assessments



Lesson Plans

Lesson	Time Frame
Lesson 1 Lab Safety & Etiquette	3 days
Lesson 2 Scientific Method	10 days
Lesson 3 Scientific Measurements	7 days

Teacher Notes: In order to help obtain accurate measurements, it is important the teacher focuses on breaking down which tool to use and how to use it correctly. In addition, students must learn how to read and identify proper scales. Gizmos and PhET are helpful interactive tools to visually explain each concept.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

www.explorelearning.com



Lesson Plan 1 Template

Content Area: Science **Lesson Title:** Lab Safety & Etiquette **Time Frame:** 3 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use iPads to view and analyze digital lab safety scenarios and identify appropriate and inappropriate laboratory practices.
- Students will use digital collaboration tools (Google Slides, Canva, or similar platforms) to create and share lab safety posters and infographics.
- Students will use QR codes placed around the classroom to access videos, images, and descriptions of laboratory safety equipment during the scavenger hunt.
- Students will complete a digital lab safety assessment and reflection activity.

Equipment Needed:

- iPads or laptop computers
- Assorted laboratory glassware and equipment
- Safety goggles and aprons
- Sample chemical containers and labels
- Eyewash station, safety shower, fire extinguisher, fire blanket, and first aid kit
- Laboratory safety symbols cards
- QR code cards and scavenger hunt sheets
- Chart paper, markers, and poster materials
- Textbook and digital safety resources

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Explain the importance of laboratory safety and etiquette in preventing accidents and injuries. • Identify the locations and purposes of classroom safety equipment and emergency procedures.	Lesson Sequence 1. Anchoring Phenomenon: Students view images and short video clips of actual laboratory accidents and discuss the question: "Why do even experienced scientists follow strict safety	• Signed laboratory safety contract and classroom rules agreement. • Safety Equipment Scavenger Hunt responses. • Safety Scenario analysis sheets. • Lab Safety Poster or digital infographic.



- | | | |
|--|--|--|
| <ul style="list-style-type: none">• Demonstrate proper handling and use of common laboratory equipment and materials.• Distinguish between safe and unsafe laboratory behaviors through the analysis of real-world scenarios.• Apply laboratory safety procedures to hypothetical and hands-on situations.• Evaluate potential hazards and propose solutions to reduce risks in scientific investigations.• Collaborate with peers to develop and communicate laboratory safety expectations.• Design and create a laboratory safety product that communicates essential safety rules and procedures. | <p>procedures every time they enter a laboratory?"</p> <ol style="list-style-type: none">2. Students brainstorm prior experiences with science labs and generate a list of possible laboratory hazards.3. Students view the Flinn lab safety video and identify examples of unsafe practices, recording observations and explaining how each accident could have been prevented.4. Students view a lab safety iMovie highlighting common hazards and emergency procedures within the science classroom.5. Students participate in a Safety Equipment Scavenger Hunt by locating classroom safety equipment using QR codes, photographs, and clue cards, then explaining the purpose and proper use of each item.6. Students rotate through hands-on safety stations where they practice properly wearing goggles and aprons, safely carrying glassware, reading chemical warning labels, and responding to simulated emergency situations. | <ul style="list-style-type: none">• Teacher observations during hands-on safety stations.• Group presentations and explanations of safety procedures.• Exit ticket: "What is the most important laboratory safety rule and why?"• Laboratory Safety Test. |
|--|--|--|



7. Students analyze Safety Scenario cards and work collaboratively to identify what went wrong, how accidents could have been prevented, and what actions should be taken after an incident occurs.
8. Student groups create a Lab Safety Poster or digital infographic illustrating important laboratory rules, safety symbols, and emergency procedures.
9. Groups present their safety products to the class and justify why certain rules are essential to maintaining a safe learning environment.
10. Students complete an individual reflection explaining how scientists' responsibility for safety connects to careers in science, medicine, engineering, and industry.

Differentiation:

- Tiered assignments will provide varying levels of support and complexity while maintaining common learning goals.
- Students may complete the safety product as a poster, infographic, slide presentation, video, or public service announcement.
- Visual supports, vocabulary cards, and guided notes will support students who require additional scaffolding.
- Safety scenarios may be differentiated by complexity and presented through text, images, or videos.
- Students may work independently, with partners, or in collaborative groups based on readiness and instructional needs.
- Extension opportunities will allow advanced learners to research famous laboratory accidents and develop recommendations that improved modern laboratory practices.



- Mini-lessons and teacher conferencing will be provided to reinforce concepts and address misconceptions.
- Students may demonstrate understanding through written responses, presentations, models, or multimedia products.

Resources Provided:

- Textbook
- Digital lab safety videos and iMovie
- iPads and online safety resources
- Laboratory supplies, glassware, and safety goggles
- Safety equipment and classroom emergency resources
- QR code activities and scenario cards
- Poster materials and digital presentation tools



Lesson Plan 2 Template

Content Area: Science

Lesson Title: Scientific Method

Time Frame: 10 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

Students will use iPads and online simulations, including the Scientific Method Gizmo, to design, conduct, and analyze virtual experiments.

Students will use digital resources to investigate examples of experimental design and real-world scientific investigations.

Students will use digital tools such as Google Slides, Canva, or similar applications to create and present scientific method posters.

Students will collect, organize, and communicate experimental data using digital charts and tables.

Equipment Needed:

- iPads or laptop computers
- Swing Time Lab materials (string, washers, masses, meter sticks, timers)
- Scientific Method Gizmo
- Lab notebooks and data sheets
- Graph paper
- Chart paper and markers
- Safety goggles
- Assorted laboratory materials and glassware
- Internet access and digital resources

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Describe and sequence the steps of the scientific method. • Differentiate among observations, questions, hypotheses, procedures, data, and conclusions. • Distinguish between independent,	Lesson Sequence 1. Anchoring Phenomenon: Students observe a video showing two pendulums of different lengths swinging at different rates and discuss the question: "Why do the pendulums behave	• Experiment Worksheet identifying and correcting procedural errors. • Variables Worksheet identifying independent, dependent, and controlled variables. • Swing Time Lab data tables and graphs.



dependent, and controlled variables. • Differentiate between controlled and non-controlled experiments. • Design and conduct investigations that test a hypothesis and answer scientific questions. • Collect, organize, analyze, and communicate data using tables, graphs, and evidence-based explanations. • Evaluate the quality of experimental procedures and identify sources of error. • Apply the scientific method to solve real-world problems and make evidence-based decisions.	differently, and how could scientists investigate this phenomenon?" 2. Students brainstorm everyday questions that could be investigated scientifically and identify characteristics of testable questions. 3. Students complete an Experiment Worksheet containing flawed experimental scenarios and work collaboratively to identify procedural errors and propose improvements. 4. Students complete a Variables Worksheet by analyzing scenarios and identifying independent, dependent, and controlled variables. 5. Students participate in the Swing Time Lab by designing and conducting an investigation to determine what factors affect the period of a pendulum. 6. Student groups develop hypotheses, identify variables, collect data, and revise procedures as needed during the investigation. 7. Students create tables and graphs to organize and analyze experimental data and identify patterns.	• Scientific Method Gizmo activities and responses. • Scientific Method Poster. • Group presentations explaining experimental procedures and conclusions. • Teacher observations during investigations and discussions. • Exit ticket: "Why is controlling variables important in an experiment?" • Post-assessment.
---	--	---



- | | | |
|--|---|--|
| | <ol style="list-style-type: none">8. Students use the Scientific Method Gizmo to conduct virtual investigations and compare their results to their hands-on experiments.9. Student groups present their investigations and explain how evidence supports or refutes their hypotheses.10. Students reflect on how scientists use repeated investigations, collaboration, and evidence to develop scientific knowledge. | |
|--|---|--|

Differentiation:

- Tiered assignments will provide varying levels of support and complexity while maintaining common learning goals.
- Students may work independently, with partners, or in collaborative groups based on readiness and instructional needs.
- Guided notes, graphic organizers, sentence starters, and partially completed experimental designs will support students who require additional scaffolding.
- Investigation scenarios may be differentiated by complexity and presented through text, diagrams, or videos.
- Students may demonstrate understanding through written explanations, posters, presentations, videos, or digital products.
- Extension opportunities will allow advanced learners to design and conduct additional investigations using self-generated questions and procedures.
- Mini-lessons and teacher conferencing will be provided to reinforce concepts and address misconceptions.
- Flexible grouping and multiple methods of presenting information will ensure access for all learners.

Resources Provided:

- Internet resources and scientific websites
- Scientific Method Gizmo
- iPads and laptop computers
- Swing Time Lab materials
- Laboratory supplies and glassware
- Safety goggles
- Graph paper, chart paper, and presentation materials



Lesson Plan 3 Template

Content Area: Science **Lesson Title:** Scientific Measurements **Time Frame:** 7 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use Vernier Go Direct temperature probes to collect and analyze temperature data during measurement investigations.
- Students will use digital scales and timers to improve measurement precision and compare analog and digital measurements.
- Students will use the Measurements Gizmo to practice collecting, recording, and analyzing scientific data.
- Students will use spreadsheet software to organize measurement data, perform metric conversions, and identify patterns in collected data.

Equipment Needed:

- iPads or laptop computers
- Vernier Go Direct temperature probes
- Digital balances
- Triple beam balances
- Meter sticks and metric rulers
- Graduated cylinders
- Thermometers
- Stopwatches
- Beakers and assorted laboratory glassware
- Measurement objects and samples of varying sizes and masses
- Safety goggles
- Graph paper and data sheets

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Identify and properly use scientific instruments used to measure length,	Lesson Sequence 1. Anchoring Phenomenon: Students examine two graduated cylinders	• Measurement station data sheets.



mass, volume, temperature, and time. • Select appropriate tools and units for various scientific measurements. • Collect precise and accurate measurements using both analog and digital equipment. • Distinguish between precision and accuracy and evaluate possible sources of measurement error. • Record and organize measurement data using appropriate units and significant figures. • Convert measurements within the metric system using the ladder method and dimensional reasoning. • Apply measurement and conversion skills to solve scientific and real-world problems. • Analyze measurement data and communicate findings using tables, graphs, and evidence-based explanations.	containing seemingly equal amounts of water that produce different measurements because they are viewed at different angles and discuss the question: "How can scientists ensure their measurements are accurate and reliable?" 2. Students discuss why scientists around the world use standardized units and why precise measurements are essential in medicine, engineering, manufacturing, and scientific research. 3. Students rotate through Making Measurements stations where they use various laboratory instruments to measure length, mass, volume, temperature, and time. 4. Students compare measurements obtained using analog and digital instruments and discuss factors that influence precision and accuracy. 5. Students participate in a Density Challenge by measuring the mass and volume of mystery objects and calculating their densities to	• Length, mass, volume, density, temperature, and time laboratory activities. • Metric Conversion Investigation. • Density Challenge calculations and explanations. • Measurements Gizmo activities and responses. • Teacher observations during laboratory stations. • Group presentations and data discussions. • Exit ticket: "Why do scientists need measurements to be both accurate and precise?"
--	--	---



- identify unknown materials.
6. Students complete a Metric Conversion Investigation in which they estimate, measure, and convert quantities between metric units using the ladder method.
 7. Students use Vernier Go Direct probes to monitor temperature changes and analyze data collected during a short heating or cooling investigation.
 8. Students use the Measurements Gizmo to practice measurement skills and investigate how measurement errors influence scientific conclusions.
 9. Student groups create visual data tables and graphs that summarize their measurement investigations and explain patterns in the data.
 10. Students conclude by discussing how accurate measurements allow scientists and engineers to design products, conduct experiments, and communicate findings consistently around the world.

Differentiation:



- Tiered assignments will provide varying levels of support and complexity while maintaining common learning goals.
- Students may work independently, with partners, or in collaborative groups based on readiness and instructional needs.
- Guided notes, reference charts, conversion ladders, and partially completed data tables will support students who require additional scaffolding.
- Laboratory stations may include varying levels of challenge, ranging from direct measurements to multi-step calculations and analysis tasks.
- Students may demonstrate understanding through written explanations, calculations, diagrams, presentations, or digital products.
- Extension opportunities will allow advanced learners to investigate significant figures, percent error, and measurement uncertainty in experimental investigations.
- Mini-lessons and teacher conferencing will be provided to reinforce concepts and address misconceptions.
- Flexible grouping and multiple methods of presenting information will ensure access for all learners.

Resources Provided:

- Vernier Go Direct probes
- Measurements Gizmo
- Laboratory supplies and glassware
- Safety goggles
- Digital and analog measuring instruments
- Graph paper and data sheets
- Spreadsheet templates and digital graphing tools



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson Strongly, Moderately or Weakly meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☒	☐	☐
Provide scaffolding for acquiring targeted knowledge/skills	☒	☐	☐
Integrate global perspectives	☐	☒	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☒	☐	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☒	☐	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☐	☒	☐

Curriculum Design Template

Content Area: Science	Grade Level: 8	Unit Title: Foundations of Science
Created: 2026	Board Approved on:	



Unit Overview Template

Content Area: Science **Grade Level:** 8 **Unit Title:** Matter and its Interactions

Unit Summary: During the course of this unit, students will develop models used to differentiate between physical and chemical changes/properties of matter and use this information to determine if a chemical reaction has occurred. In addition, describe the atomic structure of various molecules and use this information to identify how this matter shapes the world around us. Students will continue to learn the history of the formation of the periodic table of elements and learn several trends behind its arrangement. At the conclusion of this unit students will use their knowledge of chemistry to design, test, and modify a system that either releases or absorbs thermal energy.

Primary Interdisciplinary Connections: Mathematics

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy

Unit Rationale: The chemistry unit reinforces the importance of understanding how the matter around us interacts with other matter. This unit reinforces the concept of identifying a substance by its properties, and furthermore explains why elements are considered the basic building blocks of matter. Matter will be broken down into its smallest parts, atomic theories will be explained, and several periodic table trends discussed.

Career Readiness (Standard 9):

9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a)

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.

Learning Targets

Standards: MS-PS1, MS-ETS1, ELA.RI.8, ELA.W.8, ELA.SL.8, ELA.L.8, MATH.A-CED, MATH.A-REI

Content Statements: Matter and its Interactions, Engineering Design, ELA, Algebra

CPI#: **Cumulative Progress Indicator (CPI):**

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.
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
MS-PS1-6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.



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.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
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.
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.
ELA.RI.8.2	Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.
ELA.RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
ELA.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.
ELA.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.
ELA.W.8.1.D	Establish and maintain a formal style.
ELA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
ELA.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
ELA.W.8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.
ELA.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.
ELA.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
ELA.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
ELA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
ELA.L.8.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.



MATH.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MATH.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).

Science and Engineering Practices:

Asking Questions and Defining Problems

Asking questions and defining problems in grades 6–8 builds on K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.

- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)
- Develop a model to describe unobservable mechanisms. (MS-PS1-5)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3), (MS-PS1-2)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on 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.

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)



Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6)

Disciplinary Core Ideas (DICs):

PS1.A: Structure and Properties of Matter

- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2)

PS1.B: Chemical Reactions

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-5)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)
- Some chemical reactions release energy, others store energy. (MS-PS1-6)

ETS1.A: Defining and Delimiting Engineering Problems

- 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 are likely to limit possible solutions. (MS-ETS1-1)

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. (MS-ETS1-4), (secondary to MS-PS1-6)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- 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 those characteristics may be incorporated into the new design. (MS-ETS1-3), (secondary to MS-PS1-6)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4), (secondary to MS-PS1-6)



Crosscutting Concepts:

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)
- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)

Unit Essential Questions:

- What makes up the matter around us?
- Can you predict how substances behave when combined?
- Can the properties of an object be organized in a useful manner?
- Can properties be used to identify substances?
- What models can be used to help identify molecular behavior?
- How do ice, rivers, tree roots, and animals cause mechanical weathering?
- How do water, acids, and air cause the chemical weathering of rocks?
- How is a rock classified? What is the rock cycle?
- What are precipitation, evaporation, condensation, and runoff?
- How do humans influence the water cycle?

Unit Enduring Understandings:



- Develop models used to analyze properties and differentiate between chemical and physical changes.
- Identify trends of the periodic table and identify how it is organized.
- Use periodic table trends to predict how chemicals will react with one another.
- Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- Understand how the arrangement of molecules changes after a chemical reaction.
- Identify phases of matter and phase changes.
- Compare physical properties (density, solubility, boiling point and conductivity) and chemical properties (flammability, color change).
- Observe and identify evidence of chemical reactions.
- Describe the factors that determine how fast physical and chemical weathering occurs.
- Explore how rocks change from one type to another.
- Illustrate the water cycle.
- Identify the major factors that affect the water cycle.

Unit Learning Targets:

Students will...

- Identify the chemical and physical properties of substances through observation and experimentation.
- Recognize that during a chemical reaction mass is conserved and particles rearrange themselves to form new substances.
- Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
- Describe the pH scale and explain how it is used; in addition explain the process of neutralization and relate this to human health.
- Conclude that weathering causes major changes to Earth's surface.
- Diagram how a rock can move through the different stages of the rock cycle.



Evidence of Learning

Summative Assessment: Unit Assessment and Labs

Equipment Needed: Student iPads, laboratory materials and supplies, safety equipment, measuring tools, calculators

Teacher Resources: Teacher laptop, textbook, laboratory materials and supplies, safety equipment, measuring tools, calculators

Formative Assessments:

- Exit/Admit cards
- Class discussion/observation
- Self assessing lab activities
- Lab reports/summary questions
- Test/Quiz/Unit Exam
- Online Gizmo questions
- Homework
- Adult/student modeling
- Peer/Self Assessments
- Presentations
- Kinesthetic Assessments



Lesson Plans

Lesson	Time Frame
Lesson 1 Properties of Matter	4 days
Lesson 2 Atoms and the Periodic Table	5 days
Lesson 3 Chemical Bonds & Chemical Reactions	7 days

Teacher Notes: To help identify periodic table trends it is important for students to have an understanding of element properties and placement within the table. It is also important to reinforce through modeling and examples the law of conservation of mass and its connection to chemical reactions. Gizmos and PhET are helpful interactive tools to visually explain these concepts.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

www.explorelearning.com

www.rsc.org/learn-chemistry

www.chem4kids.com

<https://student.societyforscience.org/sciencenews-students>



Lesson Plan 1 Template

Content Area: Science **Lesson Title:** Properties of Matter **Time Frame:** 4 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use the Phases of Matter and Water Cycle Gizmos to model particle motion and track the movement of matter through Earth's systems.
- Students will use molecular model simulations to visualize atomic structure and particle arrangements in solids, liquids, and gases.
- Students will use digital graphing tools to organize and analyze solubility and temperature data collected during investigations.
- Students will use short scientific animations to visualize processes that cannot be observed directly, including atomic structure and molecular motion.

Equipment Needed:

- iPads or laptop computers
- Periodic Tables of Elements
- Atom model kits or modeling materials (marbles, beads, clay)
- Assorted laboratory glassware
- Thermometers
- Hot plates and ice baths
- Solids and liquids for property investigations
- Solutes and solvents for solubility investigations
- Safety goggles
- Graph paper and data sheets

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Describe the structure of an atom and identify the location and function of protons, neutrons, and electrons. • Develop and use models to represent atoms and	Lesson Sequence 1. Anchoring Phenomenon: Students observe an ice cube melting, dissolving salt in water, and a piece of steel wool rusting and discuss the question: "Why do some changes	• Atom Model Lab and explanations. • Atomic Challenge Lab/Game responses. • Phases of Matter Gizmo activities.



explain properties of matter that cannot be observed directly. • Identify and describe solids, liquids, and gases in terms of particle arrangement and motion. • Explain phase changes as changes in energy and particle movement. • Compare and classify physical properties, including density, solubility, boiling point, and conductivity. • Distinguish between physical and chemical changes using observational evidence. • Investigate how temperature, solvents, and solutes influence solubility and solution concentration. • Construct models that explain the movement of matter through the water cycle and connect phase changes to Earth's systems. • Analyze how human activities influence water resources and the distribution of water on Earth. • Use evidence from investigations to explain how the properties and interactions of matter affect natural processes.	simply rearrange matter while others create entirely new substances?" 2. Students participate in an interactive discussion about matter and brainstorm examples of physical and chemical changes observed in everyday life. 3. Students use atom notes and animations to investigate atomic structure and discuss why scientists rely on models to understand particles that cannot be seen directly. 4. Students complete the Atom Model Lab by constructing models representing protons, neutrons, and electrons and explaining the organization of atoms. 5. Students participate in the Atomic Challenge Lab/Game by using marbles or manipulatives to determine atomic number, atomic mass, element symbols, and electron arrangements. 6. Students use the Phases of Matter Gizmo to observe particle behavior in solids, liquids, and gases and relate particle motion to phase changes. 7. Students complete a Properties of Matter investigation by testing substances for density, conductivity, solubility,	• Properties of Matter investigation data sheets. • Solutions and Solubility Lab graphs and conclusion questions. • Water Cycle model and explanations. • Water Cycle Gizmo activities. • Teacher observations during investigations and discussions. • Exit ticket: "How do the properties of matter determine the changes we observe in nature?" • Atoms assessment.
---	---	--



- and evidence of physical or chemical changes.
8. Students conduct a Solutions and Solubility Lab by investigating how temperature affects the amount of solute that dissolves and graphing their results.
 9. Students construct a model of the water cycle to demonstrate how matter moves continuously through Earth's systems and changes state during the process.
 10. Students use the Water Cycle Gizmo to trace the path of water molecules and investigate how human activities affect the availability and distribution of water resources.
 11. Student groups communicate findings through models, data displays, and evidence-based explanations connecting atomic structure, properties of matter, and Earth's systems.

Differentiation:

- Tiered assignments will provide varying levels of support and complexity while maintaining common learning goals.
- Guided notes, vocabulary supports, graphic organizers, and partially completed models will support students requiring additional scaffolding.
- Students may work independently, with partners, or in collaborative groups depending on readiness and instructional needs.
- Laboratory investigations may be differentiated by complexity, ranging from qualitative observations to quantitative analysis and graphing.



- Students may demonstrate understanding through models, diagrams, written explanations, presentations, videos, or digital products.
- Extension opportunities will allow advanced learners to investigate additional applications of matter properties in environmental science, engineering, and materials science.
- Mini-lessons and teacher conferencing will reinforce concepts and address misconceptions.
- Multiple methods of presenting information and demonstrating understanding will ensure access for all learners.

Resources Provided:

- Phases of Matter Gizmo
- Water Cycle Gizmo
- Molecular model simulations and animations
- Periodic Tables of Elements
- Atom modeling materials
- Laboratory supplies and glassware
- Safety goggles
- Graph paper and data sheets
- Digital graphing and presentation tools



Lesson Plan 2 Template

Content Area: Science **Lesson Title:** Atoms and the Periodic Table **Time Frame:** 5 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use interactive periodic table applications to investigate element properties, atomic structure, and trends within groups and periods.
- Students will use the Balancing Chemical Equations Gizmo to model chemical reactions and visualize conservation of mass at the particle level.
- Students will use digital simulations and animations to observe how atoms rearrange during chemical reactions.
- Students will use collaborative digital presentation tools to communicate patterns discovered in the periodic table and explain balanced chemical equations.

Equipment Needed:

- iPads or laptop computers
- Interactive Periodic Table applications
- Periodic Tables of Elements
- Atom model kits or manipulatives
- Balancing equation cards or manipulatives
- Marbles, beads, or molecular model kits
- Chart paper and markers
- Laboratory glassware and assorted lab materials
- Safety goggles
- Data sheets and graphic organizers

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Describe major events that contributed to the historical development of the periodic table. • Explain how scientists use patterns to organize	Lesson Sequence 1. Anchoring Phenomenon: Students observe steel wool burning and compare the mass and appearance of	• Alien Periodic Table Challenge Lab. • PT Timeline Challenge. • Atom and element models.



information and make predictions about matter. • Identify and interpret information found on the periodic table, including atomic number, atomic mass, groups, and periods. • Recognize relationships among elements based on their location and properties. • Develop and use models to explain the structure and organization of atoms and elements. • Describe the information conveyed in a chemical equation. • Identify reactants, products, coefficients, and chemical symbols used in equations. • Explain the Law of Conservation of Mass and apply it to chemical reactions. • Balance common chemical equations using logical reasoning and particle models. • Model how atoms are rearranged during chemical reactions while demonstrating that matter is conserved.	materials before and after the reaction. Students discuss the question: "If matter cannot be created or destroyed, how can substances look completely different after a chemical reaction?" 2. Students examine historical models of the periodic table and discuss how scientists recognized patterns among elements and continually refined their understanding of matter. 3. Students use periodic table notes and interactive resources to identify trends and patterns in groups, periods, and element properties. 4. Students complete the Alien Periodic Table Challenge by organizing unknown elements according to shared properties and justifying their placements using evidence and patterns. 5. Students participate in the PT Timeline Challenge by arranging significant scientific discoveries in chronological order and discussing how scientific knowledge develops over time.	• Chemical equation identification activities. • Conservation of Mass Modeling Activity. • Balancing Chemical Equations Lab. • Balancing Chemical Equations Gizmo activities. • Teacher observations during investigations and discussions. • Exit ticket: "How does the periodic table help scientists predict the properties and behavior of matter?" • Periodic Table assessment. • Chemical Equations assessment.
--	--	--



- | | | |
|--|--|--|
| | <ol style="list-style-type: none">6. Students construct atom and element models using manipulatives to represent atomic structure and relate atomic organization to the arrangement of the periodic table.7. Students use chemical equation notes and particle diagrams to identify reactants, products, and symbols used in chemical reactions.8. Students participate in a Conservation of Mass Modeling Activity by physically rearranging atom manipulatives before and after simulated reactions to demonstrate that atoms are conserved and simply reorganized.9. Students complete the Balancing Chemical Equations Lab by using models and counters to represent atoms and determine coefficients that satisfy conservation of mass.10. Students use the Balancing Chemical Equations Gizmo to visualize reactions at the particle level and reinforce balancing strategies.11. Student groups communicate their findings and explain | |
|--|--|--|



how patterns, models, and evidence allow scientists to organize matter and predict chemical behavior.

Differentiation:

- Tiered assignments will provide varying levels of support and complexity while maintaining common learning goals.
- Guided notes, graphic organizers, color-coded periodic tables, and partially completed equations will support students requiring additional scaffolding.
- Students may work independently, with partners, or in collaborative groups based on readiness and instructional needs.
- Manipulatives and physical models will provide multiple representations of atomic structure and chemical reactions.
- Students may demonstrate understanding through written explanations, diagrams, presentations, videos, or digital products.
- Extension opportunities will allow advanced learners to investigate periodic trends, predict properties of unknown elements, and balance more complex chemical equations.
- Mini-lessons and teacher conferencing will reinforce concepts and address misconceptions.
- Multiple methods of presenting information and demonstrating understanding will ensure access for all learners.

Resources Provided:

- Interactive Periodic Table applications
- Balancing Chemical Equations Gizmo
- Periodic Tables of Elements
- Atom model kits and manipulatives
- Laboratory supplies and glassware
- Safety goggles
- Graphic organizers and data sheets
- Digital simulations and animations



Lesson Plan 3 Template

Content Area: Science **Lesson Title:** Chemical Bonds & Reactions **Time Frame:** 7 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use iPads to complete an Ionic and Covalent Bonds Gizmo simulation and model how atoms gain, lose, and share electrons to form compounds.
- Students will use digital simulations and teacher-created multimedia resources to visualize particle interactions and observe chemical reactions that cannot be seen directly.
- Students will use iPads to collect, record, and analyze pH data and compare their findings to published pH scales and real-world applications.
- Students will use digital resources to investigate the role of acids, bases, and chemical reactions in environmental issues, consumer products, medicine, and industry.

Equipment Needed:

- iPads
- Assorted labware and chemicals
- Safety goggles and aprons
- pH paper and universal indicator solution
- Household acids and bases
- Molecular model kits or colored beads
- Periodic tables
- Laboratory handouts and graphic organizers
- Ionic and Covalent Bonds Gizmo access

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Differentiate between atoms and ions and explain how ions form through the gain or loss of electrons. • Describe the formation of ionic and covalent bonds and compare the properties	Lesson Sequence 1. Anchoring Phenomenon: Students observe an effervescent tablet placed in water and an antacid tablet neutralizing an acidic solution. Students ask,	• Ionic and Covalent Bond Gizmo • Taking Charge of Ionic Formulas Lab • Naming Covalent Compounds Lab



of ionic and molecular compounds. • Construct and interpret models showing how atoms rearrange during chemical reactions. • Identify evidence that a chemical reaction has occurred, including color change, gas production, precipitate formation, temperature change, and light production. • Classify chemical reactions based on observable evidence and changes in matter. • Investigate the properties of acids and bases and explain how the pH scale is used to describe the strength of acidic and basic substances. • Evaluate how chemical reactions and pH influence human health, environmental quality, manufacturing, and everyday products. • Develop scientific explanations and engineering solutions using evidence gathered from laboratory investigations.	"Why do substances combine to create entirely new materials, and how can scientists predict these changes?" 2. Engage students in a discussion of everyday chemical changes, including cooking food, rusting metals, baking, and cleaning products. 3. View Chemical Bonds Notes and use visual models to differentiate between ionic and covalent bonding. 4. Create particle models using molecular kits, colored beads, or drawings to represent electron transfer and electron sharing. 5. Complete the Taking Charge of Ionic Formulas Lab and use the criss-cross rule to determine ionic formulas and identify patterns in ionic compounds. 6. Complete the Naming Covalent Compounds Lab and apply systematic naming conventions to molecular compounds. 7. Use the Ionic and Covalent Bonds Gizmo to investigate how atoms form stable compounds and visualize particle interactions at the atomic level.	• Chemical Reactions I-V Lab • Acid/Base and pH Scale Lab and Activity • Laboratory data tables and observations • Student-created particle models • Exit tickets and discussion responses • Group presentations and scientific explanations • Teacher observation and questioning during investigations
--	---	--



8. View Chemical Reactions Notes and analyze examples of chemical and physical changes.
9. Conduct the Chemical Reactions I-V investigations and observe evidence of chemical reactions including gas production, temperature change, precipitate formation, and color change.
10. Record qualitative and quantitative observations and construct explanations for the observed changes.
11. Conduct the Acid and Base Lab and test the pH of common household substances.
12. Recreate the pH scale using universal indicator colors and classify substances as acidic, neutral, or basic.
13. Analyze how acids and bases are used in medicine, agriculture, manufacturing, environmental management, and consumer products.
14. Design and communicate explanations for how understanding chemical reactions and pH can help solve real-world problems involving water quality,



health, food
production, and
environmental
sustainability.
15. Collaborate in groups
to analyze laboratory
data, compare results,
and communicate
scientific explanations
supported by evidence.

Differentiation:

- Tiered assignments provide varying levels of scaffolding and complexity while maintaining common learning goals.
- Graphic organizers, vocabulary supports, and partially completed examples support students requiring additional assistance.
- Mini-lessons and small-group instruction reinforce concepts including bonding, formulas, and pH.
- Students may demonstrate understanding through written explanations, diagrams, digital presentations, physical models, or verbal presentations.
- Extension opportunities allow students to investigate industrial applications of chemical reactions, environmental chemistry, pharmaceuticals, or consumer product chemistry.
- Flexible grouping allows students to collaborate, peer tutor, and communicate scientific reasoning through multiple modalities.

Resources Provided:

- iMovie and teacher-created multimedia resources
- Ionic and Covalent Bonds Gizmo access
- Lab supplies, chemicals, glassware, and safety goggles
- Molecular model kits
- Periodic tables
- Universal indicators and pH paper
- Laboratory handouts and graphic organizers



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson Strongly, Moderately or Weakly meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☒	☐	☐
Integrate global perspectives	☐	☒	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☒	☐	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☐	☒	☐

Curriculum Design Template

Content Area: Science	Grade Level: 8	Unit Title: Matter and its Interactions
Created: 2026		Board Approved on:



Unit Overview Template

Content Area: Science **Grade Level:** 8 **Unit Title:** Motion and Stability: Forces and Interactions

Unit Summary: During the course of this unit students will measure motion as a change in the position of an object in respect to time. Motion is typically described in terms of velocity, acceleration, displacement, and time. Attaching a reference point to an object and measuring its change in position relative to another reference point can observe motion. An object that does not move is considered to be at rest or stationary. The object's motion cannot change unless acted upon by an unbalanced force. Thus a force is any influence that causes an object to undergo a certain change, either concerning its movement, or its direction. This unit will conclude by relating force upon a body over its area to create pressure. Furthermore, students will discuss variations in fluid pressure and common applications & principles.

Primary Interdisciplinary Connections: Mathematics

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☐ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy

Unit Rationale: The motion & forces unit supports the idea of forces having both direction and magnitude. As a result, forces can cause objects with mass to accelerate. Most importantly, motion and forces create the framework of Newton's 3 Laws of Motion and help relate an object's mass and velocity to its momentum. Accordingly, they help to describe the law of conservation of momentum. Force over a given area creates pressure. This pressure changes according to height and depth.

Career Readiness (Standard 9):

- 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a)
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Learning Targets

Standards: MS-PS2, MS-ETS1, ELA.RI.8, ELA.W.8, ELA.SL.8, ELA.L.8, MATH.A-CED, MATH.A-REI, MATH.A-SSE, MATH.A-APR

Content Statements: Motion and Stability: Forces and Interactions, Engineering Design, ELA, Algebra

CPI#:

Cumulative Progress Indicator (CPI):

MS-PS2-1

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.



MS-PS2-2	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
MS-PS2-3	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
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.
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.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
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.
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.
ELA.RI.8.2	Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.
ELA.RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
ELA.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.
ELA.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.
ELA.W.8.1.D	Establish and maintain a formal style.
ELA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
ELA.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
ELA.W.8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.



ELA.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.
ELA.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
ELA.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
ELA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
ELA.L.8.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
MATH.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MATH.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MATH.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
MATH.A-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).

Science and Engineering Practices:

Asking Questions and Defining Problems

Asking questions and defining problems in grades 6–8 builds on K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.

- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)



- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on 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.

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)
- 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. (MS-PS2-4)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds from grades K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

Disciplinary Core Ideas (DICs):

PS2.A: Forces and Motion

- 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)
- 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 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)
- 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)



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)
- 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)
- 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, or a ball, respectively). (MS-PS2-5)

ETS1.A: Defining and Delimiting Engineering Problems

- 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 are likely to limit possible solutions. (MS-ETS1-1)

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. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- 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 those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

Crosscutting Concepts:

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3), (MS-PS2-5)

Systems and System Models

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1), (MS-PS2-4)



Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2), (MS-PS2-4)

Unit Essential Questions:

- What properties identify a valid reference point used to detect motion?
- What does a graph of constant speed look like?
- What does a graph of acceleration look like?
- How are speed and velocity different?
- What are the effects of balanced and unbalanced forces on motion of an object?
- What are Newton's 3 laws of motion?
- How do friction, mass, and surface area affect an object in "free-fall?"
- How do altitude and depth affect fluid pressure?
- What are some common applications of Pascal's, Archimedes', and Bernoulli's Principles?

Unit Enduring Understandings:

- Differentiate between speed and velocity.
- Use constant speed and acceleration graphs to interpret change in motion.
- Model how various forces can act on an object at the same time.
- Model how various fundamental forces act over a distance to influence the motion of an object.
- Calculate the net force acting on an object, and determine the effect on the motion of an object.
- Identify how Newton's 3 Laws of Motion are related to balanced and unbalanced forces.
- Model collisions between objects through the transfer of momentum.
- Recognize how altitude and depth affect fluid pressure.

Unit Learning Targets: **Students will...**



- Use a reference point to accurately recognize and measure the motion of an object.
- Measure distance and time accurately, then create and interpret a distance vs. time graph.
- Describe the motion of an object as it accelerates.
- Measure force accurately using spring scales.
- Model forces acting on objects using force diagrams.
- Use computer simulations to create models for gravity, electric and magnetic forces.
- Use Newton's 3 Laws of Motion to identify how balanced and unbalanced forces affect motion.
- Observe the effects of friction and gravity during "free-fall."
- Build a floating vessel capable of holding the most passengers demonstrating buoyancy, Archimedes Principle, and fluid pressure.
- Discuss daily applications of Bernoulli's and Pascal's Principle.



Evidence of Learning

Summative Assessment: Unit Assessment and Labs

Equipment Needed: Student iPads, laboratory materials and supplies, safety equipment, measuring tools, calculators

Teacher Resources: Teacher laptop, textbook, laboratory materials and supplies, safety equipment, measuring tools, calculators

Formative Assessments:

- Exit cards
- Discussion
- Self-Assessing lab activities
- Lab Reports
- Test/Quiz
- Online Gizmo Quiz
- Homework
- Student modeling



Lesson Plans

Lesson	Time Frame
Lesson 1 Motion	8 days
Lesson 2 Forces	15 days
Lesson 3 Engineering Collision Safety: Crumple Zones and Impact Forces	6 days

Teacher Notes: To help identify a change in motion it is important students understand what constitutes a valid reference point. It is also important for students to understand the difference between balanced and unbalanced forces, and which cause a change in motion. Finally, it is essential students understand what creates the buoyant force, and how this force affects the floating or sinking of an object.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

www.explorelearning.com



Lesson Plan 1 Template

Content Area: Science

Lesson Title: Motion

Time Frame: 8 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☒ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☒ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use Gizmos simulations to investigate relationships among distance, time, speed, velocity, and acceleration through virtual experiments.
- Students will use video analysis tools on their iPads to record motion and collect data from classroom investigations and engineering challenges.
- Students will use graphing applications and digital spreadsheets to create and analyze motion graphs and calculate speed and acceleration.
- Students will use digital design tools to document and communicate the design process and performance of their gravity-powered race cars.

Equipment Needed:

- iPads
- Ramps and inclined planes
- Meter sticks and measuring tapes
- Stopwatches
- Motion carts and tracks
- Toy cars
- K'Nex building materials
- Assorted materials for gravity-powered race cars
- Masking tape and markers for measurement stations
- Graph paper
- Lab supplies

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Explain that motion is described relative to a reference point. • Distinguish between distance and displacement.	Lesson Sequence 1. Anchoring Phenomenon: Students observe videos of roller coasters, race cars, and athletes sprinting and discuss why some	• “Graphing Motion” Lab • “Speed” Gizmo • “Average Speed” Lab • “Incline to Roll” Lab • “Velocity” Gizmo • “Acceleration Cart” Lab



• Calculate speed using distance and time measurements. • Differentiate between speed and velocity and explain the importance of direction in describing motion. • Describe and calculate acceleration using changes in speed over time. • Create, interpret, and analyze distance-time and speed-time graphs. • Use mathematical relationships and graphical data to explain patterns of motion. • Design and conduct investigations that collect and analyze motion data. • Apply engineering design principles to construct, test, and improve a gravity-powered race car. • Communicate scientific explanations and engineering solutions using data and evidence.	objects move faster, change direction, or accelerate differently even when they travel similar distances. 2. View Motion notes and discuss how an object's motion depends on its reference point. 3. Conduct a classroom motion investigation in which students walk different paths while classmates measure distance and time. 4. Complete the "Graphing Motion" lab by collecting motion data and constructing distance-time graphs to identify patterns of motion. 5. View Speed notes and calculate speed using measured distances and elapsed times from classroom investigations. 6. Conduct the "Average Speed" lab by measuring and comparing the speeds of moving objects. 7. View Velocity notes and differentiate between speed and velocity by incorporating direction into calculations and graphical representations. 8. Conduct the "Incline to Roll" lab and investigate how changes in ramp height affect the motion of rolling objects.	• "Acceleration" Gizmo • "How fast can I run" Lab • "Super worms" Lab. • K'Nex Car Challenge.
---	---	--



9. View Acceleration notes and calculate acceleration using changes in speed over time.
10. Complete the "Acceleration Cart" lab to investigate how unbalanced forces affect acceleration and represent the data graphically.
11. Conduct the "How Fast Can I Run?" lab by collecting, graphing, and analyzing personal motion data.
12. Complete the "Super Worms" lab to model and compare different types of motion.
13. Design, build, test, and modify a gravity-powered K'Nex race car using the engineering design process.
14. Collect and analyze data from multiple race trials and use evidence to improve vehicle performance.
15. Communicate experimental findings and engineering solutions through graphs, data tables, and group presentations.

Differentiation:

- Provide guided notes, formula sheets, and partially completed data tables for students requiring additional support.
- Use mini-lessons and teacher conferences to reinforce graph interpretation and mathematical calculations.



- Provide extension opportunities that require students to analyze more complex motion scenarios and compare multiple data sets.
- Allow students to demonstrate understanding through written explanations, digital presentations, diagrams, videos, or oral presentations.
- Provide flexible grouping opportunities during laboratories and engineering challenges.
- Offer varying levels of scaffolding during data analysis and graphing activities.
- Allow students to modify race car designs using different materials and constraints based on readiness levels.
- Encourage students to assume different team roles such as engineer, builder, recorder, data analyst, and presenter.

Resources Provided:

- Lab supplies
- Ramps and motion equipment
- K'Nex building materials
- Meter sticks and stopwatches
- Graph paper
- Gizmos simulations
- iPad applications for graphing and video analysis
- Teacher-created notes and digital resources



Lesson Plan 2 Template

Content Area: Science

Lesson Title: Forces

Time Frame: 15 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Students will use digital simulations and data collection tools to investigate gravitational, electric, and magnetic forces and analyze relationships among force, mass, and acceleration.
- Students will use iPad sensors, video analysis tools, and graphing applications to collect, organize, and interpret motion and force data.
- Students will use digital resources and simulations to model buoyancy, momentum transfer, and fluid behavior in real-world systems.
- Students will create digital presentations, diagrams, and engineering design portfolios to communicate scientific findings and design solutions.

Equipment Needed:

- iPads
- Spring scales and force meters
- Assorted masses and weights
- Magnets and electroscopes
- Ramps and motion carts
- Toy cars and balloons
- Marbles
- Containers of water
- Graduated cylinders and beakers
- Measuring tools and stopwatches
- Materials for constructing self-powered vehicles
- Lab supplies and safety goggles

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Explain the relationship between balanced and unbalanced forces and changes in motion.	Lesson Sequence 1. Anchoring Phenomenon: Students observe videos of roller coasters, rockets launching, hovercrafts,	• “Force” lab • “Electroscope” Lab • “Magnets” Lab • “Universal Gravitation” Lab



• Construct and interpret force diagrams that represent forces acting on objects. • Model gravitational, electrical, and magnetic forces that act over a distance. • Investigate contact forces, including applied forces, friction, normal force, and buoyancy. • Describe and analyze the effects of gravity and air resistance on objects in free fall. • Apply Newton's Laws of Motion to explain and predict the motion of stationary and moving objects. • Calculate momentum and explain how momentum is conserved and transferred during collisions. • Explain how pressure changes with depth and altitude. • Investigate Pascal's Principle, Archimedes' Principle, and Bernoulli's Principle and describe their real-world applications. • Design, build, test, and improve a self-powered vehicle that applies principles of force and motion. • Analyze data and use evidence to construct scientific explanations and engineering solutions.	high-speed crashes, and ships floating on water and discuss how invisible forces can cause objects to move, stop, sink, float, or change direction. 2. View Force notes and construct force diagrams that identify balanced and unbalanced forces acting on objects. 3. Conduct the "Force" lab by measuring pushes and pulls using force meters and analyzing the relationship between net force and motion. 4. Complete the "Electroscope" and "Magnets" labs to investigate electric and magnetic forces that act over a distance. 5. Use digital simulations to create mathematical models of gravitational, electrical, and magnetic interactions and identify patterns within the data. 6. Conduct the "Rough Stuff" and "Slide or Roll" labs to investigate factors affecting friction and methods for reducing frictional forces. 7. Complete the "Gravity & Free-Fall" and "Gravity" labs by comparing objects falling with and without air resistance	• "Rough Stuff" lab • "Slide or Roll" lab • "Gravity & Free-fall" lab • "Gravity" lab • "Newton's Laws of Motion" labs • Balloon Car Challenge. • "Bumper Cars" lab • "Momentum" webquest • "Energy & Momentum" lab • "Pressure Parts I and II" lab • "Cartesian Diver" lab • "Marble Boat" lab • "Archimedes' Principle" Gizmo • "Buoyant Force" lab • "Bernoulli's Principle" lab
--	--	---



- and analyzing the effects of gravity.
8. View Newton's Laws notes and participate in teacher demonstrations and investigations that model inertia, force, mass, and acceleration.
 9. Conduct a series of Newton's Laws investigations using carts, ramps, and masses to relate net force, friction, normal force, gravity, and applied forces.
 10. Design, build, test, and redesign a self-powered vehicle that travels a predetermined distance while applying principles of force, friction, and energy transfer.
 11. Complete the "Bumper Cars" lab and the "Energy & Momentum" lab to investigate collisions and model the transfer and conservation of momentum.
 12. Complete the "Momentum" webquest and analyze how momentum concepts are applied in automobile safety systems, sports equipment, and transportation design.
 13. View Forces in Fluids notes and investigate pressure changes with altitude and depth.



- | | | |
|--|--|--|
| | <ol style="list-style-type: none">14. Conduct the "Pressure Parts I and II" labs to measure and analyze changes in fluid pressure.15. Complete the "Cartesian Diver," "Marble Boat," and "Buoyant Force" labs to investigate floating, sinking, density, and buoyancy.16. Use the "Archimedes' Principle" Gizmo and the "Bernoulli's Principle" lab to investigate fluid behavior and explain real-world applications such as aircraft flight, hydraulic systems, and ship design.17. Communicate scientific findings and engineering solutions through data tables, graphs, scientific arguments, and digital presentations. | |
|--|--|--|

Differentiation:

- Provide guided notes, vocabulary supports, and partially completed force diagrams for students requiring additional scaffolding.
- Use mini-lessons and teacher conferences to reinforce mathematical calculations involving force, acceleration, pressure, and momentum.
- Provide structured data tables and graphic organizers to support analysis of laboratory results.
- Allow students to demonstrate understanding through written explanations, digital presentations, diagrams, videos, engineering sketches, or oral presentations.
- Provide extension opportunities that require students to design more efficient vehicles, analyze complex collision scenarios, or investigate advanced applications of fluid mechanics.
- Use flexible grouping strategies during investigations and engineering challenges.
- Allow students to assume different team roles such as engineer, builder, data analyst, materials manager, and presenter.
- Offer varying levels of support and challenge during experimental design and data analysis activities.

Resources Provided:



- Lab supplies and safety goggles
- Force meters and spring scales
- Magnets and electroscopes
- Motion carts, ramps, and masses
- Materials for self-powered vehicle construction
- Digital simulations and graphing tools
- Teacher-created notes and digital resources
- iPads and multimedia resources



Lesson Plan 3 Template

Content Area: Science

Lesson Title: Engineering Collision Safety: Crumple Zones and Impact Forces

Time Frame: 6 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- iPads for data collection, simulation, and analysis
- PhET Collision Lab simulation (digital modeling of collisions)
- Slow-motion video analysis tools (e.g., frame-by-frame crash review apps)
- Graphing or data visualization tools (built-in iPad apps or web-based tools)

Equipment Needed:

- Toy cars (various masses and designs)
- Ramps or track systems (adjustable incline)
- Cardboard sheets and tubes
- Foam blocks and sponges
- Clay or modeling material
- Masking tape and duct tape
- Meter sticks or measuring tapes
- Stopwatches
- Barrier materials (books, blocks, or wooden stops)
- Small test masses (for payload/"passenger" models)
- Balance scales (optional for mass comparisons)

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Explain how momentum changes during collisions and how force depends on change in momentum over time.	Lesson Sequence 1. Anchoring phenomenon: Students observe and analyze multiple crash test videos showing vehicles of different designs	• Collision Lab simulation data sheet • Momentum Transfer Investigation worksheet



- | | | |
|---|--|--|
| <ul style="list-style-type: none">• Describe how increasing collision time reduces impact force.• Compare elastic and inelastic collisions using models and simulations.• Analyze how mass and velocity influence collision outcomes.• Design, construct, and test a crumple zone system that reduces impact force.• Apply Newton's Laws of Motion to real-world crash safety systems.• Collect, graph, and interpret collision data to evaluate engineering solutions.• Revise and improve designs based on evidence and repeated testing. | <p>colliding at similar speeds and discuss why damage severity varies significantly despite similar motion conditions.</p> <ol style="list-style-type: none">2. Students engage in structured discussion identifying initial ideas about force, motion, and safety systems in vehicles.3. View instructional notes on momentum, force, and impulse, focusing on how force is related to change in momentum over time.4. Students participate in a guided demonstration using toy cars to observe basic collisions and record qualitative observations of motion before and after impact.5. Students use PhET Collision Lab to simulate elastic and inelastic collisions while systematically adjusting mass and velocity variables.6. Students record simulation data in structured tables and begin identifying patterns between mass, velocity, and momentum change.7. Students conduct a "Momentum Transfer Investigation" using toy cars on ramps to simulate controlled collisions and measure | <ul style="list-style-type: none">• Crumple Zone Engineering Challenge prototype• Collision data graphs (force vs. time / distance vs. impact)• CER (Claim–Evidence–Reasoning) explanation• Engineering design reflection and redesign notes• Group presentation or gallery walk of final designs• Exit ticket on impulse and force relationships |
|---|--|--|



- | | | |
|--|--|--|
| | <p>distance traveled after impact.</p> <ol style="list-style-type: none">8. Students compare rigid collisions versus padded collisions using foam, cardboard, and clay to investigate how collision time affects force.9. Students graph results to visualize relationships between collision time and impact severity.10. Students design a crumple zone prototype using provided materials with the goal of reducing impact force on a test object.11. Students test designs through repeated ramp trials, recording data on damage level, stopping distance, and collision behavior.12. Students analyze results and identify strengths and weaknesses in their designs using evidence-based reasoning.13. Students revise and rebuild crumple zone systems based on test results and peer feedback.14. Students conduct final testing trials and compare performance across designs using class data sets.15. Students create a final explanation connecting their design choices to physics concepts | |
|--|--|--|



including force, momentum, and Newton's Laws.
16. Students communicate findings through graphs, written explanations, diagrams, or short digital presentations.

Differentiation:

- Provide structured data tables and guided analysis prompts for students needing support.
- Use scaffolded CER templates with sentence starters for scientific reasoning.
- Offer simplified or advanced design constraints for crumple zone engineering challenge.
- Allow flexible demonstration of understanding (written, oral, diagram-based, or digital presentation).
- Assign collaborative roles (designer, builder, tester, data analyst, presenter) to support participation.
- Provide extension challenges such as optimizing mass ratios or minimizing damage under stricter constraints.
- Offer mini-lessons on graph interpretation, momentum calculations, and force-time relationships as needed.

Resources Provided:

- Toy cars and ramp systems
- Foam, cardboard, clay, and padding materials
- Barrier materials and measuring tools
- PhET Collision Lab simulation
- iPads and digital data tools
- Teacher-created notes and instructional materials



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson Strongly, Moderately or Weakly meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☒	☐	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☒	☐	☐
Are differentiated based on student needs	☐	☒	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Science **Grade Level:** 8 **Unit Title:** Motion and Stability: Forces and Interactions

Created: 2026

Board Approved on:



Unit Overview Template

Content Area: Science

Grade Level: 8

Unit Title: Energy

Unit Summary: During the course of this unit students will learn that there is a finite amount of energy in the universe that can be transferred to objects to change their motion, position or velocity. The students will identify the forms of energy and use mathematical formulas to describe the energy associated with various objects. The students will discuss energy conversions from one form to another in everyday objects including lamps, toasters, televisions and roller coasters. The students will research and discuss the various methods that our 21st century world uses to generate the electricity to power our modern lives. Mechanical energy relates to the motion or position of an object and the students will build various simple machines to change the motion of an object. This unit concludes with energy conversions that change the temperature of an object.

Primary Interdisciplinary Connections: Mathematics

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☐ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy

Unit Rationale: The energy conversions unit lays the framework for all future physics concepts covered in this class. This unit teaches the students that there is a set amount of energy in the universe and no more can be created or destroyed. Energy can only be transferred from one form to another or from one object to another. The conversions taking place may be used to lift a load using a simple machine, predict the motion of a roller coaster or heat up an object and observe it turn from a solid to a liquid and to a gas.

Career Readiness (Standard 9):

- 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a)
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Learning Targets

Standards: MS-PS3, MS-PS4, MS-ETS1, ELA.RI.8, ELA.W.8, ELA.SL.8, ELA.L.8, MATH.A-REI, MATH.A-SSE

Content Statements: Energy, Waves and Their Applications in Technologies for Information Transfer, Engineering Design, ELA, Algebra

CPI#:

Cumulative Progress Indicator (CPI):

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.
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-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.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
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.
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.
ELA.RI.8.2	Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.
ELA.RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
ELA.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.
ELA.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.
ELA.W.8.1.D	Establish and maintain a formal style.
ELA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.



ELA.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
ELA.W.8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.
ELA.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.
ELA.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
ELA.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
ELA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
ELA.L.8.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
MATH.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MATH.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).

Science and Engineering Practices:

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 6–8 builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to describe and/or support scientific (MS-PS4-1)

Obtaining, Evaluating, and Communicating Information



Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.

- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)

Planning and Carrying Out Investigations

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.

- 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. (MS-PS3-4)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)

Asking Questions and Defining Problems

Asking questions and defining problems in grades 6–8 builds on K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.

- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)
- Develop a model to describe unobservable mechanisms. (MS-PS3-2)
- Develop and use a model to describe phenomena. (MS-PS4-2)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)
- Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)

Engaging in Argument from Evidence



Engaging in argument from evidence in 6–8 builds on 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.

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)
- 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. (MS-PS3-5)

Disciplinary Core Ideas (DICs):

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)
- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)
- 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)

PS3.B: Conservation of Energy and Energy Transfer

- When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)
- 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)
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

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)

ETS1.A: Defining and Delimiting Engineering Problems

- 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 are likely to limit possible solutions. (MS-ETS1-1), (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. (MS-ETS1-4), (secondary to MS-PS3-3)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)



- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- 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 those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

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)

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)

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)

Crosscutting Concepts:

Scale, Proportion, and Quantity

- 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. (MS-PS3-1), (MS-PS3-4)

Systems and System Models

- Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. (MS-PS3-2)

Energy and Matter



- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5)
- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)

Patterns

- Graphs and charts can be used to identify patterns in data. (MS-PS4-1)

Structure and Function

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)
- Structures can be designed to serve particular functions. (MS-PS4-3)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)
- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-4), (MS-PS3-5)

Unit Essential Questions:

- How can energy be transferred from one object to another?
- How can energy be transformed from one form to another?
- Does the total energy in a closed system remain constant or change?
- What is the difference between renewable and nonrenewable resources?
- How are renewable and nonrenewable resources used and conserved?

Unit Enduring Understandings:

- Use graphs to express kinetic and potential energy.
- Model how energy conversions take place.
- Calculate the amount of energy in a moving object based on its mass and speed.
- Calculate the amount of potential energy in an object based on its mass and height above the Earth.
- Contrast renewable with nonrenewable resources.



- Explain how groundwater can be both a renewable and a nonrenewable resource.
- Explain how humans use and conserve natural resources.
- List advantages and disadvantages of using alternative energy resources.

Unit Learning Targets:

Students will...

- Interpret kinetic energy and potential energy graphs.
- Demonstrate, calculate, and explain energy conversions taking place.
- Understand that there is a set amount of energy in the universe that can be transformed into other forms.
- Understand that our daily lives rely on electricity and sources for generating electricity come from natural resources.
- Discuss opportunities for individuals to become better involved in efforts to conserve and recycle natural resources.



Evidence of Learning

Summative Assessment: Unit Assessment and Labs

Equipment Needed: Student iPads, laboratory materials and supplies, safety equipment, measuring tools, calculators

Teacher Resources: Teacher laptop, textbook, laboratory materials and supplies, safety equipment, measuring tools, calculators

Formative Assessments:

- Exit cards
- Discussion
- Self Assessing lab activities
- Lab Reports
- Test/Quiz
- Online Gizmo Quiz
- Homework
- Student modeling



Lesson Plans

Lesson	Time Frame
Lesson 1 Forms of Energy & Energy Conversions	10 days
Lesson 2 Heat and Temperature	8 days
Lesson 3 Electric Circuits	7 days

Teacher Notes: In order to save time, have all materials pre-cut and ready for students to use prior to the start of the lesson.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

www.explorelearning.com

www.classzone.com

www.edheads.com

www.phet.colorado.edu



Lesson Plan 1 Template

Content Area: Science **Lesson Title:** Forms of Energy & Energy Conversions

Time Frame: 10 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- iMovie (student-created scientific explanations)
- Teacher-generated video clips (phenomenon hooks and analysis prompts)
- Gizmo simulations (energy transformation modeling)
- Energy Skate Park simulation (variable manipulation and data collection)
- Digital data tables (iPads for recording and graphing)
- Online research tools (curated energy source comparison sites)

Equipment Needed:

- iPads
- Laptop computers (teacher use for modeling and projection if needed)
- Projector (teacher-led demonstrations only)
- Lab materials (ramps, balls, spring systems, measuring tapes, stopwatches)
- Roller coaster construction materials (foam tubing, tape, supports, marbles/balls)
- Chart paper and markers for energy timelines and modeling

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Compare potential and kinetic energy using observable variables in physical and digital systems. • Model energy transformation pathways using simulations, graphs, and physical models.	Lesson Sequence 1. View teacher-generated phenomenon video clips of roller coasters, falling objects, and bouncing systems, and students identify initial energy types and predict transformations using structured discussion protocols.	• “High Bounce” Potential Energy Lab. • Energy Skate park Internet Simulation Activity. • “Jason Project” Roller Coaster Builder. • Roller coaster project. • “Barbie Bungee” Project. • Energy Timeline.



- | | | |
|---|---|---|
| <ul style="list-style-type: none">• Analyze how energy transfers and transforms in real-world systems such as amusement park rides and falling objects.• Identify, describe, and apply the six forms of energy with real-world examples and evidence.• Investigate renewable and nonrenewable energy sources and evaluate their impact on society and the environment.• Communicate scientific reasoning through models, writing, discussion, and multimedia presentation.• Use data to justify conclusions about energy efficiency and system performance. | <ol style="list-style-type: none">2. Students complete a “Notice and Wonder” digital response on iPads using a shared class document to build observational reasoning and collaborative thinking.3. Use Gizmo Energy simulation to manipulate mass, height, and velocity variables while recording real-time kinetic and potential energy changes in digital data tables on iPads.4. Graph energy relationships from simulation data using spreadsheet tools (Google Sheets on iPads) to identify patterns between height, speed, and energy type.5. Conduct “High Bounce” lab where students test different materials and measure rebound height, recording data digitally and analyzing energy loss and transfer.6. Students use Energy Skate Park simulation to model gravitational potential energy, kinetic energy, and thermal loss, adjusting friction settings and recording system behavior changes.7. Build and test roller coaster systems using physical materials, then map energy transformations at key points (top of hill, loops, | <ul style="list-style-type: none">• Generating Electricity Debate |
|---|---|---|



- end point) using annotated diagrams.
8. Students create CER (Claim-Evidence-Reasoning) explanations comparing energy efficiency between their physical model and simulation results, supported with data screenshots and graphs.
 9. Conduct structured online research on electricity generation methods (solar, wind, hydro, nuclear, fossil fuels) using curated sources and complete a comparative analysis chart on environmental, economic, and efficiency factors.
 10. Engage in a collaborative “Energy Town Planning” task where groups justify the best energy source for a fictional community using scientific evidence, environmental impact, and cost reasoning.
 11. Create an iMovie presentation explaining a real-world energy transformation system (roller coaster, hydroelectric dam, wind turbine, etc.), including narration, diagrams, and embedded data evidence.
 12. Participate in peer review sessions where students evaluate each other’s iMovie projects using a rubric focused on clarity,



- evidence, and scientific accuracy.
13. View Energy notes. Students will use notes to distinguish between kinetic and potential energies.
 14. View Energy Conversions notes. Students will use diagrams and internet simulations to describe potential and kinetic energies of moving objects such as a roller coaster.
 15. Energy Timeline. Students will create a timeline showing how long it takes for natural resources to be replenished.
 16. Students will research various methods for generating electricity. Students will select and justify which method is the best for their town.

Differentiation:

- Students select from multiple lab stations (bounce testing, simulation modeling, or roller coaster construction) based on readiness and interest.
- Scaffolds include sentence frames for CER writing, guided data tables, and partially completed graphs for support learners.
- Extension tasks require advanced students to calculate efficiency percentages and energy loss rates using provided formulas.
- Visual, kinesthetic, and digital learning pathways support diverse learning preferences and engagement styles.
- Collaborative group roles include data analyst, designer, presenter, and researcher to build communication and leadership skills.
- Real-world engineering constraints are added for advanced learners (budget limits, environmental impact requirements).
- Students revise work after peer feedback to strengthen communication and scientific reasoning.
- Choice-based final product allows students to demonstrate understanding through multimedia, written explanation, or model-based presentation.



Resources Provided:

- iPads
- Simulation platforms (Gizmo Energy Skate Park and energy systems models)
- Teacher-generated phenomenon video clips
- Lab materials (ramps, springs, balls, measuring tools, timers)
- Roller coaster engineering kits (foam tubing, tape, supports)
- Digital graphing tools (Google Sheets or equivalent on iPads)
- CER writing templates and rubrics
- Energy source research packet (curated digital resources)
- iMovie editing tools on student devices
- Peer review rubrics and reflection forms



Lesson Plan 2 Template

Content Area: Science **Lesson Title:** Heat and Temperature **Time Frame:** 8 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Gizmos simulation lab (heat transfer, phase change, and particle motion models)
- iPads for data collection, graphing, and CER responses
- Digital thermometer simulation tools within Gizmos
- Short teacher-generated video clips (phenomenon-based heat transfer examples)
- Digital graphing tools for temperature vs. time analysis

Equipment Needed:

- iPads
- Laptop computers (teacher use for projection/modeling if needed)
- Labware (beakers, metal rods, thermometers, insulating materials)
- Assorted lab materials (water baths, ice, hot plates, foam, foil, cloth, plastic)
- Convection chamber apparatus
- Straw, tape, paper, and lightweight building materials (thermal house challenge)
- Safety goggles and heat-safe containers

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Be familiar with three common temperature scales, how to read a thermometer in each scale and how to use a math formula to convert between scales. • Describe the direction of heat flow. • Understand that when two objects touch, thermal energy is	Lesson Sequence 1. Anchoring phenomenon: Students observe a real-world scenario where identical cups of hot liquid cool at different rates depending on material and insulation, and students generate initial explanations for why heat loss varies. 2. Students engage in "Notice and Wonder"	• (Properly Reading) "Temperature Scales" assignment • "Equilibrium" Lab • "Radiometer" Activity • Thermal Expansion (Balloon) Home Experiment • Convection Apparatus Activity • States of Matter assignment. • Heat Loss Home Project.



transferred through conduction. • Know that all electromagnetic waves carry thermal energy in the form of radiation that can be transferred to objects through empty space. • Explain what happens to the volume of an object when heated or cooled. • Be able to apply the concept of thermal expansion to the density of fluids and explain how convection currents are formed. • Describe how the addition or removal of thermal energy from an object can change the behavior of the molecules and therefore change its state of matter. • Use knowledge to modify a straw frame and paper walled house to minimize the amount of thermal energy lost. • Design and conduct an investigation to measure effectiveness of thermal conductors and insulators.	discussion using teacher-generated video clips of heat transfer in real-world systems (ice melting, metal heating, sunlight absorption). 3. View Temperature Scales instruction and practice converting between Celsius, Fahrenheit, and Kelvin using structured guided practice on iPads. 4. Conduct "Thermal Equilibrium" lab where hot and cold water systems are combined with metal conductors to observe heat flow direction until equilibrium is reached. 5. Use Gizmos simulation to model particle motion during conduction and phase changes, adjusting temperature variables and recording data trends digitally. 6. Graph temperature vs. time during heating and cooling curves using iPad-based graphing tools to identify phase change plateaus and energy transfer patterns. 7. Investigate radiation by testing how different colors and materials absorb or reflect heat using controlled light exposure and temperature measurements. 8. Conduct convection chamber investigation and draw and label	• Heat Transfer Science Fair project. • Temperature conversion practice sheet • Thermal Equilibrium lab data and analysis • Gizmos simulation data set (particle motion and phase change) • Radiation absorption investigation results • Convection current diagram with explanation • Thermal expansion balloon lab reflection • Heat loss house engineering design and test results • CER written explanation of insulation effectiveness • Group engineering presentation or iMovie explanation • Exit ticket on heat transfer mechanisms and energy flow
---	---	--



- convection current diagrams based on observed fluid motion.
9. Perform thermal expansion balloon investigation to observe volume changes in gases when heated and cooled, connecting observations to particle theory.
 10. Build and test a “heat loss house” using straw, paper, and insulation materials, then measure temperature retention over time under controlled conditions.
 11. Modify house designs based on initial data and retest to improve insulation effectiveness.
 12. Use CER writing to explain which materials were most effective and why, supported by data from experiments and simulations.
 13. Participate in collaborative “Engineering Challenge: Energy-Efficient Housing” where groups justify design choices based on cost, efficiency, and environmental impact.
 14. Present findings through diagrams, written explanations, or short iMovie summaries showing heat transfer mechanisms in their model.
 15. View Temperature Scales notes and practice how to



- correctly read a thermometer and convert between the major scales.
16. Heat Transfer
Introduction with emphasis on direction of heat flow.
 17. Observe the movement of thermal energy from “hot” water to “cold” water when a metal bar is in direct contact with both waters.
 18. Describe how solar radiation can be reflected or absorbed by different materials and different colors to change the temperature of that substance.
 19. Observe objects expanding when heated and contracting when cooled.
 20. Accurately diagram convection currents moving within the convection apparatus.
 21. Graph and interpret data when water is turned from a solid to a liquid and then to a gas. Students will use the kinetic theory to describe the motion of the molecules within the water at different points on the graph.
 22. Interpret visual and measured empirical data to determine if modifications for minimizing heat loss are effective.



23. Apply scientific methods to solve a problem regarding thermal conductors and insulators.

Differentiation:

- Scaffolded conversion charts and guided formulas for temperature scale conversions.
- Structured CER templates with sentence frames for scientific reasoning.
- Tiered investigation options (basic materials testing vs. advanced insulation optimization challenge).
- Visual supports for particle motion, convection currents, and phase changes.
- Choice-based demonstration options (written report, diagram, video explanation, or live presentation).
- Collaborative group roles (materials engineer, data analyst, designer, presenter, researcher).
- Extension task: optimize insulation using cost vs. performance constraints and justify trade-offs.
- Mini-lessons provided for graph interpretation, thermal energy calculations, and phase change interpretation.

Resources Provided:

- iPads
- Gizmos simulation platform (heat transfer and particle models)
- Lab materials (water baths, metals, insulation materials, thermometers)
- Convection apparatus tools
- Straw, paper, tape, and building materials for engineering challenge
- Digital graphing tools
- Teacher-generated video clips
- CER templates and rubrics
- Reflection sheets and design journals



Lesson Plan 3 Template

Content Area: Science

Lesson Title: Electric Circuits

Time Frame: 7 days

Lesson Components

21st Century Themes

- ☒ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☒ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections: Mathematics

Integration of Technology:

- Gizmos Simulation Lab
- iPads (data recording, graphing, and analysis tools)
- Teacher-generated video clips (thermal transfer demonstrations)
- Digital thermometer probes / Go Temp! sensors

Equipment Needed:

- Laptop computers (teacher use / data projection and analysis)
- Labware (beakers, metal rods, insulation materials, thermometers)
- Assorted lab stations for conduction, convection, radiation investigations

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Determine if materials are conductors or insulators. • Diagram and build series and parallel circuits using power supplies, switches, light bulbs, motors and buzzers. • Determine the advantages and disadvantages of series and parallel circuits. • Be familiar with three common temperature scales, how to read a thermometer in each scale, and how to convert	Lesson Sequence 1. Students analyze real-world phenomena: Why do some materials keep houses warm while others lose heat quickly, even under the same conditions. 2. Students use teacher-generated video clips to observe thermal energy transfer in real environments (buildings, oceans, weather systems). 3. Students interact with Gizmos simulation to model particle motion under heating and	• “Electric Circuits” Lab • Temperature Scales Conversion Practice • Conduction/Convection/Radiation Lab Stations Data Sheet • Gizmo Simulation Analysis Questions • Insulation Design Test Results • Heat Transfer Graphing Activity (digital or paper) • iMovie or digital explanation of best insulating design • Exit Ticket: real-world application of heat transfer



between scales using mathematical formulas.

- Describe the direction of heat flow and predict energy transfer between systems.
- Explain conduction, convection, and radiation using real-world examples and models.
- Explain how thermal expansion affects volume, density, and fluid movement.
- Describe how changes in thermal energy affect particle motion and state changes in matter.
- Design and test materials that reduce heat loss in a model structure.
- Plan and conduct an investigation to compare thermal conductors and insulators.

cooling conditions and connect to state changes.

4. Students rotate through lab stations testing conduction using metal, wood, and plastic materials in controlled temperature water baths.
5. Students use iPads to record temperature changes over time and graph results using digital tools to identify trends and patterns.
6. Students model convection currents using heated water and food coloring to visualize density-driven motion.
7. Students design a simple insulated structure (straw + paper + foil + fabric materials) and test heat loss over time.
8. Students collaborate in small groups to evaluate which materials best reduce energy transfer and justify conclusions using evidence.
9. Students present findings through a short video explanation or digital slide summary using iMovie or similar tools.
10. Use resources to determine what types of substances are electrical conductors.
11. Use interactive simulations and electric circuits kits to build various electric circuits.
12. Describe flow of electrical energy.



Differentiation:

- Students will analyze data at multiple entry points using scaffolded temperature conversion supports and guided formula sheets.
- Students may choose to present findings as a video explanation, visual diagram, written lab report, or live demonstration.
- Extension groups will design multi-layer insulation systems and justify engineering choices using evidence-based reasoning.
- Support groups will use structured templates, sentence starters, and partially completed data tables.
- All students engage in collaborative group investigations that build communication, problem-solving, and scientific reasoning skills.

Resources Provided:

- Lab supplies and glassware (beakers, thermometers, insulation materials)
- iMovie / video creation tools
- Gizmos simulation access
- Teacher-generated video demonstrations
- iPads for data collection, graphing, and presentations
- Interactive lab stations for thermal energy investigation



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson Strongly, Moderately or Weakly meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☒	☐	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☒	☐	☐
Are differentiated based on student needs	☐	☒	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self- assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Science	Grade Level: 8	Unit Title: Energy
Created: 2026	Board Approved on:	



IEP AND 504 ACCOMMODATIONS AND MODIFICATIONS FOR EARLY CHILDHOOD AND ELEMENTARY SCHOOL STUDENTS:

Large print textbooks
Textbooks for at-home use
Additional time for assignments
Review of directions
Use of mnemonics
Have student restate information
Concrete examples
Adaptive writing utensils
Support auditory presentations with visuals
Use of a study carrel
Assistance in maintaining uncluttered space
Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
Space for movement or breaks
Study sheets and teacher outlines
Extra visual and verbal cues and prompts
Math sheets with highlighted instructions
Graph paper to assist in organizing or lining up math problems
Use of computers and calculators
Books on tape
Graphic organizers
Quiet corner or room to calm down and relax when anxious
Preferential seating
Alteration of the classroom arrangement
Reduction of distractions
Answers to be dictated
Hands-on activities
Use of manipulatives
No penalty for spelling errors or sloppy handwriting
Follow a routine/schedule
Alternate quiet and active time
Teach time management skills
Rest breaks
Verbal and visual cues regarding directions and staying on task
Agenda book and checklists
Adjusted assignment timelines
Visual daily schedule



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Varied reinforcement procedures
Immediate feedback
Work-in-progress check
Personalized examples

TESTING AND ASSESSMENT ACCOMMODATIONS AND MODIFICATIONS:

Answers to be dictated
Frequent rest breaks
Additional time
Oral testing
Untimed tests
Choice of test format (multiple-choice, essay, true-false)
Alternate ways to evaluate (projects or oral presentations instead of written tests)
Accept short answers
Open-book tests
Read test and directions to student
Provide study outline prior to tests
Highlight key directions
Test in alternative site
Use of calculator
Extra credit option
Preview test procedures
Simplified test wording; rephrased test questions and/or directions

GENERAL ACCOMMODATIONS AND MODIFICATIONS:

Use of alternative books or materials on the topic being studied
Computerized spell-check support
Word bank of choices for answers to test questions
Provision of calculator and/or number line for math tests
Reworded questions in simpler language
Projects instead of written reports
Highlighting important words or phrases in reading assignments
Modified workload or length of assignments/tests
Modified time demands
Modified grades based on IEP

BEHAVIOR ACCOMMODATIONS MODIFICATIONS:



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

Breaks between tasks
Cue expected behavior
Daily feedback to student
Have contingency plans
Use de-escalating strategies
Use positive reinforcement
Use proximity/touch control
Use peer supports and mentoring
Model expected behavior by adults
Have parent sign homework
Have parent sign behavior chart
Set and post class rules
Chart progress and maintain data



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

IEP AND 504 ACCOMMODATIONS AND MODIFICATIONS FOR MIDDLE AND HIGH SCHOOL STUDENTS:

Large print textbooks
Textbooks for at-home use
Additional time for assignments
A locker with adapted lock
Review of directions
Review sessions
Use of mnemonics
Have student restate information
Provision of notes or outlines
Concrete examples
Adaptive writing utensils
Support auditory presentations with visuals
Weekly or bi-weekly home-school communication
Space for movement or breaks
Study sheets and teacher outlines
Extra visual and verbal cues and prompts
Lab and math sheets with highlighted instructions
Graph paper to assist in organizing or lining up math problems
Use of tape recorder for lectures
Use of Interactive notebook
Use of a scribe
Use of computers and calculators
Books on tape
Graphic organizers
Quiet corner or room to calm down and relax when anxious
Preferential seating
Alteration of the classroom arrangement
Reduction of distractions
Answers to be dictated
Hands-on activities
Ability to type all assignments
Follow a routine/schedule
Teach time management and organizational skills
Rest breaks
Verbal and visual cues regarding directions and staying on task
Agenda book and checklists
Daily check-in with case manager or special education teacher
Adjusted assignment timelines
Visual daily schedule



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Varied reinforcement procedures
Immediate feedback
Work-in-progress check
Personalized examples

TESTING AND ASSESSMENT ACCOMMODATIONS AND MODIFICATIONS:

Answers to be dictated
Frequent rest breaks
Additional time
Oral testing
Choice of test format (multiple-choice, essay, true-false)
Alternate ways to evaluate (projects or oral presentations instead of written tests)
Accept short answers
Open-book or open-note tests
Read test and directions to student
Provide study guides prior to tests
Highlight key directions
Test in alternative site
Use of calculator
Extra credit option
Pace long-term projects
Preview test procedures
Simplified test wording; rephrased test questions and/or directions

GENERAL ACCOMMODATIONS AND MODIFICATIONS:

Allow outlining, instead of writing for an essay or major project
Use of alternative books or materials on the topic being studied
Computerized spell-check support
Word bank of choices for answers to test questions
Provision of calculator for math tests
Film or video supplements in place of reading text
Reworded questions in simpler language
Projects instead of written reports
Highlighting important words or phrases in reading assignments
Modified workload or length of assignments/tests
Modified time demands



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

Pass/no pass option
Modified grades based on IEP

BEHAVIOR ACCOMMODATIONS FOR STUDENTS:

- Breaks between tasks
- Cue expected behavior
- Daily feedback to student
- Have contingency plans
- Use de-escalating strategies
- Use positive reinforcement
- Use proximity/touch control
- Use peer supports and mentoring
- Model expected behavior by adults
- Have parent sign homework
- Set and post class rules
- Chart progress and maintain data



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

Accommodations and Modifications for ESL Students

- Give tests orally
- Give instructions/directions in writing and orally
- Assign a peer tutor, same language or English speaking
- Allow use of bilingual/translation dictionary
- Provide summaries of text or study guides of particular chapters
- Allow errors in speaking
- Allow errors in writing
- Accept writing in first language
- Highlight key vocabulary
- Reduce amount of work required
- Assess comprehension through demonstration or other alternative means (gestures, drawings)
- Rephrase questions, directions, and explanations
- Reduce multiple choices on assessments
- Provide study guides and/ or outlines
- Shorten reading assignments
- Allow extended time for test/project completion
- Use of audio books
- Use of graphic organizers
- Use reduced text, so that print is not dense
- Use visuals/pictures throughout lesson/unit/assignment
- Adapt homework to reflect language proficiency/home support
- Adapt homework to reflect home support
- Provide hands-on activities and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Use of translation dictionaries to locate words in the native language
- Use anecdotal records and portfolio of work as forms of assessment
- Use story retellings to assess comprehension



Cultivating compassionate and extraordinary learners!

What Does the Gifted and Talented Experience Look Like?

Springfield Public Schools

Mission Statement

The Gifted and Talented Program of the Springfield Public Schools aims to provide a meaningful and rigorous education that instills the value of lifelong learning and empowers all students to reach their full potential and become self-fulfilled creative leaders in accordance with the comprehensive standards of our state. We accomplish this by offering challenging, real-world experiences in a student-centered environment.

We recognize that students come from diverse socioeconomic, cultural, and ethnic backgrounds, and the mission of the gifted and talented program is to provide opportunities for students to explore their intellectual, creative, and artistic gifts and talents within the classroom and with beyond-the-classroom experiences. It is essential to provide diverse, appropriate, and ongoing learning experiences and environments that incorporate students' academic, psychological, and social needs. Our responsibility is to provide students with educational alternatives that teach, challenge, and expand their knowledge, while simultaneously stressing the development of independent and self-directed learners who continuously generate questions, analyze, synthesize, and evaluate information and ideas.

New Jersey Administrative Code 6A:8-3.1 defines students who are gifted and talented as those students who possess or demonstrate high levels of ability in one or more content areas when compared to their chronological peers in the local district and who require modification of their educational program if they are to achieve in accordance with their capabilities.

Goals:

To support our mission, we have established the following goals to guide our work:

- To infuse into the general education program a broad range of activities for high-level learning that will challenge all students to perform at advanced levels, and provide extended opportunities, resources, and support in particular areas where student interest or talent is demonstrated.
- To provide a continuum of gifted education services that will strengthen the total school program, offer enriching and challenging learning opportunities for all students, and provide specialized learning experiences
- To promote achievement of students' best potentials and increased ability.

Through a productive and collaborative relationship among the building principals, classroom teachers, and the Gifted and Talented teacher, our schools can create programming that will enhance the learning experience for every student and serve the unique and specialized needs of students currently demonstrating gifted behaviors.

Elements of the Schoolwide Enrichment Model, W.I.N (What I Need), differentiated instruction, advanced classes, or individual programs into a student's regular instruction program are integral to this overarching framework for gifted education in the Springfield School District.

Reference Board Policy and Regulation 2464 – Gifted and Talented Pupils (M)

Early Childhood Center

Edward V. Walton

Schoolwide Virtual Enrichment

All first and second grade students have access to the [Gifted and Talented Virtual Classroom](#). This virtual classroom is a space for students to complete various challenges and enrichment opportunities at their own pace. Students can receive feedback and additional adaptable resources to meet their individual learning needs. The virtual classroom design expands accessibility to enrichment resources and allows students to choose learning activities according to their unique interests and abilities. The purpose of the activities is to encourage problem-solving, develop critical thinking

skills, and expand curiosity and imagination. Activities are aligned to the New Jersey Student Learning Standards.

Gifted and Talented Teacher as a Resource

The Gifted and Talented teacher serves as a resource to all teachers within Edward V. Walton School. Teachers seeking resources for their high-ability learners will receive additional support from the Gifted and Talented teacher in various ways. This support may include additional units of study, challenging resources, and student projects.

Elementary Schools

James Caldwell

Thelma L. Sandmeier

The goal is to engage small groups of students in intensive learning experiences through standards-based, rigorous, and relevant units of study that supplement, not supplant, the grade-level curriculum and support students' unique learning needs.

Enrichment Experience Grade 3

Beginning in third grade, the G&T teacher will cycle through all classrooms to work on problem-solving and enrichment tasks with students. Driven by assessment data, academic performance, student interest, and teacher observation, small groups of students will meet with the G&T teacher during W.I.N. (What I Need) periods throughout the week that the teacher is assigned to their classroom teacher. Groupings will be flexible and monitored to best meet each student's needs throughout the school year. Activities will include brain teasers, puzzles, strategic thinking, problem-solving, and STEM challenges.

Targeted Gifted and Talented Programing Grades 4-5

Students may become identified as Gifted and Talented in fourth grade. Students that are identified may receive support from the G&T Teacher for up to five periods (200 minutes) a week during W.I.N. (What I Need) periods. Identified students will meet to explore grade-level content while incorporating depth and complexity in a student-centered, problem-based environment. The Gifted and Talented Program aims to provide students with various advanced and challenging learning experiences across content areas to promote independent thinking skills, refine critical thinking and communication skills, cultivate joy in learning, and expand student interests through problem-solving. The instruction that students receive incorporates 21st Century Skills and advanced content that is challenging, hands-on, and relevant to the real world.

Strategies and Practices that Support Gifted and Talented Students

- Adjusted Pace of Lessons
- Inquiry-Based Instruction
- Higher-Order Thinking Activities
- Interest-Based Content
- Real World Problem Solving/Problem Based Learning
- Independent Study/Passion Projects
- Units of Study with Like-Minded Peers

Schoolwide Virtual Enrichment

All JCS and TLS students have access to grade level-specific [Gifted and Talented Virtual Classrooms](#). These virtual classrooms are a space for students to complete various challenges and enrichment opportunities at their own pace. Students are able to receive feedback and additional opportunities based on their needs. The virtual classrooms have expanded the accessibility of enrichment resources directly to the students and allows for students to choose opportunities according to their interests and abilities. The purpose of the activities is to encourage problem solving, develop critical thinking skills, and expand curiosity and imagination in conjunction with the New Jersey Student Learning Standards.

Gifted and Talented Teacher as a Resource

In addition to classroom support, the Gifted and Talented teacher also serves as a resource to all teachers in the building. Teachers that are seeking resources for their high ability learners will receive additional support from the Gifted and Talented teacher in various ways. This may include additional units of study, challenging resources, student projects, and meeting with the G&T teacher as needed.

Additional Enrichment Opportunities

Across all grade levels 3-5, as recommended by the classroom teacher, students exhibiting a need for additional enrichment may have the opportunity to meet with the G&T teacher as the schedule allows. Groupings will be flexible and monitored to best meet the students' needs throughout the school year. Activities will include, brain teasers, puzzles, strategic thinking activities, problem-solving challenges, and STEM challenges. Students engage in an extended process of asking questions, using resources, and developing answers that lead to thinking about what and how they are learning. Students are held accountable for how they work and use their time by demonstrating their learning through products or presentations.

Students self-select to participate in individual and/or group projects based on interest and commitment. The classroom teacher and/or the enrichment teacher will help guide and monitor student exploration of chosen topics, facilitating their learning with resources and teaching of needed skills.

Secondary Schools
Florence M. Gaudineer Middle School
Jonathan Dayton High School

Grades 6-12: Access to specific content programs with higher levels of academic challenges (i.e. Pre-Algebra, Accelerated Communication Arts, and Advanced Placement Classes)

Dual Credit Courses provide students the opportunity to obtain high school credit, and college credit, simultaneously through partnerships with several institutions.

Project Lead the Way (PLTW) students become builders of technology by engaging in real world activities. Students are empowered as design thinkers collaborating on real world projects.

Gifted and Talented Identification Criteria

The Springfield Schools Gifted and Talented Program recognizes that students require differentiated learning experiences beyond the core curriculum being taught because of their advanced abilities in one or more content areas. These students may also have other cognitive qualities such as curiosity, creativity, motivation, leadership, and passion that require modifications to their academic experience.

Multiple Measures of Eligibility

Kindergarten through grade twelve identification process for gifted and talented students includes multiple measures. Multiple measures may include but are not limited to: achievement test scores; grades; student performance or products; intelligence testing; parent, student, and/or teacher recommendation; and other appropriate measures. The identification methodology is developmentally appropriate, non-discriminatory, and related to the programs and services offered by the Springfield School District. The identification procedures are reviewed annually.

According to N.J.A.C. 6A:8-3.1, all public school districts must have a board-approved gifted and talented identification process and provide services for identified students enrolled in the grades of that school district. The regulations require that identification and services be made available to students in grades K-12.

When students are recommended for the Gifted and Talented Program there are multiple measures that are considered to determine if services are necessary and appropriate. The assessments used are as follows:

- Cognitive Abilities Test (CogAT)
- Classroom Performance/Student Portfolios
- DRA2 Level
- iReady Diagnostic Scores
- Gifted Indicators Checklist
- Start Strong/NJSLA Assessment Data

The N.J.A.C. requires that students be compared to their chronological peers in the local school district. The New Jersey Department of Education has not established state-level criteria for identifying students who are gifted, such as mandated tests or assessments, grade point averages, or IQ scores. Local school districts must use multiple measures to identify students.

Procedures

<https://www.straussesmay.com/seportal/Public/DistrictPolicy.aspx?policyid=2464&id=b8a33a9f505e4998a6db3fb8e1de778b>

Gifted and Talented Program Identification Matrix

Minimum Score Required for Consideration: 14 Points

1 Point	2 Points	3 Points
Cogat Assessment Overall Stanine Score of a 7	Cogat Assessment Overall Stanine Score of an 8	Cogat Assessment Overall Stanine Score of a 9
iReady Math Assessment Just Below Current Grade Level	iReady Math Assessment On Grade Level	iReady Math Assessment ½ Year + Above Current Level
iReady ELA On Grade Level	iReady ELA ½ Year Above Current Level	iReady ELA One Full Grade Level + Above Current Level
NJSLA Math Approaching Expectations	NJSLA Math Met Expectations	NJSLA Math Exceed Expectations
NJSLA ELA Approaching Expectations	NJSLA ELA Met Expectations	NJSLA ELA Exceed Expectations
HOPE Teacher Rating Scale Raw Score: 11 - 29	HOPE Teacher Rating Scale Raw Score: 30 - 49	HOPE Teacher Rating Scale Raw Score: 50-66

Team meetings present the opportunity to review data and assess the educational needs of all students. Teacher provides examples of student work exhibiting above and beyond grade level expectations, creativity, leadership, critical and abstract thinking. Programs for gifted and talented students will be periodically evaluated for their continuing efficacy and adjusted accordingly. The parent of any student identified as gifted or talented shall be consulted regarding any program designed to address the student's particular needs.

Resource Links

https://riversideinsights.com/cognitive_abilities_test

<https://www.curriculumassociates.com/programs/i-ready-learning>

<https://www.nj.gov/education/assessment/resources/>

<https://www.routledge.com/HOPE-Teacher-Rating-Scale-Involving-Teachers-in-Equitable-Identification/Gentry-Pereira-Peters-McIntosh-Fugate/p/book/9781618214522#:~:text=The%20HOPE%20Teacher%20Rating%20Scale,making%20it%20easy%20to%20use.>

Gifted and talented student: The "[*Strengthening Gifted and Talented Education Act*](#)" defines a gifted and talented student as a "student who possesses or demonstrates a high level of ability in one or more content areas when compared to their chronological peers in the school district and who require modifications of their educational program if they are to achieve in accordance with their capabilities."

Twice-exceptional (2E) students: A twice-exceptional (2E) student is defined as "a student who is both gifted and a student with a disability. These students may also be referred to as having dual exceptionalities or as being gifted with learning disabilities (GT/LD). This also applies to students who are gifted with ADHD or gifted with autism" (New Jersey Association for Gifted Children, www.nagc.org).

Instructional adaptation: An adjustment or modification to instruction enabling a student who is gifted and talented to participate in, benefit from, and demonstrate knowledge and application of the New Jersey Student Learning Standards in one or more content areas at the instructional level of the student, not just the student's grade level.

Identifying gifted and talented students: The focus of identification is to provide programming and services in which students' specific learning needs and potential are appropriately addressed and met. In every New Jersey school district, there are students who require modifications to the general education curriculum if they are to achieve in accordance with their abilities. By identifying a student's general intellectual ability, creativity, or specific academic area aptitudes, we are acknowledging that they need programming and services outside of the general education/grade level curriculum to advance their learning.

NJDOE Fast Facts

<https://www.nj.gov/education/standards/gifted/>

<https://www.nj.gov/education/standards/gifted/legislation.shtml>

Supplemental Resources/Programming for Gifted Students

Edward V. Walton

- PETS Program – Primary Education Thinking Skills
- Group Solutions/Group Solutions 2 – Cooperative Logic Activities
- Lollipop Logic
- Beginning Thinking Skills
- AIMS Education Programming

James Caldwell and Thelma L. Sandmeier

Math/ELA

- Project M3: Mentoring Mathematical Minds
- Junior Great Books
- AIMS Education Programming
- Borenson Hands on Equations
- BizWorld
- Perplexors
- Advanced Math Explorations grade 3-5
- Challenging Units for Gifted Learners (ELA and Math)
- Creative Curriculum Extenders
- Differentiated Lessons & Projects
- Challenge Math Grades 4+
- Differentiating Instruction with Menus (All Content Areas)
- Jacob's Ladder
- Genius Hour/Passion Project
- Spatial Reasoning
- Logic Puzzles, Brain Games, Analogies

STEM

- Engineering is Elementary
- Engineer Throughout the Year
- PBS Design Squad
- DefinedSTEM
- Project Lead the Way (PLTW)

Enrichment Events

Experience for all students to be enriched through events related to the curricular or extracurricular activities. Examples include after school clubs, PTA-sponsored events, leadership opportunities, visual and performing arts, and community service opportunities.