MOORESTOWN TOWNSHIP PUBLIC SCHOOLS
MOORESTOWN, NEW JERSEY

William Allen Middle School
Science Department

Grade 8 Science

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Course Description and Fundamental Concepts

Grade 8 Science is a hands-on, inquiry-based course in which students investigate a variety of topics related to physics, chemistry and earth science. This course will prepare students to apply the basic principles of physical science in conjunction with proper laboratory skills in an effort to develop and design models that explain everyday phenomena. Students will gain both an understanding and appreciation for the relationship between scientific discovery and the real-world. Topics of study include but are not limited to: structure and properties of matter, chemical reactions, energy transformations and forces and interactions. An emphasis is placed on the modeling and application of inquiry-based, problem-solving skills.

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New Jersey Student Learning Standards (NJSLS)

Subject/Content Standards
Include grade appropriate subject/content standards that will be addressed

Standard #	Standard Description
MS-PS1	**Matter and Its Interactions**
MS-PS-1-1	Develop models to describe the atomic composition of simple molecules and extended structures.
MS-PS-1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
MS-PS-1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
MS-PS-1-5	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-PS-1-6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*
MS-PS-2	**Motion and Stability: Forces and Interactions**
MS-PS-2-1	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*
MS-PS-2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
MS-PS-2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces
MS-PS-2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
MS-PS-2-5	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-PS-3	**Energy**
MS-PS-3-1	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-PS-3-2	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.

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MS-PS-3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-PS-3-4	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-PS-3-5	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-PS-4	**Waves and Their Applications in Technologies for Information Transfer**
MS-PS-4-1	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-PS-4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
MS-PS-4-3	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	**Engineering Design**
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.

(ADD UNIT #(s) INTO CHART)

English Companion Standards

List grade-level appropriate companion standards for History, Social Studies, Science and Technical Subjects (CTE/Arts) 6-12. English Companion Standards are required in these subject/content areas.

Unit Addressed	Standard #	Standard Description
0,1,2,3,4,5,6,7,8	**RST.6-8.1**	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS1-2),(MS-PS1-3)

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	RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3)
0,1,2,3,4,5,6,7,8	**RST.6-8.3**	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)
0,1,2,3,4,5,6,7,8	**RST.6-8.7**	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-1),(MS-PS1-2),(MS-PS1-4),(MS-PS1-5)
	RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)
	WHST.6-8.1	Write arguments focused on discipline-specific content. (MS-PS2-4)
2,3,4,5,6,7,8	**WHST.6-8.7**	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS1-6)
0,1,2,3,4,5,6,7,8	**WHST.6-8.8**	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. (MS-PS1-3)
	WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3)
0,1,2,3,4,5,6,7,8	**SL.8.5**	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)

Career Awareness, Exploration, Preparation, and Training (Standard 9.2)
List appropriate units below for which standards will be addressed

By Grade 8		
Unit Addressed	**Core Idea**	**Standard / Description**
	An individual's strengths, lifestyle goals, choices, and interests affect employment and income	***9.2.8.CAP.1****: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.* ***9.2.8.CAP.2****: Develop a plan that includes information about career areas of interest.*

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		9.2.8.CAP.3*: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.* ***9.2.8.CAP.4****: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.*
	Developing and implementing an action plan is an essential step for achieving one's personal and professional goals.	***9.2.8.CAP.5****: Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.*
	Early planning can provide more options to pay for postsecondary training and employment.	***9.2.8.CAP.6****: Compare the costs of postsecondary education with the potential increase in income from a career of choice.* ***9.2.8.CAP.7****: Devise a strategy to minimize costs of postsecondary education.* ***9.2.8.CAP.8****: Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.* ***9.2.8.CAP.9****: Analyze how a variety of activities related to career preparation (e.g., volunteering, apprenticeships, structured learning experiences, dual enrollment, job search, scholarships) impacts postsecondary options.*
0,1,2,3,4,5,6,7,8	There are a variety of resources available to help navigate the career planning process.	***9.2.8.CAP.10****: Evaluate how careers have evolved regionally, nationally, and globally.* ***9.2.8.CAP.11****: Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics.* ***9.2.8.CAP.12****: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.*
	Employee benefits can influence your employment choices.	***9.2.8.CAP.13****: Compare employee benefits when evaluating employment interests and explain the possible impact on personal finances.* ***9.2.8.CAP.14****: Evaluate sources of income and alternative resources to accurately compare employment options.*

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	Communication skills and responsible behavior in addition to education, experience, certifications, and skills are all factors that affect employment and income	***9.2.8.CAP.15****: Present how the demand for certain skills, the job market, and credentials can determine an individual's earning power.* ***9.2.8.CAP.16****: Research different ways workers/ employees improve their earning power through education and the acquisition of new knowledge and skills.* ***9.2.8.CAP.17****: Prepare a sample resume and cover letter as part of an application process.* ***9.2.8.CAP.18****: Explain how personal behavior, appearance, attitudes, and other choices may impact the job application process.* ***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*
	There are resources to help an individual create a business plan to start or expand a business.	***9.2.8.CAP.20****: Identify the items to consider when estimating the cost of funding a business.*

Life Literacies and Key Skills (Standard 9.4)
List appropriate units below for which standards will be addressed

By Grade 8		
Unit Addressed	**Core Idea**	**Standard / Description**
7	**Creativity and Innovation**: Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.	***9.4.8.CI.1****: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).* ***9.4.8.CI.2****: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).* ***9.4.8.CI.3****: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).* ***9.4.8.CI.4****: Explore the role of creativity and innovation in career pathways and industries*

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0,1,2,3,4,5,6,7,8	**Critical Thinking and Problem-solving:** Multiple solutions often exist to solve a problem.	***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.CT.2****: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).*
0,1,2,3,4,5,6,7,8	**Critical Thinking and Problem-solving:** An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.	***9.4.8.CT.3:*** *Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.*
0,1,2,3,4,5,6,7,8	**Digital Citizenship:** Detailed examples exist to illustrate crediting others when incorporating their digital artifacts in one's own work.	***9.4.8.DC.1****: Analyze the resource citations in online materials for proper use.* ***9.4.8.DC.2****: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8).*
	Digital Citizenship: There are tradeoffs between allowing information to be public and keeping information private and secure.	***9.4.8.DC.3****: Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure.*
	Digital Citizenship: Digital footprints are publicly accessible, even if only shared with a select group. Appropriate measures such as proper interactions can protect online reputations.	***9.4.8.DC.4****: Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences.* ***9.4.8.DC.5****: Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.* ***9.4.8.DC.6****: Analyze online information to distinguish whether it is helpful or harmful to reputation.*
	Digital Citizenship: Digital communities are used by individuals to share information, organize, and engage around issues and topics of interest.	***9.4.8.DC.7****: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.*

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	Digital Citizenship: Digital technology and data can be leveraged by communities to address effects of climate change.	***9.4.8.DC.8****: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).*
0,1,2,3,4,5,6,7,8	**Global and Cultural Awareness:** Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction.	***9.4.8.GCA.1:*** *Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).* ***9.4.8.GCA.2:*** *Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.*
	Information and Media Literacy: Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.	***9.4.8.IML.1****: Critically curate multiple resources to assess the credibility of sources when searching for information.* ***9.4.8.IML.2****: Identify specific examples of distortion, exaggeration, or misrepresentation of information.*
0,1,2,3,4,5,6,7,8	**Information and Media Literacy:** Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.	***9.4.8.IML.3****: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).* ***9.4.8.IML.4****: Ask insightful questions to organize different types of data and create meaningful visualizations.* ***9.4.8.IML.5****: Analyze and interpret local or public data sets to summarize and effectively communicate the data.*
	Information and Media Literacy: The mode of information can convey a message to consumers or an audience.	***9.4.8.IML.6:*** *Identify subtle and overt messages based on the method of communication.*
	Information and Media Literacy: Sources of information are evaluated for accuracy and relevance when considering the use of information.	***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, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8).*

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		9.4.8.IML.8*: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).*
	Information and Media Literacy: There are ethical and unethical uses of information and media.	***9.4.8.IML.9:*** *Distinguish between ethical and unethical uses of information and media (e.g., 1.5.8.CR3b, 8.2.8.EC.2).* ***9.4.8.IML.10:*** *Examine the consequences of the uses of media (e.g., RI.8.7).* ***9.4.8.IML.11:*** *Predict the personal and community impact of online and social media activities*
	Information and Media Literacy: There is a need to produce and publish media that has information supported with quality evidence and is intended for authentic audiences.	***9.4.8.IML.12:*** *Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.* ***9.4.8.IML.13:*** *Identify the impact of the creator on the content, production, and delivery of information (e.g., 8.2.8.ED.1).* ***9.4.8.IML.14:*** *Analyze the role of media in delivering cultural, political, and other societal messages.* ***9.4.8.IML.15:*** *Explain ways that individuals may experience the same media message differently.*
	Technology Literacy: Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.	***9.4.8.TL.1****: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.* ***9.4.8.TL.2****: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).* ***9.4.8.TL.3****: Select appropriate tools to organize and present information digitally.* ***9.4.8.TL.4****: Synthesize and publish information about a local or global issue or event (e.g., MSLS4-5, 6.1.8.CivicsPI.3).*
	Technology Literacy: Digital tools allow for remote collaboration and rapid sharing of ideas unrestricted by geographic location or time.	***9.4.8.TL.5****: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.* ***9.4.8.TL.6****: Collaborate to develop and publish work that provides perspectives on a real-world problem.*

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Interdisciplinary Connections (2020 NJSLS)
List any other content standards addressed as well as appropriate units. All arts integration connections may be listed within this chart.

Visual & Performing Arts Integration (Standard 1)
List appropriate units below for which standards (1.1 through 1.5) may be addressed

Unit Addressed	Artistic Process	Anchor Standard
8	**Creating**	*Anchor Standard 1: Generating and conceptualizing ideas.* *Anchor Standard 2: Organizing and developing ideas.* *Anchor Standard 3: Refining and completing products.*
	Connecting	*Anchor Standard 10: Synthesizing and relating knowledge and personal experiences to create products.* *Anchor Standard 11: Relating artistic ideas and works within societal, cultural, and historical contexts to deepen understanding.*
1,2,8	**Performing/ Presenting/ Producing**	*Anchor Standard 4: Selecting, analyzing, and interpreting work.* *Anchor Standard 5: Developing and refining techniques and models or steps needed to create products.* *Anchor Standard 6: Conveying meaning through art.*
	Responding	*Anchor Standard 7: Perceiving and analyzing products.* *Anchor Standard 8: Applying criteria to evaluate products.* *Anchor Standard 9: Interpreting intent and meaning.*

Mathematics Standards

Unit Addressed	Content / Standard #	Standard Description
0,1,2,3,4,5,6,7,8	***Math / MP.2***	*Reason abstractly and quantitatively. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)*
0,1,2,5,6,8	***Math / MP.4***	*Model with mathematics. (MS-PS1-1),(MS-PS1-5)*
5,6,8	***Math / 6.RP.A.1***	*Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),(MS-PS3-5)*
5,6,8	***Math / 6.RP.A.2***	*Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. (MS-PS3-1)*
0,1,2,5,6,8	***Math / 6.RP.A.3***	*Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)*

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0,1,2,5,6,8	***Math / 6.NS.C.5***	*Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4)*
1,5,6,7,8	***Math / 6.SP.B.4***	*Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2)*
1,5,6,8	***Math / 6.SP.B.5***	*Summarize numerical data sets in relation to their context (MS-PS1-2)*
0,1,2,3,4,5,6,7,8	***Math / 8.EE.A.3***	*Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PS1-1)*
3,4,7,8	***Math / 6.EE.A.2***	*Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2)*
3,4,7,8	***Math / 7.EE.B.3***	*Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2)*
3,4,7,8	***Math / 7.EE.B.4***	*Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1),(MS-PS2-2)*
6,7,8	***Math / 7.RP.A.2***	*Recognize and represent proportional relationships between quantities. (MS-PS3-1),(MS-PS3-5)*
6,7,8	***Math / 8.EE.A.1***	*Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)*
6,7,8	***Math / 8.EE.A.2***	*Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. (MS-PS3-1)*
	Math / 8.F.A.3	*Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS4-1)*

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Pacing Guide (All Dates are approximate based on the school calendar)

Unit/ Topic	Month(s)
Unit 0: Introduction to Physical Science	**September** (~19 days)
Unit 1: The Structure of Matter	**October** (~19 days)
Unit 2: Physical Changes	**November** (~16 days)
Unit 3: Atoms & Their Properties	**December** (~15 days)
Unit 4: Chemical Changes	**January** (~18 days)
Unit 5: Waves & Electromagnetic Radiation	**February** (~18 days)
Unit 6: Energy Transformations	**March** (~15-20 days)
Unit 7: Climate Change	**April** (~15-20 days)
Unit 8: Motion & Collisions	**May** (~18 days)

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Units Scope and Sequence

Unit 0: Introduction to Physical Science

Learning Goals: What do I want my students to learn?

Standards

NJSLS -
MS-PS-1-1
Develop models to describe the atomic composition of simple molecules and extended structures.

- *PS1.A*

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.*

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 the characteristics may be incorporated into the new design*

Science and Engineering Practices:

- *Asking questions and defining problems*
- *Planning and carrying out investigations*
- *Analyzing and Interpreting Data*
- *Constructing Explanations*
- *Engaging in Argument from Evidence*

Crosscutting Concepts:

- *Cause and Effects*
- *Systems and system models*

NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- How do Scientists use evidence to validate a claim?
  - What is the CER approach/format?
- How does CER compose a written argument for an investigation?
- What types of equipment are used in a science lab?
- How do we conduct labs safely?
- What are the different types of labware commonly used in a science lab?
- What are the commonly used units in science?

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Learning Objectives
Students will be able to… ● Think and write critically using claim, evidence and reasoning. ● Develop a claim to answer a question regarding a phenomena. ● Use characteristic properties of a substance to identify a substance. ● Make connections with lab results and science concepts behind them to develop reasoning to show why evidence supports the claim. ● Safely use and handle glassware and equipment.

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Unit 1: The Structure of Matter

Learning Goals: What do I want my students to learn?

Standards

NJSLS -

MS-PS-1-4
Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- How can one explain the structure, properties, and interactions of Matter?
- How can one explain and predict interactions between objects and within systems of objects?
- What is the Kinetic theory of matter?
- How does kinetic energy relate to the states of matter?
- How can one explain and predict interactions between objects and within systems of objects?

Learning Objectives

Students will be able to…

- Draw or model the movement of atoms in a solid, liquid, and gas.
- Recognize that atoms and molecules are too small to be seen.
- Explain how substances change state.
- Use characteristic properties of a substance to identify a substance.
- Make connections with lab results and science concepts behind them to develop reasoning to show why evidence supports the claim.
- Define matter.
- Identify what atoms consist of and that they make up all matter.
- Describe how the properties of a compound are different from the properties of the elements that form the compound.
- Draw atomic diagrams of elements, compounds, and diatomic molecules.
- Identify the characteristic physical properties of matter.
- Identify the characteristic chemical properties of matter.
- Describe a mixture, a solution, and a pure substance.
- Distinguish between solutions, colloids, suspensions, and mixtures.
- Separate mixtures into their components using a variety of methods.

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Unit 2: Atoms & Their Properties

Learning Goals: What do I want my students to learn?

Standards

NJSLS -
MS-PS-1-1
Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS-1-4
Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS-PS-1-5
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-PS-3-1
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-PS-3-5
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

NJSLS - Career Awareness, Exploration, Preparation, and Training
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Fundamental Concepts / Big Ideas

- How can an understanding of subatomic particles lead scientists to better explain the atom and its interactions?
- How can scientists gather data for things that are not visible to the naked eye?
- How can the periodic table help us to develop new useful materials and technologies?
- How do differences in atomic structure result in an element's distinct properties?
- How can Scientists can use the distinct properties of elements or compounds to solve real-world problems?

Learning Objectives

Students will be able to…

- Determine and define atomic mass and mass number of an element
- Identify examples of elements, compounds, molecules, and diatomic molecules.
    - Categorize atoms and/or groups of atoms as elements or compounds.
- Build models of elements, compounds, and diatomic molecules.
- Change the proportions of subatomic particles within an atom to achieve specific elements, ions or isotopes.

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- Describe the arrangement of the electrons of an atom and how it determines the chemical behavior of an atom as well as its physical properties.

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Unit 3: Physical Changes

Learning Goals: What do I want my students to learn?

Standards

NJSLS:
MS-PS-1-1
Develop models to describe the atomic composition of simple molecules and extended structures.

- ***PS1.A: Structure and Properties of Matter***
  - *Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)*
  - *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),(MS-PS1-3)*
  - *Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)*
  - *In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)*
  - *Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)*
  - *The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)*

MS-PS-1-4
Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Fundamental Concepts / Big Ideas

- How does the change in a state of matter alter the matter?
- What happens to the molecules of matter when it changes from one state to the next?
- How does kinetic energy relate to the states of matter?
- How does the motion of molecules in matter change as it is heated or cooled?
- How can one explain the structure, properties, and interactions of matter?
- How can one explain and predict interactions between objects and within systems of objects?
- When energy is put into matter, where does it go? How does it alter the matter?
- How do intermolecular forces affect the properties of matter and its changes in state?

Learning Objectives

Students will be able to…

- States of Matter
  - Draw or model the movement of atoms in a solid, liquid, and gas.
  - Explain how substances change state.

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- Describe the processes of melting, freezing, evaporation, condensation, sublimation, and deposition.
- Explain how changes in temperature and pressure can cause changes in state.
- Read and interpret phase change diagrams to understand how heat is involved in a phase change.
- Create phase change diagrams to represent the changes in temperature and heat during a phase change.

- Molecules
  - Identify examples of elements, compounds, molecules, and diatomic molecules.
  - Describe how the properties of a compound are different from the properties of the elements that form the compound.
  - Build models of elements, compounds, and diatomic molecules.

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Unit 4: Chemical Changes

Learning Goals: What do I want my students to learn?

Standards

NJSLS -
MS-PS-1-1
Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS-1-2
Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-3
Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

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.

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Fundamental Concepts / Big Ideas

- How are chemical bonds formed? What is a chemical bond?
- How does the energy of two atoms change when they are bonded? How does it change when a bond is broken?
- Can you increase or decrease the rate of a chemical reaction?
- How is matter conserved during a chemical reaction?
- How is energy conserved in a chemical reaction?

Learning Objectives

Students will be able to…

- States of Matter
  - Explain what happens to the motion and energy of molecules as a substance is heated or cooled.
- Chemical Reactions and Equations
  - List the indicators that a chemical reaction has occurred and explain what happened.
  - Identify the reactants and products in a chemical reaction.
  - Distinguish between endothermic and exothermic chemical reactions.
  - Explain the law of conservation of mass.
  - Explain how chemical reactions are represented so that mass is conserved.

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    - Correctly balance a given unbalanced chemical equations.
- Benefits and Risks of Chemical Use
    - Describe and assess the appropriate uses of chemicals in medicine, food, agriculture, and sanitation.
    - Evaluate the benefits and risks of chemical use through an investigation.

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Unit 5: Waves & Electromagnetic Radiation

Learning Goals: What do I want my students to learn?

Standards

NJSLS -
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 (sent as wave pulses) are a more reliable way to encode and transmit information.

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Fundamental Concepts / Big Ideas

- How are different kinds of mechanical waves different from each other?
- What is the difference between an ocean wave and a sound wave?
- How are waves used to transfer energy and send and store information?
- What is electromagnetic radiation?
- What are the different uses of the different types of waves in the electromagnetic spectrum?
- How does solar power work?

Learning Objectives

Students will be able to…

- investigate the difference between mechanical waves by comparing ocean waves with sound waves. How sounds are produced and how they are measured will be identified.
- investigate the physical properties of waves by learning how sound waves are used. Investigating other uses of waves in our world.
- Understand how electromagnetic waves are a more reliable way to encode and transmit information than analog signals will drive learning. Investigating how data is stored and transmitted will be highlighted.
- investigate how new discoveries are made in space using the different types of electromagnetic waves. The various uses of all the different types of electromagnetic waves used in our everyday world be be recognized. How radar is used to predict weather, keep track of airplanes in the air and ships at sea will be compared.

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Unit 6: Energy Transformations

Learning Goals: What do I want my students to learn?

Standards

NJSLS -
MS-PS1-4
Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

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-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS-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.
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Fundamental Concepts / Big Ideas

- How is energy transferred and conserved?
- How can one explain the structure, properties, and interactions of matter?
- How are heat, temperature, and energy related?
- How does energy move in a system?
- How can one explain the structure, properties, and interactions of matter?
- How is energy transferred and conserved?
- What is chemical energy? What is mechanical energy?

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Learning Objectives
Students will be able to… ● Kinetic Energy o Explain how the kinetic energy of an object depends on its mass and velocity. o Generate examples of kinetic energy. o Compare kinetic energy to potential energy. o Model how kinetic energy can be transformed into potential energy and how potential energy can be transformed into kinetic energy. ● Potential Energy o Examine examples of different types of potential energy. o Compare potential energy to kinetic energy. o Model how kinetic energy can be transformed into potential energy and how potential energy can be transformed into kinetic energy. o Use a ramp to investigate energy transfer. ● Heat and Temperature o Identify heat as a form of energy that always flows from an object at a higher temperature to an object at a lower temperature. o Understand that adding heat to an object increases the kinetic energy of its molecules. o Explain the three processes by which heat is transferred- radiation, conduction, and convection. o Distinguish between heat and temperature. o Explain how two objects of different mass can have the same temperature but a different amount of thermal energy. o Explain what happens to the motion and energy of molecules as a substance is heated or cooled.

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Unit 7: Climate Change

Learning Goals: What do I want my students to learn?

Standards

NJSLS
MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-5 Earth and Human Activity : Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

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Fundamental Concepts/Big Ideas

- How does energy move in a system?
- What is climate change and what are its causes?
- How are climate change, global warming, climate, and weather different?
- How to Measure a Changing Climate
- Modeling the Greenhouse Effect
- Impacts of Climate Change using evidence
- Identifying components of the Carbon Cycle
- Use data and graphs to identify supportive evidence

Learning Objectives

Students will be able to :

- Climate Change
    - Identify and understand the factors that influence climate change.
    - Explain the types of energy sources and human activities that influence climate change (fossil fuels, greenhouse gases, renewable energy sources, electric vehicles, etc.).
    - What is weather and what is climate? How are they different?
    - How is heat transferred on Earth?
- make observations and using prior knowledge to make connections with current conditions
- build on their prior knowledge about how and why Earth's climate is changing rapidly.
- use evidence to explain why human emission of the greenhouse gas carbon dioxide is causing Earth to warm abruptly relative to natural cycles of warming.
- model how the Earth's atmosphere acts like a greenhouse and traps gasses that warm the planet.
- analyze evidence of global climate trends and changes.
- explain how the accumulation of carbon dioxide gas and other greenhouse gasses in the atmosphere contribute to a changing climate.
- explain how sea level will change as the planet warms.
- generate questions about the phenomena of global warming and climate change.

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Unit 8: Motion & Collisions

Learning Goals: What do I want my students to learn?

Standards

NJSLS -
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MS-PS3-5. Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

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Fundamental Concepts / Big Ideas

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

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Learning Objectives

Students will be able to…
● Describe the motion of an object in terms of its change in position over time compared to a reference point.
● Explain why motion can only be described in comparison to a reference point.
● Explain and demonstrate that changes in motion are due to unbalanced forces acting on an object.
● Interaction of Force and Mass
  o Describe and identify an unbalanced forces
  o Predict how an object will move when it is acted on by an unbalanced force.
  o Describe and classify forces that can act on an object.
● Newton's Laws
  o Explain and apply Newton's first law of motion.
  o Explain and apply Newton's second law of motion.
  o Explain and apply Newton's third law of motion.
● Gravity
  o Explain how gravity affects the motions of objects close to Earth.
  o Model the relationship between acceleration due to gravity and the mass of an object.
● Friction
  o Define friction and explain how it related to kinetic energy and the transfer of energy between objects that are in contact with each other.
  o Describe how friction can affect the motion of an object.

Please contact the Content Supervisor for any questions.

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