

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

Original Adoption: Original Adoption: 2023 NJSLS English Language Arts and English as a Second Language (8-21-24); Math NJSLS Mathematics (8-21-24); 2020 NJSLS Science, Social Studies, Career Readiness, Life Literacies & Key Skills, Computer Design & Thinking, Visual & Performing Arts, World Language, Comprehensive Health and Physical Education (5-11-22)

Created By:

Recommended Pacing Guide

| | |
|---|---------|
| Unit 1: Harnessing Human Energy | 18 days |
| Unit 2: Thermal Energy | 20 days |
| Unit 3: Phase Change | 20 days |
| Unit 4: Phase Change Engineering | 12 days |
| Unit 5: Chemical Reactions | 23 days |
| Unit 6: Light Waves | 20 days |
| Unit 7: Force and Motion | 20 days |
| Unit 8: Force and Motion Engineering | 10 days |
| Unit 9: Magnetic Fields | 22 days |

Alignment with State Mandates

The following colors are used throughout this document to indicate areas in which the curriculum is aligned with the following NJSA requirements:

- Holocaust and genocides ([N.J.S.A. 18A:35-28](#))
- History and contributions of African-Americans (Amistad Law) ([N.J.S.A. 18A:35-4.43](#))
- Highlight and promote diversity and inclusion (Diversity & Inclusion Law) ([N.J.S.A. 18A:35-4.36a](#))
- History of disabled and LGBT persons included in middle and high school curriculum ([Section 18A:35-4.35](#))
- Climate Change - to prepare students to understand how and why climate change happens, the impact it has on our local and global communities and to act in informed and sustainable ways. Please [click here](#) for specific examples (by subject).

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|---------------------------------|-------------------|
| Unit 1: Harnessing Human Energy | Duration: 18 days |
|---------------------------------|-------------------|

| New Jersey Student Learning Standards | |
|---------------------------------------|--|
| 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-PS3-5 | 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-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-ESS3-1 | Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|---|--|--|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> As students build models of energy systems, they question how energy from the human body's motion can be captured to power small electronic devices. They also have many opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles. <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> In order to investigate how energy from the body's | <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> 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) <p>PS3.B: Conservation of Energy and Energy Transfer:</p> <ul style="list-style-type: none"> When the motion energy of an object changes, there is inevitably some other change in energy at the same time. | <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> 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) <p>Systems and System Models</p> <ul style="list-style-type: none"> 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) |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|---|---|
| <p>motion can be captured for later use, students use the Harnessing Human Energy Simulation and physical materials to create models of energy systems. They also create visual models, called Energy Transfer Diagrams, that represent ideas about how energy is transferred and converted.</p> <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> Students learn about scientific explanations and have multiple opportunities to make increasingly complex explanations about how systems can transfer, convert, and store energy over the course of the unit. Students also design an energy solution that can help rescue workers transfer kinetic energy to power their electronic devices. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students receive instruction about the structure of a scientific argument and are supported in investigating claims and engaging in scientific reasoning. Students engage in oral argumentation and produce a written argument about the effectiveness of a proposed energy solution. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Students are introduced to Active Reading—an approach to obtaining information from science texts—and have multiple opportunities to engage in this practice. Students also evaluate evidence to determine its | <p>(MS-PS3-5)</p> <p>ETS1.A: Defining and Delimiting Engineering Problems:</p> <ul style="list-style-type: none"> 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) <p>ESS3.A: Natural Resources:</p> <ul style="list-style-type: none"> Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) | <p>Energy and Matter</p> <ul style="list-style-type: none"> Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5) <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-5) <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> 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) 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-ESS3-1) |
|--|---|---|

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|----------------------------------|--|--|
| relevance to a particular claim. | | |
|----------------------------------|--|--|

New Jersey Social and Emotional Competencies and Sub-Competencies

| | |
|------------------------------------|---|
| Self-Awareness | <ul style="list-style-type: none"> Recognize one’s feelings and thoughts. Recognize the impact of one’s feelings and thoughts on one’s own behavior. Recognize one’s personal traits, strengths, and limitations. Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. Recognize the skills needed to establish and achieve personal and educational goals. Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> Develop, implement, and model effective problem-solving and critical thinking skills. Identify the consequences associated with one’s actions in order to make constructive choices. Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> Establish and maintain healthy relationships. Utilize positive communication and social skills to interact effectively with others. Identify ways to resist inappropriate social pressure. Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. Identify who, when, where, or how to seek help for oneself or others when needed. |

Interdisciplinary Connections

ELA Standards

| | |
|------------------|--|
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| | whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| 7.NS.2 | Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---------------|---|
| 7.EE.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. |
|---------------|---|

| <u>Computer Science & Design Thinking</u> | |
|---|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| <u>Career Readiness, Life Literacies & Key Skills</u> | |
|---|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one's goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| Evidence of Student Learning | |
|--|---|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |
| Knowledge & Skills | |
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● Whenever something moves or changes, it is because of energy. (1.2) ● When something is moving, it has kinetic energy. (1.3) ● When something has the ability to make things move or change in the future, it has potential energy, even if it is not moving or changing now. (1.3) ● Nothing creates energy. If something has energy, the energy must have been transferred from something else. (2.2) ● Energy can be transferred from one object to another, and energy can be converted from one type to another. (2.2) | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How is it possible to charge electrical devices when the power is out? ● What is energy and why does it matter to the rescue team? ● How do you know something has energy? ● How can the rescue workers get energy to the batteries in their equipment during rescue missions? ● How do objects get energy? ● What is the best way for the rescue workers to capture energy from their bodies' motion during rescue missions? |
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> ● Physical scientists study physical systems and processes to learn about what makes things work the way they do. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> ● Explain the role of physical science in studying systems and processes in the natural world. |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- | | |
|---|---|
| <ul style="list-style-type: none">• Science is both a body of knowledge and the processes and practices used to add to that body of knowledge.• One thing physical scientists investigate is energy.• A system is a set of interacting parts forming a complex whole.• Energy is the ability to make things move or change.• Whenever something moves or changes, it is because of energy.• Scientists ask questions about the natural world and develop claims, or proposed answers, based on evidence.• Scientists use reasoning to explain how the evidence supports their claim.• Scientists make scientific arguments using claims, evidence, and reasoning.• When something is moving, it has kinetic energy.• When something has the ability to make things move or change in the future, it has potential energy, even if it is not moving or changing now.• Reading actively means thinking about one's own understanding as one reads.• Scientists and engineers solve energy problems in places where people don't have easy access to energy.• Engineers have created devices that convert energy from the sun or energy from the human body to electrical energy that can be stored in a battery.• Scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination, and creativity.• Both living and nonliving things can have energy.• Energy can move from object to object.• A generator is a machine that converts kinetic energy to electrical energy.• Energy sources can include hydroelectric power, solar power, fuel, wind power, and human power.• Different energy sources have different advantages and disadvantages.• Nothing creates energy. If something has energy, the energy must have been transferred from something else.• Energy can be transferred from one object to another, and energy can be converted from one type to another. | <ul style="list-style-type: none">• Describe science as both a body of knowledge and a set of practices used to build that knowledge.• Define energy as the ability to cause motion or change.• Explain that all motion and change occur because of energy.• Identify examples of energy in both living and nonliving systems.• Describe a system as a set of interacting parts that form a whole.• Explain how energy moves within and between systems.• Distinguish between kinetic energy and potential energy using real-world examples.• Explain how an object can have potential energy even when it is not moving.• Demonstrate active reading strategies by monitoring understanding and identifying key ideas in science texts.• Ask scientific questions and develop claims based on observations and evidence.• Use evidence and reasoning to support scientific claims about energy.• Construct scientific arguments using claims, evidence, and reasoning.• Explain that energy cannot be created and must be transferred or converted from another source.• Describe how energy can be transferred between objects and converted from one form to another.• Identify common energy sources, including solar, wind, hydroelectric, fuel, and human power.• Compare advantages and disadvantages of different energy sources.• Explain how generators convert kinetic energy into electrical energy.• Describe how human movement can be used as a source of energy.• Explain how electrical energy can be stored in batteries as potential energy.• Analyze how scientists and engineers design systems to capture and convert human kinetic energy.• Explain how energy-capturing floor tiles use kinetic energy and generators to produce electrical energy.• Use models, diagrams, and drawings to represent energy systems and energy transfers.• Define and apply design criteria when evaluating energy solutions.• Evaluate an energy system by considering how much energy it can capture.• Assess the quality of evidence by considering reliability and relevance. |
|---|---|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|---|
| <ul style="list-style-type: none"> ● Nothing can work without an energy source. ● The energy of human movement can be used to charge batteries. ● Scientists and engineers have designed many ways to capture human kinetic energy and convert it to electrical energy. ● Electrical energy can be stored in a battery as potential energy so it can be used later. ● Sharing expertise is an important practice in science. ● Design criteria are goals that must be met in order to solve a problem. ● Energy-capturing floor tiles can convert kinetic energy to electrical energy using special generators that work with a squeezing motion. ● Energy systems can be represented in drawings, diagrams, and physical models. ● Evidence is higher quality if it comes from a reliable source. ● A convincing argument is supported by evidence and the process of reasoning. ● When evaluating an energy system, one must consider the amount of energy the system can capture. | <ul style="list-style-type: none"> ● Explain why convincing arguments require strong evidence and clear reasoning. <ul style="list-style-type: none"> ● Collaborate and share expertise to improve understanding of energy systems. ● Demonstrate persistence, creativity, logic, and precision when solving energy-related problems. |
|---|---|

| Core Instructional & Supplemental Materials | |
|---|--|
| <p>Suggested Activities/Resources:</p> <ul style="list-style-type: none"> ● Articles in This Unit <ul style="list-style-type: none"> ○ “Energy Inventions” ○ “How We Store Energy” ○ Capturing Human Energy | <p>Supplemental Materials</p> <ul style="list-style-type: none"> ● Digital Resources included in each unit <ul style="list-style-type: none"> ○ Harnessing Human Energy Simulation ● Multi-language glossary ● Hands-On Flextension: <ul style="list-style-type: none"> ○ Designing Electrical Devices |

| Suggested Accommodations |
|---|
| <p>English Language Learners:</p> <ul style="list-style-type: none"> ● Multi-sensory instruction ● Flexible grouping ● Small group instruction ● Provide peer tutoring ● Use a strong student as a “buddy” (does not necessarily have to speak the primary language) ● Chunking information ● Scaffolded questioning ● Academic language support ● Vocabulary support ● Co-Constructed Word Banks ● Anchor charts |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

| | |
|-------------------------------|--------------------------|
| Unit 2: Thermal Energy | Duration: 20 days |
|-------------------------------|--------------------------|

| New Jersey Student Learning Standards | |
|--|--|
| MS-PS1-1 | Develop models to describe the atomic composition of simple molecules and extended structures. |
| 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-PS2-1 | Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects. |
| 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. |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|----------|--|
| 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. |
|----------|--|

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|---|---|--|
| <p>Practice 1: Asking Questions.</p> <ul style="list-style-type: none"> As students investigate which heating system will work better to warm the school, their inquiry is guided by a series of strategic questions. They also have many opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles. <p>Practice 2: Developing and Using Models.</p> <ul style="list-style-type: none"> Students complete visual representations to demonstrate their understanding of key concepts throughout the unit. They also use physical and kinesthetic models to demonstrate energy transfer between objects with the same and varying numbers of molecules. <p>Practice 3: Planning and Carrying Out Investigations.</p> <ul style="list-style-type: none"> Students plan and conduct investigations to figure out what determines how much the temperature of something will change. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> The use of the Thermal Energy Simulation leads students to collect data about the molecular nature of | <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> 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) <p>PS3.B: Conservation of Energy and Energy Transfer:</p> <ul style="list-style-type: none"> 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) <p>PS2.A: Forces and Motion:</p> <ul style="list-style-type: none"> 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) | <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-4) <p>Systems and System Models</p> <ul style="list-style-type: none"> 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) <p>Energy and Matter</p> <ul style="list-style-type: none"> Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5) <p>Connections to Nature of Science</p> |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|---|---|---|
| <p>temperature and its relationship to kinetic energy. Students analyze, interpret, and then use this data as evidence when they make their recommendation about the heating systems.</p> <p>Practice 5: Using Mathematics and Computational Thinking.</p> <ul style="list-style-type: none"> Students learn what a mathematical average is and how to calculate it. Throughout the unit, students practice calculating the average speed of molecules in order to determine the temperature of a sample. Additionally, they calculate the total energy of a sample and explore the difference between a total and an average. By the end of the unit, students can use these values to predict what the equilibrium temperature of a system of samples in contact will be. <p>Practice 6: Constructing Explanations.</p> <ul style="list-style-type: none"> In each chapter, students deepen their understanding of temperature in order to create increasingly robust explanations about the differences in the heating systems. Students first explain that the air molecules in the school move faster when the air temperature increases. They then explain that the transfer of kinetic energy via molecular collisions is how one material can increase the temperature of another material. The final component of their explanations is that the number of molecules in a sample affects the amount of total kinetic energy that | <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS- PS1-4) The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system’s total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4) <p>PS3.C: Relationship Between Energy and Forces:</p> <ul style="list-style-type: none"> 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) | <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-4), (MS-PS3-5) |
|---|---|---|

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|--|--|--|
| <p>sample has, and this can mean that a larger sample at a lower temperature can transfer more energy than a smaller sample with a higher temperature.</p> <p>Practice 7: Engaging in Argument from Evidence.</p> <ul style="list-style-type: none"> Students evaluate claims about the heating systems and about principles of thermal energy transfer. In the Science Seminar, students practice both oral and written argumentation to debate alternate claims about whether the pasteurization kits can raise the temperature of water to above 65oC. <p>Practice 8: Obtaining, Evaluating, and Communicating Information.</p> <ul style="list-style-type: none"> Students have multiple opportunities to engage in Active Reading, an approach to obtaining information from science texts. They also have frequent opportunities to communicate orally and in writing. | | |
|--|--|--|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|---|---|
| Self-Awareness | <ul style="list-style-type: none"> Recognize one’s feelings and thoughts. Recognize the impact of one’s feelings and thoughts on one’s own behavior. Recognize one’s personal traits, strengths, and limitations. Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. Recognize the skills needed to establish and achieve personal and educational goals. Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------------|---|
| | <ul style="list-style-type: none"> • Demonstrate an understanding of the need for mutual respect when viewpoints differ. • Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> • Develop, implement, and model effective problem-solving and critical thinking skills. • Identify the consequences associated with one's actions in order to make constructive choices. • Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> • Establish and maintain healthy relationships. • Utilize positive communication and social skills to interact effectively with others. • Identify ways to resist inappropriate social pressure. • Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. • Identify who, when, where, or how to seek help for oneself or others when needed. |

| <u>Interdisciplinary Connections</u> | |
|--------------------------------------|---|
| ELA Standards | |
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| MP7 | Look for and make use of structure. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.RP.2a | Decide whether two quantities are in a proportional relationship. |
| 7.RP.2b | Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. |
| 7.NS.1 | Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. |
| 7.NS.1d | Apply properties of operations as strategies to add and subtract rational numbers. |
| 7.NS.2 | Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |
| 7.EE.3 | Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations as strategies to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---------------|---|
| 7.EE.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. |
| 7.SP.4 | Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. |

| <u>Computer Science & Design Thinking</u> | |
|--|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| <u>Career Readiness, Life Literacies & Key Skills</u> | |
|--|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one's goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 9.4.8.DC.4 | Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

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

| Evidence of Student Learning | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

| Knowledge & Skills | |
|---|---|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● Things are made of molecules (or other types of atom groups). (1.3) ● When a thing gets hotter, its molecules are moving faster. (1.3) ● When a thing gets colder, its molecules are moving slower. (1.3) ● Temperature is a measure of the average speed of the molecules of a thing. (1.4) ● When a thing gets hotter, its molecules are moving faster and have more kinetic energy. (2.1) ● When a thing gets colder, its molecules are moving slower and have less kinetic energy. (2.1) ● Temperature is a measure of the average kinetic energy of the molecules of a thing. (2.1) | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● Why do things change temperature? ● What is happening when the air in the school gets warmer? ● How is something different when it is warmer or cooler? ● What causes the air molecules inside the school to speed up? ● Why do molecules change speed? ● Why does the transfer of energy between two things stop? ● Which heating system will warm the air in the school more? ● What determines how much total kinetic energy something has? ● What determines how much something will change temperature? |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--|--|
| <ul style="list-style-type: none"> ● When two things are in contact, their molecules collide, and kinetic energy transfers from the faster-moving molecules to the slower-moving molecules. (2.3) ● Energy isn't created or destroyed. Therefore, as energy transfers, it increases in one part of the system as it decreases in another part of the system. (2.3) ● The molecules of a system will transfer energy until the system reaches a stable state known as equilibrium, in which all of the molecules are moving at about the same speed. (2.5) ● For things at the same temperature, the thing with more molecules has more total kinetic energy (thermal energy) than the thing with fewer molecules. (3.2) ● At equilibrium, the average kinetic energy (temperature) of the molecules in the system is the total kinetic energy (thermal energy) evenly divided by the number of molecules in the system. (3.2) ● When a thing gains or loses energy, the energy gained or lost is divided among all the molecules of the thing. (3.2) ● Revised: Energy isn't created or destroyed. Therefore, as energy transfers, it increases in one part of the system as it decreases in another part of the system. The total energy of a system doesn't change. (3.3) | <ul style="list-style-type: none"> ● Why wasn't the water pasteurized? |
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> ● There is more movement within warmer liquid than colder liquid. ● Things are made of molecules (or other types of atom groups). ● When a thing gets hotter, its molecules are moving faster. ● When a thing gets colder, its molecules are moving slower. ● Scientists use digital simulations to represent things that are too small to see with the naked eye. ● There is a limit to how cold something can be. Scientists call this temperature absolute zero because at this temperature there is zero molecular motion. ● Temperature is a measure of the average speed of the molecules of a thing. ● Averages are useful because they make it easier to compare two sets of data. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> ● Explain that all matter is made of molecules (or other groups of atoms). ● Describe how molecular motion changes when a substance is heated or cooled. ● Explain that warmer substances have faster-moving molecules and colder substances have slower-moving molecules. ● Use particle motion to explain why warmer liquids have more movement than colder liquids. ● Explain that temperature is a measure of the average kinetic energy of molecules in a substance. ● Distinguish between temperature and total kinetic energy (thermal energy). ● Explain why colder objects can have more total thermal energy than warmer objects if they contain more molecules. ● Explain that for objects at the same temperature, the object with more molecules has more total thermal energy. |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- To find an average you add the values and divide by how many numbers are in the data set.
- Models are representations of systems; they help us understand something by making it simpler or easier to see.
- When a thing gets hotter, its molecules are moving faster and have more kinetic energy.
- When a thing gets colder, its molecules are moving slower and have less kinetic energy.
- Temperature is a measure of the average kinetic energy of the molecules of a thing.
- Reading actively means thinking about one's own understanding as one reads.
- When scientists read, they make connections between the text and science ideas they have learned or investigated.
- Energy transfer can cool things down.
- When two things are in contact, their molecules collide, and kinetic energy transfers from the faster-moving molecules to the slower-moving molecules.
- Energy isn't created or destroyed. Therefore, as energy transfers, it increases in one part of the system as it decreases in another part of the system.
- Energy between two objects transfers until their temperatures are equal and they reach a stable state.
- The molecules of a system will transfer energy until the system reaches a stable state known as equilibrium, in which all of the molecules are moving at about the same speed.
- Colder things can have more total kinetic energy (thermal energy) than warmer things if they are made up of more molecules.
- For things at the same temperature, the thing with more molecules has more total kinetic energy (thermal energy) than the thing with fewer molecules.
- At equilibrium, the average kinetic energy (temperature) of the molecules in the system is the total kinetic energy (thermal energy) evenly divided by the number of molecules in the system.
- When a thing gains or loses energy, the energy gained or lost is divided among all the molecules of the thing.
- The greater the total kinetic energy (thermal energy) something has, the more energy it has to transfer to other parts of a system.

- Use models and digital simulations to represent molecular motion that cannot be observed directly.
 - Explain why scientists use models to simplify and understand complex systems.
- Explain the concept of absolute zero as the lowest possible temperature with no molecular motion.
- Calculate averages and explain why averages are useful for comparing temperature data.
 - Explain how energy is transferred when objects are in contact through molecular collisions.
 - Explain that thermal energy transfers from faster-moving molecules to slower-moving molecules.
 - Explain that energy is conserved and is not created or destroyed during energy transfer.
 - Describe how energy transfers within a system until equilibrium is reached.
 - Explain equilibrium as a stable state where molecules move at about the same average speed.
 - Explain how energy gained or lost by an object is distributed among all of its molecules.
- Analyze how the amount of thermal energy in a system affects its ability to transfer energy.
- Use evidence from investigations or simulations to support claims about thermal energy transfer.
 - Apply active reading strategies to make connections between text and scientific ideas.
- Explain how thermal energy transfer can be used to solve real-world problems.
- Describe how natural disasters can limit access to clean drinking water.
- Explain why untreated water may contain harmful bacteria that can cause illness.
 - Explain how pasteurization uses thermal energy to reduce harmful bacteria in water.
- Construct a scientific argument that includes a claim,
- evidence, and reasoning related to thermal energy.
 - Use multiple pieces of evidence to more effectively support a scientific claim.
 - Engage in scientific discussions to refine ideas and build understanding.
 - Explain why scientists must remain open to new ideas and revise claims based on evidence.

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--|--|
| <ul style="list-style-type: none"> ● Energy isn't created or destroyed. Therefore, as energy transfers, it increases in one part of the system as it decreases in another part of the system. The total energy of a system doesn't change. ● Reasoning is a process that scientists use to connect evidence to their claims. ● Natural disasters can result in restricted access to clean drinking water. ● Untreated water may contain harmful bacteria that can cause illnesses if consumed by humans. ● Pasteurization is a method of treating water that involves heating it to a high enough temperature that almost all of the harmful bacteria are destroyed. ● Using evidence helps scientists support their claims. ● Discussing evidence and ideas with others helps build new understanding. ● Scientists need to stay open to new ideas so they can change their minds when presented with convincing evidence. ● Scientists clearly communicate how their claims and evidence are supported with reasoning in a convincing scientific argument. ● A written scientific argument needs to state a claim, describe specific evidence, and explain how the evidence supports the claim to convince its reader. ● A claim can sometimes be supported more effectively if you consider the combination of several different pieces of evidence. | |
|--|--|

Core Instructional & Supplemental Materials

| | |
|--|---|
| <p>Suggested Activities/Resources:</p> <ul style="list-style-type: none"> ● Articles in This Unit <ul style="list-style-type: none"> ○ "Absolute Zero" ○ "How Air Conditioners Make Cities Hotter" ○ "How Air Conditioners Make Cities Hotter" ○ "Thermal Energy Is NOT Temperature" ○ "Dumpling Dilemma: Oil or Water?" | <p>Supplemental Materials</p> <ul style="list-style-type: none"> ● Digital Resources included in each unit <ul style="list-style-type: none"> ○ Thermal Energy Simulation ● Multi-language glossary ● Hands-On Flexextension: <ul style="list-style-type: none"> ○ Designing Hot and Cold Packs ● The Man Who Predicted Climate Change |
|--|---|

Suggested Accommodations

| |
|--|
| <p>English Language Learners:</p> <ul style="list-style-type: none"> ● Multi-sensory instruction |
|--|

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

| | |
|-----------------------------|--------------------------|
| Unit 3: Phase Change | Duration: 20 days |
|-----------------------------|--------------------------|

| New Jersey Student Learning Standards | |
|--|--|
| MS-PS1-1 | Develop models to describe the atomic composition of simple molecules and extended structures. |
| 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-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. |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|------------------|--|
| 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-ESS1-3 | Analyze and interpret data to determine scale properties of objects in the solar system. |
| MS-ESS2-4 | Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|--|--|---|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> As students investigate the mysterious lake on Titan, their inquiry is guided by a series of strategic questions. They also have many opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles. <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> Students spend ample time exploring and investigating a digital simulation that models how substances behave at the molecular scale. They also use a digital modeling tool to create models that show their ideas about phase changes. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> For the Science Seminar, students analyze and interpret temperature and phase change data from the Simulation about the lakes of Titan and from the liquid oxygen machine. | <p>PS1.A: Structure and Properties of Matter:</p> <ul style="list-style-type: none"> 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) 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) <p>PS1.A: Structure and Properties of Matter:</p> <ul style="list-style-type: none"> Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total | <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) 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-PS3-4) Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-3) <p>Energy and Matter</p> <ul style="list-style-type: none"> Energy may take different forms (e.g. energy in fields, thermal energy, |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|---|---|--|
| <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> Students learn about scientific explanations and have multiple opportunities to make increasingly complex explanations (and defend them through argumentation) over the course of the unit as they explain what happened to the lake on Titan. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students receive instruction about the structure of a scientific argument and are supported in evaluating evidence, engaging in scientific reasoning, and producing both oral and written arguments. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Students have multiple opportunities to engage in Active Reading, an approach to obtaining information from science texts. Students also evaluate evidence to determine its relevance to a particular claim. | <p>energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-PS3-4)</p> <ul style="list-style-type: none"> 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) The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4) <p>ESS1.B: Earth and the Solar System</p> <ul style="list-style-type: none"> The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-3) <p>ESS2.C: The Roles of Water in the Earth's Surface Processes:</p> <ul style="list-style-type: none"> Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation | <p>energy of motion). (MS-PS3-5)</p> <ul style="list-style-type: none"> Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4) <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-4), (MS-PS3-5) <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3) |
|---|---|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|---|--|
| | and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) | |
|--|---|--|

New Jersey Social and Emotional Competencies and Sub-Competencies

| | |
|------------------------------------|---|
| Self-Awareness | <ul style="list-style-type: none"> Recognize one’s feelings and thoughts. Recognize the impact of one’s feelings and thoughts on one’s own behavior. Recognize one’s personal traits, strengths, and limitations. Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. Recognize the skills needed to establish and achieve personal and educational goals. Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> Develop, implement, and model effective problem-solving and critical thinking skills. Identify the consequences associated with one’s actions in order to make constructive choices. Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> Establish and maintain healthy relationships. Utilize positive communication and social skills to interact effectively with others. Identify ways to resist inappropriate social pressure. Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. Identify who, when, where, or how to seek help for oneself or others when needed. |

Interdisciplinary Connections

ELA Standards

| | |
|-----------------|--|
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
|-----------------|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.RP.2a | Decide whether two quantities are in a proportional relationship. |
| 7.NS.2 | Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---------------|--|
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |
| 7.EE.1 | Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. |
| 7.EE.2 | Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. |
| 7.EE.4 | Solve real-life and mathematical problems using numerical and algebraic expressions and equations. 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. |

| |
|--|
| <u>Computer Science & Design Thinking</u> |
|--|

| | |
|--------------------|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| |
|--|
| <u>Career Readiness, Life Literacies & Key Skills</u> |
|--|

| | |
|---------------------|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one's goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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). |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--------------------|--|
| 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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

| Evidence of Student Learning | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

| Knowledge & Skills | |
|--|---|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● A solid holds its shape and does not take the shape of its container. (1.2) ● A gas has no visible shape and fills its container. (1.2) ● A liquid flows and can take the shape of its container. (1.2) ● A solid keeps its shape because its molecules only move in place, not around each other. (1.5) | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How can the appearance of a substance change without it becoming a different substance? ● How does the appearance of a substance change when it changes phase? ● What happens to the molecules of a substance when it changes phase? ● What could cause liquid methane to change phase? ● What can cause molecules' freedom of movement to change? |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- | | |
|---|--|
| <ul style="list-style-type: none"> ● A liquid can flow because its molecules move around, not away from each other. (1.5) ● A gas does not have a visible shape because gas molecules can move away from each other. (1.5) ● A phase change is when the molecules that make up a substance experience a change to their freedom of movement. This phase change involves a macroscale change in appearance. (1.6) ● A change that can be observed at the macroscale can be explained by a change at the molecular scale, which cannot be observed with the naked eye. (1.6) ● When energy is transferred to or from a substance, it can change the molecules' freedom of movement. (2.1) ● Temperature is a measure of the average kinetic energy of the molecules of a substance. (2.2) ● Transferring energy to a substance increases the kinetic energy of that substance's molecules. Transferring energy from a substance decreases the kinetic energy of that substance's molecules. (2.2) ● Whether or not a phase change occurs is determined by the interaction between the kinetic energy of the molecules and the attraction pulling the molecules together. (3.2) ● The molecular attraction of a substance never changes. (3.2) ● A phase change occurs when the kinetic energy increases enough to overcome the attraction between molecules. (3.3) ● A phase change occurs when the kinetic energy decreases enough so that the attraction between molecules pulls them together. (3.3) ● Different substances can have either weaker or stronger molecular attraction. (3.3) | <ul style="list-style-type: none"> ● Why can transferring energy into or out of a substance change molecules' freedom of movement? ● Why didn't the liquid methane change phase before 2007? ● Why does an energy transfer not always result in phase change? ● How does molecular attraction affect whether or not a phase change will occur? ● Why is the liquid oxygen machine producing less liquid oxygen than normal? |
|---|--|

Content

Students will know...

- A solid holds its shape and does not take the shape of its container.
- A gas has no visible shape and fills its container.
- A liquid flows and can take the shape of its container.
- Laws are mathematical descriptions of natural phenomena.
- The macroscale appearance of a substance is connected to the behavior of its molecules.

Skills

Students will be able to ...

- Identify and describe the observable properties of solids, liquids, and gases.
- Distinguish how each phase of matter behaves in relation to shape and container.
- Explain how the macroscale appearance of a substance is connected to the motion and arrangement of its molecules.
- Use molecular-level explanations to describe why solids hold their shape, liquids flow, and gases expand to fill a container.

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Refutation is a strategy scientists use to eliminate possible claims.
- Scientists use diagrams to help communicate complicated ideas in a text.
- A solid keeps its shape because its molecules only move in place, not around each other.
- A gas does not have a visible shape because gas molecules can move away from each other.
- A liquid can flow because its molecules move around, not away from each other.
- A clear relationship exists between a substance's phase and its molecules' freedom of movement.
- A phase change is when the molecules that make up a substance experience a change to their freedom of movement. This phase change involves a macroscale change in appearance.
- A change that can be observed at the macroscale can be explained by a change at the molecular scale, which cannot be observed with the naked eye.
- When energy is transferred to or from a substance, it can change the molecules' freedom of movement.
- Transferring energy to a substance increases the kinetic energy of that substance's molecules.
- Transferring energy from a substance decreases the kinetic energy of that substance's molecules.
- Temperature is a measure of the average kinetic energy of the molecules of a substance.
- Evidence may be used to support or refute a claim.
- Scientists decide which claims are best supported based on all of the available evidence.
- Scientists may decide one claim is stronger and more convincing because it is supported by evidence while alternate claims are refuted by the evidence.
- Reasoning is a process that scientists use to connect evidence to their claims.
- The molecules of a substance are attracted to each other. This pull of attraction can hold molecules in place or close together, limiting their freedom of movement.
- Whether or not a phase change occurs is determined by the interaction between the kinetic energy of the molecules and the attraction pulling the molecules together.
- Explain the relationship between a substance's phase and the freedom of movement of its molecules.
 - Define a phase change as a change in molecular freedom of movement that results in a visible change in appearance.
 - Explain how changes observed at the macroscale can be explained by changes at the molecular scale.
 - Describe how transferring energy to or from a substance affects molecular motion.
 - Explain how adding energy increases molecular kinetic energy and removing energy decreases it.
 - Explain temperature as a measure of the average kinetic energy of molecules in a substance.
 - Analyze how molecular attraction and kinetic energy interact to determine whether a phase change occurs.
 - Explain that molecular attraction remains constant for a given substance but differs among substances.
 - Compare different substances based on the strength of their molecular attractions.
 - Explain why different substances change phase at different temperatures.
 - Use examples to explain how substances in air can be separated by changing temperature.
 - Use diagrams and models to represent molecular motion and phase changes.
 - Evaluate claims about phase changes using evidence.
 - Use refutation to eliminate claims that are not supported by evidence.
 - Explain how scientists decide which claims are most convincing based on available evidence.
 - Use reasoning to connect evidence to claims about phase change phenomena.
 - Construct a written scientific argument that includes a claim, supporting evidence, and clear reasoning.
 - Synthesize multiple pieces of evidence to support a single claim.
 - Engage in scientific discussion to clarify understanding and refine explanations.
 - Explain how scientists may revise their ideas when presented with stronger evidence.
 - Demonstrate clear scientific communication by explaining how and why a phase change occurs using evidence.

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|--|
| <ul style="list-style-type: none"> ● The molecular attraction of a substance never changes. ● Different substances have different molecular attractions. ● Discussing new knowledge with others can help clarify thinking. ● Strong explanations clearly state why or how something has occurred, providing evidence in support of these ideas. ● Substances in the air can be separated by changing the temperature of the air because different substances change phase at different temperatures. ● Evidence can support or refute a claim. ● A convincing argument is supported by evidence and through the process of reasoning. ● Discussing evidence and ideas with others helps build new understanding. ● Scientists can change their minds when presented with convincing evidence. ● In order to convince its reader, a written scientific argument needs to include a claim, describe specific evidence, and explain how the evidence supports the claim. ● Sometimes evidence needs to be considered together in order to best support a claim. | |
|---|--|

| Core Instructional & Supplemental Materials | |
|--|---|
| <p>Suggested Activities/Resources:</p> <ul style="list-style-type: none"> ● Articles in This Unit <ul style="list-style-type: none"> ○ “Titan Fact Sheet” ○ “Air Pressure and Boyle’s Law” ○ Weird Water Events article set ○ “What Burns? What Melts?” ○ “Liquid Oxygen” ○ “Pressure and Temperature: Evaporating Water on Mars” | <p>Supplemental Materials</p> <ul style="list-style-type: none"> ● Digital Resources included in each unit <ul style="list-style-type: none"> ○ Phase Change Simulation ● Multi-language glossary ● Hands-On Flextension: <ul style="list-style-type: none"> ○ Investigations with Dry Ice ● Phase Change Video ● UCLA Climate Scientist Aradhna Tripathi |

| Suggested Accommodations |
|--|
| <p>English Language Learners:</p> <ul style="list-style-type: none"> ● Multi-sensory instruction ● Flexible grouping ● Small group instruction ● Provide peer tutoring ● Use a strong student as a “buddy” (does not necessarily have to speak the primary language) ● Chunking information |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

| | |
|---|--------------------------|
| Unit 4: Phase Change Engineering | Duration: 12 days |
|---|--------------------------|

| New Jersey Student Learning Standards | |
|--|--|
| 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. |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|------------------|---|
| 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. |
| 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-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. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|--|--|--|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> Students consider multiple criteria in defining their design problem. They also have opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read scientific texts, such as the Futura Chemical Engineer’s Dossier. <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> Students use the Futura BabyWarmer Design Tool, a digital simulation, to build and test their designed solutions. They also use a physical model of a phase change material to model thermal energy transfer. <p>Practice 3: Planning and Carrying</p> | <p>ETS1.A: Defining and Delimiting Engineering Problems:</p> <ul style="list-style-type: none"> 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) <p>ETS1.B: Developing Possible Solutions:</p> <ul style="list-style-type: none"> 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. | <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> 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-PS3-4) <p>Energy and Matter</p> <ul style="list-style-type: none"> The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3) <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|--|---|--|
| <p>Out Investigations:</p> <ul style="list-style-type: none"> Students work through the phases of the design cycle—Plan, Build, Test, Analyze—as they develop optimal solutions to their design problem. They plan and carry out iterative tests in the Futura BabyWarmer Design Tool and collect data that help inform their subsequent designs. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> Students analyze the data recorded on data sheets to determine needed revisions to their designs. <p>Practice 5: Using Mathematics and Computational Thinking:</p> <ul style="list-style-type: none"> Students calculate differences between the results of two tests as well as evaluate graphs and tables as they look for trends, with the ultimate goal of optimizing their designs. Students break down this problem into smaller parts by isolating design variables to understand how specific design features impact the final results. <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> Students use an iterative process to optimize a design solution. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students evaluate competing design solutions, based on agreed-upon design criteria, to choose the best portable incubator design. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> | <p>(MS-ETS1-2), (MS-ETS1-3)</p> <ul style="list-style-type: none"> 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) <p>ETS1.C: Optimizing the Design Solution:</p> <ul style="list-style-type: none"> 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) <p>PS1.A: Structure and Properties of Matter:</p> <ul style="list-style-type: none"> 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) The changes of state that occur with variations in temperature or pressure can be described and predicted | <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-4) |
|--|---|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|---|--|
| <ul style="list-style-type: none"> ● Students read and research in the Futura Chemical Engineer’s Dossier; analyze different design iterations, using their data tables; and write final proposals describing their optimal designs for a baby incubator. | <p style="text-align: center;">using these models of matter. (MS-PS1-4)</p> <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> ● The term heat as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS-PS1-4) ● 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) <p>PS3.B: Conservation of Energy and Energy Transfer:</p> <ul style="list-style-type: none"> ● 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) | |
|--|---|--|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|--|--|
| Self-Awareness | <ul style="list-style-type: none"> ● Recognize one’s feelings and thoughts. ● Recognize the impact of one’s feelings and thoughts on one’s own behavior. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------------|---|
| | <ul style="list-style-type: none"> ● Recognize one’s personal traits, strengths, and limitations. ● Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> ● Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> ● Recognize and identify the thoughts, feelings, and perspectives of others. ● Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> ● Develop, implement, and model effective problem-solving and critical thinking skills. ● Identify the consequences associated with one’s actions in order to make constructive choices. ● Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> ● Establish and maintain healthy relationships. ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed. |

| <u>Interdisciplinary Connections</u> | |
|--|---|
| ELA Standards | |
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| MP7 | Look for and make use of structure. |
| 7.RP.3 | Use proportional relationships to solve multistep ratio and percent problems. |
| 7.NS.1c | Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. |
| 7.NS.2 | Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| Computer Science & Design Thinking | |
|---|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| Career Readiness, Life Literacies & Key Skills | |
|---|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one’s goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

| Evidence of Student Learning | |
|--|--|
| Formative Tasks: <ul style="list-style-type: none"> ● Teacher observations | Alternative Assessments: <ul style="list-style-type: none"> ● Oral assessments |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|---|
| <ul style="list-style-type: none"> ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <ul style="list-style-type: none"> ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

| Knowledge & Skills | |
|---|--|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● Engineers apply scientific knowledge about phase change and thermal energy to solve real-world problems. ● Phase change materials can store and release large amounts of energy without changing temperature. ● Temperature plateaus reveal when and how long a substance changes phase. ● The length of a phase change plateau affects how long a material can provide or absorb thermal energy. ● Engineering problems are defined by criteria, and solutions must be evaluated against those criteria. ● Trade-offs are an unavoidable part of engineering design and influence final solutions. ● Iteration improves designs through testing, feedback, and revision. ● Models are useful tools for testing ideas but have limitations. ● Strong engineering solutions are justified with evidence and clear reasoning. ● Diverse perspectives strengthen scientific and engineering problem solving. | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How do engineers use phase change to solve real-world temperature control problems? ● How do phase change materials store and release thermal energy? ● What does a temperature plateau tell us about a substance during a phase change? ● How does the length of a temperature plateau affect the performance of a design? ● How do criteria shape the design of an engineering solution? ● Why are trade-offs necessary when designing solutions? ● How does testing and iteration improve an engineering design? ● What are the benefits and limitations of using models in engineering? ● How can evidence be used to justify that one design is better than another? ● Why do different criteria and constraints lead to different engineering solutions? |
| Content | Skills |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

Students will know...

- Engineers design physical objects and processes that try to solve real-world problems.
- Criteria define the engineering problem.
- Background research is necessary when solving an engineering problem.
- Newborn babies must be kept at the correct temperature in order to grow and develop properly.
- Phase change materials are substances that store and release large amounts of energy during phase changes.
- The PCMs in the incubator work by storing energy during the recharging process that changes them from solid to liquid (melting).
- When PCMs change from liquid to solid (freezing), thermal energy is transferred to the incubator and the baby, keeping the baby warm.
- Engineers need to understand the problem they are trying to solve so they can design an effective solution.
- Engineers read with purpose to understand relevant background information that impacts their work.
- Scientific knowledge is constrained by human capacity, technology, and materials.
- A temperature plateau is a period in which there is no change in the kinetic energy or temperature of a substance as it undergoes a phase change.
- The temperature plateau shows the temperature at which a substance changes phase.
- The length of the temperature plateau can tell the relative length of time that it takes substances to change phase.
- Engineers sometimes use models to test their designs.
- Models have limitations because they are often simplified.
- The length of the plateaus determines how long each PCM will transfer thermal energy to keep the baby warm in the incubator.
- PCMs with short plateaus keep the baby warm for shorter periods of time, but take less time to reheat, while PCMs with longer plateaus will keep the baby warm for longer and take longer to reheat.
- Isolating variables is a key strategy for experimental design in which you select and test for the effect of one variable at a time.

Students will be able to ...

- Explain how engineers design physical objects and processes to solve real-world problems.
- Define an engineering problem by identifying criteria for a successful solution.
- Conduct and apply background research to inform engineering design decisions.
- Explain why maintaining a stable temperature is critical for newborn growth and development.
- Describe phase change materials (PCMs) as substances that store and release large amounts of thermal energy during phase changes.
- Explain how PCMs store energy during melting and release energy during freezing.
- Use thermal energy transfer concepts to explain how PCMs keep a baby warm in an incubator.
- Explain a temperature plateau as a period during a phase change when temperature and kinetic energy remain constant.
- Interpret temperature–time graphs to identify phase change plateaus.
- Analyze how the length of a temperature plateau affects how long a PCM can provide thermal energy.
- Compare PCMs with short and long plateaus in terms of warming duration and recharge time.
- Explain how understanding the problem improves the effectiveness of an engineering solution.
- Read technical texts with purpose to gather information relevant to an engineering challenge.
- Explain how scientific knowledge is constrained by human capacity, technology, and available materials.
- Use models to test and refine engineering designs.
- Identify limitations of models and explain how simplifications affect results.
- Design controlled tests by isolating and changing one variable at a time.
- Evaluate test results based on how well the design meets the defined criteria.
- Revise and iterate designs based on evidence from testing and feedback.
- Explain iteration as a process of improving designs through repeated testing and modification.
- Analyze trade-offs by weighing the impact of one criterion against others.
- Explain why trade-offs may prevent all criteria from being met equally well.
- Compare multiple design iterations to determine which solution is most effective.
- Construct an evidence-based engineering proposal explaining why a design is optimal.

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|--|
| <ul style="list-style-type: none"> ● The results of each design test are evaluated based on how the design addresses the criteria. ● Modifications are made to designs based on evaluated results. Designs are modified in order to be tested again. This is called an iteration. ● People from different social, cultural, and ethnic backgrounds work as scientists and engineers. ● Engineers take feedback into consideration during the iterative process (modifying the design at each iteration). ● For optimal designs, engineers complete several iterations, often combining the best parts of previous designs. ● Engineers consider trade-offs by weighing the impact of each criterion against the others. ● Results are evaluated based on how they address the criteria. ● Trade-offs may make it difficult or impossible to meet all the criteria for a design project. ● Strong engineering proposals use evidence to describe why the design is optimal, including a discussion of trade-offs and comparisons to earlier iterations. ● An engineer's written proposal explains to others how and why a design solution works. ● Strong proposals are written for a professional audience and use topic-specific vocabulary words. ● Engineers improve the use of evidence and the professionalism of their writing when they revise their written proposals. ● Solutions to a problem will differ based on the defined criteria. ● Chemical engineers apply the principles of chemistry and math to solve problems that involve the use of chemicals such as fuels, medical products, food, and other products. | <ul style="list-style-type: none"> ● Use topic-specific scientific and engineering vocabulary appropriate for a professional audience. <ul style="list-style-type: none"> ● Apply reasoning to connect evidence to claims in written engineering explanations. ● Revise written proposals to improve clarity, use of evidence, and professionalism. ● Explain why different criteria can lead to different design solutions. ● Recognize that scientists and engineers come from diverse social, cultural, and ethnic backgrounds. ● Describe how chemical engineers apply chemistry and mathematics to solve real-world problems involving materials and energy. |
|---|--|

Core Instructional & Supplemental Materials

| | |
|---|---|
| <p>Suggested Activities/Resources:</p> <ul style="list-style-type: none"> ● Articles in This Unit <ul style="list-style-type: none"> ○ “Request for Proposals” ○ “Phase Change Materials” ○ “Temperature Plateau” ○ “Insulating Materials” ○ “Meet an Engineer Who Works with Genetics Equipment” | <p>Supplemental Materials</p> <ul style="list-style-type: none"> ● Digital Resources included in each unit <ul style="list-style-type: none"> ○ Futura Workspace ● Multi-language glossary |
|---|---|

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- "Proposal Resources"
- "Additional Resources"

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a "buddy" (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 5: Chemical Reactions

Duration: 23 days

New Jersey Student Learning Standards

MS-PS1-1

Develop models to describe the atomic composition of simple molecules and extended structures.

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|-------------------|---|
| 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-PS1-3 | 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. |
| 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-LS1-6 | Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. |
| MS-LS1-7 | Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. |
| MSS-ESS3-1 | Construct a scientific explanation based on evidence for how the uneven distribution of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes. |
| MS-ESS3-3 | Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment |
| MS-ESS3-5 | Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|--|---|--|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> As students investigate what caused the problem with the water supply, their inquiry is guided by a series of strategic questions. They also have many opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles. <p>Practice 2: Developing and Using</p> | <p>PS1.A: Structure and Properties of Matter:</p> <ul style="list-style-type: none"> 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), | <p>Patterns</p> <ul style="list-style-type: none"> Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2) <p>Cause and Effect</p> <ul style="list-style-type: none"> Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3) Cause and effect relationships may be used |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|---|---|---|
| <p>Models:</p> <ul style="list-style-type: none"> Students spend ample time exploring and investigating a digital simulation that models how substances behave at the atomic scale during chemical reactions. They also create visual models that show their ideas about how substances form during chemical reactions. <p>Practice 3: Planning and Carrying Out Investigations:</p> <ul style="list-style-type: none"> Students conduct investigations using the digital simulation and with real substances to develop an understanding of properties of substances and of chemical reactions. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> Students analyze data about the properties of substances and data about the atoms that make up substances. <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> Students spend time discussing, writing, and creating models to aid them in developing their explanations of concepts presented in the unit. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students receive instruction about the structure of a scientific argument and are supported in evaluating evidence, engaging in scientific reasoning, and producing written arguments. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Students have multiple opportunities to engage in | <p>(MS-PS1-3)</p> <ul style="list-style-type: none"> Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) <p>PS1.B: Chemical Reactions:</p> <ul style="list-style-type: none"> 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-PS1-3), (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) <p>LS1.C: Organization for Matter and Energy Flow in Organisms:</p> <ul style="list-style-type: none"> Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7) | <p>to predict phenomena in natural or designed systems. (MS-ESS3-1)</p> <p>Stability and Change</p> <ul style="list-style-type: none"> Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5) <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) <p>Energy and Matter</p> <ul style="list-style-type: none"> 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) Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7) <p>Structure and Function</p> <ul style="list-style-type: none"> 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-PS1-3) |
|---|---|---|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|--|--|
| <p>Active Reading, an approach to obtaining information from science texts. Students also evaluate evidence to determine its strength.</p> | <p>ESS3.A: Natural Resources</p> <ul style="list-style-type: none">• Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) <p>ESS3.C: Human Impacts on Earth Systems:</p> <ul style="list-style-type: none">• Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) <p>ESS3.D: Global Climate Change:</p> <ul style="list-style-type: none">• Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5) | <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none">• Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3) <p>Influence of Science, Engineering and Technology on Society and the Natural World</p> <ul style="list-style-type: none">• The uses of technologies and any 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. Thus, technology use varies from region to region and over time. (MS-PS1-3)• 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-ESS3-1),• The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by |
|--|--|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|--|---|
| | | <p>differences in such factors as climate, natural resources, and economic conditions. Thus, technology use varies from region to region and over time. (MS-ESS3-3)</p> <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2) • Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6) <p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</p> <ul style="list-style-type: none"> • Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5) |
|--|--|---|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|---|---|
| Self-Awareness | <ul style="list-style-type: none"> • Recognize one’s feelings and thoughts. • Recognize the impact of one’s feelings and thoughts on one’s own behavior. • Recognize one’s personal traits, strengths, and limitations. • Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> • Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. • Recognize the skills needed to establish and achieve personal and educational goals. • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> • Recognize and identify the thoughts, feelings, and perspectives of others. • Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------------|---|
| | <ul style="list-style-type: none"> ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> ● Develop, implement, and model effective problem-solving and critical thinking skills. ● Identify the consequences associated with one's actions in order to make constructive choices. ● Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> ● Establish and maintain healthy relationships. ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed. |

| <u>Interdisciplinary Connections</u> | |
|--------------------------------------|---|
| ELA Standards | |
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| MP7 | Look for and make use of structure. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.NS.2 | Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |
| 7.SP.2 | Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. |

| | |
|---|---|
| Computer Science & Design Thinking | |
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|-------------------|---|
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |
|-------------------|---|

| |
|--|
| <u>Career Readiness, Life Literacies & Key Skills</u> |
|--|

| | |
|---------------------|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one’s goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

| |
|-------------------------------------|
| Evidence of Student Learning |
|-------------------------------------|

| | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
|--|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|---|
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |
|---|---|

| |
|-------------------------------|
| Knowledge & Skills |
|-------------------------------|

| | |
|---|--|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● Different substances have different properties. (1.3) ● Things that are too small (or too large) to see can be studied with models. (1.5) ● Substances have different properties because they are made of different groups of atoms. These groups vary in the type or number of atoms that make up the group. (1.6) ● Groups of atoms repeat to make up a substance. (1.6) ● During a chemical reaction, one or more starting substances (reactants) change into one or more different substances (products). (2.1) ● During a chemical reaction, atoms do not change from one type to another. (2.2) ● During a chemical reaction, atoms rearrange to form different groups of atoms. (2.2) ● During a chemical reaction, all of the atoms that make up the reactants rearrange to form the products. (3.2) ● During a chemical reaction, atoms cannot be created or destroyed. (3.3) | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How do new substances form? ● What is the reddish-brown substance in the water? ● How can you tell one substance from another? ● Why do different substances have different properties? ● How did the rust form? ● Can substances change into different substances? ● How do substances change into different substances during chemical reactions? ● What was produced during the reaction between the iron pipes and the fertilizer? ● What happens to atoms during a chemical reaction? ● Who might have used the unknown substance to steal the diamond? ● Which suspect is most likely to have made the hydrofluoric acid? |
|---|--|

| | |
|--|--|
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> ● Chemists observe substances in order to identify their properties. ● Scientists work in communities to help keep water clean and safe for consumption. ● Science investigations use a variety of methods and tools to make measurements and observations. ● Different substances have different properties. ● More detailed observations provide stronger evidence. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> ● Observe and describe the properties of substances using appropriate tools and methods. ● Explain how chemists use observations and measurements to identify and distinguish substances. ● Explain why more detailed observations provide stronger scientific evidence. ● Identify that all substances are made of atoms. ● Explain that atoms are extremely small and cannot be seen with the naked eye. ● Use models to study objects and processes that are too small to observe directly. |
|--|--|

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- | | |
|---|--|
| <ul style="list-style-type: none">• Scientists can use properties to help them distinguish between different substances.• Substances are made entirely of atoms.• Atoms are extremely small; they are not visible to the eye.• Science theories are based on a body of evidence developed over time.• The term theory as used in science is very different from the common use outside of science.• Things that are too small (or too large) to see can be studied with models.• The atoms that make up matter are organized in repeating groups that form individual molecules or larger extended structures.• Substances have different properties because they are made of different groups of atoms. These groups vary in the type or number of atoms that make up the group.• Groups of atoms repeat to make up a substance.• A chemical reaction can happen when two different substances are mixed together.• During a chemical reaction, one or more starting substances (reactants) change into one or more different substances (products).• A chemical reaction can happen with only a single reactant.• During a chemical reaction, atoms do not change from one type to another.• During a chemical reaction, atoms rearrange to form different groups of atoms.• Models are similar to and different from what they represent in important ways.• The atoms found in the products of a chemical reaction must have been present in the reactants as well.• Advances in technology influence the progress of science and science has influenced advances in technology.• Burning is a type of chemical reaction.• Fuels release energy when they burn.• During a chemical reaction, all of the atoms that make up the reactants rearrange to form the products.• During a chemical reaction, atoms cannot be created or destroyed.• During a chemical reaction, atoms cannot be created or destroyed.• Chemists can play a role in analyzing crime scene evidence. | <ul style="list-style-type: none">• Explain the difference between a scientific theory and the everyday use of the word “theory.”• Describe how atoms are organized into repeating groups that form molecules or extended structures.• Explain why substances have different properties based on the types and numbers of atoms they contain.• Identify a chemical reaction as a process in which reactants change into products.• Explain that chemical reactions can involve one or more reactants.• Explain that during a chemical reaction, atoms rearrange but do not change type.• Apply the principle that atoms are conserved during chemical reactions.• Use models to show how atoms rearrange during a chemical reaction.• Explain why the atoms in the products must have been present in the reactants.• Describe burning as a type of chemical reaction that releases energy.• Explain how fuels release energy during combustion.• Analyze how advances in technology support scientific investigation and how science contributes to technological development.• Describe how chemists contribute to real-world problem solving, such as water safety and crime scene analysis.• Explain how corrosive substances interact with other materials and cause damage.• Evaluate the quality of evidence used to support claims about chemical reactions.• Use models to determine whether a scientific claim about a reaction is possible.• Revise models and explanations when new evidence becomes available.• Engage in scientific discussions to share ideas and refine understanding.• Use reasoning to connect evidence to claims about chemical reactions.• Construct scientific arguments supported by evidence and clear reasoning.• Explain how scientists may change their conclusions when presented with convincing evidence. |
|---|--|

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Evaluating evidence quality is an important aspect of making a strong argument.
- Corrosive substances can cause damage when they come into contact with other substances.
- Scientists can use models to determine whether or not a claim is possible.
- Scientists need to revisit and revise their models when new evidence becomes available.
- Discussing evidence and ideas with others helps build new understanding.
- Scientists can change their minds when presented with convincing evidence.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- Articles in This Unit
 - “Atomic Zoom-In: Comparing Substances at a Very Small Scale”
 - “Synthetic Materials: Making Substances in the Lab”
 - “Meet a Scientist Who Preserves Artwork”
 - “Endothermic and Exothermic Reactions”
 - “What Happens When Fuels Burn?”
 - “What Happens to Your Food?”

Supplemental Materials

- Digital Resources included in each unit
 - Chemical Reactions Simulation
- Multi-language glossary
- Hands-On Flexextension:
 - Identifying Substances
 - Investigating Mixtures
- [The Periodic Table by Primo Levi](#)

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

| | |
|----------------------------|--------------------------|
| Unit 6: Light Waves | Duration: 20 days |
|----------------------------|--------------------------|

| New Jersey Student Learning Standards | |
|--|--|
| 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-LS1-1 | Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. |
| MS-LS1-2 | Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|-----------|---|
| MS-LS1-6 | Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. |
| MS-LS1-8 | Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. |
| MS-ESS3-5 | Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|--|---|--|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> As students investigate why the skin cancer rate in Australia is so high, their inquiry is guided by a series of strategic questions. They also have many opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles. <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> Students spend ample time exploring and investigating a digital simulation that models what happens when different types of light hit different materials. They also create visual models that show how light interacts with materials and how light can cause materials to change. <p>Practice 3: Planning and Carrying Out Investigations:</p> <ul style="list-style-type: none"> Students plan and conduct investigations to figure out that light carries energy and to understand how light waves can interact with | <p>PS4.A: Wave Properties:</p> <ul style="list-style-type: none"> 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) <p>PS4.B: Electromagnetic Radiation:</p> <ul style="list-style-type: none"> 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) | <p>Patterns</p> <ul style="list-style-type: none"> Graphs and charts can be used to identify patterns in data. (MS-PS4-1) <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8) <p>Stability and Change</p> <ul style="list-style-type: none"> Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5) <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1) <p>Energy and Matter</p> <ul style="list-style-type: none"> Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) <p>Structure and Function</p> <ul style="list-style-type: none"> Structures can be designed to serve particular functions by |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|--|---|--|
| <p>materials in the atmosphere.</p> <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> Students analyze and interpret data to help explain why Australia has a higher rate of skin cancer than Brazil, even though the two countries receive the same amount of sunlight. Specific data comparisons include the amount of ultraviolet light each country receives, the distribution of melanin levels in each population, and the concentration of substances in the atmosphere above the two countries. <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> As they explain the high skin cancer rate in Australia, students learn about scientific explanations and have multiple opportunities to construct increasingly complex explanations (and defend them through argumentation) over the course of the unit. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students receive instruction about the structure of a scientific argument and are supported in analyzing evidence, engaging in scientific reasoning, and producing both oral and written arguments. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Students have multiple opportunities to engage in Active Reading, an approach to obtaining information from science | <ul style="list-style-type: none"> However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2) <p>PS4.C: Information Technologies and Instrumentation:</p> <ul style="list-style-type: none"> Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3) <p>PS3.D: Energy in Chemical Processes and Everyday Life:</p> <ul style="list-style-type: none"> The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6) <p>LS1.A: Structure and Function:</p> <ul style="list-style-type: none"> All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1) Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) <p>LS1.C: Organization for Matter and Energy Flow in Organisms:</p> <ul style="list-style-type: none"> Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make | <p>taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)</p> <ul style="list-style-type: none"> Structures can be designed to serve particular functions. (MS-PS4-3) Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2) <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1) <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3) <p>Connections to Nature of Science</p> |
|--|---|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|--|---|
| | <p>sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)</p> <p>LS1.D: Information Processing:</p> <ul style="list-style-type: none"> Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8) <p>ESS3.D: Global Climate Change:</p> <ul style="list-style-type: none"> Human activities, such as the release of greenhouse gasses from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5) | <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6) |
|--|--|---|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|--|--|
| Self-Awareness | <ul style="list-style-type: none"> Recognize one’s feelings and thoughts. Recognize the impact of one’s feelings and thoughts on one’s own behavior. Recognize one’s personal traits, strengths, and limitations. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------------|---|
| | <ul style="list-style-type: none"> ● Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> ● Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> ● Recognize and identify the thoughts, feelings, and perspectives of others. ● Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> ● Develop, implement, and model effective problem-solving and critical thinking skills. ● Identify the consequences associated with one’s actions in order to make constructive choices. ● Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> ● Establish and maintain healthy relationships. ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed. |

| <u>Interdisciplinary Connections</u> | |
|---|---|
| ELA Standards | |
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| | including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| MP7 | Look for and make use of structure. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.RP.2a | Decide whether two quantities are in a proportional relationship. |
| 7.NS.2 | Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |
| 7.G.2 | Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--|--|
| | measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. |
|--|--|

| <u>Computer Science & Design Thinking</u> | |
|--|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| <u>Career Readiness, Life Literacies & Key Skills</u> | |
|--|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one’s goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| Evidence of Student Learning | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

| Knowledge & Skills | |
|---|--|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● The movement of energy can be tracked by observing the changes the energy causes to matter. (1.2) ● Light carries energy that causes materials to change. (1.2) ● When light hits a material, the material can absorb energy from the light. (1.3) ● When a material absorbs energy from light, the energy causes the material to change. (1.3) ● There are different types of light that can change a material in different ways. (2.2) ● A light source can emit more than one type of light. (2.3) ● Different types of light have different wavelengths. (2.3) ● A material absorbs energy from some types of light and not others. (2.4) ● Light travels in a straight line. (3.1) ● When a light wave hits a material, the light can be absorbed by the material, transmitted | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How does light interact with materials? ● How does light from the sun cause skin cancer? ● Why can light cause materials to change? ● How can the same amount of sunlight cause different rates of skin cancer? ● Is all light the same? ● What makes types of light different? ● Why does Australia get more ultraviolet light than other parts of the world? ● What can happen to light as it travels? ● What happens to energy when light is transmitted through or reflected off a material? ● Can the crabs see the plankton they eat near the ocean floor? |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--|--|
| <p>through the material, or reflected off the material. (3.1)</p> <ul style="list-style-type: none"> ● A material transmits or reflects some types of light and not others. (3.2) ● When light is transmitted through or reflected off a material, the energy is not absorbed, so the material does not change. (3.3) | |
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> ● A spectroscopist is a scientist who studies light and how it interacts with materials. ● Australia has one of the highest rates of skin cancer in the world. ● The movement of energy can be tracked by observing the changes the energy causes to matter. ● Light carries energy that causes materials to change. ● Science investigations use a variety of methods and tools to make measurements and observations. ● Men and women from different social, cultural, and ethnic backgrounds work as scientists and engineers. ● When light hits a material, the material can absorb energy from the light. ● When a material absorbs energy from light, the energy causes the material to change. ● Evidence may be used to support or go against (refute) a claim. ● Australia receives a similar amount of sunlight to countries that have lower skin cancer rates. ● Light from different light sources can have different effects on a material. ● Light sources can emit different types of light. ● Plants use energy from light to make their own food. ● There are different types of light that can change a material in different ways. ● Light from the sun includes gamma rays, X-rays, ultraviolet light, visible light, infrared light, microwaves, and radio waves. ● A light source can emit more than one type of light. ● Different types of light have different wavelengths. ● Sound waves require a medium to travel, but light waves do not. ● A material absorbs energy from some types of light and not others. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> ● Describe the role of a spectroscopist in studying light and its interactions with materials. ● Explain that light carries energy and can cause changes in matter. ● Use observations and measurements to track the movement of energy through changes in materials. ● Explain how materials absorb energy from light and how absorption can cause physical or chemical changes. ● Compare the effects of light from different sources on the same material. ● Identify that light sources can emit more than one type of light. ● Describe the electromagnetic spectrum, including gamma rays, X-rays, ultraviolet, visible, infrared, microwaves, and radio waves. ● Explain that different types of light have different wavelengths. ● Distinguish between light waves and sound waves based on the need for a medium. ● Explain how plants use light energy to produce food. ● Explain that materials absorb some types of light and not others. ● Explain how the atmosphere absorbs certain types of light before they reach Earth's surface. ● Analyze how ultraviolet light can damage genetic material in skin cells. ● Explain how melanin helps protect skin cells by absorbing ultraviolet light. ● Compare how differences in ultraviolet exposure can affect skin cancer risk. ● Explain how light travels in straight lines. ● Describe what happens when light is absorbed, transmitted, or reflected by a material. ● Explain why materials do not change when light is reflected or transmitted rather than absorbed. ● Explain how the reflection, transmission, and absorption of visible light determine what we see. ● Explain how fiber optic cables use light waves to transmit information. |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- The atmosphere absorbs gamma rays and X-rays, so these types of light do not reach Earth's surface.
- Ultraviolet light causes damage to genetic material in skin cells that can lead to skin cancer.
- People with darker skin tones have more melanin in their skin cells, while people with lighter skin tones have less melanin in their skin cells.
- Melanin in a skin cell can prevent damage by absorbing ultraviolet light before it reaches the genetic material.
- Australia gets higher levels of ultraviolet light than other parts of the world.
- Light travels in a straight line.
- When a light wave hits a material, the light can be absorbed by the material, transmitted through the material, or reflected off the material.
- Fiber optic cables use light waves to transmit digital information.
- How different types of visible light are reflected, transmitted, and absorbed by objects determines what we can see.
- A material transmits or reflects some types of light and not others.
- When light is transmitted through or reflected off a material, the energy is not absorbed, so the material does not change.
- There is less ozone in the atmosphere above Australia than other parts of the world.
- When evidence supports more than one claim, scientists can revise their claims by combining them to make a complete and convincing argument.
- Reasoning is a process that scientists use to explain how evidence supports their claims.
- Some types of visible light transmit farther through ocean water than others.
- Scientists build arguments based on evidence about the natural world.
- Scientists evaluate evidence in relation to claims.
- Discussing evidence and ideas with others helps build new understanding.
- Scientists can change their minds when presented with convincing evidence.
- To be convincing, a written scientific argument needs to include a claim, describe specific evidence, and explain how the evidence supports the claim.
- Analyze how different wavelengths of visible light transmit differently through ocean water.
- Evaluate evidence to support or refute claims about how light interacts with materials.
- Use reasoning to explain how evidence supports scientific claims about light waves.
- Construct a scientific argument that includes a claim, relevant evidence, and clear reasoning.
- Integrate multiple pieces of evidence to develop a more complete and convincing explanation.
- Revise claims when evidence supports more than one explanation.
- Engage in scientific discussion to clarify ideas and deepen understanding.
- Explain how scientists may change their conclusions when presented with convincing evidence.
- Recognize that scientists and engineers come from diverse social, cultural, and ethnic backgrounds.

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Sometimes different pieces of evidence need to be considered together to best support a claim.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- Articles in This Unit
 - “Harvesting Sunlight”
 - “Why No One in Space Can Hear You Scream”
 - “What Is Melanin?”
 - “How Fiber-optic Communication Works”
 - “What Eyes Can See”
 - “Making Waves at Swim Practice”

Supplemental Materials

- Digital Resources included in each unit
 - Light Waves Simulation
- Multi-language glossary
- A Shell’s Story by [Geerat Vermeij](#)

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

| | |
|---------------------------------|--------------------------|
| Unit 7: Force and Motion | Duration: 20 days |
|---------------------------------|--------------------------|

| New Jersey Student Learning Standards | |
|---------------------------------------|--|
| 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-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. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|---|--|---|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> ● As students investigate what happened to the pod during the missing seconds, their inquiry is guided by a series of strategic questions. They also have many opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles. <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> ● Students spend ample time exploring and investigating a digital simulation that models | <p>PS2.A: Forces and Motion:</p> <ul style="list-style-type: none"> ● 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 | <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> ● 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) <p>Systems and System Models</p> <ul style="list-style-type: none"> ● 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) <p>Stability and Change</p> |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|--|---|--|
| <p>changes in velocity due to forces. They also use a digital modeling tool to create models that show their ideas about force and motion.</p> <p>Practice 3: Planning and Carrying Out Investigations:</p> <ul style="list-style-type: none"> Students conduct investigations using hands-on materials and the Simulation to gather information about the relationships between force, mass, and velocity, as well as the forces objects experience in a collision. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> Students analyze data they have collected in their own hands-on and simulation investigations, as well as data presented from other sources, to draw conclusions about force, mass, and change in velocity. <p>Practice 5: Using Mathematics and Computational Thinking:</p> <ul style="list-style-type: none"> Students consider proportional relationships between force, mass, and change in velocity as they compare data from different investigation trials. <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> Students learn about scientific explanations and have multiple opportunities to make increasingly complex explanations (and defend them through argumentation) over the course of the unit as they explain what happened during the missing seconds. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students receive instruction | <p>motion. (MS-PS2-2)</p> <ul style="list-style-type: none"> 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) <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> 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) | <ul style="list-style-type: none"> 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) <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2) |
|--|---|--|

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|--|--|--|
| <p>about the structure of a scientific argument and are supported in evaluating evidence, engaging in scientific reasoning, and producing both oral and written arguments.</p> <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Students have multiple opportunities to engage in Active Reading, an approach to obtaining information from science texts. Students also evaluate evidence to determine its relevance to a particular claim. | | |
|--|--|--|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|---|---|
| Self-Awareness | <ul style="list-style-type: none"> Recognize one’s feelings and thoughts. Recognize the impact of one’s feelings and thoughts on one’s own behavior. Recognize one’s personal traits, strengths, and limitations. Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. Recognize the skills needed to establish and achieve personal and educational goals. Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> Develop, implement, and model effective problem-solving and critical thinking skills. Identify the consequences associated with one’s actions in order to make constructive choices. Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> Establish and maintain healthy relationships. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--|--|
| | <ul style="list-style-type: none"> ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed. |
|--|--|

| |
|---|
| <u>Interdisciplinary Connections</u> |
|---|

| |
|----------------------|
| ELA Standards |
|----------------------|

| | |
|---------------------|--|
| RST.6-8.1 | Cite specific textual evidence to support analysis of science and technical texts. |
| 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. |
| RST.6-8.3 | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. |
| RST.6-8.4 | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics. |
| 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). |
| 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. |
| RST.6-8.10 | By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently. |
| WHST.6-8.1 | Write arguments focused on discipline-specific content. |
| WHST.6-8.1.a | Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically. |
| WHST.6-8.1b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources |
| WHST.6-8.1.c | Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence. |
| WHST.6-8.1.d | Establish and maintain a formal style. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| WHST.6-8.2 | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. |
| WHST.6-8.2.b | Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. |
| WHST.6-8.2d | Use precise language and domain-specific vocabulary to inform about or explain the topic. |
| WHST.6-8.4 | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| WHST.6-8.5 | With some guidance and support from peers and adults, develop and strengthen by planning, revising, editing, rewriting, or trying a new approach, focusing on how well the purpose and audience have been addressed. |
| WHST.6-8.9 | Draw evidence from informational texts to support analysis, reflection, and research. |
| WHST.6-8.10 | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.RP.2a | Decide whether two quantities are in a proportional relationship. |
| 7.NS.1 | Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. |
| 7.NS.2 | Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---------------|--|
| 7.EE.3 | Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations as strategies to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. |
| 7.EE.4 | Solve real-life and mathematical problems using numerical and algebraic expressions and equations. 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. |

| <u>Computer Science & Design Thinking</u> | |
|--|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| <u>Career Readiness, Life Literacies & Key Skills</u> | |
|--|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one's goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--------------------|---|
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

| Evidence of Student Learning | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

| Knowledge & Skills | |
|---|---|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● A force is required to change the velocity of an object. (1.3) ● How an object changes velocity depends on the direction of the force exerted on that object. (1.3) ● A stronger force can cause a greater change in velocity. (1.5) ● Understanding a cause-and-effect relationship can help you infer what led to a particular result. (1.6) ● If the same strength force is exerted on two objects but the objects have different masses, | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How do forces affect motion? ● What caused the pod to change direction? ● What makes an object's motion change? ● What causes some velocity changes to be greater than others? ● The thrusters on the ACM pod exerted the same strength force as thrusters on other pods, so why did this pod move differently? ● If the same strength force is exerted on two objects, why might they be affected differently? ● After the collision, how does the pod's motion compare to the motion of the space station? ● What are the forces like in a collision? |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|--|---|
| <p>the object with less mass will have a greater change in velocity.</p> <ul style="list-style-type: none"> When two objects collide, a force is exerted on each object. The two forces are exerted in opposite directions, but they are the same strength. (3.2) Even though the force exerted on each object in a collision is the same strength, if the objects have different masses, their changes in velocity will be different. (3.3) | <ul style="list-style-type: none"> In a collision, how do forces affect the objects? Why did Vehicle 2 fall off the cliff in Claire's test of the collision scene, but Vehicle 2 did not fall off the cliff in the film <i>Iceworld Revenge</i>? |
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> Pushing or pulling an object that is not already moving can make that object start to move. Pushing or pulling an object that is already moving can make the object speed up, slow down, stop, or change direction. A force is required to change the velocity of an object. How an object changes velocity depends on the direction of the force exerted on that object. Forces vary in strength. The strength of a force affects how the velocity of the object changes. A stronger force can cause a greater change in velocity. Friction is a force exerted in the direction opposite to an object's motion, which means friction will cause an object's velocity to decrease. Understanding a cause-and-effect relationship can help you infer what led to a particular result. The same strength force can affect the velocity of different objects in different ways. The velocity of an object can be determined by dividing the distance traveled by the time it took to travel that distance. Reading actively means thinking about one's own understanding as one reads. Expert readers build understanding by asking more focused, deeper questions as they read. Wheelchairs built for stability, not speed, have greater mass. This means the wheelchairs change velocity less upon impact with other wheelchairs. Wheelchairs built for racing have the lowest possible mass. This way, the wheelchairs can change velocity as much as possible when the rider exerts a force on them. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> Explain how pushing or pulling an object can cause it to start moving. Explain how applying a force to a moving object can change its speed, direction, or cause it to stop. Define force as a push or pull that can change an object's velocity. Explain that a change in velocity requires a force. Explain how the direction of a force affects the direction of an object's motion. Compare forces based on strength and explain how force strength affects changes in velocity. Explain that a stronger force causes a greater change in velocity when mass is constant. Explain friction as a force that acts opposite an object's motion and reduces velocity. Describe cause-and-effect relationships between forces and motion. Explain why the same force can affect different objects in different ways. Calculate velocity using distance traveled and time. Use active reading strategies to monitor understanding and ask focused questions while reading scientific texts. Explain how an object's mass affects how much its velocity changes when a force is applied. Analyze real-world examples, such as different wheelchair designs, to explain how mass affects motion. Explain how advances in technology influence scientific understanding of force and motion. Predict how objects with different masses will respond when the same force is applied. Explain what happens during a collision between two objects. Explain that during a collision, each object exerts a force on the other that is equal in strength and opposite in direction. Analyze why objects with different masses experience different changes in velocity during a collision. |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- | | |
|--|---|
| <ul style="list-style-type: none"> ● Advances in technology influence the progress of science and science has influenced advances in technology. ● If the same strength force is exerted on two objects but the objects have different masses, the object with less mass will have a greater change in velocity. ● In a collision between objects, a force is exerted on each object, and that affects each object's velocity. ● Asking questions is an important strategy that scientists use when reading to check their understanding. ● A natural time to ask a deep question is when one encounters something in the text that seems unfamiliar, curious, or confusing. ● When two objects collide, a force is exerted on each object. The two forces are exerted in opposite directions, but they are the same strength. ● Even though the force exerted on each object in a collision is the same strength, if the objects have different masses, their changes in velocity will be different. ● Reasoning is the process of explaining how evidence supports or refutes a claim. ● Scientists use their understanding about cause-and-effect relationships from one situation to make predictions in other, similar situations. ● Scientists consider all available evidence before constructing arguments and making recommendations. ● Discussing evidence and ideas with others helps build new understanding. ● Scientists can change their minds when presented with convincing evidence. ● In order to convince its readers, a written scientific argument needs to state a claim, describe specific evidence, and explain how the evidence supports the claim. ● Sometimes, combining several pieces of evidence will provide stronger support for a claim than individual pieces by themselves. ● The kinetic energy of an object depends on its mass and velocity. | <ul style="list-style-type: none"> ● Use cause-and-effect reasoning to make predictions about motion in new situations. <ul style="list-style-type: none"> ● Explain how kinetic energy depends on both mass and velocity. ● Evaluate evidence to support or refute claims about force and motion. ● Use reasoning to clearly connect evidence to claims about motion and collisions. ● Construct a written scientific argument that includes a claim, specific evidence, and an explanation of how the evidence supports the claim. <ul style="list-style-type: none"> ● Synthesize multiple pieces of evidence to strengthen support for a scientific claim. ● Engage in scientific discussions to clarify ideas and deepen understanding. ● Explain why scientists may revise their conclusions when presented with convincing evidence. |
|--|---|

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- Articles in This Unit

Supplemental Materials

- Digital Resources included in each unit

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|--|---|
| <ul style="list-style-type: none">○ “Friction”○ “Designing Wheelchairs for All Shapes and Sizes”○ “Crash!”○ “Wrecking Ball” | <ul style="list-style-type: none">○ Force and Motion Simulation● Multi-language glossary● Who Was Sally Ride? |
|--|---|

Suggested Accommodations

| |
|--|
| <p>English Language Learners:</p> <ul style="list-style-type: none">● Multi-sensory instruction● Flexible grouping● Small group instruction● Provide peer tutoring● Use a strong student as a “buddy” (does not necessarily have to speak the primary language)● Chunking information● Scaffolded questioning● Academic language support● Vocabulary support● Co-Constructed Word Banks● Anchor charts● Gradual release model● Visual models● Native language support when possible (Multi-language glossary)● Sheltered English Instruction Strategies● Sentence starters <p>Special Education/Students with Disabilities:</p> <ul style="list-style-type: none">● Allow extra time to complete assignments or tests● Work in a small group● Allow answers to be given orally or dictated● Follow all IEP modifications● Calculators● Manipulatives/concrete models● Directions repeated, clarified, and reworded● Breakdown task into manageable parts <p>504 Plans:</p> <ul style="list-style-type: none">● Allow extra time to complete assignments or tests● Work in a small group● Allow answers to be given orally or dictated● Calculators● Manipulatives/concrete models● Follow all 504 modifications <p>Gifted and Talented:</p> <ul style="list-style-type: none">● Higher level questioning● Enriched assignments |
|--|

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 8: Force and Motion Engineering

Duration: 10 days

New Jersey Student Learning Standards

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------|--|
| 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. |
| 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. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|--|---|--|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> Students consider multiple criteria in defining their design problem. They also have opportunities to pose their own questions. In particular, the Active Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read scientific texts, such as the Futura Mechanical Engineer’s Dossier. <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> Students use the Futura SupplyDrop Design Tool, a | <p>ETS1.A: Defining and Delimiting Engineering Problems:</p> <ul style="list-style-type: none"> 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) <p>ETS1.B: Developing Possible Solutions:</p> <ul style="list-style-type: none"> A solution needs to be tested, and then modified on the basis of the test results, | <p>Systems and System Models</p> <ul style="list-style-type: none"> 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) <p>Stability and Change</p> <ul style="list-style-type: none"> 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) |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|---|--|--|
| <p>digital simulation, to build and test their designed solutions.</p> <p>Practice 3: Planning and Carrying Out Investigations:</p> <ul style="list-style-type: none"> During the Research phase of this internship, students investigate the factors that influence designs for how to protect objects when they collide with the ground. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> Students analyze the data recorded on their data sheets to determine needed revisions to their designs. <p>Practice 5: Using Mathematics and Computational Thinking:</p> <ul style="list-style-type: none"> Students graph data gathered from their iterative tests from the Futura SupplyDrop Design Tool in order to analyze the effectiveness of their designs. <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none"> Students use an iterative process to optimize a design solution. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Students evaluate competing design solutions, based on agreed-upon design criteria, to choose the best design for a supply pod. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Students read and research in the Futura Mechanical Engineer’s Dossier; analyze different design iterations, using their data tables; and write final proposals describing their optimal designs for a supply pod. | <p>in order to improve it. (MS-ETS1-4)</p> <ul style="list-style-type: none"> 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) <p>ETS1.C: Optimizing the Design Solution:</p> <ul style="list-style-type: none"> 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) <p>PS2.A: Forces and Motion:</p> <ul style="list-style-type: none"> 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) | <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2), (MS-PS2-4) <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> 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) |
|---|--|--|

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|--|--|--|
| | <ul style="list-style-type: none"> 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) <p>PS2.B: Types of Interactions:</p> <ul style="list-style-type: none"> 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) | |
|--|--|--|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|---|---|
| Self-Awareness | <ul style="list-style-type: none"> Recognize one’s feelings and thoughts. Recognize the impact of one’s feelings and thoughts on one’s own behavior. Recognize one’s personal traits, strengths, and limitations. Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. Recognize the skills needed to establish and achieve personal and educational goals. Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> Develop, implement, and model effective problem-solving and critical thinking skills. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|----------------------------|---|
| | <ul style="list-style-type: none"> • Identify the consequences associated with one’s actions in order to make constructive choices. • Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> • Establish and maintain healthy relationships. • Utilize positive communication and social skills to interact effectively with others. • Identify ways to resist inappropriate social pressure. • Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. • Identify who, when, where, or how to seek help for oneself or others when needed. |

[Interdisciplinary Connections](#)

| ELA Standards | |
|----------------------|---|
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| | and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.RP.2a | Decide whether two quantities are in a proportional relationship. |
| 7.RP.3 | Use proportional relationships to solve multistep ratio and percent problems. |
| 7.NS.2 | Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. |
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |

| | |
|--|---|
| <u>Computer Science & Design Thinking</u> | |
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| |
|--|
| <u>Career Readiness, Life Literacies & Key Skills</u> |
|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---------------------|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one’s goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

| Evidence of Student Learning | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|--|
| <ul style="list-style-type: none"> ● Unit Projects | |
|---|--|

| |
|-------------------------------|
| Knowledge & Skills |
|-------------------------------|

| | |
|--|---|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● Engineers apply scientific principles of force, motion, and collisions to design solutions that reduce damage and improve safety. ● Impact forces occur when objects collide and depend on mass, velocity, and the duration of the collision. ● Increasing the time over which a collision occurs can reduce the force experienced by an object. ● Engineering problems are defined by criteria, and solutions must be evaluated based on how well they meet those criteria. ● Trade-offs are unavoidable in engineering design and influence final solutions. ● Iteration improves designs through testing, analysis of data, and revision. ● Models help engineers test ideas but have limitations that must be considered. ● Strong engineering solutions are supported by evidence and clear reasoning. ● Scientific and engineering knowledge are constrained by available technology, materials, and human capacity. ● Different criteria can lead to different engineering solutions to the same problem. | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● How do engineers use knowledge of force and motion to design safer solutions? ● What factors affect the size of impact forces during a collision? ● How does increasing the time of a collision reduce damage to an object? ● How do mass and velocity influence the outcome of a collision? ● How do design criteria shape engineering solutions? ● Why are trade-offs necessary in engineering design? ● How does testing and iteration improve a design? ● What are the benefits and limitations of using models in engineering? ● How can evidence be used to justify that one design solution is better than another? ● Why can different solutions be effective when criteria and constraints vary? |
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> ● Engineers design plans, physical objects, and processes that try to solve human problems. ● Criteria define the engineering problem. ● When an object falls and hits the ground, a collision occurs. The ground exerts a force on the object, and the object exerts a force on the ground. These are called impact forces. ● After impact with the ground, the velocity of the pod changes to zero. ● Collisions involve a force acting between the objects for some amount of time. ● Increasing the time over which a collision occurs can decrease the damage to an object because it spreads out the force over a longer period of time. ● Scientific knowledge is constrained by human capacity, technology, and materials. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> ● Explain how engineers design plans, objects, and processes to solve human problems. ● Define an engineering problem by identifying criteria for a successful solution. ● Describe collisions as interactions in which objects exert forces on each other. ● Explain impact forces as forces exchanged between objects during a collision. ● Explain why an object's velocity changes to zero after impacting the ground. ● Explain that collisions occur over a period of time, not instantaneously. ● Explain how increasing the time of a collision can reduce damage by spreading out the force. ● Identify mass, velocity, and collision time as factors that affect the size of impact forces. ● Analyze how gravity causes objects to collide with the ground. |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Engineers need to understand the problem they are trying to solve so they can design an effective solution.
- Engineers sometimes use models to test their designs.
- Three factors affect the size of the forces when two objects hit each other: how long the collision lasts, the velocity on impact, and the mass of each object.
- Engineers read with purpose to understand relevant background information that impacts their work.
- Analyzing a design's function can inform revisions to its structure.
- Models have limitations because they are often simplified.
- Modifications are made to a design based on the evaluated results; the design is modified in order to be tested again. This is called an iteration.
- Engineers analyze the data from testing in order to improve upon their designs.
- Results are analyzed based on how well they address the criteria.
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.
- Engineers take feedback into consideration during the iterative process (modifying the design at each iteration).
- For optimal designs, engineers complete several iterations, often combining the best parts of previous designs.
- Engineers consider trade-offs by weighing the impact of each criterion against the others.
- Trade-offs may make it difficult or impossible to meet all the criteria for a design project.
- Strong engineering proposals use evidence to describe why the design is optimal, including a discussion of trade-offs and comparisons to earlier iterations.
- An engineer's written proposal explains to others how and why a design solution works.
- One kind of collision involves objects being pulled to Earth by gravity and hitting the ground.
- Strong proposals are written for a professional audience and use topic-specific vocabulary words.
- Explain how scientific knowledge is limited by technology, materials, and human capacity.
 - Use background research to better understand an engineering problem and inform design decisions.
 - Use models to test engineering designs and predict performance during collisions.
 - Explain the limitations of models and how simplifications affect results.
 - Analyze test data to determine how well a design meets the established criteria.
 - Revise designs based on testing results and feedback.
 - Explain iteration as a process of repeated testing and improvement.
 - Compare multiple design iterations to identify improvements and effective features.
 - Analyze trade-offs by weighing how well a design meets some criteria over others.
 - Explain why trade-offs may prevent all criteria from being fully satisfied.
 - Explain how different criteria can lead to different design solutions.
 - Apply cause-and-effect reasoning to explain how changes in structure affect a design's function.
 - Construct an evidence-based engineering proposal that explains how and why a design solution works.
 - Use topic-specific engineering vocabulary appropriate for a professional audience.
 - Use reasoning to connect test data and evidence to design claims.
 - Revise written proposals to improve clarity, use of evidence, and professionalism.
 - Explain how engineers use consistent patterns in nature, such as motion and collisions, to make predictions.
 - Recognize how mechanical engineers use the design cycle to solve a wide range of engineering problems.

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Engineers improve the use of evidence and the professionalism of their writing when they revise their written proposals.
- Solutions to a problem will differ based on the defined criteria.
- Mechanical engineers can use The Design Cycle to offer solutions to many problems beyond supply pod designs.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- Articles in This Unit
 - “Request for Proposals”
 - “Collisions and Impact Forces”
 - “Velocity, Mass, and Impact Forces”
 - “Supply Pod Materials”
 - “Proposal Resources”
 - “Additional Resources”

Supplemental Materials

- Digital Resources included in each unit
 - Futura Workspace
- Multi-language glossary

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

| | |
|--------------------------------|--------------------------|
| Unit 9: Magnetic Fields | Duration: 22 days |
|--------------------------------|--------------------------|

| New Jersey Student Learning Standards | |
|---------------------------------------|--|
| MS-PS2-3 | Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. |
| MS-PS2-4 | Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. |
| 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-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-PS3-5 | 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. |

| Science and Engineering Practices | Discipline Core Ideas/Unit Enduring Understandings | Crosscutting Concepts |
|--|---|---|
| <p>Practice 1: Asking Questions</p> <ul style="list-style-type: none"> ● As students investigate the surprising launch results, their inquiry is guided by a series of strategic questions. They also have many opportunities to pose their own questions. In particular, the Active | <p>PS2.B: Types of Interactions:</p> <ul style="list-style-type: none"> ● 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 | <p>Cause and Effect</p> <ul style="list-style-type: none"> ● Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3), (MS-PS2-5) |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | | |
|--|---|---|
| <p>Reading approach, an approach to reading based on curiosity and inquiry, supports students in asking thoughtful questions as they read science articles.</p> <p>Practice 2: Developing and Using Models:</p> <ul style="list-style-type: none"> Students complete visual representations to demonstrate their understanding of key concepts throughout the unit. Students also interpret visual models to predict the behavior of magnets and explore the digital simulation (a type of model) to learn important ideas about magnetic fields, magnetic forces, and energy. <p>Practice 3: Planning and Carrying Out Investigations:</p> <ul style="list-style-type: none"> To gather evidence, students plan tests and experiments that they then conduct by using hands-on materials and by using the digital simulation. They also evaluate the quality of experiments in terms of how they were set up to isolate variables and discuss how to improve them. <p>Practice 4: Analyzing and Interpreting Data.</p> <ul style="list-style-type: none"> Students examine sets of data from outside sources and their own investigations to evaluate claims. Students draw conclusions about unit claims and smaller investigation claims by determining patterns and correlations within sets of data. <p>Practice 5: Using Mathematics and Computational Thinking:</p> <ul style="list-style-type: none"> Students analyze numerical | <p>distances between the interacting objects. (MS-PS2-3)</p> <ul style="list-style-type: none"> 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) <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) <p>PS3.C: Relationship Between Energy and Forces:</p> <ul style="list-style-type: none"> 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) <p>PS3.A: Definitions of Energy:</p> <ul style="list-style-type: none"> 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) <p>PS3.B: Conservation of Energy and Energy Transfer:</p> <ul style="list-style-type: none"> When the motion energy of an object changes, there is inevitably some other change in energy at the same time. | <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> 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) <p>Systems and System Models</p> <ul style="list-style-type: none"> Models can be used to represent systems and their interactions— such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-4) 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) <p>Energy and Matter</p> <ul style="list-style-type: none"> Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5) <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-4) Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-5) |
|--|---|---|

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | | |
|---|-------------------|--|
| <p>data to determine the proportional relationships between the magnetic force, potential energy stored in the magnetic field, and distance between the magnets in a system of magnets.</p> <p>Practice 6: Constructing Explanations:</p> <ul style="list-style-type: none">• To answer Investigation Questions, students are prompted to explain evidence they gather through hands-on investigations, exploring the digital simulation, and reading. They also construct explanations at the end of each chapter about why the spacecraft was so much faster than expected. <p>Practice 7: Engaging in Argument from Evidence</p> <ul style="list-style-type: none">• Students evaluate claims regarding the possible reasons why the magnetic spacecraft traveled so much faster in the September launch. Using evidence from the Universal Space Agency, students engage in scientific reasoning to produce written arguments. In the Science Seminar, students practice both oral and written argumentation to explain which roller coaster launcher design will be the most effective. <p>Practice 8: Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none">• Students are introduced to Active Reading—an approach to obtaining information from science texts—and have multiple opportunities to engage in this practice. Students also evaluate evidence to determine its quality. | <p>(MS-PS3-5)</p> | |
|---|-------------------|--|

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| New Jersey Social and Emotional Competencies and Sub-Competencies | |
|--|---|
| Self-Awareness | <ul style="list-style-type: none"> ● Recognize one’s feelings and thoughts. ● Recognize the impact of one’s feelings and thoughts on one’s own behavior. ● Recognize one’s personal traits, strengths, and limitations. ● Recognize the importance of self-confidence in handling daily tasks and challenges. |
| Self-Management | <ul style="list-style-type: none"> ● Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one’s goals. |
| Social Awareness | <ul style="list-style-type: none"> ● Recognize and identify the thoughts, feelings, and perspectives of others. ● Demonstrate an awareness of the differences among individuals, groups, and others’ cultural backgrounds. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings. |
| Responsible Decision Making | <ul style="list-style-type: none"> ● Develop, implement, and model effective problem-solving and critical thinking skills. ● Identify the consequences associated with one’s actions in order to make constructive choices. ● Evaluate personal, ethical, safety, and civic impact of decisions. |
| Relationship Skills | <ul style="list-style-type: none"> ● Establish and maintain healthy relationships. ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed. |

| <u>Interdisciplinary Connections</u> | |
|---|--|
| ELA Standards | |
| L.KL.7.2 | Use knowledge of language and its conventions when writing, speaking, reading, or listening. |
| RI.AA.7.7 | Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|------------------------------|--|
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| RI.MF.7.6 | Compare and contrast texts to analyze the unique qualities of different mediums, including the integration of information from multiple formats and sources to develop deeper understanding of the concept, topic or subject and resolve conflicting information. |
| W.WR.7.5 | Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. |
| W.AW.7.1 | Write arguments on discipline-specific content (e.g., social studies, science, technical subjects, English/Language Arts) to support claims with clear reasons and relevant evidence. |
| W.AW.7.1.b | Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. |
| W.IW.7.2. | Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. |
| Mathematics Standards | |
| MP1 | Make sense of problems and persevere in solving them. |
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| MP7 | Look for and make use of structure. |
| 7.RP.2 | Recognize and represent proportional relationships between quantities. |
| 7.RP.2a | Decide whether two quantities are in a proportional relationship. |
| 7.NS.2 | Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. |

Lakewood Public School District Curriculum Guide

| | |
|----------|-----------------------|
| Grade: 7 | Content Area: Science |
|----------|-----------------------|

| | |
|--------|---|
| 7.NS.3 | Solve real-world and mathematical problems involving the four operations with rational numbers. |
|--------|---|

| <u>Computer Science & Design Thinking</u> | |
|---|---|
| 8.2.8.ITH.1 | Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| 8.2.8.ED.2 | Identify the steps in the design process that could be used to solve a problem. |
| 8.2.8.NT.3 | Examine a system, consider how each part relates to other parts, and redesign it for another purpose. |
| 8.2.8.ETW.4 | Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best |
| 8.2.8.EC.2 | Examine the effects of ethical and unethical practices in product design and development. |

| <u>Career Readiness, Life Literacies & Key Skills</u> | |
|---|--|
| 9.1.8.CR.2 | Compare various ways to give back through strengths, passions, goals, and other personal factors. |
| 9.1.8.PB.5 | Identify factors that affect one's goals, including peers, culture, location, and past experiences. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential |
| 9.4.8.CI.1 | Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, 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.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) |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 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.IML.4 | Ask insightful questions to organize different types of data and create meaningful visualizations. |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| Evidence of Student Learning | |
|--|--|
| <p>Formative Tasks:</p> <ul style="list-style-type: none"> ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker | <p>Alternative Assessments:</p> <ul style="list-style-type: none"> ● Oral assessments ● Teacher-Created Projects ● https://www.khanacademy.org/ ● Completion of webquests ● On-Line Laboratory activities ● Online assessment activities example: <ul style="list-style-type: none"> ○ Kahoot ○ Quizizz |
| <p>Summative Assessments:</p> <ul style="list-style-type: none"> ● Unit Tests ● Midterm Exam ● Final Exam ● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects | <p>Benchmark Assessments:</p> <ul style="list-style-type: none"> ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Midterm Assessment ● Unit Common Assessment |

| Knowledge & Skills | |
|---|--|
| <p>Enduring Understandings:</p> <ul style="list-style-type: none"> ● A magnetic force can attract or repel an object at a distance. (1.2) ● In a system of magnets, there is a repelling force between like poles and an attracting force between opposite poles. (1.3) ● The pattern of magnetic field lines around attracting magnets is different from the pattern of magnetic field lines around repelling magnets. (1.5) ● A magnetic force can convert potential energy stored in a magnetic field to kinetic energy. (2.2) ● The energy used to move a magnet against a magnetic force is stored as potential energy in the magnetic field. (2.3) ● Creating a model of a magnetic system and defining its parts helps scientists test and explain the relationship between force and energy. (2.4) ● Moving a magnet against a stronger magnetic force transfers more energy to the magnetic field. (3.2) | <p>Essential Questions:</p> <ul style="list-style-type: none"> ● Why do magnets move objects in different ways? ● How can the launcher make the model spacecraft move without touching it? ● How do magnets move objects? (1.2) ● How can you tell whether two magnets will attract each other, repel each other, or both? (1.3, 1.4, 1.5) ● Where did the energy to launch the model spacecraft come from? ● How can magnets cause objects to have kinetic energy? (2.1, 2.2) ● How does a system of magnets store potential energy in the magnetic field? (2.3) ● Why was there so much more potential energy stored in the launcher system on Wednesday than on Tuesday? ● What affects the amount of potential energy stored in the magnetic field when a magnet is moved against a magnetic force? (3.1, 3.2) ● Which design will launch the roller coaster car the fastest? |

Lakewood Public School District Curriculum Guide

| | |
|-----------------|------------------------------|
| Grade: 7 | Content Area: Science |
|-----------------|------------------------------|

| | |
|---|---|
| <ul style="list-style-type: none"> ● A magnetic force is stronger closer to a magnet. (3.2) | |
| <p>Content <i>Students will know...</i></p> <ul style="list-style-type: none"> ● A magnetic force can attract or repel an object at a distance. ● Men and women from different social, cultural, and ethnic backgrounds work as scientists and engineers. ● In a system of magnets, there is a repelling force between like poles and an attracting force between opposite poles. ● Evidence is stronger when the variable being tested is isolated, which means only one variable is changed at a time. ● Visual models help scientists explain concepts. ● Earth has a huge magnetic field that stretches into space. ● Magnetic forces between the magnetic poles of Earth and the compass needle cause a compass needle to rotate and point north. ● Reading actively means thinking about one's own understanding as one reads. ● While reading actively, it is helpful to be aware of and annotate words that are unfamiliar or challenging. ● The pattern of magnetic field lines around attracting magnets is different from the pattern of magnetic field lines around repelling magnets. ● Magnetic field lines are a visual model that represents the shape of the invisible magnetic field around a magnet. ● Magnetic field line models help make predictions about the motion of magnets, but they are not physical lines in space. ● Where there is an attractive force between opposite poles of magnets, the field lines are drawn to connect magnets. ● Where there is a repulsive force between like poles of magnets, the field lines for each magnet are drawn so they do not touch. ● Evidence may be used to support or refute a claim. ● Being aware of unfamiliar or confusing words when we read science texts improves our ability to make sense of the texts. ● Texts often contain clues about the meaning of unfamiliar words. ● Potential energy can be stored in a system. | <p>Skills <i>Students will be able to ...</i></p> <ul style="list-style-type: none"> ● Explain that magnetic forces can attract or repel objects at a distance. ● Describe how "like" magnetic poles repel and opposite magnetic poles attract. ● Use evidence from investigations to support or refute claims about magnetic interactions. ● Design and conduct investigations that isolate variables to strengthen evidence about magnetic forces. ● Explain that Earth has a magnetic field that extends into space. ● Explain how Earth's magnetic field causes a compass needle to rotate and point north. ● Use visual models to represent magnetic fields and explain invisible forces. ● Interpret magnetic field line models to describe patterns around attracting and repelling magnets. ● Explain that magnetic field lines are models used to predict behavior, not physical lines in space. ● Use field line patterns to predict the motion of magnets in a system. ● Demonstrate active reading strategies by identifying unfamiliar vocabulary and using context clues to determine meaning. ● Explain how potential energy can be stored in a magnetic field. ● Describe how energy is transferred to a magnetic field when a magnet is moved against a magnetic force. ● Explain how magnetic forces can convert stored potential energy into kinetic energy. ● Analyze how the amount of stored potential energy affects changes in kinetic energy in a magnetic system. ● Compare magnetic systems based on the strength of their magnetic forces. ● Explain why magnetic force is stronger closer to a magnet. ● Analyze how moving a magnet against a stronger magnetic force transfers more energy to the system. ● Create and label models of magnetic systems to explain relationships between force and energy. ● Explain how electromagnets create strong magnetic fields. ● Describe real-world applications of electromagnets, including transportation technologies. ● Explain how advances in science and technology influence one another. |

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Sports like snowboarding, skydiving, trampoline gymnastics, and powerbocking involve changes between potential energy and kinetic energy.
- Progress in science advances technology, and technology innovations advance scientific understanding.
- Potential energy can be stored in a magnetic field.
- A magnetic force can convert potential energy stored in a magnetic field to kinetic energy.
- The energy used to move a magnet against a magnetic force is stored as potential energy in the magnetic field.
- Sharing ideas is an important and valuable way to learn from one another and deepen our understanding of science ideas.
- Creating a model of a magnetic system and defining its parts helps scientists test and explain the relationship between force and energy.
- When a magnet system stores more potential energy, there can be a greater change to a magnet's kinetic energy.
- Some magnet systems produce a stronger magnetic force than others.
- Moving a magnet against a stronger magnetic force transfers more energy to the magnetic field.
- A magnetic force is stronger closer to a magnet.
- Using transition words and phrases in a causal explanation can signal that you are talking about a series of events, which can help make the explanation clearer.
- Electromagnets can create very powerful magnetic fields.
- Electromagnets have many applications, and those include launching roller coaster cars.
- A convincing argument is created through the process of reasoning and is well supported by evidence.
- Discussing evidence and ideas with others helps build new understanding.
- Scientists can change their minds when presented with convincing evidence.
- Use causal language to clearly explain sequences of events involving magnetic force and energy transfer.
 - Construct a scientific argument that includes a claim, relevant evidence, and reasoning.
 - Evaluate the quality of evidence when comparing competing claims about magnetic systems.
 - Engage in scientific discussions to share ideas and refine understanding.
 - Explain why scientists may revise their explanations when presented with convincing evidence.
 - Recognize that scientists and engineers come from diverse social, cultural, and ethnic backgrounds

Core Instructional & Supplemental Materials

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

Suggested Activities/Resources:

- Articles in This Unit
 - “Meet a Scientist Who Studied Magnets” by Warren Henry
 - “Earth’s Geomagnetism”
 - “Painting with Static Electricity”
 - The Potential for Speed article set
 - “Escaping a Black Hole”

Supplemental Materials

- Digital Resources included in each unit
 - Magnetic Fields Simulation
- Multi-language glossary
- Hands-On Flexextension:
 - Exploring Electrostatic Force
 - Water Wheel Design

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models

Lakewood Public School District Curriculum Guide

Grade: 7

Content Area: Science

- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background