# CONTENT
# Middle School Science

## 8th Grade /Advanced Science

## BOARD APPROVAL DATE: 09/2019

## BOARD ADOPTION OF STATE STANDARDS: 09/2016

| Unit Overview (Standards Coverage) | | | | |
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| **Unit** | **Standards** | **Unit Focus** | **Skills Overview** | **Suggested Pacing** |
| **Unit 1: Introduction to Chemistry** | **SCI.MS-PS1 Matter and Its Interactions:**<br>**SCI.MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures.**<br>**SCI.MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.**<br>**SCI.MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.**<br>**SCI.MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.**<br>**SCI.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.**<br>**SCI.MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.**<br>**SCI.MS-PS3 Energy: SCI.MS-PS3-1 Construct and interpret graphical displays of data to** | **As matter changes from one state to another, the distances and the forces between the particles change, and the amount of thermal energy in the matter changes. An atom is the smallest unit of an element and is made mostly of empty space. It contains a tiny nucleus surrounded by an electron cloud. Elements can join together by sharing, transferring, or pooling electrons to make chemical compounds. Atoms are neither created nor destroyed in chemical reactions. Energy can be released when chemical bonds form or absorbed when chemical bonds are broken.** | **I can identify the physical and chemical properties used to describe matter.**<br><br>**I can describe how energy changes when matter changes.**<br><br>**I can identify ways to tell that a chemical reaction has occurred through the law of conservation of mass.** | **18 weeks** |

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| | **describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**<br>**SCI.MS-ETS1 Engineering Design:**<br>**SCI.MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**<br>**SCI.MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**<br>**SCI.MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**<br>**SCI.MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.** | | | |
| **Unit 2**<br>**Forces, Motion and Energy** | **MS-PS2 Forces and Interactions:**<br>**SCI.MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the** | **Core concepts and principles of science and use measurement and observation tools to assist in categorizing,representing, and interpreting the natural and designed world. An object's** | **I can identify action-reaction pairs involved in the motion of two colliding objects.**<br><br>**I can predict the differences in gravitational force between sets** | **18 weeks** |

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| | **forces on the object and the mass of the object.**<br>**SCI.MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. SCI.MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.**<br>**SCI.MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**<br>**SCI.MS-PS3 Energy: SCI.MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**<br>**SCI.MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. SCI.MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.**<br>**SCI.MS-PS3-4 Plan an investigation to determine the relationships among the energy** | **motion changes if a net force acts on the object. Energy causes change by affecting the movement and position of objects. Energy can be transformed from one form to another and transferred from object to object. Thermal energy can be transferred by conduction, radiation, and convection. Thermal energy can also be transformed into other forms of energy.** | **of two objects based on their masses and/or the distance between the objects.**<br><br>**I can evaluate evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.** | |

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| | **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.**<br>**SCI.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.**<br>**SCI.MS-ETS1 Engineering Design:**<br>**SCI.MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**<br>**SCI.MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**<br>**SCI.MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**<br>**SCI.MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.** | | | |

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| **Unit 3:**<br>**Sound and Light** | **SCI.MS-PS4 Waves and Electromagnetic Radiation:**<br>**SCI.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.**<br>**SCI.MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through a various materials.**<br>**SCI.MS-ETS1 Engineering Design:**<br>**SCI.MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**<br>**SCI.MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**<br>**SCI.MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**<br>**SCI.MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process** | **Waves transfer energy without transferring matter. Mechanical waves require a medium. A continuous wave is a regular repeating sequence of wave pulses. Interference occurs when two or more waves move through a medium at the same time.** | **I can explain how radio waves transmit information.**<br><br>**I can explain how a wave's speed is related to its wavelength and frequency.**<br><br>**I can explain how cell phones work.** | **4 weeks** |

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| | **such that an optimal design can be achieved.** | | | |

**This document outlines in detail the answers to the following four questions:**

1. **What do we want our students to know?**
2. **How do we know if they learned it?**
3. **What do we do if they did not learn it?**
4. **What do we do when they did learn it?**

| Unit 1: 8th Grade/Advanced Science Introduction to Chemistry | | |
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| **Content & Practice Standards (write in full)** | **Interdisciplinary Standards** | **Critical Knowledge & Skills** |
| **SCI.MS-PS1 Matter and Its Interactions:**<br>● **SCI.MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures.**<br>● **SCI.MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.**<br>● **SCI.MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.**<br>● **SCI.MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.**<br>● **SCI.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.**<br>● **SCI.MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.**<br>**SCI.MS-PS3 Energy:**<br>● **SCI.MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object.**<br>**SCI.MS-ETS1 Engineering Design:**<br>● **SCI.MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** | **Language Arts Literacy**<br>● **RST.6-8.1 - Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.(MS-PS1-2),(MS-PS1-3)**<br>**Mathematics**<br>● **RST.6-8.3 - Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)**<br>● **RST.6-8.7 - Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-1),(MS-PS1-2),(MS-PS1-4),(MS-PS1-5)**<br>● **WHST.6-8.7 - Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS1-6)**<br>● **WHST.6-8.8 - Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)**<br>● **MP.2 Reason abstractly and quantitatively. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)**<br>● **MP.4 Model with mathematics. (MS-PS1-1),(MS-PS1-5)**<br>● **6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)** | ● **Students will know:**<br>○ **Describing matter**<br>○ **Classifying matter**<br>○ **Measuring matter**<br>○ **Changes in matter**<br>○ **States of matter**<br>○ **Molecular arrangement**<br>○ **Changes of state**<br>○ **Gas behavior**<br>○ **Introduction to atoms**<br>○ **Organizing the elements**<br>○ **Metals**<br>○ **Nonmetals and metalloids**<br>○ **Atoms, bonding, and the periodic table**<br>○ **Observing chemical change**<br>○ **Describing chemical reactions**<br>○ **Law of Conservation of Mass** |

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| • **SCI.MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**<br>• **SCI.MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**<br>• **SCI.MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.** | • **6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4)**<br>• **8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PS1-1)**<br>• **6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2)**<br>• **6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-PS1-2)**<br>**TECHNOLOGY STANDARDS**<br>• **8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**<br>• **B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.**<br>• **C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.**<br>• **E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.**<br>• **F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to** | |

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| | **plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**<br>● **21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century.**<br>● **For further clarification see NJ World Class Standards at www.NJ.gov/education/aps/cccs/career/**<br>**● CRP1. Act as a responsible and contributing citizen and employee.**<br>**● CRP2. Apply appropriate academic and technical skills.**<br>**● CRP4. Communicate clearly and effectively and with reason.**<br>**● CRP5. Consider the environmental, social and economic impacts of decisions.**<br>**● CRP6. Demonstrate creativity and innovation.**<br>**● CRP7. Employ valid and reliable research strategies.**<br>**● CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**<br>**● CRP11. Use technology to enhance productivity.** | |

| **Unit 1 8th Grade/Advanced Science** | |
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| **Stage 1 – Desired Results** | |
| **UNIT SUMMARY** | **CORE AND SUPPLEMENTAL MATERIALS/RESOURCES (OPEN RESOURCES)** |
| *As matter changes from one state to another, the distances and the forces between the particles change, and the amount of thermal energy in the matter changes. An atom is the smallest unit of an element and is made mostly of empty space. It contains a tiny nucleus surrounded by an electron cloud. Elements can join together by sharing, transferring, or pooling electrons to make chemical compounds. Atoms are neither created nor destroyed in chemical reactions. Energy can be released when chemical bonds form or absorbed when chemical bonds are broken.* | Pearson: Introduction to Chemistry<br>Argument - Driven Inquiry in Physical Science: Lab Investigations for Grades 6-8<br>Internet Resource Links:<br>https://www.pearsonsuccessnet.com<br>https://www.brainpop.com<br>www.discoveryeducation.com<br>https://phet.colorado.edu<br>www.pbslearningmedia.org<br>https://www.khanacademy.org/science/physics |

| **ENDURING UNDERSTANDINGS** |
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| Students will understand that…<br>● Identify the properties used to describe matter.<br>● Describe what makes up matter.<br>● Describe the properties of a mixture.<br>● Describe the units used to measure mass and volume.<br>● Explain how to determine the density of a material.<br>● Explain what a physical change is.<br>● Explain what a chemical change is.<br>● Describe how energy changes when matter changes.<br>● Describe the motion of particles in a solid.<br>● Describe the motion of particles in a liquid.<br>● Describe the motion of particles in a gas.<br>● Explain what happens to a substance during changes between solid and liquid.<br>● Explain what happens to a substance during changes between liquid and gas.<br>● Explain what happens to a substance during changes between solid and gas.<br>● Explain how pressure and temperature of a gas are related.<br>● Explain how volume and temperature of a gas are related.<br>● Explain how pressure and volume of a gas are related.<br>● Describe how atomic theory developed.<br>● Describe the modern model of the atom.<br>● Explain how Mendeleev discovered the pattern that led to the periodic table.<br>● Identify the data about elements found in the periodic table.<br>● Explain how the periodic table is useful.<br>● Summarize the properties of metals.<br>● Describe how metals are classified in the periodic table.<br>● Explain what determines an element's chemistry.<br>● Explain how changes in matter can be described.<br>● Identify ways to tell that a chemical reaction has occurred.<br>● Identify the information included in a chemical equation.<br>● Explain how mass is conserved during a chemical reaction.<br>● Identify three categories of chemical reactions.<br><br>Essential Questions:<br>● How is matter described?<br>● Why does a substance change states? |

- How is the periodic table organized?
- How can bonding determine the properties of a substance?
- How is matter conserved in a chemical reaction?
- What determines the properties of a solution?

| **Students will know…** | **Students will be able to…** |
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| *What content will be covered that students must master?*<br>● Describing matter<br>● Classifying matter<br>● Measuring matter<br>● Changes in matter<br>● States of matter<br>● Changes of state<br>● Gas behavior<br>● Introduction to atoms<br>● Organizing the elements<br>● Metals<br>● Nonmetals and metalloids<br>● Atoms, bonding, and the periodic table<br>● Observing chemical change<br>● Describing chemical reactions | *What should students be able to accomplish to demonstrate understanding?*<br>● Identify the properties used to describe matter.<br>● Describe what makes up matter.<br>● Describe the properties of a mixture.<br>● Describe the units used to measure mass and volume.<br>● Explain how to determine the density of a material.<br>● Explain what a physical change is.<br>● Explain what a chemical change is.<br>● Describe how energy changes when matter changes.<br>● Describe the motion of particles in a solid.<br>● Describe the motion of particles in a liquid.<br>● Describe the motion of particles in a gas.<br>● Explain what happens to a substance during changes between solid and liquid.<br>● Explain what happens to a substance during changes between liquid and gas.<br>● Explain what happens to a substance during changes between solid and gas.<br>● Explain how pressure and temperature of a gas are related.<br>● Explain how volume and temperature of a gas are related.<br>● Explain how pressure and volume of a gas are related.<br>● Describe how atomic theory developed.<br>● Describe the modern model of the atom.<br>● Explain how Mendeleev discovered the pattern that led to the periodic table.<br>● Identify the data about elements found in the periodic table.<br>● Explain how the periodic table is useful.<br>● Summarize the properties of metals.<br>● Describe how metals are classified in the periodic table.<br>● Explain what determines an element's chemistry.<br>● Explain how changes in matter can be described.<br>● Identify ways to tell that a chemical reaction has occurred.<br>● Identify the information included in a chemical equation.<br>● Explain how mass is conserved during a chemical reaction.<br>● Identify three categories of chemical reactions. |

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| **Stage 2 – Assessment Evidence** | |
| Suggested Formative Assessments:<br>Small group presentation feedback, peer review, foldables, Web-Quests, Kahoot, BrainPop, quiz, exit cards<br><br>Suggested Performance Tasks: (Summative Assessments)<br>*What projects, hands-on lessons, use of manipulatives, active participation in new situations, etc. will reveal evidence of meaning-making and transfer (true understanding)?*<br>Labs, STEM projects, Claim evidence justification posters, common assessment<br><br>*How will students demonstrate their understanding (meaning-making and transfer) through complex performance?*<br>Foldables, posters, projects, presentations, performance assessments, argumentation sessions, common assessment | Other Evidence **(Alternate Assessments)**:<br>*What other means of assessment will be used throughout this unit?*<br>Project rubrics, peer evaluations, project-based learning, questioning techniques, formal and informal students presentations, whole class discussions, graphic and computer based displays of knowledge, warm-ups |
| **Stage 3 – Learning Plan** | |
| *• Where is the work headed? Why is it headed there? What are the student's final performance obligations, the anchoring performance assessments? What are the criteria by which student work will be judged for understanding? (These are questions asked by students. Help the student see the answers to these questions upfront.)*<br><br>*• Hook the student through engaging and provocative entry points: thought-provoking and focusing experiences, issues, oddities, problems, and challenges that point toward essential questions, core ideas, and final performance tasks.*<br><br>*• Explore and Equip. 21st Century Learning and Interdisciplinary connections. Engage students in learning experiences that allow them to explore the big ideas and essential questions; that cause them to pursue leads or hunches, research and test ideas, try things out. Equip students for the final performances through guided instruction and coaching on needed skill and knowledge. Have them experience the ideas to make them real.*<br><br>*•Organize and sequence the learning for maximal engagement and effectiveness, given the desired results.*<br><br>***What pre-assessments will you use to check students' prior knowledge, skill levels, and potential misconceptions?***<br>***Are all three types of goals (acquisition, meaning, and transfer) addressed in the learning plan?***<br>***Does the learning plan reflect principles of learning and best practices?***<br>***Is there tight alignment with Stages 1 and 2?***<br>***Is the plan likely to be engaging and effective for all students?***<br><br>***PROGRESS MONITORING***<br>***How will you monitor students' progress toward acquisition, meaning-making, and transfer, during lesson events?***<br>***What are potential rough spots and student misunderstandings?*** | |

***How will students get the feedback they need?***
***What supports are needed for students to be successful? Re-teach, small group instruction, etc.***

Progress Monitoring:

Warm Up/Do Now
Assessment rubrics
Project-based learning
Essay-writing
Formal and informal presentations
Class discussions
Graphic and computer-based projects
Check for understanding questions
Critical Thinking Practice
Class polls check for understanding
Quizlet and other interactive online activities
Quizzes
Exit/Closure activities
Homework
Class participation

Feedback and Support:

Rubrics
Peer-peer conferencing
Teacher-student individual conferencing
Immediate verbal feedback
Modeling/Reteaching

Potential Misunderstanding:

New vocabulary
New and/or abstract concepts
Data and graph analysis
Common/popular misconceptions
Essential question distinctions

Samples of learning activities go here:

Small groups for classroom activities or projects
Hands-on and inquiry-based projects
Laboratory investigations and demonstrations
Argument-Driven Inquiry Claim/Evidence/Justification activities
Project-based learning and models
Computer-based research and projects
Content/discussion-driven videos, animations, and other media
Writing and vocabulary practice activities
Diagram and graphing activities
Critical thinking questions and activities
Argument-driven inquiry based on claim evidence justification framework.
Introductory labs, application labs, STEM designs and redesigns based on Chemistry tasks to solve everyday problems.

**Planned Differentiation & Interventions for Tiers I, II, III, ELL, 504s, SPED, and Gift & Talented Students**

*• Rethink and revise. Dig deeper into ideas at issue (through the faces of understanding). Revise, rehearse, and refine, as needed. Guide students in self-assessment and self-adjustment, based on feedback from inquiry, results, and discussion.*

*• Evaluate understandings. Reveal what has been understood through final performances and products. Involve students in a final self-assessment to identify remaining questions, set future goals, and point toward new units and lessons.*

*•Tailor (personalize) the work to ensure maximum interest and achievement. Differentiate the approaches used and provide sufficient options and variety (without compromising goals) to make it most likely that all students will be engaged and effective.*

**Gifted & Talented/Advanced:**

- **Extension activities**
- **Opportunities for Critical Thinking**
- **Problem Solving/Design Challenges**
- **Technology Integration**
- **Student Choice Activities**
- **The use of more advanced or complex concepts**
- **Argument driven inquiry**
- **Claim evidence**
- **Suggested lessons: Thermal Energy & Matter, Chemical & Physical Changes, Physical Properties of Matter, Conservation of Mass, Design Challenge, Thermal Energy & Specific Heat, Rate of Energy Transfer, Radiation & Energy Transfer, Endothermic and Exothermic Lab, Density Lab,**

**Note: Advanced projects are considered more independent, more in depth in content, more student-driven, and requiring greater demonstration of mastery and synthesis of concepts and critical thinking than similar activities performed in general science.**

**Tier I:**

- **Choice Boards**
- **Guided Reading**
- **Independent Research & Projects**
- **Project-Based Learning**
- **Graphic Organizers**

**Tier II:**

- **Leveled Rubrics**
- **Tiered Products**
- **Varied Product Choices**
- **Stations/Centers**
- **Work Alone/Together**

**Tier III:**

- **Goal-Setting with Students**
- **Homework Options**
- **Personal Agendas**

**ELL:**

- **Small Group Instruction**
- **Flexible Grouping**
- **Peer Buddies**
- **Graphic Organizers**
- **Technology Integration**
- **Provide clear and specific directions**
- **Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**

**504s:**

- **Multisensory Instruction / Multiple modalities**
- **Flexible Grouping**
- **Small Group Instruction**
- **Peer Buddies**
- **Graphic Organizers**
- **Chunking Information**
- **Scaffolded Questioning**
- **Manipulatives**
- **Provide clear and specific directions, orally and in writing**
- **Allow for differentiated assessment as long as it meets requirements / demonstrates proficiency of NJSLS**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**
- **Provide extended time**
- **Assign peer tutor**
- **Utilize visual charts/cues**

**SPED:**

- **Multisensory Instruction / Multiple modalities**
- **Flexible Grouping**

- **Small Group Instruction**
- **Peer Buddies**
- **Graphic Organizers**
- **Chunking Information**
- **Scaffolded Questioning**
- **Manipulatives**
- **Provide clear and specific directions, orally and in writing**
- **Allow for differentiated assessment as long as it meets requirements / demonstrates proficiency of NJSLS**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**
- **Provide extended time**
- **Assign peer tutor**
- **Utilize visual charts/cues**

| Unit 2: 8th Grade Advanced Science/ Forces, Interactions and Energy | | |
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| **Content & Practice Standards** | **Interdisciplinary Standards** | **Critical Knowledge & Skills** |
| • SCI.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.<br>• SCI.MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.<br>• SCI.MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.<br>• SCI.MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.<br>SCI.MS-PS3 Energy:<br>• SCI.MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.<br>• SCI.MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.<br>• SCI.MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.<br>• SCI.MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.<br>• SCI.MS-PS3-5 Construct, use, and present arguments to support the claim that when the | ELA/Literacy -<br>• RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS3-1),(MS-PS3-5)<br>• RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS3-3),(MS-PS3-4)<br>• RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)<br>• WHST.6-8.1 Write arguments focused on discipline content. (MS-PS3-5)<br>• WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3),(MS-PS3-4)<br>• SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)<br>Mathematics -<br>• MP.2 Reason abstractly and quantitatively. (MS-PS3-1),(MS-PS3-4),(MS-PS3-5)<br>• 6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),(MS-PS3-5)<br>• 6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. | Determine when an object is in motion.<br>Calculate an object's speed.<br>Describe what velocity is.<br>Demonstrate how to graph motion.<br>Describe the motion of an object as it accelerates.<br>Demonstrate how to graph acceleration.<br>Describe what a force is.<br>Describe how balanced and unbalanced forces are related to an object's motion.<br>Describe friction and identify factors that determine the friction between two objects.<br>Identify the factors that affect the gravitational force between two objects.<br>State Newton's first law of motion.<br>State Newton's second law of motion.<br>State Newton's third law of motion.<br>Explain how momentum is determined and conserved.<br>Describe the motion of an object during free fall.<br>Describe the factors that keep objects in orbit around Earth.<br>Name and describe the two basic types of energy: potential and kinetic.<br>List other forms of energy<br>Explain how different forms of energy are related and how energy is transformed.<br>Track the flow of energy from the sun to an indoor appliance in several ways.<br>State the law of conservation of energy.<br>Explain temperature and how it is measured.<br>Explain how heat is related to temperature and thermal energy and the differences between the three concepts.<br>Describe the three forms of heat transfer.<br>Use specific heat, conductors, and insulators, and thermal expansion to describe how materials respond to heat. |

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| **kinetic energy of an object changes, energy is transferred to or from the object.**<br>**SCI.MS-ETS1 Engineering Design:**<br>● **SCI.MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**<br>● **SCI.MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**<br>● **SCI.MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**<br>● **SCI.MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**<br><br>**Explanation of standards:**<br>**PS3.A: Definitions of Energy**<br>**●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)**<br>**●The term "heat" as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and radiation (particularly infrared and light). In science, heat is used only for this second meaning; it refers to energy transferred when two objects or systems are at different temperatures. (secondary to MS-PS1-4)** | **(MS-PS3-1)**<br>● **6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS2-1)**<br>● **6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2)**<br>● **7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2)**<br>● **7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1),(MS-PS2-2)**<br>● **7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-1),(MS-PS3-5)**<br>● **8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)**<br>● **8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots** | **Explain how electric charges and fields interact.**<br>**Describe how static electricity builds up and transfers.**<br>**Explain how an electric current is produced.**<br>**Explain how conductors are different from insulators.**<br>**Explain what causes current to flow and how resistance affects current.**<br>**Describe the basic features of an electric series and parallel circuits.**<br>**Explain how to calculate electric power and energy use.**<br>**Describe measures that help protect people from electrical shocks and short circuits.**<br>**Identify and describe the properties of magnets.**<br>**Explain how magnetic poles interact.**<br>**Describe a magnetic field.**<br>**Describe Earth's magnetic field.**<br>**Explain how electric current is related to magnetism.**<br>**Identify some characteristics of a magnetic field produced by a current.**<br>**Describe the characteristics of solenoids and electromagnets.**<br>**Explain how electrical energy can be transformed into mechanical energy.**<br>**Describe how electric motors work.**<br>**Explain how an electric current can be produced in a conductor.**<br>**Describe how a generator works.**<br>**Describe the function of a transformer.** |

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| **●Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (secondary to MS-PS1-4)**<br>**●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)**<br>**●A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)**<br>**PS3.B: Conservation of Energy and Energy Transfer**<br>**●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)**<br>**●Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)**<br>**●When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5) PS2.A: Forces and Motion**<br>**● 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)**<br>**● 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)**<br>**● 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)**<br><br>**PS2.B: Types of Interactions** | **of small perfect cubes. Know that √2 is irrational. (MS-PS3-1)**<br>● **8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1),(MS-PS3-5)**<br>● **6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-PS3-4)**<br>● **SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1),(MS-ESS2-2),(MS-ESS2-6)**<br>**TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**<br>● **8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**<br>● **B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.**<br>● **C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.**<br>● **E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.**<br>● **F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**<br>**21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to** | |

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| **● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)**<br>**● 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)**<br>**● 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-PS-2-5) PS3.C: Relationship Between Energy and Forces**<br>**● 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)** | **prepare for life as citizens and workers in the 21st century. For further clarification see NJ World**<br>**● Class Standards at www.NJ.gov/education/aps/cccs/career/**<br>**● CRP1. Act as a responsible and contributing citizen and employee.**<br>**● CRP2. Apply appropriate academic and technical skills.**<br>**● CRP4. Communicate clearly and effectively and with reason.**<br>**● CRP5. Consider the environmental, social and economic impacts of decisions.**<br>**● CRP6. Demonstrate creativity and innovation.**<br>**● ● CRP7. Employ valid and reliable research strategies.**<br>**● CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**<br>**● CRP9. Model integrity, ethical leadership and effective management.**<br>**● CRP11. Use technology to enhance productivity.** | |

**Unit 2: 8th Grade Advanced Science/ Forces, Interactions and Energy**

**Stage 1 – Desired Results**

| UNIT SUMMARY | CORE AND SUPPLEMENTAL MATERIALS/RESOURCES (OPEN RESOURCES) |
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| *Brief 2-4 sentence description of unit purpose, what is covered, and what students will understand at the conclusion of the unit.*<br>An object's motion changes if a net force acts on the object. Energy causes change by affecting the movement and position of objects. Energy can be transformed from one form to another and transferred from object to object. Thermal energy can be transferred by conduction, radiation, and convection. Thermal energy can also be transformed into other forms of energy. | Pearson: Forces and Energy<br>Argument - Driven Inquiry in Physical Science: Lab Investigations for Grades 6-8<br>Internet Resource Links:<br>https://www.pearsonsuccessnet.com<br>https://www.brainpop.com<br>www.discoveryeducation.com<br>https://phet.colorado.edu<br>www.pbslearningmedia.org<br>https://www.khanacademy.org/science/physics |

**ENDURING UNDERSTANDINGS**

Students will understand that…

- Newton's Third Law of Motion relate forces to explain the motion of objects.
- Gravitational, electrical, and magnetic forces explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. In particular, students will develop the understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and repelling (negative).
- Objects can exert forces on each other even though the objects are not in contact, through fields.
- One must apply an engineering practice and concept to solve a problem caused when objects collide.
- The crosscutting concepts of cause and effect; system and system models; stability and change; and the influence of science, engineering, and technology on society and the natural world serve as organizing concepts for these disciplinary core ideas.
- In the PS2 performance expectations, students are expected to demonstrate proficiency in asking questions, planning and carrying out investigations, and designing solutions, and engaging in argument; and to use these practices to demonstrate an understanding of the core ideas.

Essential Questions:

- How do you describe the motion of an object?
- How do objects react to forces?
- How do machines make it easier to do work?
- How is energy conserved in a transformation?
- How does heat flow from one object to another?
- How does an electric circuit work?

| **Students will know…** | **Students will be able to…** |
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| *What content will be covered that students must master?*<br>● Describing Motion<br>● Speed and velocity<br>● Acceleration<br>● The Nature of Force<br>● Friction and Gravity<br>● Newton's Laws of Motion<br>● Momentum<br>● Free Fall and Circular Motion<br>● Work and Power<br>● Understanding Machines<br>● Putting Machines Together<br>● What is Energy<br>● Energy Transformation and Conservation<br>● Temperature, Thermal Energy, and Heat<br>● The Transfer of Heat<br>● Thermal Properties | *What should students be able to accomplish to demonstrate understanding?*<br>● Determine when an object is in motion.<br>● Calculate an object's speed.<br>● Describe what velocity is.<br>● Demonstrate how to graph motion.<br>● Describe the motion of an object as it accelerates. Demonstrate how to graph acceleration.<br>● Describe what a force is.<br>● Describe how balanced and unbalanced forces are related to an object's motion.<br>● Describe friction and identify factors that determine the friction between two objects. Identify the factors that affect the gravitational force between two objects.<br>● State Newton's first law of motion.<br>● State Newton's second law of motion.<br>● State Newton's third law of motion.<br>● Explain how momentum is determined and conserved.<br>● Describe the motion of an object during free fall. Describe the factors that keep objects in orbit around Earth. |

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| ● Electric Charge and Static Electricity<br>● Electric Current | ● Name and describe the two basic types of energy: potential and kinetic.<br>● List other forms of energy<br>● Explain how different forms of energy are related and how energy is transformed.<br>● Track the flow of energy from the sun to an indoor appliance in several ways.<br>● State the law of conservation of energy.<br>● Explain temperature and how it is measured. Explain how heat is related to temperature and thermal energy and the differences between the three concepts.<br>● Describe the three forms of heat transfer.<br>● Use specific heat, conductors, and insulators, and thermal expansion to describe how materials respond to heat.<br>● Explain how electric charges and fields interact. Describe how static electricity builds up and transfers.<br>● Explain how an electric current is produced. Explain how conductors are different from insulators.<br>● Explain what causes current to flow and how resistance affects current.<br>● Describe the basic features of an electric series and parallel circuits.<br>● Explain how to calculate electric power and energy use.<br>● Describe measures that help protect people from electrical shocks and short circuits.<br>● Identify and describe the properties of magnets. Explain how magnetic poles interact.<br>● Describe a magnetic field.<br>● Describe Earth's magnetic field.<br>● Explain how electric current is related to magnetism.<br>● Identify some characteristics of a magnetic field produced by a current.<br>● Describe the characteristics of solenoids and electromagnets.<br>● Explain how electrical energy can be transformed into mechanical energy.<br>● Describe how electric motors work.<br>● Explain how an electric current can be produced in a conductor.<br>● Describe how a generator works.<br>● Describe the function of a transformer. |
| **Stage 2 – Assessment Evidence** | |
| Suggested Formative Assessments:<br>Small group presentation feedback, peer review, foldables, Web-Quests, Kahoot, BrainPop, quiz, exit cards<br><br>Suggested Performance Tasks: (Summative Assessments) | Other Evidence **(Alternate Assessments)**:<br>*What other means of assessment will be used throughout this unit?*<br>Project rubrics, peer evaluations, project-based learning, questioning techniques, formal and informal students presentations, whole class discussions, graphic and computer based displays of knowledge, warm-ups |

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| *What projects, hands-on lessons, use of manipulatives, active participation in new situations, etc. will reveal evidence of meaning-making and transfer (true understanding)?*<br>Labs, STEM projects, claim evidence justification posters, common assessment<br><br>*How will students demonstrate their understanding (meaning-making and transfer) through complex performance?*<br>Foldables, posters, projects, presentations, performance assessments, argumentation sessions, common assessment | |

**Stage 3 – Learning Plan**

*• Where is the work headed? Why is it headed there? What are the student's final performance obligations, the anchoring performance assessments? What are the criteria by which student work will be judged for understanding? (These are questions asked by students. Help the student see the answers to these questions upfront.)*

*• Hook the student through engaging and provocative entry points: thought-provoking and focusing experiences, issues, oddities, problems, and challenges that point toward essential questions, core ideas, and final performance tasks.*

*• Explore and Equip. 21st Century Learning and Interdisciplinary connections. Engage students in learning experiences that allow them to explore the big ideas and essential questions; that cause them to pursue leads or hunches, research and test ideas, try things out. Equip students for the final performances through guided instruction and coaching on needed skill and knowledge. Have them experience the ideas to make them real.*

*•Organize and sequence the learning for maximal engagement and effectiveness, given the desired results.*

***What pre-assessments will you use to check students' prior knowledge, skill levels, and potential misconceptions?***
***Are all three types of goals (acquisition, meaning, and transfer) addressed in the learning plan?***
***Does the learning plan reflect principles of learning and best practices?***
***Is there tight alignment with Stages 1 and 2?***
***Is the plan likely to be engaging and effective for all students?***

***PROGRESS MONITORING***
***How will you monitor students' progress toward acquisition, meaning-making, and transfer, during lesson events?***
***What are potential rough spots and student misunderstandings?***
***How will students get the feedback they need?***
***What supports are needed for students to be successful? Re-teach, small group instruction, etc.***

Progress Monitoring:

Warm Up/Do Now
Assessment rubrics
Project-based learning
Essay-writing

Formal and informal presentations
Class discussions
Graphic and computer-based projects
Check for understanding questions
Critical Thinking Practice
Class polls check for understanding
Quizlet and other interactive online activities
Quizzes
Exit/Closure activities
Homework
Class participation

Feedback and Support:

Rubrics
Peer-peer conferencing
Teacher-student individual conferencing
Immediate verbal feedback
Modeling/Reteaching

Potential Misunderstanding:

New vocabulary
New and/or abstract concepts
Data and graph analysis
Common/popular misconceptions
Essential question distinctions

Samples of learning activities go here:

Small groups for classroom activities or projects
Hands-on and inquiry-based projects
Laboratory investigations and demonstrations
Argument-Driven Inquiry Claim/Evidence/Justification activities
Project-based learning and models
Computer-based research and projects
Content/discussion-driven videos, animations, and other media
Writing and vocabulary practice activities
Diagram and graphing activities
Critical thinking questions and activities
Argument-driven inquiry based on claim evidence justification framework.

Introductory labs, application labs, STEM designs and redesigns based on Physics tasks to solve everyday problems.

**Planned Differentiation & Interventions for Tiers I, II, III, ELL, 504s, SPED, and Gift & Talented Students**

*• Rethink and revise. Dig deeper into ideas at issue (through the faces of understanding). Revise, rehearse, and refine, as needed. Guide students in self-assessment and self-adjustment, based on feedback from inquiry, results, and discussion.*

*• Evaluate understandings. Reveal what has been understood through final performances and products. Involve students in a final self-assessment to identify remaining questions, set future goals, and point toward new units and lessons.*

*•Tailor (personalize) the work to ensure maximum interest and achievement. Differentiate the approaches used and provide sufficient options and variety (without compromising goals) to make it most likely that all students will be engaged and effective.*

**Gifted & Talented/Advanced:**

- **Extension activities**
- **Opportunities for Critical Thinking**
- **Problem Solving/Design Challenges**
- **Technology Integration**
- **Student Choice Activities**
- **The use of more advanced or complex concepts**
- **Argument driven inquiry**
- **Claim evidence reasoning/justification**
- **Suggested lessons: Strength of gravitational forces, mass & free fall, force & motion, mass & motion, magnetic forces, design challenge, unbalanced forces, kinetic and potential forces, electrical energy & light bulbs, and circuits.**

**Note: Advanced projects are considered more independent, more in depth in content, more student-driven, and requiring greater demonstration of mastery and synthesis of concepts and critical thinking than similar activities performed in general science.**

**Tier I:**

- **Choice Boards**
- **Guided Reading**
- **Independent Research & Projects**
- **Project-Based Learning**
- **Graphic Organizers**

**Tier II:**

- **Leveled Rubrics**
- **Tiered Products**
- **Varied Product Choices**
- **Stations/Centers**
- **Work Alone/Together**

**Tier III:**

- **Goal-Setting with Students**
- **Homework Options**
- **Personal Agendas**

**ELL:**

- **Small Group Instruction**
- **Flexible Grouping**
- **Peer Buddies**
- **Graphic Organizers**
- **Technology Integration**
- **Provide clear and specific directions**
- **Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**

**504s:**

- **Multisensory Instruction / Multiple modalities**
- **Flexible Grouping**
- **Small Group Instruction**
- **Peer Buddies**
- **Graphic Organizers**
- **Chunking Information**
- **Scaffolded Questioning**
- **Manipulatives**
- **Provide clear and specific directions, orally and in writing**
- **Allow for differentiated assessment as long as it meets requirements / demonstrates proficiency of NJSLS**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**
- **Provide extended time**
- **Assign peer tutor**
- **Utilize visual charts/cues**

**SPED:**

- **Multisensory Instruction / Multiple modalities**
- **Flexible Grouping**
- **Small Group Instruction**
- **Peer Buddies**
- **Graphic Organizers**
- **Chunking Information**
- **Scaffolded Questioning**
- **Manipulatives**
- **Provide clear and specific directions, orally and in writing**
- **Allow for differentiated assessment as long as it meets requirements / demonstrates proficiency of NJSLS**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**
- **Provide extended time**
- **Assign peer tutor**
- **Utilize visual charts/cues**

| Unit 3: 8th Grade/Advanced Science Sound and Light | | |
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| **Content & Practice Standards** | **Interdisciplinary Standards** | **Critical Knowledge & Skills** |
| **SCI.MS-PS4 Waves and Electromagnetic Radiation**<br>● **SCI.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.**<br>● **SCI.MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through a various materials.**<br>**SCI.MS-ETS1 Engineering Design**<br>● **SCI.MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**<br>● **SCI.MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**<br>● **SCI.MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**<br>● **SCI.MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.** | **Language Arts Literacy**<br>● **RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)**<br>● **RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5), (MS-PS4-3)**<br>● **RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)**<br>● **WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-PS4-3)**<br>● **SL.8.5 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-PS4-1) (MS-PS4-2)**<br>**Mathematics**<br>● **MP.2 Reason abstractly and quantitatively. (MS-PS4-1)**<br>● **MP.4 Model with mathematics. (MS-PS4-1)**<br>● **6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1)**<br>**6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1)**<br>**7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS4-1)**<br>**8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS4-1)** | **Students will know**<br>● **What are Waves**<br>● **Properties of Waves**<br>● **Interactions of Waves**<br>● **The Nature of Electromagnetic Waves**<br>● **Waves of the Electromagnetic Spectrum**<br>● **Wireless Communication**<br>● **Seeing Light**<br>● **Using Light** |

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| | **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**<br>● **8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**<br>● **A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations**<br>● **B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.**<br>● **C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.**<br>● **D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.**<br>● **E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.**<br>● **F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**<br>● **21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills**<br>● **needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class**<br>● **Standards at www.NJ.gov/education/aps/cccs/career/** | |

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| | • **CRP2. Apply appropriate academic and technical skills.**<br>• **CRP4. Communicate clearly and effectively and with reason.**<br>• **CRP5. Consider the environmental, social and economic impacts of decisions.**<br>• **CRP7. Employ valid and reliable research strategies.**<br>• **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**<br>• **CRP11. Use technology to enhance productivity.** | |

**Unit 3 8th Grade/Advanced Science**

**Stage 1 – Desired Results**

| **UNIT SUMMARY** | **CORE AND SUPPLEMENTAL MATERIALS/RESOURCES (OPEN RESOURCES)** |
|---|---|
| *Waves transfer energy without transferring matter. Mechanical waves require a medium. A continuous wave is a regular repeating sequence of wave pulses. Interference occurs when two or more waves move through a medium at the same time. Sound is a pressure variation transmitted through matter as a longitudinal wave. Sound is produced by vibrating objects in matter.* | Pearson: Sound and Light<br>Internet Resource Links:<br>https://www.pearsonsuccessnet.com<br>https://www.brainpop.com<br>www.//discoveryeducation.com<br>https://phet.colorado.edu<br>www.pbslearningmedia.org<br>https://www.khanacademy.org/science/physics |

**ENDURING UNDERSTANDINGS**

Students will understand that…

- Explain what causes mechanical waves.
- List and describe three types of mechanical waves.
- Describe the basic properties of waves.
- Explain how a wave's speed is related to its wavelength and frequency.
- Describe how reflection, refraction, and diffraction change a wave's direction.
- State the different types of interference.
- Explain how standing waves form.
- State what an electromagnetic waves consists of.
- List and describe the models that explain the behavior of electromagnetic waves.
- Explain how electromagnetic waves are alike and how they are different.
- Describe the waves that make up the electromagnetic spectrum.
- Explain how radio waves transmit information.
- Explain how cell phones work.
- Explain how communications satellites work.

- Identify the kinds of reflection.
- Explain how one sees objects.

Essential Questions:

- What are the properties of waves?
- What determines the pitch and loudness of sound?
- What kinds of waves make up the electromagnetic spectrum?
- How does light interact with matter?

| **Students will know…** | **Students will be able to…** |
|---|---|
| *What content will be covered that students must master?*<br>● What are Waves<br>● Properties of Waves<br>● Interactions of Waves<br>● The Nature of Electromagnetic Waves<br>● Waves of the Electromagnetic Spectrum<br>● Wireless Communication<br>● Seeing Light<br>● Using Light | *What should students be able to accomplish to demonstrate understanding?*<br>● Explain what causes mechanical waves.<br>● List and describe three types of mechanical waves.<br>● Describe the basic properties of waves.<br>● Explain how a wave's speed is related to its wavelength and frequency.<br>● Describe how reflection, refraction, and diffraction change a wave's direction.<br>● State the different types of interference.<br>● Explain how standing waves form.<br>● State what an electromagnetic waves consists of.<br>● List and describe the models that explain the behavior of electromagnetic waves.<br>● Explain how electromagnetic waves are alike and how they are different.<br>● Describe the waves that make up the electromagnetic spectrum.<br>● Explain how radio waves transmit information.<br>● Explain how cell phones work.<br>● Explain how communications satellites work.<br>● Identify the kinds of reflection.<br>● Explain how one sees objects. |

**Stage 2 – Assessment Evidence**

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|---|---|
| Suggested Formative Assessments:<br>Small group presentation feedback, peer review, foldables, Web-Quests, Kahoot, BrainPop, quiz, exit cards<br><br>Suggested Performance Tasks: (Summative Assessments) | Other Evidence **(Alternate Assessments)**:<br>*What other means of assessment will be used throughout this unit?*<br>Project rubrics, peer evaluations, project-based learning, questioning techniques, formal and informal students presentations, whole class discussions, graphic and computer based displays of knowledge, warm-ups |

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|---|---|
| *What projects, hands-on lessons, use of manipulatives, active participation in new situations, etc. will reveal evidence of meaning-making and transfer (true understanding)?*<br>Labs, STEM projects, claim evidence justification posters, common assessment<br><br>*How will students demonstrate their understanding (meaning-making and transfer) through complex performance?*<br>Foldables, posters, projects, presentations, performance assessments, argumentation sessions, common assessment | |

**Stage 3 – Learning Plan**

*• Where is the work headed? Why is it headed there? What are the student's final performance obligations, the anchoring performance assessments? What are the criteria by which student work will be judged for understanding? (These are questions asked by students. Help the student see the answers to these questions upfront.)*

*• Hook the student through engaging and provocative entry points: thought-provoking and focusing experiences, issues, oddities, problems, and challenges that point toward essential questions, core ideas, and final performance tasks.*

*• Explore and Equip. 21st Century Learning and Interdisciplinary connections. Engage students in learning experiences that allow them to explore the big ideas and essential questions; that cause them to pursue leads or hunches, research and test ideas, try things out. Equip students for the final performances through guided instruction and coaching on needed skill and knowledge. Have them experience the ideas to make them real.*

*•Organize and sequence the learning for maximal engagement and effectiveness, given the desired results.*

***What pre-assessments will you use to check student' prior knowledge, skill levels, and potential misconceptions?***
***Are all three types of goals (acquisition, meaning, and transfer) addressed in the learning plan?***
***Does the learning plan reflect principles of learning and best practices?***
***Is there tight alignment with Stages 1 and 2?***
***Is the plan likely to be engaging and effective for all students?***

***PROGRESS MONITORING***
***How will you monitor students' progress toward acquisition, meaning-making, and transfer, during lesson events?***
***What are potential rough spots and student misunderstandings?***
***How will students get the feedback they need?***
***What supports are needed for students to be successful? Re-teach, small group instruction, etc.***

Progress Monitoring:

Warm Up/Do Now
Assessment rubrics
Project-based learning
Essay-writing

Formal and informal presentations
Class discussions
Graphic and computer-based projects
Check for understanding questions
Critical Thinking Practice
Class polls check for understanding
Quizlet and other interactive online activities
Quizzes
Exit/Closure activities
Homework
Class participation

Feedback and Support:

Rubrics
Peer-peer conferencing
Teacher-student individual conferencing
Immediate verbal feedback
Modeling/Reteaching

Potential Misunderstanding:

New vocabulary
New and/or abstract concepts
Data and graph analysis
Common/popular misconceptions
Essential question distinctions

Samples of learning activities go here:

Small groups for classroom activities or projects
Hands-on and inquiry-based projects
Laboratory investigations and demonstrations
Argument-Driven Inquiry Claim/Evidence/Justification activities
Project-based learning and models
Computer-based research and projects
Content/discussion-driven videos, animations, and other media
Writing and vocabulary practice activities
Diagram and graphing activities
Critical thinking questions and activities
Argument-driven inquiry based on claim evidence justification framework.

Introductory labs, application labs, STEM designs and redesigns based on Energy tasks to solve everyday problems.

**Planned Differentiation & Interventions for Tiers I, II, III, ELL, 504s, SPED, and Gift & Talented Students**

*• Rethink and revise. Dig deeper into ideas at issue (through the faces of understanding). Revise, rehearse, and refine, as needed. Guide students in self-assessment and self-adjustment, based on feedback from inquiry, results, and discussion.*

*• Evaluate understandings. Reveal what has been understood through final performances and products. Involve students in a final self-assessment to identify remaining questions, set future goals, and point toward new units and lessons.*

*•Tailor (personalize) the work to ensure maximum interest and achievement. Differentiate the approaches used and provide sufficient options and variety (without compromising goals) to make it most likely that all students will be engaged and effective.*

**Gifted & Talented/Advanced:**

- **Extension activities**
- **Opportunities for Critical Thinking**
- **Problem Solving/Design Challenges**
- **Technology Integration**
- **Student Choice Activities**
- **The use of more advanced or complex concepts**
- **Argument driven inquiry**
- **Claim evidence**
- **Suggested lessons: Wave properties, light & information transfer, design challenge, telephone lab**

**Note: Advanced projects are considered more independent, more in depth in content, more student-driven, and requiring greater demonstration of mastery and synthesis of concepts and critical thinking than similar activities performed in general science.**

**Tier I:**

- **Choice Boards**
- **Guided Reading**
- **Independent Research & Projects**
- **Project-Based Learning**
- **Graphic Organizers**

**Tier II:**

- **Leveled Rubrics**
- **Tiered Products**
- **Varied Product Choices**
- **Stations/Centers**
- **Work Alone/Together**

**Tier III:**

- **Goal-Setting with Students**
- **Homework Options**
- **Personal Agendas**

**ELL:**

- **Small Group Instruction**
- **Flexible Grouping**
- **Peer Buddies**
- **Graphic Organizers**
- **Technology Integration**
- **Provide clear and specific directions**
- **Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**

**504s:**

- **Multisensory Instruction / Multiple modalities**
- **Flexible Grouping**
- **Small Group Instruction**
- **Peer Buddies**
- **Graphic Organizers**
- **Chunking Information**
- **Scaffolded Questioning**
- **Manipulatives**
- **Provide clear and specific directions, orally and in writing**
- **Allow for differentiated assessment as long as it meets requirements / demonstrates proficiency of NJSLS**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**
- **Provide extended time**
- **Assign peer tutor**
- **Utilize visual charts/cues**

**SPED:**

- **Multisensory Instruction / Multiple modalities**
- **Flexible Grouping**
- **Small Group Instruction**
- **Peer Buddies**
- **Graphic Organizers**
- **Chunking Information**
- **Scaffolded Questioning**
- **Manipulatives**
- **Provide clear and specific directions, orally and in writing**
- **Allow for differentiated assessment as long as it meets requirements / demonstrates proficiency of NJSLS**
- **Provide class notes ahead of time to allow students to preview material and increase comprehension**
- **Provide extended time**
- **Assign peer tutor**
- **Utilize visual charts/cues**

| Unit 4 ELA GRADE/COURSE | | |
|---|---|---|
| **Content & Practice Standards** | **Interdisciplinary Standards** | **Critical Knowledge & Skills** |
| • | • | • |

| Unit 4 ELA GRADE/COURSE | |
|---|---|
| **Stage 1 – Desired Results** | |
| **UNIT SUMMARY** | **CORE AND SUPPLEMENTAL MATERIALS/RESOURCES (OPEN RESOURCES)** |
| *Brief 2-4 sentence description of unit purpose, what is covered, and what students will understand at the conclusion of the unit.* | |
| **ENDURING UNDERSTANDINGS** | |
| Students will understand that…<br>•<br><br>Essential Questions:<br>• | |
| **Students will know…** | **Students will be able to…** |
| *What content will be covered that students must master?*<br>•<br>• | *What should students be able to accomplish to demonstrate understanding?*<br>•<br>• |
| **Stage 2 – Assessment Evidence** | |
| Performance Tasks: (Summative Assessments)<br>*What projects, hands-on lessons, use of manipulatives, active participation in new situations, etc. will reveal evidence of meaning-making and transfer (true understanding)?*<br><br>*How will students demonstrate their understanding (meaning-making and transfer) through complex performance?*<br><br>Formative Assessments: | Other Evidence **(Alternate Assessments)**:<br>*What other means of assessment will be used throughout this unit?* |
| **Stage 3 – Learning Plan** | |
| *• Where is the work headed? Why is it headed there? What are the student's final performance obligations, the anchoring performance assessments? What are the criteria by which student work will be judged for understanding? (These are questions asked by students. Help the student see the answers to these questions upfront.)* | |

*• Hook the student through engaging and provocative entry points: thought-provoking and focusing experiences, issues, oddities, problems, and challenges that point toward essential questions, core ideas, and final performance tasks.*

*• Explore and Equip. 21st Century Learning and Interdisciplinary connections. Engage students in learning experiences that allow them to explore the big ideas and essential questions; that cause them to pursue leads or hunches, research and test ideas, try things out. Equip students for the final performances through guided instruction and coaching on needed skill and knowledge. Have them experience the ideas to make them real.*

*•Organize and sequence the learning for maximal engagement and effectiveness, given the desired results.*

***What pre-assessments will you use to check students' prior knowledge, skill levels, and potential misconceptions?***
***Are all three types of goals (acquisition, meaning, and transfer) addressed in the learning plan?***
***Does the learning plan reflect principles of learning and best practices?***
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***PROGRESS MONITORING***
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***How will students get the feedback they need?***
***What supports are needed for students to be successful? Re-teach, small group instruction, etc.***

Samples of learning activities go here:

**Planned Differentiation & Interventions for Tiers I, II, III, ELL, 504s, SPED, and Gift & Talented Students**

*• Rethink and revise. Dig deeper into ideas at issue (through the faces of understanding). Revise, rehearse, and refine, as needed. Guide students in self-assessment and self-adjustment, based on feedback from inquiry, results, and discussion.*

*• Evaluate understandings. Reveal what has been understood through final performances and products. Involve students in a final self-assessment to identify remaining questions, set future goals, and point toward new units and lessons.*

*•Tailor (personalize) the work to ensure maximum interest and achievement. Differentiate the approaches used and provide sufficient options and variety (without compromising goals) to make it most likely that all students will be engaged and effective.*

**Gifted & Talented:**

| |
|---|
| **Tier I:** |
| **Tier II:** |
| **Tier III:** |
| **ELL:** |
| **504s:** |
| **SPED:** |