**Quinton Township School District**

**Science Curriculum Guide**

**8th Grade**

**Curriculum MAP** **Key: Careers Technology Interdisciplinary Studies**

| Marking Period | 1 | Unit Title | Force and Motion | Pacing | 30 days |
|---|---|---|---|---|---|

**Unit Summary:** Students use *system and system models* and *stability and change* to understanding ideas related to why some objects will keep moving and why objects fall to the ground. Students apply Newton's third law of motion to related forces to explain the motion of objects. Students also apply an engineering practice and concept to solve a problem caused when objects collide. The crosscutting concepts of *system and system models* and *stability and change* provide a framework for understanding the disciplinary core ideas. Students demonstrate proficiency in *asking questions*, *planning and carrying out investigations, designing solutions, engaging in argument from evidence*, *developing and using models,* and *constructing explanations and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

**Knowledge -** By the end of this unit, students will know:

- The causes of motion.
- The difference between speed and velocity.
- Unbalanced forces cause acceleration.
- The larger the force the larger the acceleration.
- The inverse relationship between mass and acceleration.
- Newton's 3rd law acts in force pairs.

**Skills -** By the end of this unit, students will be able to:

- Interpret motion graphs
- Calculate speed.
- Calculate Weight.
- Calculate Force.
- Explain any moving object using Newton's Laws.
- Calculate momentum.
- Calculate basic sum of force problems.

**Essential Questions:**

1. What causes motion to occur?
2. What do motion graphs look like for objects moving with constant velocity?

3. What do graphs look like for objects that are accelerating?
4. How is the speed of an object calculated?
5. How is velocity similar / different from velocity?
6. How is acceleration calculated?
7. How do unbalanced forces affect the motion of an object?
8. How does friction affect an object when at rest or in motion?
9. What are the biggest factors that affect the force of gravity?
10. How is weight calculated?
11. What does Newton's 1st law state about objects at rest or in motion?
12. How does the mass of an object and the force acting on that object affect the object's acceleration?
13. How can Newton's 3rd law of motion be used to explain the motion of a rocket?
14. What factors affect the momentum of an object?
15. How is momentum different from inertia?

## NGSS 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-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.

## Interdisciplinary Connections/Including 21st Century Themes and Skills:

*English Language Arts/Literacy-*

- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS2-1),(MS-ETS1-1),(MS-ETS1-2) **RST.6-8.1**
- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2) **RST.6-8.3**
- 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-ETS1-1) **WHST.6-8.8**
- Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2) **WHST.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-ETS1-2),(MS-ETS1-3) **RST.6-8.9**

- 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-ETS1-2) **WHST.6-8.7**

*Mathematics*

- Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3),(MS-ETS1-1),(MS-ETS1-2) **MP.2**
- 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) **6.NS.C.5**
- Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2) **6.EE.A.2**
- 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) **7.EE.B.3**
- 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) **7.EE.B.4**
- 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 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-ETS1-1),(MS-ETS1-2) **7.EE.3**

21st Century Themes and Skills

*Computer Science and Design Thinking*

- 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
- 8.2.8.ITH.2: Compare how technologies have influenced society over time

*Career Readiness, Life Literacies, and Key Skills*

- 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.

| Overview of Activities | Teacher's Guide/Resources | Core Instructional Materials | Technology Infusion |
|---|---|---|---|
| 1. **Force and Motion Classwork/Homework**<br>2. **Lab 1: Graphing Motion Simulation Lab**<br>3. **Lab 2: Constant Speed Graphical Analysis Lab**<br>4. **Lab 3: Accelerated Motion Lab**<br>5. **Lab 4: Sticky Sneakers**<br>6. **Lab 5: Forces and Friction Simulation Lab**<br>7. **Lab 7: Newton's Laws of** | 1. **Force and Motion Classwork/Homework Answers Guide**<br>2. **Force and Motion SMART Notebook Notes**<br>3. **NJCTL.com**<br>4. **Legends of Learning**<br>5. **Edpuzzle**<br>6. **Force and Motion Pacing Guide** | 1. **Force and Motion SMART Notebook Notes**<br>2. **Force and Motion Classwork/Homework**<br>3. **Labs** | 1. **SMARTboard Applications**<br>2. **Google Applications**<br>3. **Legends of Learning**<br>4. **Edpuzzle** |

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| **Motion** | | | |

| Formative Assessment Plan | Summative Assessment Plan |
|---|---|
| Formative assessment informs instruction and is on going through a unit to determine how students are progressing with the high expectations of standards.<br><br>**Suggested activities to assess student progress:**<br>Daily Science Starters<br>Daily/Weekly Classwork & Homework Completion<br>Kahoot!<br>Rubric-for projects<br>Self-reflection | Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.<br><br>**Final Assessments:**<br>Quiz 1 - Motion<br>Quiz 2 - Graphing Motion<br>Quiz 3 - Forces<br>Quiz 4 - Newton's Laws<br>Quiz 5: Newton's 3rd Law & Momentum<br>Test - Forces and Motion Test |

| Differentiation | | | |
|---|---|---|---|
| **Special Education** | **ELL** | **At Risk** | **Gifted and Talented** |
| • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• The students will be given study guides for tests<br>• Students will be given notes for quizzes<br>• Projects will be modified for students who need it to be.<br>• Homework is also modified for those students who need it.<br>• Students will be given extra time to complete all assignments. | • Provide ELL students with multiple literacy strategies.<br>• Rosetta Stone<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). | • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• Students will be given extra time to complete all assignments.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. | • Allow students to provide additional support for students struggling (peer teaching)<br>• Expanded learning projects to further student understanding<br>• Student teaching lessons<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and |

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|---|---|---|---|
| ● All quizzes and tests have been modified for the students to meet their needs.<br>● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).<br>● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Structure the learning around explaining or solving a social or community-based issue.<br>● Collaborate with after-school programs or clubs to extend learning opportunities. | ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Translate printed communications for parents in native language<br>● Hold conferences with translator present<br>● Review Special Education listing for additional recommendations | multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Make modifications to instructional plans based on I and RS Plan. | cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Promote self-initiated and self-directed learning and growth.<br>● Enable students to explore continually changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world. |

| Marking Period | 1 | Unit Title | Types of Interactions | Pacing | 30 days |
|---|---|---|---|---|---|

**Unit Summary:** Students use *cause and effect*; *system and system models*; and *stability and change* to understand ideas that explain why some materials are attracted to each other while others are not. Students apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. In particular, students develop understandings that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are expected to consider the influence of science, engineering, and technology on society and the natural world. Students are expected to demonstrate proficiency in *asking questions*, *planning and carrying out investigations*, *designing solutions*, and *engaging in argument*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

**Knowledge -** By the end of this unit, students will know:

- Source and factors that affect gravitation.
- Source and factors that affect electrical forces.
- Sources and factors that affect magnetic forces.
- The interrelationships between electricity & magnetism.

**Skills -** By the end of this unit, students will be able to:

- Differentiate between the transfers of force via direct contact vs. fields.
- Explain that mass and distance of separation affect the magnitude of gravitational attraction.
- Diagram/explain charge distribution in positive and negative objects.
- Sketch/explain electric fields.
- Explain that charge strength and distance of separation affect the magnitude of electrical forces.
- Diagram/explain the source of magnetism in terms of magnetic domains.
- Sketch/explain magnetic fields.
- Explain that magnetic strength and distance of separation affect the magnitude of magnetic forces.
- Identify the fact that moving electric charge produces magnetic fields and vice versa.

**Essential Questions:**

1. How are forces exerted over a distance?
2. What causes a a) gravitational field, b) electric field, and a c) magnetic field?
3. What are the three types of fields discussed in this unit? How are they similar? How are they different?
4. What happens to the strength of a field as we move farther away from its source?

**NGSS Standards:**

- **MS-PS2-3 -** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- **MS-PS2-4 -** 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-PS2-5 -** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- **MS-ETS1-1 -** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2 -** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3 -** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4 -** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

## Interdisciplinary Connections/Including 21st Century Themes and Skills:

*English Language Arts/Literacy-*

- Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.(HS-PS2-5), (HS-PS2-3) **WHST.11-12.7**
- Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS2-5) **WHST.11-12.8**
- Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS2-5) **WHST.11-12.9**

*Mathematics*

- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS2-5),(HS-PS2-4) **HSN.Q.A.1**
- Define appropriate quantities for the purpose of descriptive modeling. (HS-PS2-5),(HS-PS2-4) **HSN.Q.A.2**
- Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS2-5),(HS-PS2-4) **HSN.Q.A.3**
- Reason abstractly and quantitatively. (HS-PS2-4) **MP.2**
- Model with mathematics. (HS-PS2-4) **MP.4**
- Interpret expressions that represent a quantity in terms of its context. (HS-PS2-4) **HSA.SSE.A.1**
- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS2-4) **HSA.SSE.B.3**

21st Century Themes and Skills

*Computer Science and Design Thinking*

- 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
- 8.2.8.ITH.2: Compare how technologies have influenced society over time

*Career Readiness, Life Literacies, and Key Skills*

- 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.

| Overview of Activities | Teacher's Guide/Resources | Core Instructional Materials | Technology Infusion |
|---|---|---|---|
| 1. **Types of Interactions Classwork/Homework**<br>2. **Lab 1: Gravity Simulation**<br>3. **Lab 2: Electrostatic Lab**<br>4. **Lab 3: Electric Fields and Forces Simulation**<br>5. **Lab 4: Magnetism Lab**<br>6. **Lab 5: Magnetic Fields Simulation**<br>7. **Lab 7: Electromagnetism Lab** | 1. **Types of Interactions Classwork/Homework Answers Guide**<br>2. **Types of Interactions SMART Notebook Notes**<br>3. **NJCTL.com**<br>4. **Legends of Learning**<br>5. **Edpuzzle**<br>6. **Types of Interactions Pacing Guide** | 1. **Types of Interactions SMART Notebook Notes**<br>2. **Types of Interactions Classwork/Homework**<br>3. **Labs** | 1. **SMARTboard Applications**<br>2. **Google Applications**<br>3. **Legends of Learning**<br>4. **Edpuzzle** |

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| Formative assessment informs instruction and is on going through a unit to determine how students are progressing with the high expectations of standards.<br><br>**Suggested activities to assess student progress:**<br>Daily Science Starters<br>Daily/Weekly Classwork & Homework Completion<br>Kahoot!<br>Rubric-for projects<br>Self-reflection | Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.<br><br>**Final Assessments:**<br>Quiz 1 - Transfer of Force<br>Quiz 2 - Interactions Between Charges<br>Quiz 3 - Magnetic Forces and Field<br>Quiz 4 - Electromagnetic Interactions<br>Test - Types of Interactions Test |

| Differentiation | | | |
|---|---|---|---|
| **Special Education** | **ELL** | **At Risk** | **Gifted and Talented** |

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| • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• The students will be given study guides for tests<br>• Students will be given notes for quizzes<br>• Projects will be modified for students who need it to be.<br>• Homework is also modified for those students who need it.<br>• Students will be given extra time to complete all assignments.<br>• All quizzes and tests have been modified for the students to meet their needs.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering | • Provide ELL students with multiple literacy strategies.<br>• Rosetta Stone<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Translate printed communications for parents in native language<br>• Hold conferences with translator present<br>• Review Special Education listing for additional recommendations | • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• Students will be given extra time to complete all assignments.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Make modifications to instructional plans based on I and RS Plan. | • Allow students to provide additional support for students struggling (peer teaching)<br>• Expanded learning projects to further student understanding<br>• Student teaching lessons<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Use project-based science learning to connect science with observable phenomena.<br>• Promote self-initiated and self-directed learning and growth.<br>• Enable students to explore continually changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world. |

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| practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Structure the learning around explaining or solving a social or community-based issue.<br>● Collaborate with after-school programs or clubs to extend learning opportunities. | | | |

| **Marking Period** | **1** | **Unit Title** | **Relationships Among Forms of Energy** | **Pacing** | **30 days** |
|---|---|---|---|---|---|

**Unit Summary:**In this unit, students use the practices of *analyzing and interpreting data*, *developing and using models*, and *engaging in argument from evidence* to make sense of relationship between energy and forces. Students develop their understanding of important qualitative ideas about the conservation of energy. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students also understand the difference between energy and temperature, and the relationship between forces and energy. The crosscutting concepts of *scale, proportion, and quantity*, *systems and system models*, and *energy and matter* are called out as organizing concepts for these disciplinary core ideas. Students use the practices of *analyzing and interpreting data*, *developing and using models*, and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

**Knowledge -** By the end of this unit, students will know:

- The difference between mechanical and non-Mechanical energy.
- The variables that kinetic energy depend upon.
- The variables that gravitational potential energy depend upon.
- The variables that elastic potential energy depend upon.
- The Law of Conservation of Energy states that energy can be transferred from one type to another, but cannot be created or destroyed.
- The difference between renewable and non-renewable energy sources.

- How different types of energy resources convert mechanical energy into electrical energy.

**Skills -** By the end of this unit, students will be able to:

- Calculate when work is done on a system.
- Calculate kinetic energy.
- Calculate gravitational potential energy .
- Calculate elastic potential energy.
- Demonstrate understanding of mechanical energy transfer via diagrams.

## Essential Questions:

1. What is work?
2. What types of energy make up mechanical energy?
3. How is mechanical energy transferred from one form to another?

## NGSS 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 arrangements 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-ETS1-2 -** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
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## Interdisciplinary Connections/Including 21st Century Themes and Skills:

*English Language Arts/Literacy-*

- 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)* **RST.6-8.1**
- 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) **RST.6-8.7**
- Write arguments focused on discipline content. *(MS-PS3-5)* **WHST.6-8.1**

- 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) **WHST.6-8.7**
- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-PS3-2)* **SL.8.5**

*Mathematics*

- Reason abstractly and quantitatively. (MS-PS3-1),( MS-PS3-5) **MP.2**
- Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),(MS-PS3-5) **6.RP.A.1**
- Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. (MS-PS3-1) **6.RP.A.2**
- Recognize and represent proportional relationships between quantities. (MS-PS3-1),(MS-PS3-5) **7.RP.A.2**
- Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1) **8.EE.A.1**
- Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational. (MS-PS3-1) **8.EE.A.2**
- 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) **8.F.A.3**

21st Century Themes and Skills

*Computer Science and Design Thinking*

- 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
- 8.2.8.ITH.2: Compare how technologies have influenced society over time

*Career Readiness, Life Literacies, and Key Skills*

- 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.

| Overview of Activities | Teacher's Guide/Resources | Core Instructional Materials | Technology Infusion |
|---|---|---|---|
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| Formative Assessment Plan | Summative Assessment Plan |
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| Formative assessment informs instruction and is on going through a unit to determine how students are progressing with the high expectations of standards.<br><br>**Suggested activities to assess student progress:**<br>Daily Science Starters<br>Daily/Weekly Classwork & Homework Completion<br>Kahoot!<br>Rubric-for projects<br>Self-reflection | Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.<br><br>**Final Assessments:**<br>Quiz 1 - Work and Energy<br>Quiz 2 - Kinetic Energy<br>Quiz 3 - Potential Energy<br>Quiz 4 - Conservation of Energy<br>Test - Relationships Among Forms of Energy Test |

| Differentiation | | | |
|---|---|---|---|
| **Special Education** | **ELL** | **At Risk** | **Gifted and Talented** |
| • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• The students will be given study guides for tests<br>• Students will be given notes for quizzes<br>• Projects will be modified for students who need it to be.<br>• Homework is also modified for those students who need it.<br>• Students will be given extra time to complete all assignments.<br>• All quizzes and tests have been modified for the students to meet their needs. | • Provide ELL students with multiple literacy strategies.<br>• Rosetta Stone<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to | • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• Students will be given extra time to complete all assignments.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). | • Allow students to provide additional support for students struggling (peer teaching)<br>• Expanded learning projects to further student understanding<br>• Student teaching lessons<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple |

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| • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Use project-based science learning to connect science with observable phenomena.<br>• Structure the learning around explaining or solving a social or community-based issue.<br>• Collaborate with after-school programs or clubs to extend learning opportunities. | provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Translate printed communications for parents in native language<br>• Hold conferences with translator present<br>• Review Special Education listing for additional recommendations | • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Make modifications to instructional plans based on I and RS Plan. | representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Use project-based science learning to connect science with observable phenomena.<br>• Promote self-initiated and self-directed learning and growth.<br>• Enable students to explore continually changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world. |

| **Marking Period** | **1** | **Unit Title** | **Thermal Energy** | **Pacing** | **30 days** |
|---|---|---|---|---|---|

**Unit Summary:** In this unit, students *ask questions*, *plan and carry out investigations*, *engage in argument from evidence*, *analyze and interpret data, construct explanations*, *define problems and design solutions* as they make sense of the difference between energy and temperature. They use the practices to make sense of how the total change of energy in any system is always equal to the total energy transferred into or out of the system. The crosscutting concepts of *energy and matter, scale, proportion, and quantity*, and *influence of science, engineering, and technology on society and the natural world* are the organizing concepts for these disciplinary core ideas. Students ask *questions*, *plan and carry out investigations*, *engage in argument from evidence*, *analyze and interpret data*, *construct explanations*, *define problems and design solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

**Knowledge -** By the end of this unit, students will know:

- The temperature of a substance is proportional to the *average* kinetic energy of the substance's molecules .
- Things expand when heated and contract when cooled due to the increase/decrease in kinetic energy.
- The three common scales to measure temperature (Kelvin, Celsius, and Fahrenheit)
- The difference between temperature and thermal energy
- Three methods of heat transfer: convection, conduction and radiation
- How conductors and insulators differ
- The direction of heat flow and the 2$^{nd}$ law of thermodynamics.
- The variables that affect temperature change in an object.
- The definition of specific heat (capacity).
- The 1$^{st}$ law of thermodynamics and how it relates to energy
- What heat engines do

**Skills -** By the end of this unit, students will be able to:

- Relate the motion and spacing of a substance's particles to the substance's temperature.
- Describe why object's expand or contract in terms of the temperature change of the object as well as the motion of the object's particles.
- Measure a substance's temperature using a standard thermometer and convert between Kelvin, Celsius and Fahrenheit.
- Relate thermal expansion/contraction to how thermometers work.
- Identify when substances can have the same temperature but possess different amounts of thermal energy.
- Differentiate between examples of convection, conduction and radiation.
- Use their knowledge of conductors and insulators to maximize and minimize thermal energy transfer.
- Determine temperature changes between two objects that exchange thermal energy.
- Be able to describe what happens to usable energy in a system.
- Describe the relationship between energy transferred, type/amount of matter, and temperature.
- Use the thermal energy/specific heat equation to calculate: temperature change, heat added or lost, mass of objects, and specific heats.
- Determine qualitatively the relative temperature of objects given a heat input and the objects' specific heat capacity.
- Describe examples of the 1$^{st}$ law of thermodynamics
- Identify examples of heat engines, specifically an internal combustion engine.

**Essential Questions:**

1. How is temperature related to kinetic energy?
2. What are three scales commonly used to measure temperature and how do they relate to on another?
3. Why do things feel hot or cold?
4. What is the definition of thermal energy and how does it relate to heat?
5. How do conductors and insulators differ?
6. What are the 1st and 2nd laws of thermodynamics?
7. What to heat engines do?

## NGSS Standards:

- **MS-PS3-3 -** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **MS-PS3-4 -** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- **MS-PS3-5 -** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- **MS-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.

## Interdisciplinary Connections/Including 21st Century Themes and Skills:

*English Language Arts/Literacy-*

- Cite specific textual evidence to support analysis of science and technical texts. (MS-PS3-5),MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3) **RST.6-8.1**
- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS3-3),(MS-PS3-4) **RST.6-8.3**
- 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-PS3-3),(MS-PS3-4),(MS-ETS1-3) **RST.6-8.7**
- Compare and contrast the information gained from experiments, simulations, videos, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3) **RST.6-8.9**
- 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-ETS1-2) **WHST.6-8.7**
- 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-ETS1-1) **WHST.6-8.8**
- Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2) **WHST.6-8.9**

- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4) **SL.8.5**

*Mathematics*

- Reason abstractly and quantitatively. (MS-PS3-4)**,**(MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4) **MP.2**
- Summarize numerical data sets in relation to their context. (MS-PS3-4) **6.SP.B.5**
- 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 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-ETS1-1),(MS-ETS1-2),(MS-ETS1-3) **7.EE.3**
- Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (MS-ETS1-4) **7.SP**

21st Century Themes and Skills

*Computer Science and Design Thinking*

- 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
- 8.2.8.ITH.2: Compare how technologies have influenced society over time

*Career Readiness, Life Literacies, and Key Skills*

- 9.2.8.CAP.10: Evaluate how careers have evolved regionally, nationally, and globally.
- 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.
- 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.

| Overview of Activities | Teacher's Guide/Resources | Core Instructional Materials | Technology Infusion |
|---|---|---|---|
| 1. **Thermal Energy Classwork/Homework**<br>2. **Lab 1: Temperature and KE**<br>3. **Lab 2: Thermal Energy Transfer**<br>4. **Lab 3: Conductors and Insulators**<br>5. **Lab 4: Thermal Energy Transfer 2**<br>6. **Lab 5: Thermodynamics** | 1. **Thermal Energy Classwork/Homework Answers Guide**<br>2. **Thermal Energy SMART Notebook Notes**<br>3. **NJCTL.com**<br>4. **Legends of Learning**<br>5. **Edpuzzle**<br>6. **Thermal Energy Pacing Guide** | 1. **Thermal Energy SMART Notebook Notes**<br>2. **Thermal Energy Classwork/Homework**<br>3. **Labs** | 1. **SMARTboard Applications**<br>2. **Google Applications**<br>3. **Legends of Learning**<br>4. **Edpuzzle** |

| Formative Assessment Plan | Summative Assessment Plan |
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| Formative assessment informs instruction and is on going through a unit to determine how students are progressing with | Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit. |

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| the high expectations of standards.<br><br>**Suggested activities to assess student progress:**<br>Daily Science Starters<br>Daily/Weekly Classwork & Homework Completion<br>Kahoot!<br>Rubric-for projects<br>Self-reflection | **Final Assessments:**<br>Quiz 1 - Temperature and Kinetic Energy<br>Quiz 2 - Thermal Energy Transfer<br>Quiz 3 - Thermal Energy Transfer part 2<br>Quiz 4 - Thermodynamics<br>Test - Thermal Energy Test |

| **Differentiation** | | | |
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| **Special Education** | **ELL** | **At Risk** | **Gifted and Talented** |
| • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• The students will be given study guides for tests<br>• Students will be given notes for quizzes<br>• Projects will be modified for students who need it to be.<br>• Homework is also modified for those students who need it.<br>• Students will be given extra time to complete all assignments.<br>• All quizzes and tests have been modified for the students to meet their needs.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. | • Provide ELL students with multiple literacy strategies.<br>• Rosetta Stone<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. | • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• Students will be given extra time to complete all assignments.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. | • Allow students to provide additional support for students struggling (peer teaching)<br>• Expanded learning projects to further student understanding<br>• Student teaching lessons<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and |

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| • Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>• Use project-based science learning to connect science with observable phenomena.<br>• Structure the learning around explaining or solving a social or community-based issue.<br>• Collaborate with after-school programs or clubs to extend learning opportunities. | • Translate printed communications for parents in native language<br>• Hold conferences with translator present<br>• Review Special Education listing for additional recommendations | • Make modifications to instructional plans based on I and RS Plan. | multiple ways to demonstrate their understandings.<br>• Use project-based science learning to connect science with observable phenomena.<br>• Promote self-initiated and self-directed learning and growth.<br>• Enable students to explore continually changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world. |

| **Marking Period** | **1** | **Unit Title** | **The Electromagnetic Spectrum** | **Pacing** | **30 days** |
|---|---|---|---|---|---|

**Unit Summary:** In this unit of study, students *develop and use models, use mathematical thinking,* and *obtain, evaluate, and communicate information* in order to describe and predict characteristic properties and behaviors of waves. Students also apply their understanding of waves as a means of sending digital information. The crosscutting concepts of *patterns* and *structure and function*

are used as organizing concepts for these disciplinary core ideas. Students *develop and use models, use mathematical thinking,* and *obtain, evaluate, and communicate information.* Students are also expected to use these practices to demonstrate understanding of the core ideas.

**Knowledge -** By the end of this unit, students will know:

- The source of waves
- The parts of a wave including wavelength, amplitude, frequency, crest, trough, and equilibrium position.
- The calculation of a wave's velocity.
- How pitch and loudness are a function of a wave's structure.
- The behavior of waves according to the law of reflection.
- The speed and direction of a wave changes when it undergoes refraction.
- Waves spread out as they pass through an opening during diffraction.
- Waves can add up to become stronger and cancel each other out during constructive and destructive interference.
- Sound is caused by a vibrating object and requires a medium to move.
- Smaller objects produce higher pitched sounds.
- Loudness is a measure of the amplitude of a wave and is measured in decibels.
- Sound waves vibrate parts of the ear and the ear sends that information to the brain during hearing.
- The speed of sound varies in air according to the temperature of the air.
- The pitch of a sound wave is affected by a sound source in motion and this is called the Doppler Effect.
- How electromagnetic radiation acts as a wave
- The different types of electromagnetic radiation that compose the electromagnetic spectrum
- The different interactions of radiation with matter, including reflection, absorption and refraction
- How we perceive different colors

**Skills -** By the end of this unit, students will be able to:

- Describe the source of a wave.
- Label diagrams of basic sound waves.
- Calculated the velocity of a wave utilizing the wave equation.
- Label and explain diagrams of refraction.
- Label and explain diagrams of diffraction.
- Sketch and explain constructive and destructive interference.
- Describe the source of a longitudinal sound wave as cause by a vibrating object.
- Label longitudinal waves parts including compressions and rarefactions and relate a vibrating object to the source of each part.
- Relate the frequency of a sound wave to the observed pitch of that wave.
- Relate the amplitude of a sound wave to the observed loudness of that wave.
- Describe the basics of hearing and the structure of the outer, middle, and inner ear.
- Describe how the speed of sound is affected on warmer and cooler days.
- Describe the observed pitch that originates from a moving sound source.
- Describe the arrangement of sound waves produced when a sound source is moving faster than the speed of sound.
- Complete calculations based on wavelength, frequency and energy
- Differentiate between the different properties and uses of electromagnetic radiation
- Compare and contrast specular and diffuse reflection
- Explain how absorption results in changes in temperature of objects and different perceived colors

- Explain how refraction occurs and estimate angles of reflection and refraction

## Essential Questions:

1. What causes a wave?
2. What are the basic "parts" of a wave?
3. What are the properties that all waves exhibit?
4. What is a mechanical wave?
5. How do pitch and loudness correspond to the structure of a wave?
6. How does the Human ear detect sound?
7. What happens to the pitch of a sound wave when the sound source is in motion?
8. What happens to the sound waves of a plane that travels faster than the speed of sound?
9. What is radiation?
10. How are light waves and mechanical waves different?
11. What is the relationship between wavelength, frequency and energy of electromagnetic radiation?
12. What are the different types of electromagnetic radiation?
13. What are the different types of reflection?
14. How does the absorption of light result in the different colors that we see?
15. How do objects refract through different mediums?

## NGSS 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.

## Interdisciplinary Connections/Including 21st Century Themes and Skills:

*English Language Arts/Literacy-*

- Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3) **RST.6-8.1**
- Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3) **RST.6-8.2**
- Compare and contrast the information gained from experiments, simulations, videos, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3) **RST.6-8.9**
- Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3) **WHST.6-8.9**

- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS4-1),(MS-PS4-2) **SL.8.5**

*Mathematics*

- Reason abstractly and quantitatively. (MS-PS4-1) **MP.2**
- Model with mathematics. (MS-PS4-1) **MP.4**
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1) **6.RP.A.1**
- Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1) **6.RP.A.3**
- Recognize and represent proportional relationships between quantities. (MS-PS4-1) **7.RP.A.2**
- 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) **8.F.A.3**

21st Century Themes and Skills

*Computer Science and 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.ITH.2: Compare how technologies have influenced society over time

*Career Readiness, Life Literacies, and Key Skills*

- 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.
- 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.

| Overview of Activities | Teacher's Guide/Resources | Core Instructional Materials | Technology Infusion |
|---|---|---|---|
| 1. **Wave Properties/ Electromagnetic Spectrum Classwork/Homework**<br>2. **Lab 1: Slinky**<br>3. **Lab 2: Wave Equation**<br>4. **Lab 3: Tuning Fork**<br>5. **Lab 4: Doppler Effect Simulation**<br>6. **Lab 5: Light Intensity versus Distance**<br>7. **Lab 6: Scaling the Electromagnetic Spectrum**<br>8. **Lab 7: Spectroscopy**<br>9. **Lab 8: Bending of Light Virtual Lab** | 1. **Wave Properties/ Electromagnetic Spectrum Classwork/Homework Answers Guide**<br>2. **Wave Properties/ Electromagnetic Spectrum SMART Notebook Notes**<br>3. **NJCTL.com**<br>4. **Legends of Learning**<br>5. **Edpuzzle**<br>6. **Wave Properties/ Electromagnetic Spectrum Pacing Guides** | 1. **Wave Properties/ Electromagnetic Spectrum SMART Notebook Notes**<br>2. **Wave Properties/ Electromagnetic Spectrum Classwork/Homework**<br>3. **Labs** | 1. **SMARTboard Applications**<br>2. **Google Applications**<br>3. **Legends of Learning**<br>4. **Edpuzzle** |

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| **10. Lab 9: Intensity of Refracted Light Virtual Lab** | | | |

| Formative Assessment Plan | Summative Assessment Plan |
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| Formative assessment informs instruction and is on going through a unit to determine how students are progressing with the high expectations of standards.<br><br>**Suggested activities to assess student progress:**<br>Daily Science Starters<br>Daily/Weekly Classwork & Homework Completion<br>Kahoot!<br>Rubric-for projects<br>Self-reflection | Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.<br><br>**Final Assessments:**<br>Quiz 1 - What is a Wave?<br>Quiz 2 - Parts of a Wave/Wave Equation<br>Quiz 3 - Properties of Waves<br>Quiz 4 - Sound<br>Test - Wave Properties Test<br>Quiz 1 - Electromagnetic Radiation<br>Quiz 2 - Electromagnetic Spectrum<br>Quiz 3 - Interactions with Matter<br>Test - Electromagnetic Spectrum Test |

| Differentiation | | | |
|---|---|---|---|
| **Special Education** | **ELL** | **At Risk** | **Gifted and Talented** |
| • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• The students will be given study guides for tests<br>• Students will be given notes for quizzes<br>• Projects will be modified for students who need it to be.<br>• Homework is also modified for those students who need it. | • Provide ELL students with multiple literacy strategies.<br>• Rosetta Stone<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and | • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• Students will be given extra time to complete all assignments.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to | • Allow students to provide additional support for students struggling (peer teaching)<br>• Expanded learning projects to further student understanding<br>• Student teaching lessons<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. |

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| ● Students will be given extra time to complete all assignments.<br>● All quizzes and tests have been modified for the students to meet their needs.<br>● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).<br>● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Structure the learning around explaining or solving a social or community-based issue.<br>● Collaborate with after-school programs or clubs to extend learning opportunities. | cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Translate printed communications for parents in native language<br>● Hold conferences with translator present<br>● Review Special Education listing for additional recommendations | share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Make modifications to instructional plans based on I and RS Plan. | ● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Promote self-initiated and self-directed learning and growth.<br>● Enable students to explore continually changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world. |

| Marking Period | 1 | Unit Title | Stability and Change on Earth | Pacing | 30 days |
|---|---|---|---|---|---|

**Unit Summary:** Students construct an understanding of the ways that human activities affect Earth's systems. Students use practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts on the development of these resources. Students also understand that the distribution of these resources is uneven due to past and current geosciences processes or removal by humans. The crosscutting concepts of *patterns, cause and effect*, and *stability and change* are called out as organizing concepts for these disciplinary core ideas. In this unit of study students are expected to demonstrate proficiency in *asking questions, analyzing and interpreting data, constructing explanations, and designing solutions.* Students are also expected to use these practices to demonstrate understanding of the core ideas

**Knowledge -** By the end of this unit, students will know:

- Sources of natural resources in terms of the atmosphere, lithosphere, hydrosphere and biosphere
- How humans use natural resources
- Specific examples of natural resources and their uses
- The distribution of natural resources on the planet varies due to different geological processes
- Changes in population affect natural resource consumption and Earth's environment.
- The major impacts on Earth's environment that occur due to natural resource consumption.
- How humans contribute to ecological footprint per capita
- The relationship between biodiversity, human population growth, ecological footprint per capita and economic income of a given population
- Why ecological overshoot is not sustainable in the long term
- The definition and requirement for sustainability
- Examples of sustainable actions that individual and society as a whole can take
- The difference between climate and weather
- How to interpret graphs of long term climate data
- That the greenhouse effect is responsible for making our planet habitable
- How an enhanced greenhouse effect occurs
- That the greenhouse gases most influential to climate change and rising temperatures are caused by burning fossil fuels
- The difference between anthropogenic and natural causes of climate change
- That carbon dioxide is the greenhouse gas that humans emit the most of through electricity production and transportation
- The major impacts of global climate change
- How climate scientists obtain historical records of our atmosphere
- The role of the Intergovernmental Panel on Climate Change (IPCC) in global climate change
- The difference between mitigation and adaptation strategies as they relate to climate change
- Technologies and behaviors that can be used or implemented to reduce the rate at which climate change is happening

**Skills -** By the end of this unit, students will be able to:

- Define natural resources
- Identify forms of natural resources and distinguish between each in terms of their source.
- Describe how natural resources play a role in society
- Explain how the distribution of various natural resources were shaped by past and current geological processes
- Describe how the population has changed in the last several decades and what impact this has on natural resource consumption and the Earth's environment.
- Identify and describe specific impacts of human natural resource consumption. Including land depletion through deforestation and agriculture, depletion of aquifers, pollution of land and air via mining, agriculture and burning of fossil fuels and global warming from deforestation and fossil fuel burning.
- Explain how the rate of change in ecological footprint is related to the rate of change in population growth and a country's economic income.
- Describe how the planet's biodiversity is linked to human population and ecological footprint per capita.
- Explain why long term ecological overshoot is detrimental to the planet and its inhabitants.
- Describe what actions people in a society can take to lessen ecological overshoot.
- Describe sustainable actions/technologies and identify how it benefits the planet
- Identify examples of climate versus weather
- Distinguish climate from weather using scenarios and graphs
- Describe what happens to incoming solar radiation once it reaches Earth's atmosphere?
- Identify greenhouse gases and their role in climate change
- Identify and describe anthropogenic sources of climate change
- Identify and describe natural sources of climate change
- Relate the cause and effects of climate change impacts.
- Describe the role of ice cores in climate science.
- Explain the function of the IPCC versus governmental policy makers.
- Describe specific examples of mitigation and adaptation strategies in different governmental sectors (i.e. human health, ecosystems, etc.) in the face of climate change

**Essential Questions:**

1. What is a natural resource?
2. What makes a natural resource renewable? Non-renewable?
3. Where do natural resources come from?
4. How are natural resources used in society? What are some examples?
5. Why does the distribution of natural resources vary across the globe?
6. Is there a correlation between natural resource consumption and population growth?
7. Can a renewable resource ever be depleted?
8. What impacts do humans have on Earth's environment when we gather and use natural resources?
9. What is the relationship between ecological footprint per capita, human population growth, economic income and changes in biodiversity?
10. Why is an ecological overshoot harmful to the planet?
11. What does it mean to be sustainable?
12. What are some examples of sustainable activities and technologies?
13. How does sustainability benefit both people and the planet?
14. Is being sustainable an individual effort or a global effort? Why?

15. What is climate and how does it compare to weather?
16. What are temperature anomalies and what does this mean in terms of climate?
17. What causes the climate and weather on Earth?
18. What is the difference between longwave and shortwave radiation and how do they impact the Earth's atmosphere?
19. What causes global climate change?
20. How does global climate change impact society?
21. How do scientists know what the past climate was like?
22. What are some technologies and behaviors that will help to reduce climate change?

## NGSS Standards:

- **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.
- **MS-ESS3-3 -** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ESS3-4 -** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- **MS-ESS3-5 -** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

## Interdisciplinary Connections/Including 21st Century Themes and Skills:

*English Language Arts/Literacy-*

- Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-1),(MS-ESS3-2) **RST.6-8.1**
- 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-ESS3-2) **RST.6-8.7**
- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS3-1) **WHST.6-8.2**
- Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1) **WHST.6-8.9**

*Mathematics*

- Reason abstractly and quantitatively. (MS-ESS3-2) **MP.2**
- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-1),(MS-ESS3-2) **6.EE.B.6**
- 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-ESS3-1),(MS-ESS3-2) **7.EE.B.4**

21st Century Themes and Skills

*Computer Science and 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.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs
- 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
- 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.

*Career Readiness, Life Literacies, and Key Skills*

- 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem
- 9.4.8.IML.14: Analyze the role of media in delivering cultural, political, and other societal messages.
- 9.4.8.IML.10: Examine the consequences of the uses of media
- 9.4.8.IML.9: Distinguish between ethical and unethical uses of information and media
- 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change
- 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose
- 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

| Overview of Activities | Teacher's Guide/Resources | Core Instructional Materials | Technology Infusion |
|---|---|---|---|
| 1. **Stability and Change on Earth Classwork/Homework**<br>2. **Lab 1: Natural Resource Activity**<br>3. **Lab 2: Mapping Our Human Footprint Activity**<br>4. **Lab 3: Sustainable Solutions for Cities Project**<br>5. **Lab 4: Minimizing Human Impact Research Project**<br>6. **Lab 5: The Greenhouse Effect Model**<br>7. **Lab 6: Analyzing an Ice Core**<br>8. **Lab 7: Be a Part of the Solution** | 1. **Stability and Change on Earth Classwork/Homework Answers Guide**<br>2. **Stability and Change on Earth SMART Notebook Notes**<br>3. **NJCTL.com**<br>4. **Legends of Learning**<br>5. **Edpuzzle**<br>6. **Stability and Change on Earth Pacing Guides** | 1. **Stability and Change on Earth SMART Notebook Notes**<br>2. **Stability and Change on Earth Classwork/Homework**<br>3. **Labs** | 1. **SMARTboard Applications**<br>2. **Google Applications**<br>3. **Legends of Learning**<br>4. **Edpuzzle** |

| Formative Assessment Plan | Summative Assessment Plan |
|---|---|
| Formative assessment informs instruction and is on going through a unit to determine how students are progressing with the high expectations of standards.<br><br>**Suggested activities to assess student progress:** | Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.<br><br>**Final Assessments:**<br>Quiz 1 - Natural Resources |

| | |
|---|---|
| Daily Science Starters<br>Daily/Weekly Classwork & Homework Completion<br>Kahoot!<br>Rubric-for projects<br>Self-reflection | Quiz 2 - Distribution and Consumption<br>Quiz 3 - Human Impact<br>Test - Natural Resources and Human Impact Test<br>Quiz 1 - Climate and Greenhouse Effect<br>Quiz 2 -Causes of Climate Change<br>Quiz 3 - Climate Change Impacts<br>Quiz 4 - Reducing Climate Change<br>Test - Global Climate Change Test |

| **Differentiation** | | | |
|---|---|---|---|
| **Special Education** | **ELL** | **At Risk** | **Gifted and Talented** |
| • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• The students will be given study guides for tests<br>• Students will be given notes for quizzes<br>• Projects will be modified for students who need it to be.<br>• Homework is also modified for those students who need it.<br>• Students will be given extra time to complete all assignments.<br>• All quizzes and tests have been modified for the students to meet their needs.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. | • Provide ELL students with multiple literacy strategies.<br>• Rosetta Stone<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. | • Teacher's aide will read to the students as needed<br>• Students can type or speech to text notes.<br>• Students will be given extra time to complete all assignments.<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. | • Allow students to provide additional support for students struggling (peer teaching)<br>• Expanded learning projects to further student understanding<br>• Student teaching lessons<br>• Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.<br>• Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>• Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and |

| | | | |
|---|---|---|---|
| ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).<br>● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).<br>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Structure the learning around explaining or solving a social or community-based issue.<br>● Collaborate with after-school programs or clubs to extend learning opportunities. | ● Translate printed communications for parents in native language<br>● Hold conferences with translator present<br>● Review Special Education listing for additional recommendations | ● Make modifications to instructional plans based on I and RS Plan. | multiple ways to demonstrate their understandings.<br>● Use project-based science learning to connect science with observable phenomena.<br>● Promote self-initiated and self-directed learning and growth.<br>● Enable students to explore continually changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world. |