

# Unit: Adaptations

Content Area: **Science**  
Course(s): **Integrated Science 8**  
Time Period: **1 marking period**  
Length: **13 Weeks**  
Status: **Published**

## Unit Overview

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Students will explore how scientists use the evidence found in rocks to build a time line of Earth's history.

Students will learn how fossils form and how evidence from fossils is used to describe key patterns in the history of life.

Students will demonstrate how populations of living things change over time, and how they become better suited to living and reproducing in their environments.

Students will learn how humans impact life on Earth.

Students will survey human impacts on Earth and Earth's species and collect evidence on how to address these impacts.

## Transfer

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Students will be able to independently use their learning to...

- Use various phenomena to explain Earth's history and the history of life on Earth.
- Use examples of features of living things to explain how it allows them to successfully survive and reproduce in their environment.
- Explain how changes in the environment impact populations of living things.
- Understand the impact of human technology on food, genetics, and populations.

## Meaning

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## Understandings

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Students will understand ...

## Chapter 1

How scientists use the evidence found in rocks to build a time line of the Earth's history

How fossils form and how evidence from fossils is used to describe key patterns in the history of life, such as mass extinctions and changes in living things over time

How to combine information from different fossil sites around the world, looking for patterns

## Chapter 2

How whales lost their legs and end up with flippers

How populations of living things change over time and how they become better suited to living and reproducing in their environments

Make an argument about the history of whales based on the collection of whale fossils and the interpretation of data

## Chapter 3

How humans impact life on Earth

How humans have been shaping the of organisms for thousands of years through breeding programs and genetic technologies

How to survey human impacts on Earth and Earth's species and collect evidence for a debate on how humans should address these impacts

## **Essential Questions**

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### Chapter 1

- How do scientists learn about Earth's history, and what have they learned?
- What do fossils reveal about the history of life on Earth?

### Chapter 2

- How can the traits found in a population of living things change over time?
- Where can scientists see natural selection happening?
- Where does the variation needed for evolution through natural selection come from?
- What kinds of evidence help scientists figure out how Earth's organisms are related to one another?

### Chapter 3

- How can humans influence the evolution of living things?
- How can genetic engineering change how humans live?
- How do humans affect Earth's systems?

## **Application of Knowledge and Skill**

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### **Students will know...**

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#### Chapter 1

How scientists use the evidence found in rocks to build a time line of the Earth's history

How fossils form and how evidence from fossils is used to describe key patterns in the history of life, such as mass extinctions and changes in living things over time

How to combine information from different fossil sites around the world, looking for patterns

#### Chapter 2

How whales lost their legs and end up with flippers

How populations of living things change over time and how they become better suited to living and reproducing in their environments

Make an argument about the history of whales based on the collection of whale fossils and the interpretation of data

#### Chapter 3

How humans impact life on Earth

How humans have been shaping the of organisms for thousands of years through breeding programs and genetic technologies

How to survey human impacts on Earth and Earth's species and collect evidence for a debate on how humans should address these impacts

## **Students will be skilled at...**

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Students will be skilled at...

- Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) and other media that will be useful in answering a scientific question.
- Develop models that will describe various scientific phenomena
- Make observations from several sources to construct an evidence-based account for natural phenomena.
- Compare and critique multiple solutions to a problem.
- Analyze data to determine if tests and/or tools are working as intended.
- Observe and construct explanations of various scientific phenomena relating to populations of various organisms.

## **Academic Vocabulary**

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### **Learning Goal 1 (Chapter 1)**

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Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

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.

SCI.MS-LS4-1

Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

### **Target 1 (Lesson 1)**

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Students will analyze data and construct explanations for patterns found in the fossil record.

## **Target 2 (Lesson 2)**

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Explore the skeletons of modern organisms along with fossils found in different strata to identify similarities and differences across organisms and make arguments based on evidence.

## **Learning Goal 2 (Chapter 1)**

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Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

SCI.MS-ESS1-4

Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

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.

## **Target 1 (Lesson 1)**

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Students will analyze data and construct explanations for patterns found in the fossil record.

## **Target 2 (Lesson 3)**

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Develop a model based on specific criteria and constraints, in order to understand how to extract fossils.

### **Learning Goal 3 (Chapter 2)**

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Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

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.

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.

SCI.MS-LS3-1

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

### **Target 1 (Lesson 2)**

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Model natural selection in different environments, then explore how species have adapted to changes in their environments.

### **Target 2 (Lesson 3)**

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Model genes, proteins, and genetic mutations that affect proteins.

### **Learning Goal 4 (Chapter 2)**

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Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

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.

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.

SCI.MS-LS4-2

Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

### **Target 1 (Lesson 4)**

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Match fossils with their closest modern day organisms and explore multiple ways to tell that two organisms may have common ancestry. Then, use data to produce an argument to support a theory of evolution.

### **Learning Goal 5 (Chapter 2)**

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Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy

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.

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.

SCI.MS-LS4-3

Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

### **Target 1 (Lesson 4)**

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Match fossils with their closest modern day organisms and explore multiple ways to tell that two organisms may have common ancestry. Then, use data to produce an argument to support a theory of evolution.

### **Learning Goal 6 (Chapter 2)**

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Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

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.

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.

SCI.MS-LS4-4

Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a

specific environment.

### **Target 1 (Lesson 1, 2)**

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Explore how trait variation relate to survival through simulation to find food and compete for resources in different conditions.

### **Learning Goal 7 (Chapter 2)**

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Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

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.

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.

SCI.MS-LS4-6

Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

### **Target 1 (Lesson 1)**

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Explore how trait variation relates to survival of organisms living under different conditions.

### **Target 2 (Lesson 3)**

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Model genes, proteins, and genetic mutations that affect proteins.

### **Learning Goal 8 (Chapter 3)**

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Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.



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.
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.
SCI.MS-LS4-5	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

### **Target 1 (Lesson 1)**

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Develop an understanding of natural selection and artificial selection on a population by studying an organism bred by artificial selection.

### **Target 2 (Lesson 2)**

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Discuss the ideas behind transferring one organism's genes to another.

### **Learning Goal 9 (Chapter 3)**

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Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

SCI.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.
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.
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.

### **Target 1 (Lesson 2)**

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Discuss the ideas behind transferring one organism's genes to another.

### **Target 2 (Lesson 3)**

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Model how humans impact their environment and how populations are affected by resource competition.

## **Target 3 (Lesson 4)**

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Design a solution for a local environmental problem in order to understand how human populations impact natural resources and Earth's systems.

### **Formative Assessment and Performance Opportunities**

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Chapter 1: Analyzing a fossil dig site

Chapter 2: Evolutionary history of whales

Chapter 3: Bioethics debate

#### **Lesson Game**

Students test their understanding of key concepts with an educational game.

#### **Interactive Tutorial**

Students can work independently to check their understanding in a safe environment that provides instant feedback but is not graded.

#### **Interactive Student Notebook**

Students record their understanding of both the reading and activity. Review during the lesson to gauge student understanding.

#### **Vocabulary Cards**

Students check their understanding of key vocabulary terms with digital flip cards.

#### **Class Participation/Discussion Questions**

Throughout the lesson students will have opportunities embedded in the lesson to check for student understanding.

## Summative Assessment

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NJSLS-Science Designed Lesson Assessments:

- Earth's history
- Fossils and the history of life
- Darwin's theory of evolution through natural selection
- Observing natural selection in action
- Genes and natural selection
- Evolutionary relationships
- Artificial selection
- Genetic engineering and society
- Human population and global change

LinkIt Common Assessment

## Accommodations/Modifications

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### Quicker Coverage

Share Models as a Class. Consider skipping the final step of pairs meeting to compare products, and ending with a class discussion of the various models and histories. This will save time by avoiding class reorganization and by allowing you to keep the comparative discussions focused. At the same time, it will expose students to a greater variety of models and histories that were produced throughout the class.

Eliminate the Stations. Consider completing the station activities from Investigation 1 as class demonstrations with student volunteers to save time. You can call up student volunteers to participate in the 10-second rounds and then as a class, keep track of how each tool performs.

### Deeper Coverage

Find More Patterns. Have students study the timeline of fossils over Earth's 4.6 billion year history from Investigation 2. Ask each student to write out five questions with answers that depend on seeing the patterns in this history. Then have students pair up to quiz each other by taking turns as one student reads a list of questions and the other student answers.

Expand the Game. Then ask students to design a game that would show how populations change when you consider two factors: having successful mouthparts gets you more food, and this often leads to more time and energy to have more offspring. Tell them to include at least three generations of rounds in their game. They

can write out the rules to their game, and if you have time you could consider even letting students play their games in groups.

**Reinforce Vocabulary** Before beginning the lesson, review the vocabulary from the reading. Pre-teach words like *natural selection*, *adaptation*, and *evolution*. Make a point of helping students understand the difference between natural selection and evolution. The similarity in concept can sometimes confuse students trying to establish whether they mean the same thing. Also, introduce students to *genetic variation*. Remind students what genes are and explain that genes are responsible for traits.

Research risks of artificial selection

## English Language Learners

**Pre-teach Relative and Absolute Dating.** Understanding the terms *relative* and *absolute dating* ahead of time can help students distinguish between the goals of each investigation in the lesson. Ask students to think of several ways to use *relative* in a sentence. Then ask them to use *absolute* in a sentence, such as "It is *absolutely* true that I am freezing cold!" Ask them if there is a comparison being made with this use of the term and make sure they understand that there is not. Note that some students might be confused that absolute dating requires a comparison of the proportion of two elements. Remind them that it does not require a comparison of more than one fossil or rock sample.

**Reinforce Vocabulary.** Before beginning the lesson, review the vocabulary from the reading. Pre-teach words like *natural selection*, *adaptation*, and *evolution*. Also, introduce students to *genetic variation*. Remind students what genes are and explain that genes are responsible for traits.

Research in native language

## Learners Reading and Writing Below Grade Level

**Read Handouts Aloud.** Have different students read each segment aloud. The reading can be divided either within groups or among the class.

**Outline the Explanation.** Tell students they can prepare their explanation in outline form rather than writing a full paragraph of complete sentences. Make sure they include a Claim, Evidence, and Reasoning in their explanation.

Provide copy of readings

## Learners with Special Education Needs

**Make Calculations as a Class.** This will allow you to walk students through how to calculate a percentage and compare this to the graph that allows interpretation of these data for absolute dating. That way you'll be able to note if some students are having trouble following the math or the graphing and give more time to explaining these parts of the activity.

Show Videos to Help Comprehension. Search for videos online showing birds eating different kinds of food.

Assist with analyzing sources.

## **Advanced Learners**

Trace Fossils. Ask students to conduct research on trace fossils. Ask students to find examples of trace fossils and write how they think trace fossils form, and whether they follow the same rules of how location and composition give clues to the time of origin that are discussed in this lesson.

Create a Word Game Have students take the vocabulary terms from this lesson and create a word game for using these terms: trait, population, genetic variation, natural selection, evolution, and adaptation. They could make a crossword puzzle with clues for each word, a paragraph that uses each of the words with fill-in-the-blanks, or a quiz game using these terms. Give students a chance to exchange and play each other's games.

Modify the game

## **Enhanced Learning**

Utilize TCI videos and websites to enhance lessons.

Discuss current events related to the lesson.

## **Unit Resources**

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TCI Online Manual/ Materials

Vocabulary Cards

TCI Kit

Student Textbook

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

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## **Interdisciplinary Connections**

LA.W.8.1.A	Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.8.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
LA.W.8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
LA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
LA.W.8.2.A	Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).
LA.W.8.2.B	Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
LA.W.8.2.C	Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
LA.W.8.2.F	Provide a concluding statement or section that follows from and supports the information or explanation presented.
LA.RI.8.1	Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RI.8.2	Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.
LA.RI.8.3	Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories).
LA.RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
MA.6.EE.B.6	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.
MA.6.EE.C.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
MA.6.NS.C.7b	Write, interpret, and explain statements of order for rational numbers in real-world contexts.
MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.6.RP.A.3d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
MA.6.SP.B.5b	Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.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.
MA.8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems

where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.