**7th Grade Launch Unit**

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| **Unit Topic: Energy/Conservation**  **Estimated Time: 2 Weeks**  **This Launch Unit was designed to address a possible learning gap between 6th Grade Science and 7th Grade Science.** | | | | |
| **Standards** | | | | |
| S6E6. Obtain, evaluate, and communicate information about the uses & conservation of various natural resources and how they impact the Earth.  a. Ask questions to determine the differences between renewable/sustainable energy resources  b. Design and evaluate solutions for sustaining the quality and supply of natural resources such as water, soil, and air.  c. Construct an argument evaluating contributions to the rise in global temperatures over the past century.  [Click here to see the Energy and Conservation Learning Progression – Appendix A](#appendixA) | | | | |
| **Science and Engineering Practices & Crosscutting Concepts:** [See Appendix B](#AppendixB) | | | | |
| **Teacher Background Knowledge** | | | | |
| Earth and Human Activity:  Earth’s surface processes affect and are affected by human activities. Humans depend on all of the planet’s systems for a variety of resources, some of which are renewable or replaceable and some of which are not. Natural hazards and other geological events can significantly alter human populations and activities. Human activities, in turn, can contribute to the frequency and intensity of some natural hazards. Indeed, humans have become one of the most significant agents of change in Earth’s surface systems. In particular, it has been shown that climate change—which could have large consequences for all of Earth’s surface systems, including the biosphere—is driven not only by natural effects but also by human activities. Sustaining the biosphere will require detailed knowledge and modeling of the factors that affect climate, coupled with the responsible management of natural resources.  Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources, including air, water, soil, minerals, metals, energy, plants, and animals. Some of these resources are renewable over human lifetimes, and some are nonrenewable (mineral resources and fossil fuels) or irreplaceable if lost (extinct species).  Materials important to modern technological societies are not uniformly distributed across the planet (e.g., oil in the Middle East, gold in California). Most elements exist in Earth’s crust at concentrations too low to be extracted, but in some locations—where geological processes have concentrated them—extraction is economically viable. Historically, humans have populated regions that are climatically, hydrologically, and geologically advantageous for freshwater availability, food production via agriculture, commerce, and other aspects of civilization. Resource availability affects geopolitical relationships and can limit development. As the global human population increases and people’s demands for better living conditions increase, resources considered readily available in the past, such as land for agriculture or drinkable water, are becoming scarcer and more valued.  All forms of resource extraction and land use have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors—for example, scientific modeling of the long-term environmental impacts of resource use can help identify potential problems and suggest desirable changes in the patterns of use. Much energy production today comes from nonrenewable sources, such as coal and oil. However, advances in related science and technology are reducing the cost of energy from renewable resources, such as sunlight, and some regulations are favoring their use. As a result, future energy supplies are likely to come from a much wider range of sources.  BioGeology/Global Climate Change:  Evolution, including the emergence and extinction of species, is a natural and ongoing process that is shaped by Earth’s dynamic processes. The properties and conditions of Earth and its atmosphere affect the environments and conditions within which life emerged and evolved—for example, the range of frequencies of light that penetrate the atmosphere to Earth’s surface. Organisms continually evolve to new and often more complex forms as they adapt to new environments. The evolution and proliferation of living things have changed the makeup of Earth’s geosphere, hydrosphere, and atmosphere over geological time. Plants, algae, and microorganisms produced most of the oxygen (i.e., the O2) in the atmosphere through photosynthesis, and they enabled the formation of fossil fuels and types of sedimentary rocks. Microbes also changed the chemistry of Earth’s surface, and they continue to play a critical role in nutrient cycling (e.g., of nitrogen) in most ecosystems.  Organisms ranging from bacteria to human beings are a major driver of the global carbon cycle, and they influence global climate by modifying the chemical makeup of the atmosphere. Greenhouse gases in particular are continually moved through the reservoirs represented by the ocean, land, life, and atmosphere. The abundance of carbon in the atmosphere is reduced through the ocean floor accumulation of marine sediments and the accumulation of plant biomass; atmospheric carbon is increased through such processes as deforestation and the burning of fossil fuels.  As Earth changes, life on Earth adapts and evolves to those changes, so just as life influences other Earth systems, other Earth systems influence life. Life and the planet’s nonliving systems can be said to co-evolve.  Global climate change, shown to be driven by both natural phenomena and by human activities, could have large consequences for all of Earth’s surface systems, including the biosphere (see [ESS3.C](https://www.nap.edu/read/13165/chapter/11#ess3.c) for a general discussion of climate). Humans are now so numerous and resource dependent that their activities affect every part of the environment, from outer space and the stratosphere to the deepest ocean.  However, by using science-based predictive models, humans can anticipate long-term change more effectively than ever before and plan accordingly. Global changes usually happen too slowly for individuals to recognize, but accumulated human knowledge, together with further scientific research, can help people learn more about these challenges and guide their responses. For example, there are historical records of weather conditions and of the times when plants bloom, animals give birth or migrate, and lakes and rivers freeze and thaw. And scientists can deduce long-past climate conditions from such sources as fossils, pollen grains found in sediments, and isotope ratios in samples of ancient materials.  Scientists build mathematical climate models that simulate the underlying physics and chemistry of the many Earth systems and their complex interactions with each other. These computational models summarize the existing evidence, are tested for their ability to match past patterns, and are then used (together with other kinds of computer models) to forecast how the future may be affected by human activities. The impacts of climate change are uneven and may affect some regions, species, or human populations more severely than others.  Climate models are important tools for predicting, for example, when and where new water supplies will be needed, when and which natural resources will become scarce, how weather patterns may change and with what consequences, whether proposed technological concepts for controlling greenhouse gases will work, and how soon people will have to leave low-lying coastal areas if sea levels continue to rise. Meanwhile, important discoveries are being made—for example, about how the biosphere is responding to the climate changes that have already occurred, how the atmosphere is responding to changes in anthropogenic greenhouse gas emissions, and how greenhouse gases move between the ocean and the atmosphere over long periods. Such information, from models and other scientific and engineering efforts, will continue to be essential to planning for humanity’s—and the global climate’s—future.  It is important to note that although forecasting the consequences of environmental change is crucial to society, it involves so many complex phenomena and uncertainties that predictions, particularly long-term predictions, always have uncertainties. These arise not only from uncertainties in the underlying science but also from uncertainties about behavioral, economic, and political factors that affect human activity and changes in activity in response to recognition of the problem. However, it is clear not only that human activities play a major role in climate change but also that impacts of climate change—for example, increased frequency of severe storms due to ocean warming—have begun to influence human activities. The prospect of future impacts of climate change due to further increases in atmospheric carbon is prompting consideration of how to avoid or restrict such increases.  Resource: "7 Dimension 3: Disciplinary Core Ideas - Earth and Space Sciences." National Research Council. 2012. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press. doi: 10.17226/13165. | | | | |
| **Big Ideas/Enduring Understandings:**   * The Sun serves as the primary source of energy for Earth’s climate system. * Earth’s climate system is regulated by complex interactions of biotic and abiotic factors. * Earth’s climate system varies as a result of both natural and human-made processes. * Understanding climate systems is improved through observations, studies, and modeling. * Global climate change will impact human lives. | | **Essential Questions:**   * How do human *needs* effect Earth? * How do human *wants* effect Earth? * How do people model and predict the effects of human activity on Earth? | | |
| **Vocabulary: (Synonymous to Concepts)**  renewable (sustainable) resources non-renewable resources  biosphere atmosphere biotic factors  abiotic factors weather climate  global climate change scientific model | | | | |
| **Literature Connections:** | | **STEM Career Connections:** | | |
| **Materials and Safety Considerations:**  \*\*Lessons are designed with simplicity in mind. Full materials lists and safety considerations can be found if you look below for “Click here for full lesson.” | | **Distance Learning Options:**  \*\*Pieces of the lessons that can easily be adapted or used as-is for distance learning are highlighted below | | |
| **Lesson Components** | | | | |
| **PHENOMENA**  **(*Storyline Approach to Transitioning into Life Science Unit 1: Cell Structure & Function*** | | | | |
| ***Topic 1 Water Wars Map 2010-present***    (Source: <http://worldwater.org/conflict/map/>) | | | ***Topic 2***      (Source: <https://www.washingtonpost.com/graphics/2019/national/climate-environment/climate-change-america/>) | |
| **ENGAGE** | | | | |
| ***Topic 1*** limitations of natural resources | | | ***Topic 2*** **renewable energy resources 🡪** climate change | |
| Without being informed of what is represented in the sequence of [maps](https://cobbk12org-my.sharepoint.com/personal/amy_gilbert_cobbk12_org/Documents/PrePlanning%20PD%20Resources/Maps%20of%20Water%20War%20Conflicts%20Over%20Time.pptx?web=1) (water conflicts over time), students study the data that is provided (date range, location, quantity) to identify patterns (location) and make predictions about what can be expected to occur in the future (increase or decrease in dots). (Source: <http://worldwater.org/conflict/map/>)  Students then informed that each of the dots represents an area where people are in conflict of water resources (i.e. water wars). Students re-examine the trends associated with location and quantity. Students generate a list of questions about the water conflict patterns. Possible student questions:  *Why are there so many water conflicts centered around the Indian Ocean?*  *We noticed there is a water conflict in Georgia. What is it?*  Students then asked to brainstorm a list of all resources that humans and other living things need in order to live/thrive in their environments. Students asked to simultaneously categorize these things as either needs or wants:   |  |  | | --- | --- | | ***Needs*** | ***Wants*** | | Food (other plants, animal, fungi, bacteria) | Technology (refrigerator, WiFi, entertainment) | | Ample, Clean Space (Home/Shelter) | Transportation (fuel/oil) | | Clean Air | Energy/Electricity |   Students then challenged to ask questions about and/or consider limitations on their ***needs***. Provide time for students to work in the alone zone, and then with partners to consider resource limitations.  After appropriate time, ask student volunteers to share their scenarios of how/when a living things’ needs may be limited. If a volunteer shares a human example, ask the class to talk with partners about a possible example with a different kind of living thing. Again, ask volunteers to share their thoughts.  *Teacher Note:* Use talk moves that encourage all students to make their thinking visible.  *Teacher Note:* If students do not consider a variety of living things, consider providing additional examples. Example Discourse:  Student 1: *My partner and I thought about times when we are at home and all the family comes over. Sometimes it means that there isn’t enough space for everyone. So, some of us will have to play outside or maybe sit at different tables to eat.*  Teacher: *Yes, that example does a good job of illustrating what it can mean when you do not have ample space. What kind of space limitations can you see other animals or plants experiencing? Let me provide a plant example that might help you think of something you know. One time I planted a dozen daffodil bulbs (show image of daffodil/bulbs like the ones below), but only 8 of them actually grew up, turned green, and blossomed. I think this probably happened because they did not all have enough space to grow in their soil, and maybe even because there wasn’t enough space for all of them to get to the sunlight so they could make food.* | | | Show students model of temperature changes in the US *without telling them what is being represented*. As in engaging in Topic 1 provide time for students to study the data provided to identify patterns and make predictions about what can be expected in the future. (Source: <https://www.washingtonpost.com/graphics/2019/national/climate-environment/climate-change-america/>)  Students then informed that the model presents changes in temperature over time in the United States. Students re-examine the trends associated with location and temperature. Students generate a list of questions about the temperature trends. Possible student questions:  *Why is the temperature changing?*  *Why is the temperature changing so much in the Midwest?*  *How did the scientists get this data?*  Students post questions on shared screen space. (Possible Digital Space: <https://jamboard.google.com/d/1bTCK0w4_JKyoh1xl2iF9s-rcPInOEjEzR8XUuBjimn0/edit?usp=sharing> )  Students then re-visit their Needs vs. Wants table from the Engage phase of Topic 1. Make explicit that many of the *wants* are connected to a need for electricity or transportation. Therefore, students will now be learning more about how those energy demands may affect Earth.  *Teacher Note:* Assessing students’ core ideas about *energy* may be needed at this time. A *quick check* on energy could be as simple as a photo splash where students show thumbs up for something that is/has energy or thumbs down for something that is not energy. Or it could be as complex as a card sort. For example:   |  |  | | --- | --- | |  |  | | (rainbow) | (love) | | (battery) | (thinking) | | (food) | (time) | | (metals) | (money) |   To summarize ideas about energy, return student attention to the Jamboard (frame 2) to make their thinking visible:  A close up of a map  Description automatically generated  In transition to the explore phase, remind students of the purpose this lesson: figure out/make sense of the effect of human energy *wants* on Earth. *(EQ: How do human energy wants effect Earth?)*  Ask students to move to frame 3 of the Jamboard, and then record their initial thinking about the EQ:  A picture containing table  Description automatically generated | |
| **EXPLORE** | | | | |
| ***Topic 1*** limitations of natural resources | | | ***Topic 2* renewable energy resources 🡪** climate change | |
| Make explicit that living things (including humans) needs can be more broadly categorized as water, soil, and air. Prompt students to consider why these three categories encompass everything on their needs list. Specifically lead discussion about the interdependence of water, soil, and air on food/nutrition needs.  Possible Discourse Prompt: *Choose any one thing that you like to eat (e.g. pizza). Think through the role of water, soil, and air in you being able to eat pizza.*  Inform students that they will be choosing and becoming an expert in one natural resource in order to answer the question *How do human needs effect Earth?*. Preview the performance task expectations:  As an expert, students will obtain and communicate information to peers, including possible solutions to the limitations of a natural resource. Part of this information must include an overview a conflict/problem associated with the natural resource (past or present).   1. Overview the solution to the conflict. 2. Critique the solution for both its strengths and weaknesses. 3. Design/modify for a different, improved solution.   Upon students making their choice, the exploration is initiated through an article/current event. Example articles linked below:  Water Options:  [*Two Million Americans Still Don’t Have Running Water*](https://newsela.com/read/americans-without-water/id/2000003939/?search_id=fd55e1c2-8844-4a0e-b92d-ffefe1c317de)  [*The Biggest Challenge of the Next Century is the Clean Water Crisis*](https://newsela.com/read/lib-water-crisis-desalination/id/53196/?collection_id=2000000156&search_id=b354b04a-0e2e-44fc-8a93-34457017077d)  Water/Air Option:  [*The Global Reaction to Water and Air Pollution*](https://newsela.com/read/lib-water-air-pollution/id/30937/?collection_id=2000000156&search_id=a8995a0e-44b0-4807-84ae-3ab07bd7a7a1)  Air Option:  [*Air Pollution: How three global cities tackle the problem*](https://www.bbc.com/news/world-50287565)  Soil Option:  [*Dust Bowl*](https://www.history.com/topics/great-depression/dust-bowl) | | | As a class, students watch the video [Georgia Power 101](https://youtu.be/We5c_jlQ5l8). Provide time for students to then watch a second time and organize information into the [graphic organizer](http://www.learningpower.org/content/dam/gpc-learningpower/doc/sixth_grade_in-class_activity_sheet.pdf).  Additional Student Resource (if needed):  <http://sciencenetlinks.com/lessons/renewable-energy-sources/>  HMH Textbook p 589 (Unit 7)  Facilitate student discussion:  *How did you decide which resources would be renewable vs non-renewable?*  *Share with me some of your decisions.*  *(Teacher Note: Use Jamboard frame 4)A screenshot of a social media post  Description automatically generated*  *What unique language did the video use to distinguish these resource types? (finite versus infinite)*  *How did you decide what those words meant?*  *How did that help you figure out/make sense of how to categorize the resources?*  Ticket out the Door/Quick Check: *If I asked you to create an analogy with this new language, how would it read?*  (*Teacher Note: This can serve as a formative assessment. Possible Student Response:* ***Infinite is to Renewable as Finite is to Non-Renewable***)  As transition into the explain phase, students re-evaluate the model presented in the engage phase to further consider what causes may leading to temperature changes:    Students then read the [article](https://www.washingtonpost.com/graphics/2019/national/climate-environment/climate-change-america/) to obtain historical anecdotal information coupled with a preview of scientific processes used to gather temperature data.  *Teacher Note:* Consider creating a comprehension check that corresponds with how the article explains science and engineering practices, cross cutting concepts, and core ideas. | |
| **EXPLAIN** | | | | |
| ***Topic 1*** limitations of natural resources | | | ***Topic 2*** renewable energysources *🡪* ***Climate Change*** | |
| From chosen article students begin to organize needed information for their infographic.  *Teacher Note*: Students will need to obtain additional information to be successful. See HMH Textbook pp 649-662 (Unit 7, Lesson 5)  Possible organizer:  Students then create an infographic, poster or similar type of graphic organizer to communicate/explain their information.  Possible Rubric: <http://science-infographics.org/general-infographic-rubric/>  Options for Digital Platforms:  [www.canva.com](http://www.canva.com)  <https://piktochart.com/formats/infographics/>  *Teacher Note:* Consider displaying/explaining expectations with the use of an exemplar model. | | | Students reflect on the EQ. After time in the alone zone and then with partners, students post any changes to their initial thinking in Jamboard frame 5:  A screenshot of a cell phone  Description automatically generated  Now share the following data with students explaining that the data has been collected by scientists using a variety of methods:    Ask students to write 2 concluding statements from the data and one question.  *Teacher Note: If you noticed students struggling to interpret the earlier model, consider supporting students in interpreting the graph by using the* [*I2 strategy*](https://media.bscs.org/icans/Icans_I2_SE.pdf)*.*  *Teacher Note: Expected students’ responses – Global temperature is rising/increasing. Carbon dioxide levels are rising/increasing. Expected student question – Why is it rising/increasing? Or What is making it go up?*  From anticipated student questions, inform students that they are now going to self-direct their learning in order to construct an argument evaluating contributions to the rise in global temperatures over the past century.  Suggested Resource (complete with guide to CER): <https://www.climategen.org/our-core-programs/climate-change-education/curriculum/next-generation-climate-for-grades-6-8/worksheets/>  Full Curriculum Options:  [Our Changing Climate](https://cobbk12org-my.sharepoint.com/personal/amy_gilbert_cobbk12_org/Documents/Climate-Generation-Our-Changing-Climate.pdf)  [Next Generation Climate](https://cobbk12org-my.sharepoint.com/personal/amy_gilbert_cobbk12_org/Documents/Climate-Generation-Next-Generation-Climate.pdf) | |
| **EXPAND** | | | | |
| ***Topic 1*** limitations of natural resources | | | ***Topic 3*** renewable energysources *🡪* ***Climate Change*** | |
| Students obtain new information about limitations of other natural resources via a gallery walk of their peer’s infographics/posters.   |  |  | | --- | --- | | Natural Resource | Air Water Soil  Mineral \_\_\_\_\_\_ | | Summary of Problem or Conflict  (1 -2 sentences) |  | | Initial Solution  (visual representation, model, or written summary) |  | | Proposed Solution by Peer/Team  (visual representation, model, or written summary) |  | | Advantages of Proposal |  | | Disadvantages of Proposal |  |   In summary, students reflect upon what they have learned about:   * the role of scientists and engineers to maintain the quality and access to needed natural resources, as well as, * how this quality/access would ultimately impact characteristics of ecosystems/Earth. | | | Using the student handout [Climate Change Repercussions](https://cobbk12org-my.sharepoint.com/personal/amy_gilbert_cobbk12_org/Documents/Climate-Change-Repercussions-Research-Project.pdf) students will now consider the effects of activity at the local level on the larger global climate.  Student Prompt as outlined on the handout: *We know that the climate is changing. And we know that humans are contributing to those changes. This activity will help you become familiar with the repercussions (impacts) that the area you live in may be experiencing now or in the future.*  Source: [Our Changing Climate](https://cobbk12org-my.sharepoint.com/personal/amy_gilbert_cobbk12_org/Documents/Climate-Generation-Our-Changing-Climate.pdf)  Summary: Students re-visit the questions they posed both in the engage and explain phases. Students “trade” questions with other classmates. This classmate will then construct an explanation that answers their peer’s question. Students should be able to construct their explanation 3-5 sentences. Students then trade back to their original question, evaluate the response provided by their peer, and provide feedback by either adding to or taking away from the explanation.  *Teacher Note: Consider using student responses as a formative assessment.* | |
| **ADDITIONAL RESOURCES** | | | | |
| **STEM Challenges** | **Science Probes** | **Picture Perfect Sci** | | **Mystery Science** |
| **ASSESSMENT** | | | | |
| ***Topic 1*** limitations of natural resources | | | ***Topic 2*** renewable energy sources 🡪 climate change | |
| Assessment Prompt:  Construct an explanation about the potential impact of the fracking process on natural resources such as air, water, and soil. Ideate a possible solution to at least one negative impact.  Begin assessment by providing time for students to obtain information both in the alone zone and with a partner from the infographic about fracking:    Provide time for students/partnerships to agree upon and write at least one question they would like answered in preparation for their assessment. Collect questions and answer as possible.  Possible Student Questions: *Why do we need the natural gas? How is natural gas used? How did the natural gas get in the rock? Why doesn’t it move in the air with the other gases?*  Resource to Share with Students about Uses of Natural Gas in Manufacturing Electricity: <https://www.georgiapower.com/company/energy-industry/energy-sources/natural-gas.html>  Alone Zone – Students construct an explanation about the potential impact of the fracking process on natural resources such as air, water, and soil. Students ideate a possible solution to at least one of the possible negative impacts. ([Link to Possible Rubric](https://cobbk12org-my.sharepoint.com/personal/amy_gilbert_cobbk12_org/Documents/PrePlanning%20PD%20Resources/Rubric%20for%20Constructing%20Explanations.docx)) | | | Assessment Prompt:   1. Read each argument. Which best supports the claim, *Human energy consumption to meet the demands for food, transportation, and manufacturing electricity is the primary contributor to global climate change*? 2. Environmental observations are the foundation for understanding the climate system. From the bottom of the ocean to the surface of the Sun, instruments on weather stations, buoys, satellites, and other platforms collect climate data. To learn about past climates, scientists use natural records, such as tree rings, ice cores, and sedimentary layers. Historical observations, such as native knowledge and personal journals, also document past climate change. 3. Scientists have conducted extensive research on the fundamental characteristics of the climate system and their understanding will continue to improve. Current climate change projections are reliable enough to help humans evaluate potential decisions and actions in response to climate change. 4. The overwhelming consensus of scientific studies on climate indicates that most of the observed increase in global average temperatures since the latter part of the 20th century is very likely due to human activities, primarily from increases in greenhouse gas concentrations resulting from the burning of fossil fuels. 5. Human activities have affected the land, oceans, and atmosphere, and these changes have altered global climate patterns. Burning fossil fuels, releasing chemicals into the atmosphere, reducing the amount of forest cover, and rapid expansion of farming, development, and industrial activities are releasing carbon dioxide into the atmosphere and changing the balance of the climate system. 6. Why did you think this statement supported the claim better than the others? | |
| **Differentiation:**  \*\*Click on full versions of lessons listed above for specific suggestions for differentiation | | | | |

**APPENDIX A**

**Disciplinary Core Idea: Earth Science Learning Progression**

**Energy & Conservation (from** [**A Framework for *K-12 Framework***](https://www.nap.edu/read/13165/chapter/11#192)**)**

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| --- | --- | --- | --- |
| By the end of grade 2 | By the end of grade 5 | By the end of grade 8 | By the end of grade 12 |
| Living things need water, air, and resources from the land, and they try to live in places that have the things they need.  Humans use natural resources for everything they do: for example, they use soil and water to grow food, wood to burn to provide heat or to build shelters, and materials such as iron or copper extracted from Earth to make cooking pans. | All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways.  Some resources are renewable over time, and others are not. | Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources.  Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geological processes.  Renewable energy resources, and the technologies to exploit them, are being rapidly developed. | Resource availability has guided the development of human society. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors. |

**APPENDIX B**

**Science and Engineering Practices:** Based on the fourth quarter standards, there may be a gap in the understanding of the following Science and Engineering Practices:

# Obtaining, Evaluating, and Communicating Information: Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.



**Cross-Cutting Concepts:**

