2014–2015 School Year

Field Trip Guide

School Program: Dig Deep

- Welcome to Q?rius
- Field Trip Logistics
  - Getting the Most from Q?rius
  - Class Overview
- Connections to Curriculum Standards

Part lab, part collections vault, part DIY garage, part hangout, and all fun.

Q?rius – Unlock your world.

qrius.si.edu
Welcome to Q?rius

Welcome to a New Kind of Field Trip

Thank you for choosing Q?rius at the Smithsonian's National Museum of Natural History as your field trip destination! We think of Q?rius as both a place and an experience. We are excited to offer your students the chance to explore science, nature, and culture in a whole new way while supporting your curriculum needs.

We share your passion for learning! We have designed this Q?rius field trip to stimulate your students’ curiosity and to inspire them to better understand the world and their place in it.

The Q?rius Learning Lab

Q?rius is a first-of-its-kind interactive and experimental environment - part lab, part collections vault, part DIY garage, part hangout, and all fun and inspiring. We call it Q?rius because it is designed to inspire curiosity in a whole new way in the next generation of scientists and science-minded citizens. It is an exhibit-sized interactive space filled with resources that are available only to your students at the world’s largest natural history museum. The lab includes:

- A collection of 6,000 objects – fossils, bones, insects, cultural artifacts, pressed plants, and more – all accessible for investigations, carefully selected to support learning goals connected to curriculum for your specific class experience
- A suite of digital tools, including videos, virtual objects, and references to maximize learning from objects and link objects to core science ideas and the people who study them
- Scientific tools integrated with all school experiences
- Student materials based on scientists’ field books to guide the Q?rius experience

The Q?rius Approach

All classes and self-guided experiences:

- Feature the work and amazing discoveries of Smithsonian scientists
- Link real-world research of Smithsonian scientists to curriculum standards for a unique approach to inspiring your students
- Use inquiry-based, team-oriented approaches to key questions similar to those addressed by Smithsonian scientists
- Reflect the input of teens and teachers with whom we partnered so that we could guarantee program appeal for students and relevance for teachers
- Integrate objects, data, scientific equipment, and digital assets to investigate core ideas

Questions? Please feel free to contact us at (202) 633-4039 or NMNHSchoolPrograms@si.edu.
FIELD TRIP LOGISTICS

We look forward to your visit to Q?rius. The logistical information provided below will help you prepare for your visit and ensure a smooth arrival. Please see page 8 for information on introducing your students to field trip content.

| GETTING READY | • Carefully review your confirmation letter. To make any changes to your reservation, e-mail us at NMNHSchoolPrograms@si.edu or call us at 202-633-4039. Or, visit http://www.mnh.si.edu/calEvents/programs-for-school-groups.htm, click on the “Wait List” button for the event you registered for, and select “Overwrite Previous Response if you have already registered for this event” on the registration form.
• Review all information in this packet so that you know what you can expect from your visit. Contact us at NMNHSchoolPrograms@si.edu if you have questions or concerns.
• Prior to arriving at the Museum, please divide students into no more than 6 teams of 4-6 individuals who will pursue the class investigation together.
• Arrange for the proper number of chaperones (see below) and distribute the Chaperone Guide to them. |

| ARRIVAL AND DEPARTURE | ADDRESS: 10th Street NW and Constitution Avenue NW, Washington, DC 20013
HOURS: School groups can enter the Museum anytime after 10:00 a.m.
ENTRANCES: The best entrance for school groups is at 10th Street and Constitution Ave., NW, which is also the accessible entrance. You also may choose to enter through the main doors on the National Mall.
CLOSEST METRO STATIONS: Federal Triangle or Smithsonian on the Blue or Orange Lines. Archives-Navy on the Green or Yellow Lines.
BUS DROP-OFF LANE: Beginning at 9:30 a.m., Monday-Friday, the curb lane of Constitution Avenue adjacent to the Museum is reserved for school bus drop-off.
STUDENT PICK-UP LANE FOR BUSES: Please board buses on Madison Drive NW (the Museum exit on the Mall side).
SECURITY: For the safety of your students, all bags will be inspected upon entry to the Museum. We encourage students to leave their backpacks/bags on the bus or at school to speed up the entry process. |

| RESTROOMS AND LUNCH | RESTROOMS: Restrooms are located near Q?rius on the Ground floor in the Constitution Avenue Lobby and also on the First floor, just off the Sant Ocean Hall.
LUNCH: The Atrium Café is open to groups and individuals who purchase their lunch at the Museum. If your students bring their own lunches, they are welcome to eat outside the Museum on the National Mall. |

| CHAPERONES | • To guarantee the best learning experience for your students, we require one chaperone for every 10 students in grades 6-8 and one chaperone for every 15 students in grades 9-12.
• Please share the Chaperone Guide and lesson plans with your chaperones in advance so that they will be fully prepared to accompany and guide students in their learning. |
An Invitation to Experience Science

This School Program will engage your students in an immersive 60-minute program led by an experienced Museum Educator. Students will use objects, data, scientific equipment, and digital assets to investigate core ideas of natural history science and to gain skills in the practices of science. Students will complete a series of activities, document their results, and discuss their conclusions with each other and with the class.

In School: Starting the Experience

- Research shows that students who are oriented to the logistics of a field trip typically learn more from their experience than those who are not. Be sure to discuss schedule, lunch plans, restroom availability, and – most importantly – your expectations for students before arrival.
- Collaboration and communication are central components of science. You can prepare your students for collaboration by assigning them to teams of 4-6 individuals in advance and asking them to brainstorm ways in which they will work as a team, learn as a team, and achieve consensus.
- Before your visit, go to Q?rius online at qrius.si.edu and check out fun and intriguing virtual self-guided activities and science stories.
- Invite your students to practice their scientific inquiry skills by completing some of our online activities. These activities will introduce them to the types of investigations they will do on their field trip and get them exploring even before they arrive at the Museum!
- Remind students in advance that they will be working with valuable scientific equipment and collections, just like Museum scientists behind the scenes. These are important resources for learning more about the world and our place in it, and we ask that students treat equipment and collections with care and respect, just as our scientists do.

In Q?rius: Behind-the-Scenes Access

- Experienced Museum Educators and volunteers will lead your class. Students also will benefit significantly if their teachers and chaperones actively engage in the program, so please join in, remind them of the directions/instructions provided at each station, and support their learning.
- Just like scientists, students will work together in teams to complete an investigation, using real Museum specimens and sophisticated equipment.
- Equipment and objects are more accessible in Q?rius than anywhere else in the Museum. Students may need gentle reminders to treat objects and equipment carefully while investigating!
- To keep clutter to a minimum, personal items such as backpacks, lunches, and outerwear should be stored away from work tables.
School Program: Dig Deep

| CLASS DESCRIPTION | Playing the role of geologists, students will go looking for iron ore! Specifically, they are tasked with evaluating how much iron ore may be present beneath the earth’s surface at a particular location. An iron ore deposit is worth locating, by the way, because the iron recovered can be used for buildings, cars, and other technologies that we use every day! Students will use a geologic map and drill cores to predict and draw a cross-section of the geology beneath the surface. The skills and practices developed in this class are similar to those used by real geologists, including Smithsonian geologists Sorena Sorensen and Ben Andrews. And like the Smithsonian scientists, students will learn through practice to read the stories in rocks and use geologic models. |
| SUMMARY OF STUDENT EXPERIENCE | As budding geologists, students first must build the necessary skills to explore the earth for natural resources and study its dynamic processes. With these skills in mind, each team of students will work together to identify the extent of an iron ore deposit targeted for mining. Using a model of a geologic area, students will work together to decide where to drill a core in order to “hone in” on the exact location of the ore. Just like real geologists, they must plan to extract the most information possible from the least amount of drilling. They must keep in mind that they have limited funds for their expedition and that there are serious environmental impacts caused by excessive drilling. In each drill core, students will find clues about where the iron ore might be. (Pay attention to the slope of the layers, for example, and any evidence of faulting.) After interpreting all of the information, students will predict the location of iron ore and draw a model of the area that shows where the iron ore is. Finally, students will compare their models to one provided by Dr. Sorensen and will participate in a classroom discussion of modeling and of the tradeoffs involved in this real-world scenario. |

| GRADE RANGE | Grades 6-12 |
| DURATION OF PROGRAM | 60 minutes |

Scientist Focus

Dig Deep gives students first-hand experiences with the skills and practices used by Smithsonian scientist Sorena S. Sorensen, Curator-in-Charge of Rock and Ore Collections. Dr. Sorensen studies the effects of fluids on rocks by examining landforms and rocks in field locations across the United States. She also uses a variety of geochemical analytical methods, including imaging techniques, that help her identify trace elements in rocks. Dig Deep reflects Dr. Sorensen’s passion for field work, for modeling, and for unsolved mysteries revealed by studying the Earth. She has led field programs all over the world, from California, Nevada, and Washington State to the Dominican Republic, Venezuela, Burma, and Guatemala.
Goals & Outcomes

GOAL
Students will apply knowledge of geologic forces and features and will employ the scientific practices of asking questions, defining problems, and developing models to solve the real-world problem of predicting the location of a non-renewable resource in an economically and environmentally responsible way.

STUDENT OBJECTIVES
In this Investigation students will:
• Observe rock features resulting from tectonic forces
• Discuss differences between and/or costs and benefits of renewable and non-renewable resources
• Identify geologic patterns and understand how tectonic forces formed them
• Observe and understand that the same features seen in small rocks can also be observed on a macro scale, with the same formative processes at work
• Understand that scientists use models to observe objects and processes that they cannot observe normally

STUDENT OUTCOMES
Students who demonstrate understanding can:
• Use models to predict the behavior of a system
• Use maps to discuss and explain evidence of plate movement
• Explain how tectonic forces shape the Earth
• Understand that geology affects the distribution of natural resources
• Describe the economic and environmental tradeoffs of geologic exploration

Central Questions and Concepts
• Tectonic forces shape the layers of the Earth.
• Natural resources found in the Earth’s layers are partially distributed by tectonic forces.
• Extracting natural resources from the Earth impacts the environment.
• How do scientists visualize processes that are substantially bigger or smaller, or that take substantially more or less time, than what we know from everyday experience?
• What is modeling and what are its limitations and opportunities?

Program Format

ARRIVAL
You can find the entrance to Q?rius in the Constitution Avenue lobby on the Ground Floor of the Museum. If your class begins at 10:15 a.m., please enter the Museum at Constitution Avenue and 10th Street beginning at 10:00 a.m. If you will be exploring the Museum before your Q?rius class, please bring your students to the Constitution Avenue lobby 15 minutes prior to the start of your class.
A Museum Educator will meet your group and escort you to a Q?rius classroom. Then students will learn about their challenge (You are now geologists on a team looking for iron ore!), find out what is expected of them as they work in Q?rius, and attend to the tools that they will need.

**INTRODUCTION (5 MINUTES)**
Through a classroom discussion led by a Museum Educator, students explore ways in which humans have used renewable and non-renewable resources to support their lifestyle throughout time.

**INVESTIGATION (20 MINUTES)**
Through educator-facilitated demonstrations and working in small teams of 4 - 6 individuals, students will have to gather the skills and knowledge needed to interpret a geologic map, geologic features, and drill cores.

**CORE CHALLENGE (15 MINUTES)**
Students will continue to work in their small teams. Using a tabletop model that includes a cross-section of the Earth hidden behind a removable layer, they will select drill cores by removing parts of the layer covering the cross section. With each drill core, the team will uncover evidence to predict the location and extent of the iron ore deposit in this defined area.

**DISCUSSION AND CONCLUSION (20 MINUTES)**
At the end of their investigation, student groups will report their results and justify their conclusions, drawing upon evidence from their work. They will compare their results to those generated by NMNH geologists. Through facilitated discussion, students will evaluate their results and alternative solutions, including the range of constraints, technological opportunities, and social, cultural, and environmental impacts.

**Before Your Visit**

**GRADES 6-8**

**SCIENTIFIC TERMS**
The Dig Deep class will use these terms in the context of natural history scientific investigations. Please review the terms with students before arrival.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Ore</td>
<td>Model</td>
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<tr>
<td>Plate Tectonics</td>
<td>Layer</td>
</tr>
<tr>
<td>Tectonic forces</td>
<td>Cross-section</td>
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**PREPARATION QUESTIONS**
1. What is integrated natural resource management?
2. How do plate tectonics explain important features of the Earth’s surface and major geologic events?
3. What methods and instruments do geologists use to determine the features of the Earth?
GRADES 9-12

SCIENTIFIC TERMS

<table>
<thead>
<tr>
<th>Ore</th>
<th>Deposition</th>
<th>Tectonic forces</th>
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</thead>
<tbody>
<tr>
<td>Lithology</td>
<td>Cross-section</td>
<td>Geographic</td>
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PREPARATION QUESTIONS

1. What impacts do changing technology and social regulations have on the management of nonrenewable resources?
2. Resource availability has guided the development of human society. List and discuss the pros and cons of human activity on the environment.
3. How do plate tectonics explain important features of the Earth’s surface and major geologic events?

Related Resources

PERMANENT EXHIBITS AT THE NATIONAL MUSEUM OF NATURAL HISTORY

The Hall of Geology, Gems, & Minerals includes four major galleries: Plate Tectonics; Rocks; Moon, Meteorites, and the Solar System; and Gems. In these galleries, visitors take in 3,500 specimens from the Museum’s collection of gems, minerals, rocks and meteorites. Two dozen interactive computer presentations and videos, large panels of stunning artwork, and a real-time display of global earthquake data provide explanations of geologic concepts.

The Plate Tectonics gallery uses rock specimens, interactives, and real-time data to explain forces and resulting geologic features.

SUGGESTED ACTIVITY: Students can reinforce concepts and understanding by examining real-time data and rock specimens evincing tectonic forces. Follow up in the classroom by viewing the This Dynamic Planet map at http://nhb-arcims.si.edu/ThisDynamicPlanet/index.html.

The Rocks gallery presents the processes that act upon rocks (water and forces) as well as applications of rocks for human use.

SUGGESTED ACTIVITY: Ask students to gather information on spectacular rock samples that they view. Then, learn more about these rock specimens by going online to: http://collections.mnh.si.edu/search/ms/.

The Moon, Meteorites, and the Solar System gallery offers students the opportunity to explore similarities and differences between the Earth, its moon, and its other neighbors in space.

Back in School: Curiosity Continues

The Q?rius website at qrius.si.edu offers a variety of different follow-up opportunities for your students. Students can conduct an investigation with an online activity, jump into science stories, create a digital field book, complete a natural history badge challenge, or explore science in action.
Smithsonian Science How delivers real-world science into classrooms through free, interactive, live webcasts and supporting classroom resources. The 25-minute programs feature the research and personalities of the Smithsonian’s National Museum of Natural History, providing your students with positive STEM role models, information about science careers and pathways, and connections to current research. Every webcast includes a package of standards-aligned lessons, activities, and other resources that highlight science content and practice.

**DO AN ACTIVITY**
Are your students predisposed to the super science skill of pattern recognition? In the “Decoding Mars” activity, students can look for geologic features that indicate evidence of water on Mars. Other online activities invite students to measure coral reef diversity in Bali or examine human bones.

**JUMP INTO SCIENCE STORIES**
Delve into the same topics being explored by Smithsonian scientists, such as volcanoes, genomics, extinction, and human evolution. Read about the cutting-edge work and adventures of Smithsonian scientists, watch videos of them in action, hear them talk about what inspires their curiosity, and manipulate digital objects similar to the ones they use.

**CREATE A DIGITAL FIELDBOOK**
Just like a scientist records their observations, students ages 13 and over may record the results from their experiences with Q?rius activities and collections online. Create an account to save objects, stories, images, and notes to a Digital Field Book.

**EARN A NATURAL HISTORY BADGE**
Field Book accounts also enable students over age 13 to earn points for their activities online that they can share through their own social media networks. Complete multiple activities online or while exploring Q?rius on subsequent visits, get enough points, and earn a digital badge that you can share through social media.

**EXPLORE SCIENCE IN ACTION**
Watch videos of real-life scientists explaining their work, how they got started in their careers, and how they balance and integrate their work, passions, and everyday lives.

**KEEP EXPLORING SCIENCE**
Even more Web-based science learning activities can be accessed through the Museum’s main webpages, including a forensic mystery webcomic and interactive maps. Activities cover topics such as the Earth and solar system, human culture and diversity, and life’s diversity.

**RECOMMENDED RESOURCES FROM SMITHSONIAN SCIENTISTS**
**GEOLOGIC TIME**
http://paleobiology.si.edu/geotime/
Travel through 4.6 billion years of life’s history on Earth and get a sense of the interplay between Earth and life processes.
**THIS DYNAMIC EARTH**  
http://www.mnh.si.edu/earth/main_frames.html
An extensive resource for both teachers and students, The Dynamic Earth provides a wealth of information about the Earth. The interactive webpages are divided into four sections based on the research conducted at the Museum: Plate Tectonics and Volcanoes, Gems and Minerals, the Solar System, and Rocks and Mining.

**GLOBAL VOLCANISM PROGRAM**  
http://www.volcano.si.edu/
The Smithsonian Institution’s Global Volcanism Program (GVP) is devoted to a better understanding of Earth’s active volcanoes and their eruptions during the last 10,000 years. Their website includes a dynamic map of the Earth, maps and photos of volcanoes, and current updates on volcanic activity around the world.

**LESSON PLANS**  
**OCEAN PORTAL**  
http://ocean.si.edu/for-educators/lessons/it%E2%80%99s-sedimentary-my-dear-watson
Ocean Portal offers many interdisciplinary curriculum opportunities, including this lesson on sedimentary deposits. Students analyze core sample data to identify the sediment composition of the ocean floor. In the process, they map localities using latitude and longitude, locate and access core sample images from Google Earth to make their own qualitative observations, and analyze sediment data.
### Next Generation Science Standards

#### Crosscutting Concepts
- **Patterns**
  - Use patterns to identify cause and effect relationships

- **Systems and System Models**
  - Use models to represent systems and their interactions
  - Models are limited in that they only represent certain aspects

#### Science and Engineering Practices
- **Asking Questions and Defining Problems**
  - Specifying relationships between variables, and clarifying arguments and models

- **Developing and Using Models**
  - Using and revising models to describe, test, and predict more abstract phenomena

#### Disciplinary Core Ideas

**MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

**ESS2.B: Plate Tectonics and Large-Scale System Interactions**
Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth’s plates have moved great distances, collided, and spread apart.

### Grades 6-8

**Crosscutting Concepts**
- **Patterns**
  - Observe patterns in systems at different scales (and cite patterns as empirical evidence for causality in supporting their explanations of phenomena – assessment)

- **Scale, Proportion and Quantity**
  - Recognize patterns observable at one scale may not be observable or exist at other scales

- **Systems and System Models**
  - Use models to predict the behavior of a system
  - Recognize that predictions have limited precisions and reliability due to assumptions and approximations

**Science and Engineering Practices**
- **Asking Questions and Defining Problems**
  - Formulating, refining, and evaluating empirically testable questions and design problems using models and simulations

- **Developing and Using Models**
  - Using models to predict and show relationships among variables between systems and designed worlds

**Disciplinary Core Ideas**

**HS-ESS1-6.** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history.
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<th>STANDARDS</th>
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| **NEXT GENERATION SCIENCE STANDARDS (CONTINUED)** | **ESS3.A: Natural Resources**
Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. | **HS-ESS3-2.** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. |
| | **ESS3.C: Human Impacts on Earth Systems**
Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. | **ESS2.B: Plate Tectonics and Large-Scale System Interactions**
Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth’s surface and provides a framework for understanding its geologic history. |
| **DISTRICT OF COLUMBIA PUBLIC SCHOOLS** | **SCIENTIFIC INVESTIGATION AND INQUIRY**
6.1 Asking questions
6.7 Draw conclusions | **ENVIRONMENTAL SCIENCE STANDARDS AND LEARNING ACTIVITIES: NATURAL RESOURCES**
E.5. Numerous Earth resources are used to sustain human affairs. The abundance and accessibility of these resources can influence their use.
1. Recognize that the Earth’s resources for humans, such as fresh water, air, arable soil, and trees, are finite. Explain how these resources can be conserved through reduction, recycling, and reuse. |
| | **STANDARDS AND LEARNING ACTIVITIES**
6.1 Broad Concept: Scientific progress is made by asking relevant questions and conducting careful investigations.
7. Draw conclusions based on scientific evidence | |
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| DISTRICT OF COLUMBIA PUBLIC SCHOOLS (CONTINUED) | **ROCK CYCLE**  
6.7. Broad Concept: Rock materials are continuously recycled in the rock cycle.  
5. Describe how sedimentary rocks are formed when older rocks are subjected to weathering into sediments, and those sediments are eroded, transported, deposited, then compacted and cemented.  
6. Observe and describe common igneous, metamorphic, and sedimentary rocks.  
**PLATE TECTONICS**  
6.8. Broad Concept: Plate tectonics explain important features of the Earth’s surface and major geologic events. | 2. Differentiate between renewable and nonrenewable resources (including sources of energy), and compare and contrast the pros and cons of using nonrenewable resources.  
8. Understand and describe the concept of integrated natural resource management and the values of managing natural resources as an ecological unit. |

| MARYLAND COMMON CORE STATE CURRICULUM | **1.0 SKILLS AND PROCESSES**  
C. Communicating Scientific Information  
1. Develop explanations that explicitly link data from investigations conducted, selected readings and when appropriate, contributions from historical discoveries.  
e) Explain how different models can be used to represent the same thing.  
D. Technology  
1. Analyze the value and the limitations of different types of models in explaining real things and processes. | **GOAL 1: SKILLS AND PROCESSES**  
1.1 The student will explain why curiosity, honesty, openness, and skepticism are highly regarded in science.  
1.3 The student will carry out scientific investigations effectively and employ the instruments, systems of measurement, and materials of science appropriately.  
1.4 The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication.  
1.4.6 The student will describe trends revealed by data.  
**GOAL 2: CONCEPTS OF EARTH/SPACE SCIENCE**  
2.4 The student will analyze the dynamic nature of the geosphere.  
2.4.3 The student will explain changes in Earth’s surface using plate tectonics.  
Theory of Plate Tectonics |
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<tr>
<td>MARYLAND COMMON CORE STATE CURRICULUM (CONTINUED)</td>
<td>b) Identify and describe the processes that form igneous rocks</td>
<td>THEORY OF PLATE TECTONICS</td>
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<tr>
<td></td>
<td>c) Identify and describe the processes that form metamorphic rocks.</td>
<td>2.5 The student will investigate methods that geologists use to determine the history of Earth.</td>
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<td><strong>6.0 ENVIRONMENTAL SCIENCE</strong></td>
<td>2.5.2 The student will compare events in Earth’s history that have been grouped according to similarities.</td>
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<td><strong>B. Environmental Issues</strong></td>
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<tr>
<td>Grade 6</td>
<td>1. Recognize and explain that human-caused changes have consequences for Maryland’s environment as well as for other places and future times.</td>
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<tr>
<td></td>
<td><strong>A. Natural Resources and Human Needs</strong></td>
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<tr>
<td>Grade 6</td>
<td>1. Recognize and compare how different parts of the world have varying amounts and types of natural resources and how the use of those resources impacts environmental quality.</td>
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<td>Grade 7</td>
<td>1. Recognize and explain the impact of a changing human population on the use of natural resources and on environmental quality.</td>
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<td><strong>SOCIAL STUDIES</strong></td>
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<td>3.0 GEOGRAPHY</td>
<td><strong>D. MODIFYING AND ADAPTING TO THE ENVIRONMENT</strong></td>
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<td>Grade 6</td>
<td>1. Analyze why and how people modify their natural environment and the impact of those modifications</td>
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<tr>
<td>Grade 7</td>
<td>1. Analyze why and how people in contemporary world regions modify their natural environment and the impact of those modifications</td>
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<td></td>
<td>c. Identify and explain land use issues that illustrate the conflict between economic growth, deforestation, mining, and burning fossil fuels</td>
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<td>GRADES 6-8</td>
<td>GRADES 9-12</td>
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<tr>
<td>MARYLAND COMMON CORE STATE CURRICULUM (CONTINUED)</td>
<td><strong>Grade 8</strong> 1. Analyze why and how people in the United States modify their natural environment and the impact of those modifications a. Analyze the trade-offs of using resources to pursue economic opportunities v. preserving the environment, such as westward movement b. Explain the consequences of modifying the natural environment, such as soil erosion, loss of soil fertility and over-fishing</td>
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<tr>
<td>MARYLAND STEM STANDARDS OF PRACTICE</td>
<td><strong>2.A.</strong> Analyze interdisciplinary connections <strong>3.B.</strong> Apply appropriate vocabulary when communicating <strong>3.E.</strong> Develop an evidenced-base argument <strong>4.A.</strong> Ask questions <strong>5.A.</strong> Engage in critical thinking <strong>6.</strong> Collaborate as a STEM team</td>
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<tr>
<td>VIRGINIA STANDARDS OF LEARNING</td>
<td><strong>GRADE 6 Scientific Investigation, Reasoning, and Logic</strong> <strong>6.1</strong> The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which i) models and simulations are designed and used to illustrate and explain phenomena and systems; <strong>Earth Resources</strong> <strong>6.9</strong> The student will investigate and understand public policy decisions relating to the environment. a) management of renewable resources; b) management of nonrenewable resources; c) the mitigation of land-use and environmental hazards through preventive measures; and</td>
<td><strong>EARTH SCIENCE</strong> <strong>ES.1</strong> The student will plan and conduct investigations in which c) scales, diagrams, charts, graphs, tables, imagery, models, and profiles are constructed and interpreted; f) current applications are used to reinforce Earth science concepts <strong>ES.2</strong> The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include a) science explains and predicts the interactions and dynamics of complex Earth systems <strong>ES.6</strong> The student will investigate and understand the differences between renewable and nonrenewable resources. d) environmental costs and benefits.</td>
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<td>d) cost/benefit tradeoffs in conservation policies.</td>
<td>es.7 The student will investigate and understand geologic processes including plate tectonics. Key concepts include: a) geologic processes and their resulting features; and b) tectonic processes.</td>
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| 21ST CENTURY SKILLS | • Learning and Innovation Skills - Work creatively with others  
• Critical Thinking and Problem Solving - Use systems thinking, Solve problems  
• Communication and Collaboration - Communicate clearly  
• Collaborate with others  
• Information Literacy  
• Access and Evaluate Information  
• Initiative and Self-Direction - Manage goals and time and Be self-directed learners |