

Mining in Maryland Daily Lesson Plan Details

Day 1 – Introduction to Mining

Teacher Materials and Set-Up

- Have **Mining in Maryland PowerPoint presentation** (mm-presentation.ppt) connected to LCD projector and computer.
- Optionally: Display the *What Do All These Places Have in Common* poster in the front of the room. Cover the bottom part of the poster.
- **KWL-Chart Suggestions** (mm-kwl-suggestions.doc)

Student Materials

You will need enough copies of the following handouts from the **Student Research packet** for each student:

- **Vocabulary Worksheet** (mm-vocabulary.doc)
- **KWL Chart** (mm-kwl.doc)

Procedures

1. Bring up the first slide on the PowerPoint presentation, and take responses to the question, *what do all these places have in common?*
 - Optionally, point out the *What Do All These Places Have in Common* poster, and ask students for responses. Ask, *would you believe me if I told you that all these sites were once mining sites?***Bring up Slide #2**
2. Ask students what they know about mining to establish prior knowledge. **(Slide #3)** Responses may include things they've heard on the news, such as the dangers of mining or even historically, mining for gold during the gold rush. **Show Slide #4.**
3. Guide the discussion to *what types of things are mined.* **(Slide #5)** Typical responses may include general terms such as rocks and minerals, or materials that students are more familiar with such as coal, gold, copper, iron, etc. Put all responses on the board or chart paper. Guide the discussion to bring up resources mined (coal, cement, sand, gravel, clay, crushed stone) in Maryland. Ask questions such as: *Where does the sand on a golf course come from? Where did the concrete that was used to build this school come from?*
4. Ask: *Why do we mine?* Take responses.
Ask: *Does anyone here use toothpaste, cosmetics, appliances, tableware? Does the house you live in have windows, aluminum siding, shingles, nails, screws? Do you ever take the highway or cross over a bridge when traveling in a car? Have you ever watched TV or worked on a computer?* Explain that these and thousands of other

products we use on a daily basis contain materials and substances drawn from the earth – these substances or resources have been mined.

5. **Slide #6** – Discuss some basic statistics about the mining industry.
6. Ask: *Of the materials listed on the board (or chart paper), which ones do you think are mined in Maryland?* Don't reveal the answers...ask: *How can we find out?*
7. Tell students that for the next 6-7 days they will be learning more about the mining industry in Maryland. Explain that they will explore more in depth: why and how natural resources are mined, how we use the resources that are mined in Maryland, the economic and environmental impacts of mining, and some solutions to environmental problems associated with mining. At the end of their inquiry and research, they will create a presentation to be delivered at a Mining Conference, so they must take accurate and thorough notes throughout the process.
8. Distribute the vocabulary worksheet. As a class, define the following vocabulary words: mining, non-fuel mining, natural resources.
9. Distribute the **Student KWL Chart** and have students complete the K and W columns of the chart, individually or in pairs. For students who are having trouble, use the **KWL Chart Suggestions** as a guide to help them think about the types of issues they should be considering.

Wrap Up:

As a class, discuss what students included in the K-W sections of their chart. Tell students that for the next several days, they will work in small groups to conduct inquiry-based Internet research to learn about specific resources mined in Maryland. For homework, tell students to try to find out which resources are mined in Maryland.

Days 2,3,4 – Mining in Maryland Research

Teacher Materials and Set-Up

- **Mining in Maryland PowerPoint presentation** (mm-presentation) connected to a computer with LCD projector; begin with Slide #7-Day 2
- Arrange to have access to a computer lab with Internet access for the next three days. *Modifications: If only a few computers are available, have student groups rotate working on Internet research on computers, reading the handouts and completing the production map. You may also print out web pages listed on the Student Research Organizer.*
- **Research Answer Key** (mm-researchanswerkey.doc)

Student Materials

You will need enough copies of the following handouts from the **Student Research packet** for each student:

- **Mining in Maryland Student Research Organizer** (mm-research.doc)
- **Mining in Maryland Counties** (mm-mapmarylandcounties.doc)
- **Map of Maryland with Minerals** (found on page 1 of Mineral Industry of Maryland in Student Group Handouts folder)

You will need enough copies of the following handouts from the **Student Research Packet/ Student Group Handouts** for **each group of students**:

- **Mineral Industry of Maryland** (mm-mineralindustrymaryland.pdf)
- **Maryland Coal Basins Map** (mm-marylandcoalbasins.pdf)
- **Facts About Maryland's Mining Industry** (mm-factsaboutmaryland.pdf)
- **Natural Aggregate color brochure** (*Alternatively, you can use the PDF files included in the Student Research Packet (Student-Group → Natural Aggregate Brochure-PDF Files folder)*)
- **What Everyone Should Know about Coal** brochure
- Colored pencils

Pre-determine heterogeneous groups of 2-3 students. Some of the reading is fairly advanced so be sure that lower performing students are placed with more advanced readers to ensure understanding.

Procedures

1. Ask students if they were able to find out which resources are mined in the State of Maryland.
2. **Slide #7**
3. **Slides 8-9** – map of minerals mined in Maryland. Note: details on the map will be hard to read projected, which is why it's recommended that you print a copy for each student.
Discuss:

- *Looking at the map closely, what minerals appear to be mined the most? The least?*
 - *What mined material is not on the map? (coal) Why is that? (map only shows non-fuels)*
 - Be sure to note on Slide #8 that cement is not a mined material per se, but rather cement production is part of the mining industry. Through the production process, cement utilizes other mined materials. It's included here because of cement production's value and significance to the economy and the mining industry.
4. **Slide #10** - Tell students that for the next three days they will be investigating different aspects of common resources mined in Maryland.
 - Have students take out their vocabulary sheets.
 - Define aggregate.
 - Ask students if they know the difference between cement and concrete. Explain: *Cement and concrete might be synonymous as household terms, but by nature are different. Cement, an ultra-fine gray powder, binds sand and rocks into a mass or matrix of concrete. Cement is the key ingredient of concrete.*
 5. Put students in groups of 2-3 and distribute all materials listed in the Set-up section above.
 6. Allow students to take the next 2 ½ days to complete their research and production map. Depending upon your classroom/lab set up, you may need to rotate student groups working on computers.
 - Note: the *Mineral Industry of Maryland* document and some of the websites might be difficult for some students so you may need to walk around the room and help with interpreting some of the data and information. Also, use the **Research Answer Key** as a guide when helping students.
 7. About 20 minutes before the class period ends on Day 4, bring the class back together and discuss research findings. Tell students to take notes on their chart as well as the "additional notes" section of their worksheet. Use the **Research Answer Key** as a guide.

First, focus on the Economy:

 - *What are some of the economic benefits of mining?*
 - *How does mining of these materials ultimately help you, the consumer, and the greater community?*
 - *Can you think of ways that mining these materials helps to improve/ maintain your quality of life?*

Next, focus on the Environment:

 - *What kinds of environmental issues or concerns did you discover as a result of your research?*
 - *In your research, did you read about any solutions to these issues? If so, what are some of the solutions?*

Wrap-Up

For homework after Day 4, have students fill in their K-W-L chart and vocabulary sheet as best they can. Tell students that tomorrow, they will be focusing more on some of the environmental concerns of mining and some solutions that are currently being used in the industry.

Day 5 – Erosion Demonstration / Solutions to Environmental Concerns

The amount of time required for this day's activities will depend upon whether or not you choose to do the optional hands-on activities

Teacher Materials and Set-Up

You will need the following for the demonstration:

- steam table or large shallow pan
- sand
- gravel
- water

Research Answer Key (mm-researchanswerkey.doc)

Optional: In the Teacher Packet, you will find two optional hands-on activities (optional-experiments-day5.doc) that may help to help reinforce students' understanding of solutions to two of the environmental problems associated with mining (settling basins and acid drainage treatment). If you choose to do them, it would be best to conduct the experiments prior to moving on to Day 6.

Student Materials

- Students will need their Erosion Demonstration page and Cause and Effect Trees pages from their **Research Organizer** (mm-researchorganizer.doc)

Procedures

1. Review what the class learned from the previous days' research and what they filled in their "L" column of their K-W-L chart so far.
2. Review the vocabulary terms: runoff, erosion and acid drainage. Be sure students understand the difference between sediment and acid runoff.
3. As a class, review some of the environmental problems students discovered from their research. Ask: *Why/ how is erosion a problem?*
4. To help students understand the erosion problem, conduct the following demonstration:
 - Spread the gravel in a layer at the bottom of one end of the pan
 - Place 4-6 cm of sand on top of the gravel creating a slope
 - Slowly pour the water over the sloped end of the pan and observe the movement of the sand
5. Direct students to their Erosion Demonstration page of their packet. Have students complete in small groups of 2-3. Tell students to refer to their research notes from the previous day to record their answers.
6. Be sure to review the answers with students to ensure understanding.
7. In small groups, have students fill in two *cause and effect* relationships.
8. As a class, review some of the *cause and effect* relationships.

9. Ask: *What are some solutions to these problems that you discovered as part of your Internet research?* Students should refer to their research organizer and notes. Guide a discussion, using your **Research Answer Key**. *Note that some of the answers in the Answer Key are in addition to what students will find in their research. Therefore, be sure to review the material, and encourage students to take notes.*
10. If you choose, now would be a good time to conduct the two optional experiments before moving on to Day 6.

Wrap-Up

Have students complete their K-W-L Charts for homework.

Days 6-7 –Mine Reclamation and the Role of the Government

The amount of time required for this day’s activities will depend upon whether or not you choose to do the optional activities listed in Part I.

Teacher Materials and Set-Up

Have **Mining in Maryland PowerPoint presentation** (mm-presentation.ppt) connected to an LCD projector and computer (Slides 11 to end)

You will need the following materials for the demonstration/experiment:¹

- Terrarium or large glass bowl
- Sand
- Rocks
- Lumps of coal
- Top soil
- Plants (real or plastic)
- Plastic spoon or other digging implement

Prepare the excavation demonstration by placing the coal samples at the bottom of the terrarium, and surrounding them with rocks. Cover the rocks and coal with sand, topsoil, and plants.

If you have enough materials, set up several stations around the room and have student groups conduct the experiment on their own.

Student Materials

- Students will need their Mine Reclamation and Role of the Government pages from their Research Organizer
- You will need enough copies of the following handouts from the **Student Research packet** for each student:
 - **Regulatory Timeline** handout (mm-regulatorytimeline.doc)
 - **Baltimore Sun December 2006** article (mm-baltsun-dec06.doc)

Procedures

Part I – Mine Reclamation

In this teacher-guided activity, you will take the students through Slides 12-18 of the PowerPoint presentation as you discuss as a class the mine reclamation process. Direct students to take out their Mine Reclamation page from their research organizer packet and have them fill out answers throughout the class discussion.

1. Review from their research the different mining processes (underground mining, surface mining, quarrying, etc.)
2. **Bring up Slide 12**

¹ Adapted from teachcoal.org lesson.
Teacher Resources/ mm-lessondetails.doc

3. Tell students that you're going to simulate digging for coal.
4. Demonstrate how to conduct the excavation (or take a student volunteer) without disrupting the plant life or the existing ecosystem. This is quite difficult.
5. Ask: *What kind of mining is this?* (surface mining).
6. After the coal has been recovered, demonstrate (or have the student demonstrate) restoring the terrarium to its pre-excavation condition.
7. Ask: *How difficult was it to not disturb the land when digging for coal?* (nearly impossible). *Did we restore it exactly? What is disrupted at sites where surface mining is done?* **Slide 13**
 - Encourage them to think about rock formations, soil, plants, wildlife, water tables and drainage patterns, and possibly archaeological research.
8. Ask: *Think about the cause and effect relationships. How does surface mining disrupt an entire ecosystem?*
9. **Slide 14** *So what does happen to the land after it's been mined? Are the mining sites abandoned? Does the land just magically restore itself to its natural state?*
10. **Slide 15** - Students may have come across mine reclamation in their research so they may respond. If not, ask: *What does the word "reclaim" mean? What do you think it means regarding mining?*
11. **Slide 16** --- Define mine / land reclamation
12. **Slide 17** – Ask students how reclaimed land is currently being used. Remind them of the Slide #1 or the poster. *What are some reclamation efforts conducted by mining companies? (click on the link and show some of the success stories)*
13. **Slide 18** – Review the three main objectives of reclamation:
 - Eliminate threats to public safety, including threats to people, property, livestock or wildlife
 - Protect land and water from erosion, sedimentation, or contamination
 - Return the mined land to beneficial use or the pre-mining condition
14. **Slide 19** - Review: *How does reclamation help the environment?*

Optional Activities

15. Have students spend some time reviewing the Reclamation Process http://www.blm.gov/education/00_resources/articles/mining/reclaimingminedlandprovidesforthefuture.html. This is a kid-friendly site that takes students through the entire reclamation process – before/during/after.
16. Have student groups complete the **Mine Reclamation Case Study** about a project that was awarded in Maryland in 2001 (mm-reclamationcasestudy.doc)
17. As a class take the Coal Mining and Reclamation online quiz found at <http://www.osmre.gov/qttest.htm> (optionally, have students take the quiz on their own)

Part II – Role of the Government in Mining

Take students through the last five slides of the presentation and review the timeline which provides a brief overview of when laws and regulations were established for the mining industry, as well as the role of Maryland Department of the Environment. Have students fill in their Role of the Government page from their research packet.

1. **Slide 20** – Ask: *How does the government regulate the mining industry?* Take responses.
2. Distribute the **Regulatory Timeline** to students. Explain that regulations clarify and expand on what is written in the law. The law is written by elected officials; regulations are written by the Department charged with implementing the law.
3. **Slide 21** - *Federal and State laws and regulations have been established that require mining companies to develop operation and reclamation plans to eliminate or minimize environmental impacts.*
4. **Slide 22** – language from Maryland’s law
5. **Slide 23-25** – Role of MDE

Wrap Up

Have students complete their K-W-L Charts for homework. Distribute the **Baltimore Sun December 2006 article**, and have students respond to the questions on the last page of their research packet.

Days 7-10 - Pulling it All Together

Student Materials

You will need enough copies of the following handouts from the **Student Research packet** for each student:

- **Mining in Maryland Final Project** (mm-finalproject.doc) and the **Final Project Rubric** (mm-finalprojectrubric.doc)
 - **Unit Test**, following the presentations (mm-unittest.doc).
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Procedures

Part I

1. Pre-determine heterogeneous groups of 2-3 students ahead of time.
 2. Distribute the **Mining in Maryland Final Project** sheet to each student and review the directions. Note that a variety of format options for how they will present their information are provided, however, you may want to modify the options based on what you have available in your classroom, as well as student experience and ability
 3. Give students the next few days to work on their presentations and then present to the class or conduct a gallery walk.
 4. Celebrate a successful Mining Conference with a pizza party for the students!
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Part II

After all student groups have presented their final projects, give students the **Mining in Maryland Unit Test** (mm-unittest.doc). Add questions based on optional activities that you may have included in this unit.

Have students take out their K-W-L chart and fill in the final column.