

Ms. Tury's Environmental Science

Date: (duration ≈ 2 weeks)	Class: Environmental Science	Unit: Mineral Resources and Mining	Topic: The Mining Cycle
Student Objectives: <ol style="list-style-type: none"> 1. Define the term mineral and explain why they are important to your everyday life. 2. Explain the difference between a metal and a nonmetal, and give two examples of each. 3. Describe three processes by which ore minerals form. 4. Describe the manner in which mining companies explore for new mineral deposits. 5. Explain the difference between surface and subsurface mining and give two examples of each. 6. Describe seven important potential environmental consequences of mining. 7. Describe two ways state governments regulate mining and reclamation. 		Unit Curriculum Objectives: CONTENT— Explain how common objects are made from earth materials and why earth materials are conserved and recycled. (V.1.HS.3) PROCESS— Gather and synthesize information from books and other sources of information. (I.1.HS.7) Justify plans or explanations on a theoretical or empirical basis. (II.1.HS.1)	Vocabulary: Mineral Ore Ore body Tailings Metallic Nonmetallic Hydrothermal solutions Evaporites Surface mining Subsurface mining Smelting Subsidence Reclamation
Focus Questions: Animal, vegetable, or mineral? Where do the products we use everyday come from? In what ways does mining help to maintain your standard of living? What does the word reclaim mean?			
Resources and Materials: 20 Qs electronic game, mineral/rock samples, laptop computers, data projector, mineral scavenger hunt handout, copies for mining careers match up game, drill core assay handouts Refer to Cookie Mining Handout for materials list Refer to Build and Engineer an Underground Mine Handout (start materials drive 2 weeks prior to start of project—boxes, cardboard, etc...)			

Tentative Unit Schedule:

Day 1 Animal, Vegetable, or Mineral? discussion What are minerals? Why are they important? Mineral Scavenger Hunt	Day 2 How do we harvest minerals for our use? (types of mining) Mining Pros/Cons Research & Discussion	Day 3 Mining Careers Match Up Game Mining Exploration Drill Core Assay Project	Day 4 Cookie Mining (exploration, economics & environmental impact)	Day 5 Build and Engineer an Underground Mine-- Modeling Project
Day 6 Build and Engineer an Underground Mine-- Modeling Project	Day 7 Build and Engineer an Underground Mine-- Modeling Project	Day 8 Mineral Processing— (Copper Extraction Demo?) Mine Reclamation Research Project	Day 9 Mine Reclamation Research Project	Day 10 Mine Reclamation Research Project PRESENTATIONS

Lesson Activities:

(The following is a comprehensive list of activities for the unit; please refer to schedule.)

Introductions:

- ✓ Animal, vegetable, or mineral? (Discussion with 20 questions electronic game. Why is that first question so important?)
- ✓ Mineral Scavenger Hunt/Web quest—print friendly handouts ☺
(<http://homepage.mac.com/cohora/ext/rock.html>)
- ✓ Brainstorm Pros/Cons of Mining in small groups (see examples below)

(from: <http://www.wvpt4learning.org/lessons/pdf04/mine.pdf>)

Positive Aspects of Mines

- Provides minerals important for human use
- Source of employment/jobs
- Mines can work with agriculture (strip mine) to alternate sections of land to be mined in order to gain minerals while reducing erosion/runoff problems
- Mines can be reclaimed (strip mine) into a variety of agricultural uses such as fields for crops or grazing lands for livestock, sometimes aquatic habitats are possible as well
- Mines (open pit) can be reclaimed into recreational lakes for public use
- Mining operations can create ponds to contain and filter mine waste so that nearby waterways do not become contaminated
- Mining operations can use substances (such as powdered limestone) to neutralize hazardous chemical from processing of ores
- Room and Post construction in some underground mines can be used in order to avoid collapse
- Mining sites can be chosen carefully in order to protect endangered species

Environmental Concerns Regarding Mines

- Strip mines can produce erosion problems when large areas of soil become exposed
- Weathering of surface rock from open pit and strip mines can cause pollutants to run off into the water supply
- Depending on ore composition, mercury, arsenic, cadmium, or uranium from tailings may contaminate groundwater or the soil
- Abandoned underground mines sometimes collapse because of rotted support timbers or enlargement of the underground area by groundwater
- Open pit mines leave a large hole in the landscape, irreparably changing it
- Strip mines remove all vegetation, destroying existing habitat
- Destruction of habitat by mining can threaten endangered species
- Noise disrupts communities and may affect wild life
- Increased traffic by heavy vehicles causes pollution, dust, and vibration damage to roads, communities and may affect wild life
- Water quality may be affected by mining operations

- ✓ Mining Careers Match Up Game (<http://www.womeninmining.org/career2.htm> & <http://www.womeninmining.org/career3.htm>)
 - Give ½ of students career names and the other ½ career descriptions, have them find their match in the class

Concept Development:

- ✓ **EXPLORATION**—Drill Core Assay Activity (See TESI Handouts)
- ✓ **MINING**—Cookie Mining Activity (adaptation in progress ☺)

- ✓ **MODEL MINING**—Build and Engineer an Underground Mine (http://www.pdac.ca/miningmatters/teachers/pdf/news_0301_Curriculum_Connections.pdf)
- ✓ **MINERAL PROCESSING**—Extraction of Copper from its Ore Lab (to be developed using Environmental Science text as demo or student lab depending on time)

Closure:

- ✓ **RECLAMATION**—Mine Reclamation Research Project (See word file)

Assessment:

- ✓ Verbal/oral assessment (ongoing throughout unit)
- ✓ Thought questions following activities to be answered in complete sentences (see Handouts)

Still need to finish:

- ✓ Develop rubric for Underground Mine Models & Mineral Processing Technique
- ✓ Develop rubric for Mine Reclamation Power Point Presentations

Enrichment: (sponge activities)

- ✓ Minerals Word Scramble (<http://www.womeninmining.org/gamewordscram.htm>)
- ✓ Office of Surface Mining's reclamation quiz (see reclamation project description or <http://www.osmre.gov/qttest.htm>)

Selected Readings:

- ✓ Copper—The Ancient Metal (PDF format)
 - <http://www.mii.org/pdfs/copper.pdf>
- ✓ Geology and Natural Resource Development (PDF format)
 - <http://www.mii.org/pdfs/geology.pdf>

