

TESI 5 LESSON PLAN
Grade 8 accelerated Earth Science
(9th grade course)

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NYS Standard 4, Key Idea 3: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Performance Indicator 3.1: Explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.

Major Understandings 3.1a – 3.1c

3.1a Minerals have physical properties determined by their chemical composition and crystal structure.

- ✓ Minerals can be identified by well-defined physical and chemical properties, such as cleavage, fracture, color, density, hardness, streak, luster, crystal shape, and reaction with acid.
- ✓ Chemical composition and physical properties determine how minerals are used by humans.

3.1b Minerals are formed inorganically by the process of crystallization as a result of specific environmental conditions. These include:

- ✓ cooling and solidification of magma
- ✓ precipitation from water caused by such processes as evaporation, chemical reactions, and temperature change
- ✓ rearrangement of atoms in existing minerals subjected to conditions of high temperature and pressure

3.1c Rocks are usually composed of one or more minerals.

- ✓ Rocks are classified by their origin, mineral content, and texture.
- ✓ Conditions that existed when a rock formed can be inferred from the rock's mineral content and texture.
- ✓ The properties of rocks determine how they are used and also influence land usage by humans.

Standard 7, Key idea 2: The knowledge and skills of mathematics, science and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.

My lesson is essentially my unit on Rocks and Minerals. I have included my unit objectives (*Fairport Central School District objectives which are noted in italics*) and my goal is to incorporate what I have learned these past three weeks into my unit. I will include specific activities that I will use to answer the state standards/local objectives with a focus on minerals and mining (Objectives 1-6 and 24) for this lesson plan.

Tentative schedule: Days may vary depending on lab day schedule (Students in my school have an additional double lab period once every 4 days. Periods are 40 minutes in length.)

Day 1:

I'll ask my students what they know about rocks and minerals. Each pair of students will be given a container that has small samples of rocks and minerals. I will have them spend several minutes making observations and discussing what they have in their containers.

Next I will show photos in a power point type presentation to show me learning about rocks and minerals myself at TESI. During this, we'll discuss the importance of rocks and minerals. Why will we spend the next four to five weeks learning about rocks and minerals?

I will then use the TASA Graphic Arts CD, *The Wonders of Rocks and Minerals*, with a projector/class computer to help introduce rocks and minerals. Students will answer questions on a worksheet as notes.

Day 2:

Fairport Objective 1:

Identify the physical properties by which minerals may most often be identified.

Students will go to the computer room and work individually on two sections of the Wonders of Rocks and Minerals that explain and give examples of each of the physical and chemical properties that are used to identify minerals. (We have a site license that allows us to put the CD on as many computers as we want in the school.)

Day 3: (Double lab period)

Objective 2:

Given a mineral identification key and the Properties of Common Minerals in the NYS Earth Science Reference Tables, determine the physical properties and composition of a mineral and its identity by name.

Objective 3:

Identify some minerals using chemical properties (acid test).

Using a mineral key and a mineral kit (streak plate, glass plate, penny, and nail), students will observe the physical and chemical properties of 12 – 15 minerals and identify them by name by completing a *Mineral Identification Lab*.

We will identify the properties of one mineral together first to review the physical properties of minerals then identify that mineral by name.

Students will have the remainder of the double period to complete the activity working with their lab partner. Two lab groups will share a tray of 15 minerals and each lab group will have their own mineral kit. Once they identify the minerals students will check with me to see if they have identified them correctly. Once they have successfully identified the minerals, they will answer questions to check their understanding of the properties of minerals. Questions that don't get completed in class will be assigned for homework.

Day 4:

Objective 4a:

Identify what causes minerals to have different physical properties although most are made up of similar elements.

Objective 5:

Using the Average Chemical Composition of Earth's Crust, Hydrosphere and Troposphere in the ESRT, determine the percentage of common elements in the Earth's crust.

Using the ESRT (Earth Science Reference Tables) on page 16, *Properties of Common Minerals* chart, students will look at the composition of common minerals. Then we'll turn to page 11, chart on *Average Chemical Composition of Earth's crust, Hydrosphere, and Troposphere*, and notice that minerals are made up of a combination of mostly just 8 common elements.

Students will complete the *Toothpick and Marshmallow Lab* where, in groups, they will construct models of crystals using marshmallows and toothpicks. (The marshmallows represent the atoms of the elements and the toothpicks represent the bonds connecting the elements.) Students will choose from a cubic, hexagonal, tetrahedral, (have these constructed ahead of time to use as a model) or come up with some other structure that they think will be strongest and will hold the most weight after the connected toothpicks and marshmallows have dried.

The following rules must be obeyed when constructing models:

- ✓ The group needs to agree on a pattern and then justify their pattern with a brief reason before beginning construction.
- ✓ Structures may only be one toothpick high.
- ✓ Toothpicks cannot be broken.
- ✓ The same (consistent) pattern must be repeated when connecting marshmallows.

Materials needed for each class (up to 30 students – six groups):

1. one bag of mini marshmallows.
2. three boxes of round toothpicks.
3. six cardboard bases to put structure on to dry.

Split up the marshmallows and toothpicks between the groups and give them remaining class time (approx. 15 minutes) to build their structures.

At the end of the period, each group places their structure on the cardboard base with their lab sheet and places them on the designated counter to dry.

NOTE! Structures will usually dry (harden) in 4-7 days depending on the humidity level in school building.

Day 5: (Up to a week later)

Objective 4 a continued...

One group will go at a time. First the group will predict how many books (approx. 4 lbs each) their structure will hold.

A piece of cardboard is placed on top of the structure and then the group will test the strength of their structure by stacking textbooks, one at a time, on top of the structure until it collapses (crumbles).

For stronger structures (the tetrahedrons!) once 25 books are stacked up, they're removed, then lighter to heavier students, one at a time, stand on the structure. ***This past year, one structure held a student who weighed 150 lbs, then collapsed when a 160 lb student stood on it!***

Objective 4b:

Identify the name and be able to construct or draw the model of the silicon-oxygen structural unit in silicates.

The tetrahedron ends up always being the strongest structure in the lab.

Students then write a conclusion to the lab to say which structure was the strongest and why or why not their structure was strongest.

Day 6:

Objective 6a. Describe ways minerals form in the Earth's crust.

Students will complete Tim Corcoran's *Keweenaw in a Test Tube Lab* to introduce ways that minerals form in the Earth's crust.

I'll also show a video clip or animation of magma solidifying and we'll dissolve salt in water, pour a small amount on a watch glass, then wait overnight for the water to evaporate.

Day 7: (Double lab day)

Objective 24:

Discuss the importance of mineral resources and why they must be used wisely.

I'll introduce mining at this point. I'll briefly discuss the steps to mining: Exploration, Mining, Processing, and Reclamation. I'll use digital photos and the projector to show these steps from what we did at TESI.

I'll also show clips from *the Republic Wetlands Preserve* and either *Roots of Steel* or *The Tilden Mine* to show what's involved in the last two steps.

I'll assign one step to each person and then we'll go to the library so students can research what's involved in that step of mining. I'll also provide written literature collected from TESI as another resource.

Students will be given a couple of days outside of class to continue to research information.

Day 8.

Objective 6b.

Using the Properties of Common Minerals in the ESRT, find uses for minerals.

Students will complete Minerals in NYS Lab. This is a lab I developed with a colleague that shows minerals that are currently or have been mined in NYS. (I will most likely need to modify this with the information learned at TESI.)

Students use a four page packet as a reference that lists Minerals that have or were mined, where they were mined (county), and what the mineral is used for.

Given a map of NYS with the counties shown, students color in the county using a key, for each of the minerals. Some counties will have more than one mineral.

Students then complete a matching exercise that matches the mineral with the use and then answer a few questions.

Day 9.

Students will complete Cookie Mining activity.

Days 10 and 11:

Objective:

NYS Standard 7 (see page 1)

In each class, all students that researched each step will meet together as a group to share information. (ex. The exploration step will meet together, etc...)

Each group will need to present a 6-10 minute presentation to the class on their mining step. I'll need to develop this more completely and come up with a scoring rubric.

Day 12:

Review all objectives

Wrap up information on minerals as they relate to mining.

Assessment will be done by collecting and grading lab work and evaluating the presentations.