

Unit B: Components of Soil

Lesson 2: Minerals of Soil

Student Learning Objectives: Instruction in this lesson should result in the students achieving the following objectives:

1. Identify chemical formation of soil minerals
2. Differentiate shape of minerals
3. Understand cracking of minerals
4. Differentiate between the color of minerals

Recommended Teaching Time: 2 Hours

Recommended Resources: The following resources may be useful in teaching this lesson

- A PowerPoint has also been developed for use with this lesson plan

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Large rocks
Tape
Magnets-2 for each group
Squares of paper

Terms: The following terms are presented in this lesson (shown in italics and on PowerPoint Slide 2)

- | | |
|---|--|
| <ul style="list-style-type: none">• Sand• Silt• Clay• Triangle | <ul style="list-style-type: none">• Tetrahedron• Octahedron• Cube• Dodecahedron |
|---|--|

Interest Approach: Take bread dough. Hand out enough bread dough for each student to have a large handful. As you say a shape, have them make the shape out of the bread dough. Use shapes like Triangle, Rectangle, and Square. You can also challenge them by having them make a 3 dimensional shape like cone or cube. Then explain to the students that minerals of soil can come in all these shapes.

Summary of Content and Teaching Strategies

Objective 1: Identify chemical formation of soil minerals.

(PowerPoint Slide 3)

- I. Chemical formation of soil minerals differ due to the general make up of each mineral.
 - A. Sand formation is very large with a lot of surface area. This causes the particles to lose water quickly and not form any bonds to one another.
 - B. Silt is small and can form some bonds. However, these bonds can be easily broken and do not hold water in place for long periods of time.
 - C. Clay is so small that the chemical formation causes the particle to form very tight bonds to water and to one another. These bonds are so strong that it will hold water in place for long periods of time and can prevent water from passing through.

Have students split into groups of 3. Have a large rock for each group. Have each group try to tape a piece of paper to the rock. Then have them lightly pull on the paper. Have the rock represent how the sand will not bond to anything. Next, have two different students hold a magnet. Have them put the magnets together. Then have the students pull them apart. That will show how Silt will split when given a chance. Finally, have two students hold hands. Now have them pull apart slightly but still hold on. That should show how Clay will hold together even when being pulled apart.

Objective 2: Differentiate shape of minerals.

(PowerPoint Slide 4)

- II. Minerals come in many different shapes. These shapes are caused by how the mineral is formed. The common shapes are as follows:
 - A. Triangle
 - 1. 2 sides
 - B. Tetrahedron
 - 1. 4 sides
 - C. Octahedron
 - 1. 8 sides
 - D. Cube
 - 1. 6 sides
 - E. Dodecahedron
 - 1. 12 sides

Have small squares of paper available to the students. Each student should make a shape with the papers that have the same amount of sides as the shapes do. Show the website: <http://pubpages.unh.edu/~harter/crystal.htm> as an example of what these shapes look like.

Objective 3: Understand cracking of minerals.

(PowerPoint Slide 5)

- III. Minerals crack for one reason, water.
- A. Sand minerals are broken down rock due to the rain hitting on the rock for many years. These minerals break down smaller and smaller until they become sand, and there are variations in sizes of sand from larger sand to very small sand, almost like silt.
 - B. Silt minerals crack just like the sand, due to the rain. However, it does not start as a rock, it starts as silt. These silt particles will crack from the rain and the loss of other ions. These ions like aluminum and iron will move from one particle to another due to the movement of water. When the ions move, they can cause the mineral they left to crack due to the missing piece.
 - C. Clay cracks more often than the other two. They crack so easily because their structure is based on the very strong bond they have with the water. If the water is moved from the mineral, that mineral will crack.

Have students write down a list of ten reasons why minerals crack and what the differences are between the three minerals.

Objective 4: Differentiate between color of minerals.

(PowerPoint Slide 6)

- IV. Mineral color seen by the naked eye varies from location to location. Natural mineral color is relatively the same, however.
- A. Mineral color you can see with your eye is based on age of soil, organic matter, and what is found in the soil.
 - 1. Red soil minerals are very old and have oxidized.
 - 2. Dark minerals have a lot of organic matter found in the soil.
 - 3. Other colored soil has different minerals found in it, such as salt.
 - B. Natural soil color is gray.
 - 1. The only way natural soil color is found in poorly or somewhat poorly drained soil. This soil has the inorganic substances, like iron and aluminum, removed from the soil in concentrated in other areas, leaving the natural soil mineral color of gray revealed.

Have samples of soil with different colors. Make sure you have a soil that is gray to show the natural color of minerals. The other colors could show reds and browns.

Review/Summary: Use the student learning objectives to summarize the lesson. Student responses can be used to determine which objectives need to be reviewed. Questions on **PowerPoint Slide 7** can also be used as review.

Application:

Have students go outside in groups of three. Each group should dig a small hole from three different areas around the school to try and find a sample of each different mineral color from each hole. They will bring their small samples back to class and explain why it is that color and what shape they think the minerals come in and why.

Evaluation:

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is attached.

Answers to Sample Test:

Part One: Matching

1=h, 2=d, 3=a, 4=e, 5=f, 6=c, 7=b, 8=g

Part Two: Completion

1. water/rain/precipitation
2. brown, red, black, yellow
3. Sand

Part Three: Short Answer

1. Students can describe three of the following: cube, tetrahedron, triangle, octahedron, dodecahedron
2. The oxidizing of iron in soil causes the red color.
3. Students can list any three of the following: parent material, climate, living organisms, topography, and time.

Sample Test

Name: _____

Test

Unit B Lesson 2: Minerals of Soil

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|----------------|---------|----------|
| a. water | d. sand | g. silt |
| b. clay | e. gray | h. bonds |
| c. tetrahedron | f. cube | |

- _____ 1. When one mineral attaches to another mineral.
- _____ 2. Forms the weakest attachment to one another.
- _____ 3. The one reason minerals crack.
- _____ 4. Natural color of soil minerals.
- _____ 5. Three dimensional shape that has 8 corners.
- _____ 6. Three dimensional shape that does not have 8 corners.
- _____ 7. Mineral that forms the strongest attachment to one another.
- _____ 8. Mineral that forms the middle strength attachment to one another.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. A climate cause of cracking of minerals due to decomposition over time is _____.
2. Three colors that soils can appear to be but are not the natural color of the minerals would be _____.
3. The mineral that has the largest surface area is _____.

Part Three: Short Answer

Instructions. Use the space provided to answer the following questions.

1. Write down and describe 3 different shapes that minerals can be formed in.

a.

b.

c.

2. Describe how soil turns red over time.

3. Soil minerals crack differently between sand, silt, and clay. How are each one different?

a.

b.

c.