

Geology

Grades 3-5 or beyond

Materials: notebooks, soil samples for each group

Examples: Soil A: taken from the lake
Soil B: taken from a driveway
Soil C: taken from the woods
Soil D: sandy soil taken from a field
Soil E: clay-loam soil taken from another field
Soil F: wet, muckish soil taken from a lowland swamp
Soil G: taken from a construction site

Background

This lesson should be done after students have been introduced to the process of soil formation, the rock cycle, and have had the opportunity to observe sand, clay, loam, and have done a soil profile for these. Information regarding the Surface Geology of Michigan, including detailed descriptions of various common soils can be found at www.michiganfruitbelt.org.

The students will use this knowledge to make logical hypothesis about where each soil sample was taken from.

1. Explain to students that there is a problem and they must use their scientific skills to solve it: Someone has stolen Mr. Benton's treasure. Police believe that the treasure is buried somewhere on the estate, but they don't know where to look. Police found a man's shoe on the estate with several soil samples on it. The police took samples from around the estate but forgot to label them. Now, someone must match the samples from around the estate with the samples taken from the shoe.

2. Divide students into groups:

Each group should get 2-3 samples to test and analyze. Have students perform standard soil tests and record their observations of the following characteristics:

Color	Effects when wetted with water
Texture	Effects when dried
Weight	Other characteristics (organic material, rocks, etc.)

Exploration Phase

It is the student's job to actively observe the different soil types and decide which soil goes to which part of the estate. The students work in groups, discussing possible solutions and stating the evidence for their findings. In this phase, students will record findings in their notebooks.

Concept Introduction

Use overhead projector, with a transparency of the ESTATE MAP (page 26), record student ideas about each soil. A few possible questions to ask:

1. Who has a guess where soil A was taken from?
2. What characteristics have you found about soil A that leads you to this conclusion? .

3. Could the soil have been taken from somewhere else? Any other possibilities?
4. What do we notice that is similar about soil C and E? (both are dark soil) What is different about them? (one has twigs, acorns, other doesn't) What can this tell us?
5. Soil G is rather different than any other soil. Any guesses?

If the students disagree with an answer, they have to find information supporting their assertions. They must develop logically coherent, valid arguments for their hypothesis. If the student gives an answer without appropriate evidence, the police need evidenced claims to make these assertions useful in court.

Application Phase

Once the students have identified the soil types, the teacher poses a new problem for the students to solve. They look at the picture of the boot and decide which soil sample goes with which layer on the suspect's boot. The teacher gives a description of each soil layer because the drawing is hard to read.

Layer 1: Red in color, medium texture, small rocks embedded within

Layer 2: Black, very fine, mucky, with organic matter

Layer 3: Brown, silty, lots of organic matter present

Layer 4: Brownish gray in color, very fine and sandy, consistent texture, no gravel or rocks

Possible Questions

The first layer on the boot has small rocks and parts of metal in it. What possible soil sample could this be? Why? The next layer is very dry, yet gets sticky when wet so where could this be from and why? (Do this for each layer)

Students then look at footprints the teacher will draw onto the map and discuss possible solutions to where the treasure is buried. What area did the suspect walk through first? Last? Students can take turns coming up to the enlarged projection picture and discussing possible solutions in groups. After discussion, each group should agree on one possible solution. This means that there will be a great deal of scientific problem solving and debating skills being used.

Possible extensions of this project

The key to this exercise is to keep the students thinking scientifically and guessing. Do not give them the answer at the end of class, but wait until the next class period.

Students should record their findings and ideas about the crime in narration form. The estate could be given accurate measurements in which the students would have to manipulate to solve various math problems.

MEAP Criteria:

Science Strand 1: Standard 1.1 Constructing New Scientific Knowledge

This standard incorporates the ways that scientists and individuals investigate and learn about the world.

Science Strand Five: Standard 5.1 The Geosphere

All students will describe the earth's surface; analyze the effects of technology on the earth's surface and resources. The Geosphere includes surface and geological processes.