USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

AGI american geosciences institute
connecting earth, science, and people

Earth Science Education Activity

Exploring Soil Colors and Crayon Making

Background: Soils are one of our most important natural resources. They also are important for the beauty their many colors add to our landscapes. Most of us overlook this natural beauty because we see it every day. Often these colors blend with vegetation, sky, water, etc. Soil colors serve as pigments in bricks and pottery. Soil crayons, a mixture of soil and wax, provide an opportunity for observation of a variety of colorful soils. This natural beauty can be interesting to art students and others who want to create a natural look in their artwork.

Key Question: How can we utilize a natural resource as a medium for creative expression?

MATERIALS

The following is a list that aligns with the recommended procedure. Feel free to modify your materials as you see fit.

- soil (dried in air)
- hammer or mallet*
- sharp knife or razor blade*
- plastic baggie
- mortar and pestle (rubber-tipped)
- paper cups (8 oz.)
- knee-high nylon hose (white preferred)
- paraffin wax
- hot plate*
- saucepan (medium)
- 15-ml (milliliter) pointed centrifuge tube (hard plastic)
- small beaker/rack to hold centrifuge tubes
- small glass funnel
- wood stir sticks (popsicle sticks)
- teaspoon
- ice bath
- metal spatula or scraper (thin blade pocket knife)*

*Ensure thorough safety discussions with students regarding the proper handling and usage.

STANDARDS

NGSS

DCI: ESS3.A Natural Resources
SEP: Planning and Carrying Out Investigations
CCC: Cause and Effect; Patterns

SDG 12: Responsible Consumption and Production

Learn more about the United Nation's Sustainable Development Goals (SDGs) and explore resources for educators from UNESCO: https://en.unesco.org/themes/education/sdgs/material

Artistic depiction using soil of landscapes along the Lewis and Clark expedition route.

Credit: Jan Lang/NRCS

HANDS-ON INVESTIGATION

1. Introduce the basics of the procedure to students – preparing the soil, heating the wax in a hot water bath, and making the crayon. They will need to figure out how to:
   - **a.** make the soil samples into a fine powder,
   - **b.** mix the soil sample evenly into the hot wax, and
   - **c.** remove the crayon from the container in which it is made.

2. Have students work in groups to plan details of their investigation, including:
   - **a.** their procedure,
   - **b.** selecting soil samples they want to investigate,
   - **c.** a plan to break up the soil samples and recover a fine powder,
   - **d.** observations to make before the procedure begins, and
   - **e.** observations to make once the crayons have been created.

3. Ask students to check in with you for approval of the procedure before proceeding.

4. Have each group carry out their procedure to make one crayon, being sure to make observations of the soil before and the crayon afterwards.

ANALYSIS

1. Facilitate a class discussion where students can share their procedures and observations. Encourage peer feedback and critical reflection on the effectiveness of the different approaches. Discussion questions could include:
   - **a.** What did you observe about the soil samples before we began the procedure?
   - **b.** How did the soil samples differ from one another visually and texturally?
   - **c.** What changes did you notice in the soil samples after they were mixed with the wax?
   - **d.** How do you think the properties of the soil influenced the appearance and texture of the crayons?
   - **e.** Can you predict how the crayons might behave differently based on the soil composition?
   - **f.** How well do the crayons work? For those that work better, what parts of the procedure or qualities of the soil do you think had the most influence on this?
   - **g.** What implications might the variability in soil colors and textures have on environmental health and sustainability?
   - **h.** How might we modify the procedure to investigate other aspects of soil quality or environmental factors?

2. If time allows, give students time to revise their procedure and make more crayons.

SYNTHESIS

Ask students to reflect on this activity by writing an essay discussing the potential artistic and educational applications of soil crayons, considering factors such as color variability and texture.

EXTENSION

Ask students to use these homemade crayons to raise awareness about the importance of soil as a natural resource and soil conservation.

RECOMMENDED PROCEDURE

Prepare the soil:

1. Place dried soil on a piece paper and crush into pieces with a hammer or mallet.
2. Place some of the crushed soil into a mortar. Use a rubber-tipped pestle to crush the soil into a fine powder. Repeat to crush all of the soil.
3. Place cup of powdered soil in a paper cup. Wrap a knee-high nylon hose over the top three times.
4. Turn the cup upside down over a piece of paper and gently shake to sprinkle out the finest powder onto the paper. Use this soil powder to make the soil crayons.
5. Prepare each of the soils in this manner.

Prepare the wax:

6. Cut the wax into small (1mm or less) pieces with knife or razor blade or place a block of wax into a heavy duty plastic baggie and crush with a mallet.

Make the crayon:

7. Heat approximately 2 inches of water in a saucepan on a hotplate. (The water height needs to be just high enough to submerge the tubes, but not cover them.) Place rack or small beaker with water in the pan. When the water starts to boil, turn the hotplate down to a simmer.
8. While the water is heating, place enough small pieces of wax into a 15-ml centrifuge tube (packed slightly) to about 12 ml.
9. Place the centrifuge tube with the wax into the rack or beaker in the saucepan and wait for the wax to melt.
10. When the wax is completely melted, place the glass funnel into the top of the centrifuge tube and spoon in approximately 1 teaspoon of prepared soil. Remove funnel. Stir melted wax and soil mixture with a wooden stir stick. Continue stirring while removing the tube with the wax and soil mixture to an ice bath and remove stick.
11. Let the centrifuge tube sit in the ice bath about 15 minutes. Take the tube out of the bath and scrape the inside of the tube to remove any excess soil or wax along the rim edge of the crayon to help release it.
12. Turn the centrifuge tube upside down and gently tap on counter to release crayon.

HELPFUL HINTS

- The best temperature for melting the wax is right at its melting point. If the water is too hot, the wax becomes runny and the soil settles to the bottom quickly.
- The higher the clay content in the soil, the less problem with settling (the finer particles settle more slowly).
- The 12 ml of unmelted wax in the tube melts down to about 6 ml. Adding the spoonful of soil brings the volume to approximately 9 ml.
- Network with others to get a variety of soil colors.