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The Wagner Free Institute of Science and its supporters
The National Science Foundation, through NSF# 0139303 and #0440506
Saint Joseph's University

Sample Lesson from Grade 3 Unit: Rocks and Minerals Week 2: Mineral Tests: Hardness and Light Tests

Standards:

Pennsylvania Academic Standards for Science and Technology

3.2.4 B Describe objects in the world using the five senses

3.2.4 C Recognize and use the elements of scientific inquiry to solve problems

3.4.4 A Recognize basic concepts about the structure and properties of matter

3.5.4 B Know types and uses of earth materials

Materials:

Chart paper

Mineral Kit w/

- Penlight
- Pennies
- Nails
- Mineral Samples

Mohs scale chart and minerals

Fluorescent minerals for demonstration

Fluorescent lamps

Worksheets

Lesson:

1. Ask students what they think a scientist is. List their answers on chart paper at the front of the classroom. When finished, expand on the characteristics of a scientist (asks questions, notices detail, draws, measures, counts, etc. Keeps trying and has fun!) that the students have listed. Ask students how scientists use their senses if they are having difficulty. (10 min)
2. Explain that we will be studying rocks and minerals. Scientists who study the earth (rocks, minerals, soil, etc) are known as geologists. Ask students what tools they think geologists need and how do they report their findings? List their responses. (10 min)
3. Explain that for the next 12 weeks, we will be geologists and we will examine the properties of rocks and minerals. Explain and model each test before the students open and begin their examination.
4. In groups of four, students will be given a mineral kit for which they will study each mineral's hardness and its physical response to light. The following tests will be administered:
 - The first light test we will perform all involve using light. The first is a test that is very straightforward and simply aims for students to observe whether the mineral is opaque, clear or somewhere in between. Students will hold a penlight up to each mineral and then record the extent to which light can travel through the mineral.
 - The second light test asks students to observe how light reacts to the surface of the mineral. Students perform the same activity of shining the light on the mineral but this time they observe the surface and determine if the light bounces off the mineral so that it

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is shiny or is absorbed by the mineral so that it is dull. Student will record this data as well.

- In the hardness test, students will have the chance to test their own set of minerals for varying degrees of hardness. To perform a hardness test, student should hold the unknown mineral tightly and press the penny or nail firmly against the mineral. They need to press hard since they are trying to break the glue that bonds the atoms together. Display the Mohs Scale chart and explain that their minerals will fall into one of three categories:

Soft - mineral can easily be scratched by a penny (pre-1980 so that it is pure copper).

Medium - mineral cannot be scratched by a penny but can be scratched by a nail.

Hard - mineral cannot be scratched by a penny or nail.

All minerals come in varying degrees of hardness. Diamonds are the hardest minerals on earth. Talc, the primary ingredient in talcum powder, is the softest. Scientists classify the hardness of a mineral by using a standard of hardness called Mohs scale. Mohs scale measures ten different minerals ranging from softest to hardest, seen in the following example:

1 (Talc)	2 (Gypsum)	3 (Calcite)	4 (Fluorite)	5 (Apatite)
6 (Orthoclase)	7 (Quartz)	8 (Topaz)	9 (Corundum)	10 (Diamond)

When a scientist wishes to determine how hard a particular mineral may be, he or she will compare it to the minerals on Mohs scale. If a mineral turns out to be harder than quartz (7), but softer than topaz (8), it probably measures about 7.5 on Moh's scale.

- The final light test we be conducted after all other test have been completed, including the hardness test. Using the fluorescent lamp and demonstration minerals, turn the lights off so students can see several large, impressive fluorescent rocks. Explain that some minerals are fluorescent and some are not. Next the adults will circulate with the lamps so students can see which of their minerals fluoresces and record the data on their worksheet.

Writing Topic:

- What did you learn today about a mineral's hardness and physical response to light?

Week 3: Mineral Tests: Streak, Acidity and Smell

Standards:

Pennsylvania Academic Standards for Science and Technology

3.2.4 B Describe objects in the world using the five senses

3.2.4 C Recognize and use the elements of scientific inquiry to solve problems

3.4.4 A Recognize basic concepts about the structure and properties of matter

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Materials:

Chart paper w/ directions

Mineral Kit w/

- Vinegar
- Drop bottles
- Unglazed porcelain tiles
- Mineral Samples
- Eyedroppers
- Small cup
- Calcite

Quartz minerals for demonstration (smoky, pink, amethyst and clear)

Sulfur mineral for demonstration

Worksheets

Lesson:

1. Today we will continue to investigate the properties of minerals as we conduct three common geology experiments; streak test, smell test and acidity test.
2. Ask students what is the first property they notice when they're making observations of their minerals. Explain that color is usually the first property. Perhaps that is because minerals come in all sorts of colors and shades, many of which are quite vivid and beautiful. A mineral's exterior color, however, can be misleading when trying to identify an unknown specimen. First of all, several different minerals can have identical coloring. Secondly, there are several minerals that come in a variety of colors. Quartz, for example, is sometimes yellow, sometime pink, sometimes purple, and sometimes smoky. And pure quartz is always crystal clear. Third, impurities change the color of minerals like drops of food coloring in water. Most minerals cannot be conclusively identified on the basis of their observable color. (*Show the quartz examples*)

Minerals do have, however, an identifying color, which is the color of the mineral in its powdered form. One way to determine a mineral's identifying color is to rub it gently across a hard, porous surface (geologists typically use tiles of unglazed porcelain). Most minerals will leave a trace (or streak) of powder on the tile, making it easy for students to see the mineral's true color.

- Explain that in the **streak test**, students should gently stroke their minerals over the tiles and record the streak colors that they see in their workbook. Students should draw or smear the color in a square on the worksheet to document the color and shade.

Certain minerals also have a highly distinct smell. Sulfur is the most famous, often smelling of semi-rotten eggs.

- Explain that in order to test for **smell**, students will place small drops of water on their minerals from an eyedropper. They will then record their results.
- Students will also test for **acidity** by carefully placing several drops of vinegar onto a piece of Calcite with an eyedropper. The vinegar should start to bubble and

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fizz. Ask the kids if they can think of anything in their daily lives which bubbles and fizzes. . . something they drink . . . like carbonated beverages? Calcite contains carbonate gas, but it is locked in the crystal and is released by the acidic vinegar, which dissolved the mineral. Students will then test their other minerals to see whether or not they also contain carbonate gas.

3. Students should clean-up their area when they have completed their investigations and recorded their data.
4. Student's should complete their worksheets and formulate their conclusions.

Writing Topic:

- What did you learn today about a mineral's color, smell or acidity?