Lesson 2: Classifying and Experimenting with Minerals

Target Grade or Age Level:
Sixth grade earth science

Scientific Process(es) Addressed:
Observing, Classifying, Communicating, Inferring, Hypothesizing, Interpreting data, defining operationally and experimenting

Science Concepts Addressed/Proposed PDE Academic Standards
- 3.1.7 Unifying Themes
    - o Identify patterns as repeated processes or recurring elements in science and technology
        - ▪ Identify different forms of patterns and use them to group and classify specific objects
        - ▪ Identify repeating structure patterns
- 3.2.7 Inquiry and Design
    - o Apply process knowledge to make and interpret observations
        - ▪ Describe relationships by making inferences and predictions
        - ▪ Communicate, use space/time relationships, define operationally, raise questions, formulate hypotheses, test and experiment
- 3.5.7 Earth Sciences
    - o Recognize earth resources and how they affect everyday life
        - ▪ Identify and locate significant earth resources in Pennsylvania
        - ▪ Explain the value and uses of different earth resources

Process-Oriented Objectives
- Students will observe the physical characteristics of common minerals
- Students will make inferences about what physical characteristics are common among minerals
- Students will classify common minerals based on their physical characteristics
- Students will define operationally the physical characteristics that are most important when classifying minerals
- Students will interpret data of the physical characteristics of minerals via the Internet
- Students will hypothesize if their classification methods for defining minerals correlate with the data collected from the Internet
- Students will experiment with tools necessary for classifying minerals
- Students will classify common minerals from their experimental results
- Students will communicate their ideas in a cooperative and constructive environment

What Do I Want Children To Discover?
       I want children to begin to make connections of how we can classify different minerals found in nature, preferably common minerals in rocks. Students should discover that minerals have physical characteristics that help to define it, similar to the way people have characteristics that define themselves (height, weight, hair color, etc.).

Also, I want children to notice patterns among minerals that have similar physical characteristics.

Description of Introductory Activity (Anticipatory Set) and Discussion

   I will begin the lesson with referring to how we (the class) defined what a mineral is and how they are formed. Then I will ask the students if they believe if all minerals are the same. Many, if not all, should respond no. Next, I will ask the students if people are the same, and all should respond no. If that is the case, how can we tell each other apart or what **physical characteristics** differentiate one from others.

   Students will be grouped in triples and each person must describe a person in the group according to the following features: hair color, height, skin color, and eye color. Students will measure each other with meter sticks. The students will record their neighbor's characteristics on a note card and place it on their shirt. After the activity I will have students form groups according to their characteristics. This activity should get them in the mind frame of classifying according to physical characteristics.

   Next, I will take out a mineral sample and ask them how we can classify this rock. The students will make inferences according to their observations. Some answers that I can expect are shape and color. I will try to ask them about the "shininess" of the rock and what would happen if we were to split the rock in half.

   Concluding the anticipatory set, I will ask students to pair up with a partner that has the same hair color. The students will be directed toward the computer lab for the second half of the lesson.

Materials Needed

Notebooks, pencils, meter stick, and a mineral collection that contains: Quartz, potassium feldspar, Olivine, hornblende, mica, plagioclase feldspar, calcite, and Web-exploration chart for classifying minerals, Internet, computer laboratory

Description of Activities—Day 1 & 2

   Students will work on a Web exploration that will allow them to define operationally the major physical characteristics of minerals. Students will start on the following site: http://www.leo.lehigh.edu/envirosci/geology/rocks/rocks.html and proceed by clicking on the link "How do we classify them?" The students will read information that describes the different characteristics. Once they have finished reading the short outline, they will proceed with a classification activity using resources on the Internet. The students will begin to observe common minerals by clicking on the image with an Alt Image tag that states "Click here to observe these minerals". The students will record the observations of the images of minerals provided in their science notebook. Once the students have read and observed the minerals on that particular site, they will fill in the mineral classification table on the Activity 1 link on http://www.leo.lehigh.edu/envirosci/geology/rocks/rocks.html.

   Once the students have completed this table, they will return to http://www.leo.lehigh.edu/envirosci/geology/rocks/rocks.html and proceed with clicking on the "Activity 2" link. The students will complete the common uses table by using the Web exploration links given on that page. Both tables will be given out for the students

to use for future reference. During the activity I will guide the students by asking questions about the observations that they have written in their notebooks.

Descriptions of Activities—Days 3 & 4

Once students have collected data from the Internet they will form a hypothesis about the validity of the data they collected. The students must determine if their experiment with classifying minerals will be the same from the information provided. Students will record their hypothesis on their lab sheet for classifying minerals.

Mineral stations will be setup in the classroom and each pair of students will work together by moving to each station. At the stations, the students will be able to test for hardness by using a penny, nail and their fingernail. Students will record their data on their lab sheet as well as their visual observational data on color, streak, cleavage and fracture patterns, and luster. Using their classification chart they tabulated from the Internet the students will compare and contrast their experimental results from the information they found on the Internet.

The students will write a formal conclusion stating if their hypothesis was correct or incorrect, what physical properties of minerals were similar between their experiment and information collected via Internet, and what properties were different.

Finally, the students will write a business letter to A&G Mineral department requesting an order of their most important mineral. The students must explain how this mineral is important in their lives and its common uses.

Typical Discussion Questions
- What are some physical properties of minerals?
- How can we classify minerals according to those physical properties?
- Are there any patterns that you observed after classifying minerals?
- Is your experimental data the same as the information you collected via Internet? Explain.
- What properties of minerals were similar and different from the information collected via Internet and experimental data?
- How are minerals important in our lives? What are some common uses of minerals?

How Children Will Be Encouraged to Investigate on Their Own in the Classroom

This lesson is a very student-centered activity because it requires the students to investigate important characteristics of minerals and using a method to classify them. The students will determine if the information they collected on the Internet (similar to theoretical data) is similar to their experimental data. The students will have more opportunity to explore and share because of the paired grouping.

Expected Conclusions

Minerals have physical characteristics that geologists and other scientist use to define and classify them. The major physical characteristics used to define minerals are color, shape, hardness, luster, streak, and fracture and cleavage. Classifying minerals according to their physical characteristics help to bring out patterns that are apparent in rock structures as well. Minerals have many commercial uses and serve many of our daily needs.

Assessment (RUBRIC PROVIDED)
- Communication skills used during Web exploration
- Observations made and information provided on both Web exploration tables
- Process skills used during lab exercises
- Business letter—sentence structure, grammar, vocabulary, evidence of common uses of minerals are explained and neatness. This assignment to completed on loose-leaf paper.

Applications to Real Life Situations

        The ability to classify substances according to physical characteristics is necessary to define those substances. Students continue to classify each other according to physical attributes. Minerals, which are found in rocks, are seen and used by kids everyday. It is important they recognize the patterns that develop among rocks.

Web Exploration Activity: Observing and Classifying Minerals According to their Physical Properties

Please fill in the table with the appropriate values, observations and data provided by the Internet sites given on http://www.lehigh.edu/~cda3/minerals.html#Activity1.

Mineral Name	Color	Streak	Hardness	Luster	Cleavage	Fracture
Muscovite Mica						
Amphibole or Hornblende						
Calcite						
Olivine						
Potassium Feldspar (Microcline)						
Plagioclase Feldspar (Albite)						
Quartz						

Web Exploration Activity: Common Uses of Minerals

Please fill in the table of common uses for the minerals provided.

Mineral Name	Common Uses
Muscovite Mica	
Amphibole or Hornblende	
Calcite	
Olivine	
Potassium Feldspar (Microcline)	
Plagioclase Feldspar (Albite)	
Quartz	

Name:_____   Date:_____

Science 6—Rocks & Minerals   School:

Lab Practical: Classifying Minerals

Please work in pairs and record the data on the minerals set up at each center. You will
have 7 minutes to work at each station. Please work efficiently!! Answer all questions
and follow all directions.

Hypothesis: Do you believe that the information you collected on the Internet about the
minerals we observed will be the same when you perform your tests here? Explain why
or why not.

Making Observations and Collecting Data: Please test hardness by using a penny, nail or
fingernail. Record the color, streak by conducting a streak test, observe cleavage and
fracture and luster. Write all of your answers in the tables below

STATION	COLOR	STREAK	HARDNESS	LUSTER	CLEAVAGE	FRACTURE
1) Muscovite Mica						
2) Amphibole or Hornblende						
3) Calcite						
4) Olivine						
5) Potassium Feldspar (Microcline)						
6) Plagioclase Feldspar (Albite)						
7) Quartz						

Analyzing Data: Answer the following questions in complete sentences.

1. Are there any patterns that you observed after classifying the minerals in this lab? If so, please explain in detail.

2. Look at your mineral classification table that you completed on the Internet. Is your experimental data the same as the information that you collected from the Internet? Give examples of the minerals that gave the same results and examples of where the results are different.

3. Was your hypothesis correct? Explain why or why not?

Rubric for Lesson 2—Classifying and Experimenting With Minerals

Outstanding—Students completed task above and beyond expectation. Great examples and well-thought out explanations. Student demonstrated understanding at an advanced level.

Good—Student completed task and met expectation. Good example used and explanations were satisfactory. Student demonstrated understanding at a proficient level.

Fair—Student completed some parts of the task and was below expectation. Some evidence of examples are used, but explanations lacked depth and clarity. Student demonstrated understanding at a basic level.

Unsatisfactory—Student didn't complete tasks or minimally. Little to no examples used and explanations were minimal or none was given. Answers lack clarity and student demonstrated understanding at a limited level.

WEB EXPLORATION ACTIVITY RUBRIC

Criteria	Outstanding	Good	Fair	Unsatisfactory
Observations on Physical Properties of Minerals Handout	45-50	40-44	33-39	0-32
Observations on Common Uses of Minerals Handout	27-30	24-26	20-23	0-19
Communication Skills Used During Web Exploration	18-20	15-17	12-14	0-11
Final Score	90-100	75-89	65-74	0-64

LAB PRACTICAL RUBRIC

Criteria	Outstanding	Good	Fair	Unsatisfactory
Hypothesis	9-10	7-8	5-6	0-4
Communication Skills	9-10	7-8	5-6	0-4
Observations and Collecting Data	45-50	40-44	33-39	0-32
Analyzing Data	27-30	24-26	20-23	0-32
Final Score	90-100	75-89	65-74	0-64

BUSINESS LETTER

Criteria	Outstanding	Good	Fair	Unsatisfactory
Sentence Structure	18-20	15-17	12-14	0-11
Vocabulary Used	18-20	15-17	12-14	0-11
Evidence of Concepts of Minerals Used	18-20	15-17	12-14	0-11
Grammar	18-20	15-17	12-14	0-11
Neatness and Business Letter Format Used	18-20	15-17	12-14	0-11
Final Score	90-100	75-89	65-74	0-64