Introduction to Mineral Identification Exercise

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Background: "How do I start?" Students are often stymied when faced with a box of minerals to identify. Although we give a careful lecture and demonstration, they still don't know where to start once the box is on the table. The following exercise uses an inquiry-based approached to overcome the fear of tackling mineral identification. Few instructions are given and students discover for themselves how to approach identification.

In addition, this exercise emphasizes a fundamental part of the scientific process: observation, then interpretation. Not only do the students gain confidence at identifying minerals using physical properties, they gain a better understanding of how science is done. Once they have completed this exercise their minds will be more open to a detailed lecture on physical and chemical properties and they will be more willing to take on the given task.

This exercise uses only 4 minerals and can be done by individuals or by small (2-3) groups. Three of the minerals are nearly colorless and translucent. The fourth is colored and opaque. Having "one of these things is not like the other" gives them confidence in identifying their first mineral. The other three have different types of cleavage and other distinguishing properties that can be learned by careful observation. Duration: ~45 minutes.

Materials:

- Mineral set (one per person or group) *(I use a small plastic basket)*
  - Calcite (a translucent piece with excellent cleavage surfaces)
  - Gypsum (v. selenite; as clean a piece as possible)
  - Halite (a translucent piece with excellent cleavage surfaces)
  - Hematite (earthy red, layered or oolitic work well)

- Basic identification tools *(I use a small plastic basket)*: magnet, nail, penny, scratch plate, glass plate, magnifying glass, dilute acid bottle and wipes

- Activity handouts (one each per student)

Procedure:

1) Set up one mineral set and one test kit at each place.

2) Handout first sheet only; one to each student even if working in groups.
   a. Don't double side as they will want to set them side by side during the activity, and you don't want them to read the descriptions before they write their own.

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3) Have students lay out the four minerals in the boxes in the left column on the first sheet (order doesn't matter unless you use numbered samples and say so).

4) Brainstorm with the students about what observations they might make and write these down where all can see them. Guide them but don't deliver a detailed list with uncommon words. Let them decide what to look for.

5) Have them look at the basket of tools and brainstorm about how they might use them. Again, guide, don't deliver. A caution or procedure about using the acid is in order however.

6) Ask them to write descriptions of each mineral in the box to its right. Tell them to use their own words and remind them to only describe, not interpret.

7) When they have completed the four descriptions, have them compare with their neighbors and ask them to discuss and modify anything they thinks needs that.

8) Pass out the second sheet and have them read the descriptions. There are plenty of terms they may not understand but this will make them curious as to what they mean. This leads to a good post-discussion.

9) Once they understand most of the descriptions, they should try to match them with their own. They should then pick up the minerals form their other sheets and put them in the box they think matches best.
    a. Check to make sure all minerals are in the correct boxes. You can go around and remove the incorrect ones and ask them to try again or you can use commonly numbered samples and review with the entire class.

10) Have them read the descriptions again and pick out things they do and don't understand.

11) They are now ready to listen to a lecture using the appropriate terms and explaining why they are what they are. And to tackle an entire suite of minerals.

12) An extension of this activity the four samples can now be compared to each other. The descriptions also give chemical formulae and this can serve as another avenue of discussion.

The idea for this activity was inspired by an exercise in Todd, *Investigations in Physical Science* (Exp. 25), Saunders Pub., 1991.

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Place a specimen here.	Describe it here.
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Calcite $CaCO_3$ Color: colorless to white; transparent Streak: white Luster: vitreous (glassy) Hardness: 3 Sp. Gr.: 2.72 Cleavage/Fracture: rhombic (diamond) Other: reacts vigorously with dilute acid; transparent form double refracts	Place here the specimen that best matches the description to the left.
Gypsum (v. selenite) $CaSO_4 \cdot 2H_2O$ Color: colorless, transparent Streak: white Luster: vitreous (glassy) Hardness: 2 (soft) Sp. Gr.: 2 Cleavage/Fracture: one direction; flakes Other: crystals tabular, prismatic	Place here the specimen that best matches the description to the left.
Hematite Fe_2O_3 Color: red-brown to black Streak: red-brown Luster: earthy; metallic Hardness: 5.5 to 6.5 Sp. Gr.: 5.26 Cleavage/Fracture: uneven fracture Other: tabular specular crystals; “rusty”; layered spheres	Place here the specimen that best matches the description to the left.
Halite NaCl Color: colorless, white; may be transparent Streak: white Luster: vitreous (glassy) Hardness: 2.5 Sp. Gr.: 2.16 Cleavage/Fracture: cubic Other: cubic crystals; granular in masses; frosty; salty taste	Place here the specimen that best matches the description to the left.