Online Minerals Lab -- Instructor Notes

Materials Needed:

- Access to mineral concepts from lecture; be prepared to present/upload your own lecture materials as needed if your lab course is not directly paired with a lecture course. This can include textbook material and other references as needed, and mineral identification charts appropriate for your needs. Examples are linked below in references.
- You may substitute your own samples from your collection as part of this activity; you must have clear, high-resolution images for students to work with. Best practice would be to take photographs of mineral samples against a uniform background with a marked scale in frame and use multiple diffuse light sources to reduce shadows.
- *Optional:* video-enabled cameras to record short videos for part one of the assignment for asynchronous activities, if desired. Cellphone cameras or basic webcams are sufficient.

Total Time Needed to Complete (estimated):

- 3.0 – 4.5 hours to complete all portions of the activity. Might be spread over two labs or lecture/lab combined assignments.

Lab Delivery:

This lab exercise can be modified for either a synchronous or asynchronous learning environment. This document includes suggestions for delivering this lab exercise in an asynchronous format, but specific modifications will depend on the specific LMS used by your institution. The lab activity is written for a paired lecture/lab course and assumes that topical coverage from lecture will be used as background/introduction for this lab exercise. If that is not the case for your setting, you can make use of online video tutorials and open-access readings listed in the references at the end of this document. There is a rubric for the concept map assessment; identification keys are available for the mineral ID portion of the lab. If you use your own collection or another online mineral ID collection, you should generate your own key or contact the collection authors for access to any key(s) needed.

Part One: At-Home Materials (estimated time to complete: 25-35 minutes)

- Any five objects from around the home can be used in this activity; emphasize to students that objects will be scratched, so it is important to choose items that are not precious to them.
- To assist in density evaluations, students should select items that are of roughly similar volumes. *(But it can still be possible to complete this activity if they don't* -- even we instructors when we tested this activity used items of different volumes -- might help to say find something that will fit nicely in your hand?)
- The assignment is set to be an individual activity completed and recorded by a student on paper and then compared with video of the instructor doing the same activity followed by individual student reflection. However, some modifications could be to have students upload their own videos evaluating the density and hardness of their materials; if your LMS supports small-group discussions, this can be a way to administer this portion of the lab in an asynchronous mode.
- Instructor videos should be short (3-5 minutes) and walk through the procedure of assessing hardness and density, as in the uploaded examples (which you may use instead, if needed). For asynchronous delivery, be sure to adjust settings in the LMS so that students complete their attempts prior to viewing examples.

Part Two: Properties of Minerals (estimated time to complete: 40-60 minutes)

- The sample numbers listed in the four sections are associated with Katryn Wiese's mineral collection; you may substitute samples from your own collection or other online collections (see references) as needed.
- For synchronous administration, small-group breakout rooms will allow real-time collaboration.
- A key is available linked from the lab information sheet.
- It's good to remind students to follow the suggested timing so they can move themselves forward with the rest of the lab.

**OPTIONAL Additional relevance question to ask students: Which of the objects you've chosen are made of minerals and which not?

Part Three: Mineral Identification (estimated time to complete: 50-75 minutes)

- The total time required depends on the number of samples used. Please be sure that you cull the number to meet the needs of your students.
- Students will need access to mineral identification charts and mineral formulas to complete this portion of the activity; materials from lecture should be sufficient (see references at end of document for online resources that can be used).
- You may want to emphasize to students in their instructions that samples used in this lab will NOT be the same as the samples on lab assessments, and that they will need to identify minerals that make up various rocks in later lab exercises. (**NOTE: instructors should build their own image collections for lab assessments to increase exam integrity)
- A key is available linked from the lab information sheet if you use the original mineral collection for this exercise.

Part Four: Mineral Descriptions (estimated time to complete: 5-10 minutes)

- Students will create their own description, then try to use provided descriptions to identify minerals from a small collection. Some descriptions are better than others; some have serious flaws. This leads into student reflection on the quality of their own descriptions.
- For synchronous courses, you may consider adding jigsaw-style breakout rooms to compare descriptions of mineral specimens. If desired, you may also "pop out" this section of the lab and upload it to your course LMS as an informal quiz activity.
- You may select minerals for this exercise according to your needs; authors have selected minerals that have similar color/luster properties and require detailed descriptions of crystal form / cleavage to distinguish.
- This "quiz" is not intended to be a rigorous assessment of mineral identification, but an opportunity for student reflection on generating useful mineral descriptions.
- We encourage you to replace existing "sample descriptions" with those provided by your own students (after you've used this activity once).

Follow-Up Exercise: Mineral Use Concept Sketch (estimated time to complete: 1-2 hours)

- Assign students to small groups to promote interaction and genuine discussion of results.
- Use the rubric to assess student work.
- **OPTIONAL additional relevance question to ask students: Which minerals are found in your cell phone?

- This activity is designed for combined lecture/lab courses as a follow-up/summary of content; if you are teaching a standalone lab you may modify or omit this portion of the exercise to cut down on total time commitment.
- For more information on teaching with concept sketches, visit the NAGT Teach The Earth on-ramp site for examples and tips.

References / Links to Supporting Materials

- Online Mineral Collections:
  - Katryn Wiese Mineral Collection (default collection in this lab):
    - **BOX A Minerals -- Hardness**
      Video (*No audio) | Photo Album
    - **BOX B Minerals -- Cleavage and Fracture**
      Video (*No audio) | Photo Album
    - **BOX C Minerals -- Crystal Form**
      Video (*No audio) | Photo Album
    - **BOX D Minerals -- Optical Properties**
      Video (*No audio) | Photo Album
    - **BOX E Minerals -- Mineral Identification**
      Video (*No audio) | Photo Album
  - M.A.G.I.C.: http://www.gswweb.org/magic/min.html
  - Scott Brande (Online Mineral Guide): https://omg.georockme.com/unknown-samples
- Mineral Tutorial Videos/Pages:
  - Geoscience Videos: https://www.youtube.com/watch?v=mqXUytwB3uQ
  - How to Identify a Mineral (Mike Sammartano): https://www.youtube.com/watch?v=KB-2pO7pSK8
  - Earth Rocks! Identifying Minerals (Katryn Wiese):
    - Inside Minerals (16.5-min, 40 MB) Video only | Video w/CC | Script
    - Identifying Minerals (16-min, 72 MB) Video only | Video w/CC | Script
    - MINERALS ADDENDUM: (For lab students only!) (3-min, 7 MB) Video only | Video w/CC and Study Quizzes
  - Online Mineral Guide (Scott Brande): https://omg.georockme.com/
- Open-Access Text Resources (for lecture support / replacement):
  - An Introduction to Geology (SLCC): https://opengeology.org/textbook/3-minerals/
- Additional resources:
  - Teaching with Concept Sketches:
  - Density -- The Math You Need