

Exercise One

The Study of Minerals

MATERIALS REQUIRED

The following materials are necessary to complete this exercise and should be available in the laboratory. The quantities depend upon the number of students in the laboratory and whether or not students are to work independently or in groups.

mineral specimens	dilute hydrochloric acid (5%)
streak plate	glass plate
magnet	contact goniometer
binocular microscope	

Depending upon the size and quality of the mineral specimens, using a hand lens often helps reduce student frustration.

Recommended mineral specimens: magnetite, pyrite, hematite, graphite, augite, hornblende, smoky quartz, olivine, sphalerite, biotite, potassium feldspar, plagioclase feldspar, milky quartz, calcite, halite, fluorite, muscovite, selenite gypsum, talc, and bauxite.

TEXTBOOK REFERENCES

Tarbuck and Lutgens, *Earth Science*, 13th edition, 2012. Chapter 2

PROCEDURES AND STRATEGIES

- The time necessary to complete this exercise can be controlled by the number of mineral specimens assigned for identification. We recommend that the minimum number include those minerals listed above.
- Several methods for presenting the specimens to be identified are possible. 1) Sets for every 2–4 students can be prepared and placed in trays or plastic containers (we recommend that the individual specimens be numbered so

students can check their answers). 2) For those with a limited number of mineral samples, several sets of specimens (each on a numbered card or in a numbered tray) can be placed about the lab.

- Special instructions on the use of dilute hydrochloric acid and a contact goniometer should be given prior to beginning the lab.
- Students often have difficulty with the properties of luster, cleavage, and specific gravity. Discussing and demonstrating these properties prior to beginning the lab is recommended.
- Students often wish to know if their identifications are correct. Therefore, if you have identified individual mineral specimens by numbering them or placing them on a numbered card, we recommend that you fill out a copy of the Mineral Data Sheet and post it after the laboratory session is over.
- In conclusion, throughout the lab period it should be stressed that the goal is to learn how to identify minerals and not simply to “put a name” on them.

ANSWERS TO EXERCISE ONE QUESTIONS

Activity 1.1

1. a) natural b) inorganic c) crystalline solid d) orderly crystalline structure
e) definite chemical composition with some variation
2. Minerals = quartz, silver, and halite. All of the other items are not minerals.
3. Rocks = B and C. Minerals = A and D.
4. Color is an ambiguous property of fluorite since it is highly variable.

Activity 1.2

1. Quartz = B; Galena = A; Limonite = C; Gypsum = D, Talc = E, Native copper = A
2. Answers will vary with the mineral specimens provided for identification.

Activity 1.3

1. Quartz exhibits a variety of colors.
2. Specimen A: color = red brown, streak = red brown; specimen B: color = dark gray / black, streak = red brown.
3. Answers will vary with the mineral specimens provided for testing streak.
4. Nonmetallic

Activity 1.4

1. A = fibrous habit B = bladed habit C = banded habit D = cubic crystals
2. a) The angles are about the same. b) In short, the angles between the crystal faces of a mineral will collectively determine the geometric shape of a sample (i.e., 90-degree angles in all three dimensions will produce a cubic geometric shape).

Activity 1.5

1. A = fluorite B = topaz
2. Answers will vary depending on the samples selected.

Activity 1.6

1. The sample exhibits one direction of cleavage (basal cleavage), which produces thin sheets when cleaved.
2. a) six cleavage surfaces; b) three directions of cleavage; c) the cleavage directions meet at angles other than 90° (rhombohedral cleavage).
3. Answers will vary depending on the samples selected or provided.

Activity 1.7

1. Answers will vary depending on the samples selected.
2. Most of the samples with a high specific gravity have metallic luster.

Activity 1.8

1. Tenacity refers a mineral's resistance to breaking or deforming. Terms such as **brittle**, **malleable**, and **elastic** are used to describe tenacity.
2. Dilute hydrochloric acid on the surface of calcite will cause a "fizzing" or effervescence as carbon dioxide is released.
3. Opaque refers to no light transmitted by a mineral; translucent is when light, but no image, is transmitted; and transparent is when both light and an image are transmitted through a mineral sample.

Activity 1.9

1. Answers will vary depending on the order of the minerals identified.

Activity 1.10

2. A, C, and D are feldspar; B is quartz
3. Answers will vary depending on the order of the minerals identified.

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1. Cleavage; hardness; luster; streak; fracture.
2. A cube or cubic cleavage.
3. Muscovite = 1 direction (thin sheets); Calcite = rhombohedral (3 directions not at 90°); Halite = cubic (3 directions at 90°); Feldspar = 2 directions at 90° producing rectangular shapes.
4. Color.
5. Muscovite; plagioclase feldspar; quartz; halite; quartz; quartz; galena
6. Crystals of fluorite = A; cleavage of fluorite = B.
7. a) cubic crystals b) striations c) pyrite
8. Banded habit.
9. Hardness = 3.
10. Elastic.
11. Olivine.
12. Halite: cubic cleavage & salty taste
Galena: cubic cleavage & metallic luster
Magnetite: attracted to magnet, high specific gravity
Muscovite: light color, basal cleavage
Hematite: red-brown streak
Fluorite: octahedral cleavage
Talc: hardness of 1, “greasy” feel
Graphite: metallic luster, hardness of 1
Calcite: rhombohedral cleavage
13. Potassium feldspar and plagioclase feldspar.
14. Galena = major ore of lead; hematite = ore of iron; graphite = pencil lead; sphalerite = major ore of zinc; gypsum = wallboard; calcite = cement.