

INSTRUCTOR MANUAL

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Applications and Investigations in Earth Science

Seventh Edition

Tarbuck | Lutgens |

Pinzke

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 samples	dilute hydrochloric acid (5%)
streak plate	hand lens
magnet	glass plate

NOTE:

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, bauxite

TEXTBOOK REFERENCES

Tarback and Lutgens, *Earth Science*, 12th edition, 2009. Chapter 2

Tarback and Lutgens, *Earth Science*, 11th edition, 2006. Chapter 2

Lutgens and Tarback, *Foundations of Earth Science*, 5th edition, 2008. Chapter 1 and Appendix B

Murphy and Nance, *Earth Science Today*, 1999. Chapters 2 and 17; Appendix C

Skinner and Porter, *The Blue Planet*, 2nd edition, 1999. Chapter 6

Thompson and Turk, *Earth Science and the Environment*, 2nd edition, 1999. Chapters 42 and 21; Appendix B

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 a contact goniometer and dilute hydrochloric acid 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 Identification Chart, Table 1.3, 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

1. Minerals = quartz, emerald, and halite. All of the other items are not minerals.
2. Quartz = B; Galena = A; Limonite = C; Gypsum = D, Talc = E, Native copper = A
3. Answers will vary with the mineral specimens provided for identification.
4. Both fluorite and quartz exhibit a variety of colors.
5. Specimen A: color = red brown, streak = red brown; specimen B: color = dark gray / black, streak = red brown.
6. Answers will vary with the mineral specimens provided for testing streak.
7. Nonmetallic

8. A = fibrous habit B = bladed habit C = banded habit D = cubic crystals
9. 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° angles in all three dimensions will produce a cubic geometric shape).
10. A = fluorite B = topaz
11. Answers will vary depending on the samples selected.
12. The sample exhibits one direction of cleavage (basal cleavage), which produces thin sheets when cleaved.
13. a) six planes of cleavage; b) three directions of cleavage; c) the cleavage directions meet at angles other than 90° (rhombohedral cleavage)
- 14.–16. Answers will vary depending on the samples selected or provided.
17. A, C, and D are feldspar; B is quartz
18. Answers will vary depending on the order of the minerals identified.

NOTE:

We recommend that the Mineral Data Sheet, Figure 1.19, be filled in and made available for students to verify their mineral identifications.

ANSWERS TO EXERCISE ONE SUMMARY/REPORT PAGE QUESTIONS

1. Cleavage; hardness; luster; streak; fracture
2. A cube or cubic cleavage
3. Muscovite = one direction (thin sheets); Calcite = rhombohedral (three directions not at 90°); Halite = cubic (three directions at 90°).
4. Feldspar minerals have two directions of cleavage at 90°, producing rectangular shapes.
5. Color
6. Muscovite; plagioclase feldspar; quartz; halite; quartz; quartz; galena
7. Crystals of fluorite = A; cleavage of fluorite = B
8. a) cubic crystals b) striations c) pyrite

9. Banded habit
10. Hardness = 3
11. Elastic
12. Olivine
13. Halite: cubic cleavage and salty taste
Galena: cubic cleavage and 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
14. Potassium feldspar and plagioclase feldspar
15. Galena = major ore of lead; hematite = ore of iron; graphite = pencil lead; sphalerite = major ore of zinc;
gypsum = wallboard; calcite = cement

NOTES: