Chapter 2: Minerals

Identifying a mineral is a little like playing detective. Minerals are identified by their physical properties. How would you describe the mineral in Figure 2.2? You may say that it is shiny, gold, and has a particular shape. Each of these descriptions is a physical property (shiny is lustre, gold is colour, shape is crystal form). Physical properties can vary within the same minerals, so caution should be applied when identifying minerals. For example, colour is a property that is not a very realistic diagnostic tool in many cases, as some minerals, such as Quartz, can come in a variety of colours (e.g. Figure 2.3). Occasionally, colour can be helpful, as in the case of olivine, which is said to be “olive green”, a light to dark green (e.g. Figure 2.4). We will cover each of the physical properties in detail to help you identify the minerals.

Figure 2.2 | Describe this mineral.
Source: Randa Harris (2015) CC BY-SA 3.0
2.2.1 Hardness

Hardness refers to the resistance of a mineral to being scratched by a different mineral or material and is a product of the strength of the bonds between the atoms of a mineral. Whatever substance does the scratching is harder and the item scratched is softer. Hardness is based off a scale of 1 to
Mohs’ scale lists ten minerals in order of relative hardness, with each mineral on the scale able to scratch a mineral of lower number.

<table>
<thead>
<tr>
<th>Number</th>
<th>Mineral</th>
<th>Relative Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Talc</td>
<td>(softest mineral)</td>
</tr>
<tr>
<td>2</td>
<td>Gypsum</td>
<td>2.5 – Fingernail</td>
</tr>
<tr>
<td>3</td>
<td>Calcite</td>
<td>3 – Copper Coin</td>
</tr>
<tr>
<td>4</td>
<td>Fluorite</td>
<td>4 – Nail</td>
</tr>
<tr>
<td>5</td>
<td>Apatite</td>
<td>5.5 – Glass Plate</td>
</tr>
<tr>
<td>6</td>
<td>Orthoclase Feldspar</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Quartz</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Topaz</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Corundum</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Diamond</td>
<td>(hardest mineral)</td>
</tr>
</tbody>
</table>

Your mineral kit comes with several items of a known hardness. The glass plate has a hardness of 5.5, the iron nail has a hardness of 4, the copper coin has a hardness of 3, and your fingernail has a hardness of 2.5. If you can scratch a mineral, then it would be softer than your fingernail, so therefore its hardness would be <2.5. When trying to scratch a surface, use force, but be cautious with the glass plate. **ALWAYS lay the glass plate on a flat surface rather than holding it in your hand in case it breaks.** Do not confuse mineral powder with a scratch – use your finger to feel for a
groove created by a scratch (Figure 2.6). In contrast, mineral powder is left behind when a soft mineral scratches a harder surface. Materials of similar hardness have difficulty scratching each other, so that, for example, your fingernail may not be able to always scratch biotite, which has a hardness of 2.5 or gypsum which has a hardness of 2 (Figure 2.7).

2.2.2 Crystal Form

This property refers to the geometric shape that a crystal naturally grows into and is a reflection of the orderly internal arrangement of atoms within the mineral. If minerals have space to grow when they are developing, they will display their crystal form. These ideal growth conditions do not always occur, however, so many minerals do not display their ideal crystal form due to crowded conditions during growth. Examples of crystal form are shown in Figure 2.8.

2.2.3 Cleavage

As minerals are broken, some may cleave, or break, along smooth flat planes known as cleavage. These flat surfaces are parallel to directions of weakness within the crystal. All the bonds among the atoms within a mineral may not be of the same strength, so that when a mineral is broken, it breaks along these zones of weakness. This results in flat cleavage planes. Minerals with perfect cleavage break along a smooth, flat plane, while those with poor cleavage break in a more irregular fashion. Some minerals do not contain zones of weakness either because all of the bonds

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Figure 2.8 | Examples of crystal form. Source: Lyndsay Hauber & Joyce M. McBeth (2018) CC BY 4.0, after Randa Harris (2015) CC BY-SA 3.0
are the same strength or the weaker bonds are not aligned within a plane. If this is the case it will not have cleavage; instead, it will fracture, similar to the curved fracture of glass when you get crack in a windshield.

Be careful not to confuse cleavage with crystal form. Crystal form occurs as a mineral grows (e.g., cubes of pyrite), while cleavage only forms as a mineral breaks. See Figure 2.9 for the main types of cleavage and an example of each.

A mineral may have one or more cleavage planes. Planes that are parallel are considered the same direction of cleavage and should only count as one. One direction of cleavage is termed basal cleavage. Minerals that display this cleavage will break off in flat sheets. Two directions of cleavage
is termed prismatic, while three directions of cleavage at $90^\circ$ is referred to as cubic. A mineral with four directions of cleavage is termed octahedral. With 2 or more cleavage planes present, it is important to pay attention to the angle of the cleavage planes. To determine the angle of cleavage, look at the intersection of cleavage planes. Commonly, cleavage planes will intersect at $60^\circ$, $90^\circ$ (right angles), or $120^\circ$. Be cautious when you see a flat surface on a mineral – not every flat surface is a cleavage plane. Crystal faces can be flat, but remember they form as a mineral grows, while cleavage forms as a mineral breaks. The crystal form of quartz is a hexagonal prism, with nice flat sides. But when quartz is hit with a rock hammer, it breaks in an irregular fashion and does not exhibit cleavage.

Figure 2.10 | Comparison of cleavage angles between amphibole and pyroxene. Amphibole has cleavage angles at or near $60^\circ$ and $120^\circ$, and pyroxene has angle at or near $90^\circ$.

Source: Joyce M. McBeth (2018) CC BY 4.0, after Randa Harris (2015) CC BY-SA 3.0

Also use caution when trying to distinguish the minerals pyroxene and amphibole. Both minerals are black or greenish-black, with similar hardness, making them difficult to tell apart. You must observe the cleavage angles to tell them apart. Cleavage angles in pyroxene are near $90^\circ$, so expect it to look boxy and form right angles, while cleavage angles in amphibole are $60^\circ$ and $120^\circ$, so expect a more bladed or pyramid like appearance (e.g. Figure 2.10).
2.2.4 Fracture

When minerals do not break along cleavage planes, but rather break irregularly, they are said to *fracture*. Commonly, fracture surfaces are either uneven or conchoidal, a ribbed, smoothly curved surface similar to broken glass (e.g. Figure 2.11).

2.2.5 Lustre

*Lustre* refers to the appearance of the reflection of light from a mineral’s surface. It is generally broken into two main types: **metallic** and **non-metallic**. Minerals with a metallic lustre have the colour of a metal, like silver, gold, copper, or brass (e.g. Figure 2.12). While minerals with a metallic lustre are often shiny, not all shiny minerals are metallic. Make sure you look for the colour of a metal, rather than for just a shine. Minerals with non-metallic lustre do not appear like metals. They may be vitreous or glassy (e.g. Figure 2.13A), earthy or dull (e.g. Figure 2.13B), waxy (e.g. Figure 2.13C), greasy or oily, etc.
2.2.6 Streak

**Streak** is an easily detectable physical property. It refers to the colour left behind on an unglazed piece of porcelain when a mineral is rubbed along its surface. A streak plate is included in your rock and mineral kit to test this property. Often a mineral will have a streak of a different colour than the mineral (e.g. Figure 2.14). Some minerals will have a white streak, which is difficult to see along the white streak plate. If you rub a mineral along the streak plate and do not see an obvious streak,
wipe your finger along the streak plate; a mineral with a white streak will leave a white powder behind that will rub on your finger (e.g. Figure 2.15). Alternatively, you may use the black streak plate, which was provided in your mineral identification kit.

### 2.2.7 Special Physical Properties

Minerals may be magnetic, and this property is simply tested by seeing if your nail is attracted to a mineral. Magnetite is an example of a magnetic mineral. The mineral halite is simply table salt, so it will taste salty. Sphalerite will release a sulfurous smell when streaked, and talc will feel soapy when touched.

**Specific gravity** is the ratio of a mineral’s weight to the weight of an equal volume of water. A mineral with a specific gravity of 2 would weigh twice as much as water. Most minerals are heavier than water, and the average specific gravity for all minerals is approximately 2.7. Some minerals are quite heavy, such as pyrite with a specific gravity of 4.9-5.2, native copper, with a specific gravity of 8.8-9.0, and native gold at 19.3, which makes panning useful for gold, as the heavy mineral stays behind as you wash material out of the pan.
2-E1 LAB EXERCISES – MINERAL IDENTIFICATION

This lab contains 27 numbered mineral samples, labelled 1 – 27, separated into drawers. Use these instructions to test and identify them. You will test for different properties after learning about them, then work on identification at the end of the lab. As you identify properties of each sample, fill in the table provided in this lab and complete the multiple-choice questions to test your knowledge. It is recommended that you obtain a mineral identification kit from the campus bookstore. It will contain:

- A copper coin
- Glass plate (wrapped in paper) – this will be used in testing hardness
- Zinc coated nail
- Unglazed porcelain plate – this will be used as a streak plate
- Black streak plate – this will be used to identify white streaks
- Hydrochloric acid bottle (empty)
- Magnifying glass (10x). To use this, hold it very close to your eye and bring the sample near the glass until it is in focus (approximately one inch from your eye).
- Magnet – this will be used to test for magnetism in minerals

Take the drawers provided by your TA and view the minerals, numbered 1-27; there are 21 different minerals provided, so expect to see some repeat minerals. We will first examine hardness from these samples and will answer more questions about them later in the lab. Look closely at each of the minerals, using the hand lens to observe them.

You need to experiment with each sample to test for its hardness, using Figure 2.5 for reference. Remember that hardness is determined by scratching the mineral. First, decide which minerals have a hardness greater than 5.5 (the hardness of glass). Lay the glass on a flat surface, then try to scratch it with each mineral by pressing down hard with the mineral. Table 2.1 is provided for you to make notations about each mineral. Note that you do not have to fill in every physical property for every mineral, just fill in the properties you are asked about as you work. Note on the table which minerals have a hardness greater than 5.5. You may also test samples by using materials to scratch them. The copper coin has a hardness of 3; any mineral that it can scratch will have a hardness less than 3. You can further refine this by using your fingernail (only natural fingernails work for this), which has an approximate hardness of 2.5, so if both the copper coin and your fingernail scratches it, you know its hardness must be <2.5. Additionally, you can use a zinc coated nail, which
has a hardness of 4, and other minerals to test the hardness. For example, if you have two minerals that have a hardness of <2.5, you can see if one will scratch the other, then you know which mineral is harder.

1. Sample 11: What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

2. Sample 25: What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

3. Sample 12: What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

4. Sample 26: What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

5. Sample 10: What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

6. Sample 19. What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

7. Sample 27. What is this sample’s hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail
<table>
<thead>
<tr>
<th>Lustre</th>
<th>Hardness</th>
<th>Cleavage</th>
<th>Other Properties</th>
<th>Mineral Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Red-brown to brown in colour. H=6-7.5. SG=3.5-4.5. Conchoidal fracture. Vitreous lustre. Crystals are 12-sided and common.</td>
<td>Garnet Fe₃Mg₂Ca₃Al₅Si₆O₂₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pale-yellow to olive-green in colour. H=6-5-7. Commonly granular, with glassy grains</td>
<td>Olivine (Fe,Mg)₂SiO₄</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Variety of colours [grey=chert; black=flint; red=jasper; banded=agate]. H=7. SG=2.7. Conchoidal fracture. Dull lustre.</td>
<td>Cryptocrystalline Quartz SiO₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clearly Shows</td>
<td>Black to greenish black in colour. H=5-6.5. SG=3.3. C=2 planes at ~90°. Short, stubby crystals.</td>
<td>Pyroxene Ca,Mg₃Fe₂Al₅Si₇O₂₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black to greenish black in colour. H=6. SG=3.3. C=2 planes at ~60° and 120°. Elongated crystals.</td>
<td>Amphibole Na,Ca,Mg₃Fe₂Al₅Si₇O₂₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tan-pink, white, green in colour. H=6-6.5. SG=2.6. C=2 planes at ~90°. Colour variation lines on cleavage surface.</td>
<td>Potassium Feldspar K₂Al₂Si₃O₈</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White to blue-grey to black in colour. H=6-6.5. SG=2.7. C=2 planes at ~90°. Striations on cleavage plane. Blue play of colours may be present.</td>
<td>Plagioclase Feldspar NaAlSi₃O₈ to CaAl₂Si₃O₈</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor</td>
<td>White to grey to pale green in colour. H=1. SG=2.7. C=1. though rarely seen. Soapy feel.</td>
<td>Talc Mg₃Si₄O₉(OH)₈</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yellow to yellow-brown in colour. H=4-5.5. SG=4.5. St=yellow-brown. Earthly lustre.</td>
<td>Limonite Fe₂O₃·mH₂O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Colourless to white in colour. H=2. SG=2.3. C=3. though 2 directions may be difficult to see.</td>
<td>Gypsum CaSO₄·2H₂O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Colourless to white, blue, yellow, or red in colour. H=2. SG=1.9. C=3 at 90°. Bitterer than halite.</td>
<td>Sylvaite KCl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Colourless to white in colour. H=2.5. SG=2.2. C=3 planes at ~90°. cubic. Tastes salty.</td>
<td>Halite NaCl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Colourless, light brown, to yellow in colour. H=2.5. SG=2.8. C=1 perfect. Breaks into thin sheets that are elastic.</td>
<td>Muscovite KAl₃(AlSi₃O₁₀)(OH)₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Brown to black in colour. H=2.5-3. SG=3. C=1 perfect. Breaks into thin, elastic sheets.</td>
<td>Biotite K(Mg,Fe)₃AlSi₃O₁₀(OH)₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Colourless, white, yellow in colour. H=3. SG=2.7. C=3 rhombohedral. Strong effervescence in acid.</td>
<td>Calcite CaCO₃</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clearly Shows</td>
<td>Steel grey to black in colour. H=5-6. SG=5.3. St=red-brown. Metallic lustre.</td>
<td>Hematite Fe₂O₃</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black in colour. H=6. SG=5.2. St=black. Strongly magnetic.</td>
<td>Magnetite Fe₃O₄</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor</td>
<td>Brass-yellow in colour. H=6-6.5. SG=5. St=green-on-black. Resinous lustre.</td>
<td>Pyrite FeS₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Brass-yellow in colour. H=3.5-4.5. SG=4.2. St=greenish black. Varnished to green or black in air.</td>
<td>Chalcopyrite CuFeS₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yellow-brown to dark-brown in colour. H=4-5.5. SG=4.5. St=yellow-brown.</td>
<td>Limonite Fe₂O₃·mH₂O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clearly Shows</td>
<td>Silver grey in colour. H=2.5. SG=7.5. C=3 planes at ~90°. Very heavy.</td>
</tr>
</tbody>
</table>

Figure 2.19 | Mineral Identification Chart.  
Source: Lyndsay Hauber (2018) CC BY 4.0, after Randa Harris (2015) CC BY-SA 3.0
8. Sample 24: This sample has:
   a. no cleavage (it fractures)
   b. 1 cleavage plane
   c. 2 cleavage planes at 90°
   d. 3 cleavage planes at 90° (cubic)
   e. 4 cleavage planes
9. Sample 24: What other unique property does this sample have?
   a. effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur
10. Sample 21: This sample has:
    a. no cleavage (it fractures)
    b. 1 cleavage plane
    c. 2 cleavage planes at 90°
    d. 3 cleavage planes at 90°
    e. 4 cleavage planes
11. Sample 15: This sample has:
    a. no cleavage (it fractures)
    b. 1 cleavage plane
    c. 2 cleavage planes at 90°
    d. 3 cleavage planes at 90°
    e. 4 cleavage planes
12. Sample 13: This sample has:
    a. no cleavage (it fractures)
    b. 1 cleavage plane
    c. 2 cleavage planes at 90°
    d. 3 cleavage planes at 90°
    e. 4 cleavage planes
13. Sample 18: This sample has:
    a. no cleavage (it fractures)
    b. 1 cleavage plane
    c. 2 cleavage planes at 90°
    d. 3 cleavage planes at 90°
    e. 4 cleavage planes
14. Sample 18: What is this sample’s hardness?
    a. harder than glass
    b. similar to glass
    c. softer than nail but harder than copper
    d. softer than copper but harder than a fingernail
    e. softer than a fingernail
15. Sample 20: This sample has:
    a. no cleavage (it fractures)
    b. 1 cleavage plane
    c. 2 cleavage planes at 90°
    d. 3 cleavage planes at 90°
    e. 4 cleavage planes
16. Sample 16: This sample has:
    a. no cleavage (it fractures)
    b. 1 cleavage plane
    c. 2 cleavage planes at 90°
    d. 3 cleavage planes at 90°
    e. 2 cleavage planes at 60°/120°
17. Sample 16: What is this sample's hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

18. Sample 17: This sample has:
   a. no cleavage (it fractures)
   b. 1 cleavage plane
   c. 2 cleavage planes at 90°
   d. 3 cleavage planes at 90°
   e. 4 cleavage planes

19. Sample 22: What is this sample's hardness?
   a. harder than glass
   b. softer than glass but harder than nail
   c. softer than nail but harder than copper
   d. softer than copper but harder than a fingernail
   e. softer than a fingernail

20. Sample 22: This sample has:
   a. no cleavage (it fractures)
   b. 1 cleavage plane
   c. 2 cleavage planes at 90°
   d. 3 cleavage planes at 90°
   e. 4 cleavage planes

21. Sample 4: What is the streak of this sample?
   a. dark grey streak
   b. white streak
   c. reddish brown streak
   d. pale yellow streak

22. Sample 4: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, resinous
   d. non-metallic, waxy
   e. metallic

23. Sample 1: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, resinous
   d. non-metallic, waxy
   e. metallic

24. Sample 6: What is the streak of this sample?
   a. dark grey to black streak
   b. grey streak
   c. reddish brown streak
   d. pale yellow streak

25. Sample 6: Which other item(s) is/are characteristic(s) of this sample?
   a. very heavy
   b. harder than glass
   c. metallic lustre
   d. both a and b
   e. both a and c
26. Sample 8: What is the streak of this sample?
   a. dark grey to black streak
   b. grey streak
   c. reddish brown streak
   d. pale yellow streak
27. Sample 8: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, greasy
   d. non-metallic, waxy
   e. metallic
28. Sample 9: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, greasy
   d. non-metallic, waxy
   e. metallic
29. Sample 9: Due to its appearance, this sample has often been confused with native gold, a mineral with a hardness of 2.5-3. How does its hardness compare with that of gold?
   a. Sample 9 is harder than gold.
   b. Sample 9 is softer than gold.
30. Sample 14: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, greasy
   d. non-metallic, waxy
   e. metallic
31. Sample 2: What is the streak of this sample?
   a. dark grey to black streak
   b. grey streak
   c. reddish brown streak
   d. pale yellow streak
32. Sample 2: What another unique property does this sample have?
   a. effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur
33. Sample 5: Examine this entire sample closely with a hand lens. What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, greasy
   d. non-metallic, waxy
   e. metallic
34. Sample 23: What is the streak of this sample?
   a. dark grey to black streak
   b. white streak
   c. reddish brown streak
   d. pale yellow streak
35. Sample 7: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, greasy
   d. non-metallic, waxy
   e. metallic
36. Sample 7: What is the streak of this sample?
   a. dark grey to black streak
   b. grey streak
   c. yellow-brown to brown-black streak
   d. pale yellow streak
37. Sample 3: What is the streak of this sample?
   a. dark grey to black streak
   b. grey streak
   c. reddish brown streak
   d. pale yellow streak

38. Sample 3: What is the lustre of this sample?
   a. non-metallic, vitreous
   b. non-metallic, earthy
   c. non-metallic, greasy
   d. non-metallic, waxy
   e. metallic

39. Sample 1: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite

40. Sample 2: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite

41. Sample 2: What other unique property does this sample have?
   a. effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur

42. Sample 3: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite

43. Sample 4: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite

44. Sample 4: What other unique property does this sample have?
   a. effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur

45. Sample 5: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite

46. Sample 6: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite

47. Sample 7: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. sphalerite
   e. magnetite
   f. hematite
Sample 7: What other unique property does this sample have?
   a. effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur

Sample 8: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. pyrite
   e. magnetite
   f. hematite

Sample 9: What is this sample?
   a. chalcopyrite
   b. limonite
   c. galena
   d. pyrite
   e. magnetite
   f. hematite

Sample 10: What is this sample?
   a. quartz
   b. muscovite
   c. potassium feldspar
   d. calcite
   e. biotite
   f. plagioclase feldspar

Sample 11: What is this sample?
   a. quartz
   b. muscovite
   c. potassium feldspar
   d. calcite
   e. biotite
   f. plagioclase feldspar

Sample 12: What is this sample?
   a. quartz
   b. muscovite
   c. potassium feldspar
   d. calcite
   e. biotite
   f. plagioclase feldspar

Sample 13: What is this sample?
   a. quartz
   b. muscovite
   c. potassium feldspar
   d. calcite
   e. biotite
   f. plagioclase feldspar

Sample 14: What is this sample?
   a. quartz
   b. muscovite
   c. potassium feldspar
   d. calcite
   e. biotite
   f. plagioclase feldspar

Sample 15: What is this sample?
   a. quartz
   b. muscovite
   c. potassium feldspar
   d. calcite
   e. biotite
   f. plagioclase feldspar

Sample 16: What is this sample?
   a. quartz
   b. amphibole
   c. potassium feldspar
   d. olivine
   e. pyroxene
   f. plagioclase feldspar
58. Sample 17: What is this sample?
   a. quartz
   b. amphibole
   c. potassium feldspar
   d. olivine
   e. pyroxene
   f. plagioclase feldspar

59. Sample 18: What is this sample?
   a. quartz
   b. amphibole
   c. potassium feldspar
   d. olivine
   e. pyroxene
   f. plagioclase feldspar

60. Sample 19: What is this sample?
   a. quartz
   b. amphibole
   c. potassium feldspar
   d. olivine
   e. pyroxene
   f. plagioclase feldspar

61. Sample 20: What is this sample?
   a. quartz
   b. amphibole
   c. potassium feldspar
   d. olivine
   e. pyroxene
   f. plagioclase feldspar

62. Sample 21: What is this sample?
   a. quartz
   b. gypsum
   c. cryptocrystalline quartz
   d. calcite
   e. halite
   f. plagioclase feldspar

63. Sample 22: What is this sample?
   a. quartz
   b. gypsum
   c. cryptocrystalline quartz
   d. calcite
   e. halite
   f. plagioclase feldspar

64. Sample 23: What is this sample?
   a. quartz
   b. gypsum
   c. cryptocrystalline quartz
   d. calcite
   e. halite
   f. plagioclase feldspar

65. Sample 24: What is this sample?
   a. talc
   b. gypsum
   c. cryptocrystalline quartz
   d. garnet
   e. halite
   f. plagioclase feldspar

66. Sample 24: What other unique property does this sample have?
   a. it effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur

67. Sample 25: What is this sample?
   a. talc
   b. gypsum
   c. cryptocrystalline quartz
   d. garnet
   e. halite
   f. plagioclase feldspar
68. Sample 26: What is this sample?
   a. talc
   b. gypsum
   c. cryptocrystalline quartz
   d. garnet
   e. halite
   f. plagioclase feldspar

69. Sample 26: What other unique property does this sample have?
   a. it effervescence in acid
   b. it is magnetic
   c. it tastes salty
   d. it feels soapy
   e. it smells like sulfur

70. Sample 27: What is this sample?
   a. talc
   b. gypsum
   c. cryptocrystalline quartz
   d. garnet
   e. halite
   f. plagioclase feldspar
Table 2.1 | Mineral Notation Chart – Fill in this chart as you work through the lab. An example of a mineral you do not have available (#0) is included. You do not have to fill out every column for every mineral – just follow along in the lab and determine the properties you are asked about.
Source: Lyndsay Hauber (2018) CC BY 4.0, after Randa Harris (2015) CC BY-SA 3.0

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<th>Lustre</th>
<th>Hardness</th>
<th>Cleavage/Fracture</th>
<th>Streak</th>
<th>Other Notable Properties (include colour when diagnostic)</th>
<th>Mineral Name</th>
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<td>Non-metallic</td>
<td>Less than 2.5 (softer than a fingernail)</td>
<td>3 cleavage planes at 90°</td>
<td>white</td>
<td>Bitter taste; key mineral in potash</td>
<td>Sylvite</td>
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