**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_**

**Geology Lab #4-Mineral Identification**

Geologists study rocks, and since a rock is simply an aggregate of minerals, mineral identification is a fundamental skill for the work of most geologists. In this lab, we will learn how to identify some common minerals from their physical properties.

Every mineral, even ones that look the same, has a unique chemical composition. The elements and arrangement of atoms within different minerals are what give minerals their unique characteristics. In this lab we will look at some ways to differentiate minerals and understand why their chemical compositions yield different characteristics.

**During this lab, your group will visit six stations. You can visit stations A, B, C, D, & E in any order, STATION F MUST BE VISITED LAST!!!!**

You will have 10 minutes to complete each station.

If you finish before time is up at the station, you may move on.

***STATION A: Density and Specific Gravity***

Density is a measure of how much mass is contained within a certain volume.

**Density(g/ cm3) = Mass(g)/Volume(cm3)**

The density of a mineral measures how tightly packed the atoms are within the mineral.

Determine the density of two mineral samples, galena (marked with blue dots) and graphite (marked with no dots), by measuring the volume and mass of each.

• Measure the volume (in cm3) by seeing how much water the mineral displaces and noting that

1 ml of water has a volume of 1 cm3.

• Measure the mass of the sample (in grams) by weighing it.

• Divide mass by volume to get density (in g/cm3).

**1.** Pick up samples of the two minerals that are about the same size.

Which one feels denser? (Circle one) Galena Graphite

**2.** Determine the density of each of the minerals. Use enough water to cover the sample.

 **Mineral: Galena Graphite**

**A.** Place the mineral sample on the scale and record its mass here.

 Mass of mineral \_\_\_\_\_\_\_g \_\_\_\_\_\_\_g

**B.** Pour some water in the beaker and measure

and record its volume here (no sample).

 Original vol. of water\_\_\_\_\_\_\_ml \_\_\_\_\_\_\_ml

**C.** Put the mineral sample into the water in

the beaker and measure the new volume.

 Vol. of mineral + water \_\_\_\_\_\_\_ml \_\_\_\_\_\_ml

**D.** Subtract the old volume from the new

volume to get the volume of the sample.

 Volume of mineral \_\_\_\_\_\_ml \_\_\_\_\_\_ml

**E.** Use the metric relationship (1ml = 1 cm3)

to convert the mineral volume to cm3.

 Volume of mineral \_\_\_\_\_\_cm3 \_\_\_\_\_cm3

**F.** Divide the mass of your sample by its

volume to calculate its density.

 Density of mineral \_\_\_\_\_g/cm3 \_\_\_\_\_g/cm3

**3.** Sometimes this mineral property is expressed as specific gravity, which is simply the density of the mineral (from part 2F) divided by the density of water. The density of water is 1 g/cm3. Work out the specific gravity (G) for galena and graphite.

 *Example:* if your density was 5 g/cm3 then you would do 5÷1=5

**Galena Graphite**

Measured specific gravity, G: \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

***STATION B: Magnetism and Reaction with Acid***

1. Carbonate minerals (like calcite and dolomite) are easily identified by their reactions with HCl, hydrochloric acid. Calcite fizzes vigorously on contact with 3% HCl. Dolomite also fizzes on contact with HCl but only when powdered and then, less vigorously.

Find the four light colored minerals A-D. Use HCl to discover which is calcite and which is dolomite. The remaining two samples are of quartz and halite. Use hardness to distinguish among these, noting that quartz is harder and cannot be scratched with a nail.

Please rinse all the acid off the samples when you finish.

 Calcite is sample \_\_\_\_\_\_\_

 Dolomite is sample \_\_\_\_\_\_\_

 Halite is sample \_\_\_\_\_\_\_

 Quartz is sample \_\_\_\_\_\_\_

1. Use the magnets to discover which of the three mystery minerals, labeled A, B, C, is magnetite.

 Magnetite is sample (circle its letter): A B C

***Station C: Luster and Color***

Color can help in mineral identification, but it is often unreliable. Notice the variety of quartz in the sample tray. Slight chemical contaminations or internal crystal irregularities produce significantly varied colors.

Luster describes the way a mineral reflects light. Metallic minerals are opaque, are usually shiny, and always have a streak (this will be explored in station D). Non-metallic minerals have many types of luster, which are referred to as vitreous(glassy), resinous, silky, earthy, etc.

Take a good look at the mineral samples (gypsum, calcite, pyrolusite, and olivine). The luster of gypsum can be silky, calcite can be termed pearly, pyrolusite can be termed earthy (dull), and olivine is generally considered vitreous (or glassy).

For each of the following minerals, describe their colors and match the minerals to their luster types (can use the answers more than once):

Silky Vitreous (glassy) Silky Earthy (dull) Metallic

**Mineral Color(s) Luster**

1. Chalcopyrite: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Calcite: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Kyanite: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Galena: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Quartz: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Think about your observations of quartz’s luster and color. Which, color or luster, is a more reliable physical property for mineral ID? Why?

***Station D: Hardness and Streak***

Use the hardness kit and streak plate to determine the hardness and streak of the named minerals in the sample tray. If a mineral powders on the surface you are scratching, wipe it off and see which actually got scratched. Use your fingernail, the glass scratch plate, the penny, etc. to determine the hardness of the mineral and write down the hardness. If your mineral is softer than your fingernail its <2. If the mineral is harder than glass but softer than the streak plate, its 6-7.

|  |  |
| --- | --- |
| **Material** | **Hardness** |
| Scratched with pencil | 1 |
| Scratched with penny | 2 |
| Glass plate | 5.5 |
| Streak Plate | 7.0 |

**Mineral Hardness Streak**

1. Hematite \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Talc \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Graphite \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Fluorite \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Quartz \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notice that streak is not always the same as the color of the mineral crystal. In which case(s) is this so?

***Station E: Fracture and Cleavage***

Some hints for seeing cleavage:

1. Look for parallel planar breaks within and along the sides of the mineral sample
2. Repeated sharp corners or edges may define intersecting cleavage planes
3. Count any set of parallel surfaces once
4. Count only broken surfaces; crystal faces formed during crystal growth are not cleavage planes

For the minerals at the station record the number of cleavage planes.

 **Mineral Number of Cleavage Planes**

1. Calcite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Halite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Hornblende \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Muscovite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Station F: Mystery Mineral ID***

Identify the three mystery minerals. Use the Mineral ID Key Chart at the station to help you identify the minerals A, B, and C. List the evidence for your decisions as to their identities: i.e., hardness, color, # of cleavage planes or whether it fractures instead, streak, etc. Be specific.

**Sample Letter Name Evidence**

1. \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Station F: Mineral ID Chart

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Cleavage or Fracture?** | **Streak?** | **Luster?** | **Hardness?** | **Color?** | **Other Properties?** | **Mineral Name** |
| Fracture | Colorless | Vitreous | 6.5-7.5 | Red, Green, black, or any color | n/a | Garnet |
| One direction | white | Pearly to greasy | 1 | Green, gray, white, silver, and others | Feels greasy, tiny flakes upon rubbing | Talc |
| Perfect in three directions | White | Vitreous-pearly | 3-3.5 | White, gray, red, brown, clear | Very heavy for nonmetallic mineral | Barite |
| fracture | black | Metallic | 6-6.5 | Brassy yellow | Sometimes in crystal shapes | Pyrite |
| Fracture | Yellowish-brown | Dull earthy | 4-5.5 | Yellow, brown, or black | Earthy color and appearance | Limonite |

1. Which properties were most helpful in identification? Why?
2. What was the most important thing you learned today about mineral identification?