**Physical Properties of Minerals and Mineral Identification**

**Introduction**

Minerals are naturally occurring, usually inorganic, solids that possess a definite chemical compositions and a specific, orderly arrangement of atoms. This lab will help you to develop the ability to identify common minerals found at the earth’s surface. Although there are literally thousands of minerals, the small number of the most common rock forming, ore, and industrial minerals studied here make up a large part of the earth’s crust. Identification is accomplished by testing and observing the physical properties studied in the first part of this laboratory. The second part of the lab will focus on describing the physical properties of a mineral and on identifying minerals using the physical properties.

**Objectives:**

* Recognize and describe the physical properties of minerals
* Develop and use a mineral identification key to name minerals
* Identify minerals using physical properties

**Activities Focusing on Physical Properties**

Minerals exhibit certain properties, called physical properties, which can be tested and observed, leading to the correct identification of the mineral. Many (but not all) of these properties are unique to a given mineral. One of the keys to identifying minerals is observing a combination of physical properties displayed by a mineral. Therefore, you must be sure of the meaning of each of the physical properties. On the following pages, you will define and study these properties: luster, color, streak, hardness, cleavage, fracture, and others, such as, magnetism, effervescence in HCl, and double refraction.

**STATION #1: Important Terminology**

Please fill in the definitions of the following vocabulary terms (as they relate to minerals and science class). Use your notes, vocab sheet, and this lab packet to help you with this task.

1. Color
2. Streak
3. Luster
4. Hardness
5. Cleavage
6. Fracture

What are three special characteristics that particular minerals may have?

**STATION #2: Luster & Color**

Study the various mineral samples provided to answer the following questions.

1. Some minerals are said to be metallic in luster. Which ones do you think exhibit this characteristic? Record your results in the data chart below.

|  |  |  |
| --- | --- | --- |
| **Name** | **Metallic?** | **Non-metallic?** |
| Pyrite |  |  |
| Quartz |  |  |
| Hematite |  |  |

How many samples can be grouped into each of the following luster types?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Metallic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Non-metallic

1. Study the mineral samples of quartz provided. What is the reason for the variety of colors that quartz exhibits? (HINT: Think about what a single drop of food coloring does to a glass of water.)
2. Is color a reliable physical property to help identify a given mineral sample? Explain your answer.

**STATION #3: Streak**

1. What causes a mineral to leave a streak on the streak plate?
2. Study the collection of samples provided and complete the data table by recording your observations for each sample:

|  |  |
| --- | --- |
| **Mineral Name** | **Streak Color** |
| Hematite |  |
| Graphite |  |
| Olivene |  |
| Corundum |  |

**STATION #4: Magnetism, Effervescence & Double Refraction**

Study the collection of samples provided and complete the data table by recording your observations for each sample:

|  |  |  |  |
| --- | --- | --- | --- |
| **Mineral Name** | **Reaction to HCl** | **Magnetic?** | **Double Refraction?** |
| Magnetite |  |  |  |
| Quartz |  |  |  |
| Calcite |  |  |  |

1. Place ***1 drop*** of HCl on each of the 3 minerals **in the Station #4 table** listed above. Record your results in the data table. (Blot the mineral dry after recording your results.)
2. Place a magnet (or paper clip) on each of the minerals listed above. Carefully tilt the mineral to see what happens to the magnet. Record your observations in the data table.
3. Place each mineral over these instructions one by one. Record your observations for each of the minerals in the data table above.

**STATION #5: Cleavage & Fracture**

Study the collection of samples of single mineral crystals. Cleavage and fracture are related to how a mineral breaks apart. They are controlled by the internal atomic arrangement of the mineral.

1. Study the group of minerals exhibiting cleavage and complete the data table. For each, describe the cleavage in terms of the number of directions and the angle between them. Also, provide a simple sketch of the sample emphasizing the cleavage.

|  |  |  |
| --- | --- | --- |
| **Mineral Name** | **Cleavage**  **Or**  **Fracture** | **Sketch** |
| Calcite |  |  |
| Muscovite |  |  |
| Galena |  |  |
| Quartz |  |  |

**STATION #6: Hardness**

The following hardness guide is useful determine the range of the hardness of an unknown mineral sample.

**Hardness Guide:**

|  |  |
| --- | --- |
| **Hardness** | **Description** |
| less than 2.5 | Mineral can be scratched by fingernail (H = 2.5) |
| 2.5 to 3.5 | Mineral cannot be scratched by fingernail (H = 2.5) and  cannot scratch penny (H = 3.5) |
| 3.5 to 5.5 | Mineral can scratch a penny (H = 3.5) and  cannot scratch glass (H = 5.5) |
| Greater than 5.5 | Mineral can scratch glass (H = 5.5) |

Determine the hardness for the small group of minerals provided and complete the data table. Make sure to included evidence to support the hardness value that you have assigned to each of the following minerals.

|  |  |
| --- | --- |
| **Mineral Name** | **Hardness Range (include evidence for your choice)** |
| Graphite |  |
| Calcite |  |
| Quartz |  |
| Apatite |  |

**Post Lab Questions:**

1. Describe the procedure for identifying a mineral and arriving at its name.
2. Name the physical property (test) that is described by each of the following statements:
   1. Breaks along smooth planes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Scratches glass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. A red-colored powder on unglazed porcelain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Describe the shape **and** sketch a mineral that has cleavage.
4. Which would tell you more about a mineral’s identity: luster or hardness? Why?