# Properties of Minerals Lab

**Background**: The physical properties of minerals are used by Mineralogists to help determine the identity of a specimen. Some of the tests can be performed easily in the field, while others require laboratory equipment. The following list of tests is in no particular order and there is no set suggested order of testing samples.

## Properties of Minerals

The following physical properties of minerals can be easily used to identify a mineral:

**Color**: most minerals have a distinctive color that can be used for identification. In opaque minerals, the color tends to be more consistent, so learning the colors associated with these minerals can be very helpful in identification. Translucent to transparent minerals have a much more varied degree of color due to the presence of trace minerals. Therefore, color alone is not reliable as a single identifying characteristic.

**Streak**: streak is the color of the mineral in powdered form. Streak shows the true color of the mineral. In large solid form, trace minerals can change the color appearance of a mineral by reflecting the light in a certain way. Trace minerals have little influence on the reflection of the small powdery particles of the streak. The streak of metallic minerals tends to appear dark because the small particles of the streak absorb the light hitting them. Non-metallic particles tend to reflect most of the light so they appear lighter in color or almost white. Since streak is a more accurate illustration of the mineral's color, streak is a more reliable property of minerals than color for identification.

**Cleavage or Fracture**: minerals tend to break along lines or smooth surfaces when hit sharply. Different minerals break in different ways showing different types of cleavage. Cleavage is defined using two sets of criteria. The first set of criteria describes how easily the cleavage is obtained. Cleavage is considered perfect if it is easily obtained and the cleavage planes are easily distinguished. It is considered good if the cleavage is produced with some difficulty but has obvious cleavage planes. Finally it is considered imperfect if cleavage is obtained with difficulty and some of the planes are difficult to distinguish. The second set of criteria is the direction of the cleavage surfaces. The names correspond to the shape formed by the cleavage surfaces: cubic, rhombohedral, octahedral, dodecahedral, basal or prismatic. Fracture describes the quality of the cleavage surface. Most minerals display either uneven or grainy fracture, conchoidal (curved, shell-like lines) fracture, or hackly (rough, jagged) fracture.

**Tenacity**: tenacity is the characteristic that describes how the particles of a mineral hold together or resist separation.

**Crystalline Structure**: mineral crystals occur in various shapes and sizes. The particular shape is determined by the arrangement of the atoms, molecules or ions that make up the crystal and how they are joined. This is called the crystal lattice. There are degrees of crystalline structure, in which the fibers of the crystal become increasingly difficult or impossible to see with the naked eye or the use of a hand lens. Microcrystalline and cryptocrystalline structures can only be viewed using high magnification. If there is no crystalline structure, it is called amorphous. However, there are very few amorphous crystals and these are only observed under extremely high magnification.

**Taste**: only soluble minerals have a taste, but it is very important that minerals not be placed in the mouth or on the tongue.

**Hardness**: hardness is one of the better properties of minerals to use for identifying a mineral. Hardness is a measure of the mineral's resistance to scratching. In 1812, the Mohs scale of mineral hardness was devised by the German mineralogist Frederich Mohs (1773-1839.) He selected these ten (10) minerals because they were readily available. The softest mineral, talc, has a Mohs scale rating of one (1.) Diamond is the hardest mineral and has a rating of ten (10.) Softer minerals can be scratched by harder minerals because the forces that hold the crystals together are weaker and can be broken by the harder mineral.

| Hardness | Mineral | Associations and Uses |
|---|---|---|
| 1 | Talc | Talcum powder. |
| 2 | Gypsum | Plaster of Paris. Gypsum is formed when seawater evaporates from the Earth's surface. |
| 3 | Calcite | Limestone and most shells contain calcite. |
| 4 | Fluorite | Fluorine in fluorite prevents tooth decay. |
| 5 | Apatite | Source of phosphorus, used in fertilizer. |
| 6 | Orthoclase | Orthoclase is feldspar, and in German, "feld" means "field". |
| 7 | Quartz | Jewelry. |
| 8 | Topaz | The November birthstone. Emerald and aquamarine are varieties of beryl with a hardness of 8. |
| 9 | Corundum | Sapphire and ruby are varieties of corundum. Twice as hard as topaz. |
| 10 | Diamond | Used in jewelry and cutting tools. Four times as hard as corundum. |

**Diaphaneity or Amount of Transparency**: diaphaneity is a mineral's degree of transparency or ability to allow light to pass through it. The degree of transparency may also depend on the thickness of the mineral.

**Magnetism**: magnetism is the characteristic that allows a mineral to attract or repel other magnetic materials.

**Odor**: most minerals have no odor unless they are acted upon in one of the following ways: moistened, heated, breathed upon, or rubbed.

**Specific Gravity**: specific gravity of a mineral is a comparison or ratio of the weight of the mineral to the weight of an equal amount of water. The weight of the equal amount of water is found by finding the difference between the weight of the mineral in air and the weight of the mineral in water.

**Luster**: luster is the property of minerals that indicates how much the surface of a mineral reflects light. The luster of a mineral is affected by the brilliance of the light used to observe the mineral surface. Luster of a mineral is described in the following terms:

- metallic: the mineral is opaque and reflects light as a metal would
- submettalic: the mineral is opaque and dull; the mineral is dark colored
- nonmetallic: the mineral does not reflect light like a metal
- waxy: the mineral looks like paraffin or wax
- vitreous: the mineral looks like broken glass
- pearly: the mineral appears iridescent, like a pearl
- silky: the mineral looks fibrous, like silk
- greasy: the mineral looks like oil on water
- resinous: the mineral looks like hardened tree sap (resin)
- adamantine: the mineral looks brilliant, like a diamond

**Laboratory Activity**: you will need the Periodic Table of Elements and page 16 of the ESRT.

## Identification

1. Name the element represented by the following chemical symbols:

| Symbol | Name | | Symbol | Name |
|---|---|---|---|---|
| Fe | | | Ti | |
| K | | | Ca | |
| Pb | | | Na | |
| Si | | | Mg | |

2. Which mineral is a food additive? _____

3. Which mineral(s) bubble with acid? _____

4. What mineral is used to make plaster of paris? _____

5. What mineral is attracted by a magnet? _____

6. What mineral is used to make the "lead" of a pencil? _____

## Common Characteristics & Composition

7. Hematite, Pyrite & Magnetite _____

8. Olivine, Quartz, & Garnet _____

9. Calcite, Dolomite, & Flourite _____

10. Sulfur, Calcite, & Olivine _____

11. Galena, Pyrite, & Sulfur _____

12. Galena, Magnetite, & Pyrite _____

13. Pyroxene, Amphibole, & Feldspar(s) _____

14. Talc, Biotite Mica, & Pyroxene _____

15. Graphite, Pyrite, & Hematite _____

## Mineral Families

16. What is common amongst talc, mica, amphibole, feldspars, olivine, quartz and garnet?

17. What is common amongst calcite and dolomite?

18. What is common amongst galena and pyrite?

******When doing the lab report write-up, be sure to follow the guidelines.******