Geology
Lancaster High School

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Date
Block

Mineral Identification

Minerals

Minerals are defined as naturally occurring, inorganic, solids with a definite chemical composition and a regular, internal crystalline structure. The keys to this definition are the chemical composition and the crystalline structure. Different chemical compositions result in different minerals. A good example is the mineral plagioclase. Plagioclase is a member of the feldspar group, but there is more than one type of plagioclase. Albite and anorthite are two examples. Albite has a chemical composition of $NaAlSi_3O_8$, while anorthite's chemical composition is $CaAl_2Si_2O_8$. Very similar, but different - therefore they are classified as two different minerals.

Different crystalline structures, or the way the atoms and molecules are arranged, result in different minerals. A good example is diamond and graphite. Both minerals are composed of carbon (C). The same chemical composition, but two different crystalline structures - therefore, they are two different minerals.

Physical Properties

Determination of the actual chemical composition and crystalline structure of a mineral is difficult without the proper equipment. In an introductory level lab it is impossible for us to determine these two aspects of a mineral. Fortunately, these two aspects determine a mineral's physical properties. The arrangement of the atoms and molecules and the strength of the bonding between the atoms result in different physical properties for different minerals. While many minerals share common physical properties, when all of a mineral's physical properties are examined, it often results in a unique set of physical properties, which can be used to identify the mineral.
Below you will find a chart, which defines the physical properties and provides the means for determining the physical property of a mineral sample. These definitions and methods are simplified.

Mineral Physical Properties Chart

PHYSICAL PROPERTY	Definition	Testing Method
Cleavage	Breakage of a mineral along planes of weakness in the crystal structure.	Examine the mineral for areas where the mineral is broken. Look for areas where the light reflects from planar surfaces. This can be easily confused with a crystal face and is the most difficult properties for students to master.
Color	Visible light spectrum radiation reflected from a mineral.	Look at the sample and determine its color - white, black, green, clear, etc.
Crystal Form	Geometric shape of a crystal or mineral.	Examine and describe the geometric shape of the mineral - cubic, hexagonal, etc. Not commonly seen in most introductory lab samples.
Fracture	Breakage of a mineral, not along planes of weakness in the crystal structure.	Examine the mineral for areas where the mineral is broken. Describe the breakage as either irregular or conchoidal (has the appearance of broken glass)

Geology
Lancaster High School

Name
Date
Block

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Hardness	Resistance to scratching or abrasion.	Use minerals of known hardness from the Moh's Hardness Kits. Scratch the unknown mineral with a known hardness to determine which mineral is harder. Continue doing this with harder or softer minerals from the kit until the hardness is determined.
Luster	Character of the light reflected by a mineral.	Look at the sample to determine if the mineral is metallic in appearance (looks like a chunk of metal) or non-metallic (doesn't look like a chunk of metal).
Magnetism	Electromagnetic force generated by an object or electrical field.	Use a magnet to determine if the magnet is attracted to the sample.
Reaction to HCl	Chemical interaction of hydrochloric acid and calcium carbonate ($CaCO_3$).	Place one small drop of HCl on a sample a watch for a reaction - effervesces (bubbles).
Specific Gravity	Ratio of the mass of a mineral to the mass of an equal volume of water.	Measure the mass of the sample and then compare it to the mass of the rock suspended in water. Refer back to the SG lab for the formula to calculate.
Streak	Color of the mineral when it is powdered.	Grind a small amount of a mineral into a powder on a porcelain streak plate and determine the color of the powder.
Taste	Nerve ending reaction in the tongue to different chemicals.	Lick the mineral. **(not recommended in an introductory lab - you don't know who has handled or licked the sample before you)**
Other Properties	Fluorescence, Radioactivity	Requires special equipment such as a UV lamp and Geiger counter. These are not commonly tested for in an introductory lab.

Complete the following in preparation for the mineral identification lab:

1. A **mineral** is:

2. Explain how to identify minerals by the following physical tests. Indicate which mineral tests are most helpful for specific minerals or a particular group of mineral:
   a. Color of the mineral:

   b. Streak:

c. The manner in which a mineral breaks:
   - Cleavage
   - Fracture

d. Luster (define):
   - Metallic (Describe, give examples):
   - Kinds of non-metallic lusters:

3. What is the difference between the **hardness** and the **strength** of a mineral?

4. Explain what Moh's Hardness Scale is and specifically how it can be used to figure out the hardness of a mineral:

5. Measuring hardness: Describe how the following instruments are used to identify a mineral's level of hardness on Moh's hardness scale:
   a. Fingernail
   b. Penny
   c. Nail
   d. Glass

6. Describe other special properties some minerals have that are not included in the preceding questions.

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Name
Date
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Procedure

Complete the data tables below with the rock samples provided to you by your teacher.

Number	Color	Streak	Fracture/ Cleavage	Luster	Hardness	Other magnetism, effervescence or taste	Name (not a guess)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Geology
Lancaster High School

Name
Date
Block

Mineral Identification

Number	Color	Streak	Fracture/ Cleavage	Luster	Hardness	Other magnetism, effervescence or taste	Name (not a guess)
16							
17							
18							
19							
20							
21							
22							
23							
24							

Analysis/Conclusion

1. Describe how identifying the physical and chemical properties of a mineral can help in its identification.

2. Obsidian is not listed on the mineral classification chart. Based on the definition of a mineral, why is obsidian not considered a mineral?

3. List at least three minerals that are necessary or helpful to life as we know it and tell how/why they are helpful or necessary.