Geology

Lancaster High School

Name
Date
Block

Mohs Hardness Scale Lab

Background Information:

Hardness tests of minerals are among the easiest and most useful tests to perform. What Geologists often refer to as hardness is more accurately described as resistance to abrasion. In this activity we are testing how easily one substance will scratch another. As an example, copper is relatively easy to scratch and thus has a lower rating on the scale of hardness than, say, a diamond which can only be scratched by another diamond. The most widely used scale for hardness was published in 1822 by Frederick Mohs, an Austrian mineralogist who got the basic concept from scratch tests performed routinely by miners. Since Mohs published the scale, it bears his name rather than that of the unknown genius who thought of it. The scale selects 10 minerals as standards, arranging them in order of increasing hardness. These are, as most of you probably know:

1 = Talc
2 = Gypsum
3 = Calcite
4 = Fluorite
5 = Apatite
6 = Orthoclase
7 = Quartz
8 = Topaz
9 = Corundum
10 = Diamond

These minerals were selected for their abundance, as well as their differing hardness. The scale is uneven. For example, diamond at 10 is much harder then corundum at 9, while fluorite at 4 is only slightly higher than calcite at 3.

Believe it or not, most people do not normally carry around samples of the 10 minerals on the Mohs Hardness Scale. However, there are several simple "tools" people often have with them that can be useful in determining the relative hardness of an unknown mineral specimen. For example your fingernail (without nail polish) has a hardness of 2.5, a penny has a hardness of about 3.5, a steel nail has a hardness of about 4.5, glass has a hardness of 5.5 and a streak plate has a hardness of 6.5.

Performing a hardness test requires good technique. You need to find a quality surface or edge on your unknown to test. Take care to make sure you are testing the right grain; e.g. not the bit of quartz right next to it. In some cases it is easier to scratch the unknown across the standard (the point of an unknown mineral grain across a calcite cleavage). In other cases it is easier to test the standard across the unknown (tip of a nail across cleavage surface of the unknown grain). In an ideal case, you should try to do both, to double check your findings. You need to press hard enough to get a good effect, but not so hard as to fracture either sample. Practice will help you get the proper level of stress to exert.

As a result of your test, you will look for a scratch. Rub aside any powder to see if a distinct scratch has been left. Calcite will leave a trail of powder across quartz. Rub away the powder and you'll see the quartz is unharmed. A hand lens will help you see the scratch. In this way you can bracket the hardness of your unknown between two of your standards (harder than a fingernail, softer than a penny; hardness is between 2.5 and 3.5). The ease with which one substance scratches another is also useful. Quartz easily scratches calcite, telling you of a large hardness difference. Quartz will scratch feldspar with much more difficulty. When testing a standard against an unknown that is of equal hardness, both substances will leave shallow scratches on each other.

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Materials

For this experiment you will need:

- mineral samples 1-9 from Mohs hardness scale
- fingernail
- piece of glass
- a steel nail or washer
- a penny

Procedure

1. Select a fresh, clean surface on the specimen to be tested.
2. Hold the specimen firmly and attempt to scratch it with the point of each object of known hardness listed in the data table.
3. If the object of known hardness is harder, you should feel a definite "bite" into the surface of the specimen.
4. Look for an etched line. It is a good idea to rub the observed line with your finger to ensure that it is actually etched into the surface of the specimen. In this case, the crystal left a deep, definite scratch in the surface.
5. Answer Yes or no for each box in the data table as a result of your test.
6. If there is any question about the result of the test, repeat it being sure to use a sharp point and a fresh surface.

Repeat the procedure for the other mineral samples listed.

Sample #	Did your fingernail scratch the sample?	Did the sample scratch a penny?	Did the nail scratch the sample?	Did the sample scratch the glass?	Hardness Range?	Mineral Name
1						
2						
3						
4						
5						
6						
7						
8						
9						

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Analysis and Conclusion

For each item below, select the letter that labels the correct part of the image.

_____ 1. Mineral cannot scratch glass but scratches a fingernail.

_____ 2. Mineral scratches glass but is scratched by quartz.

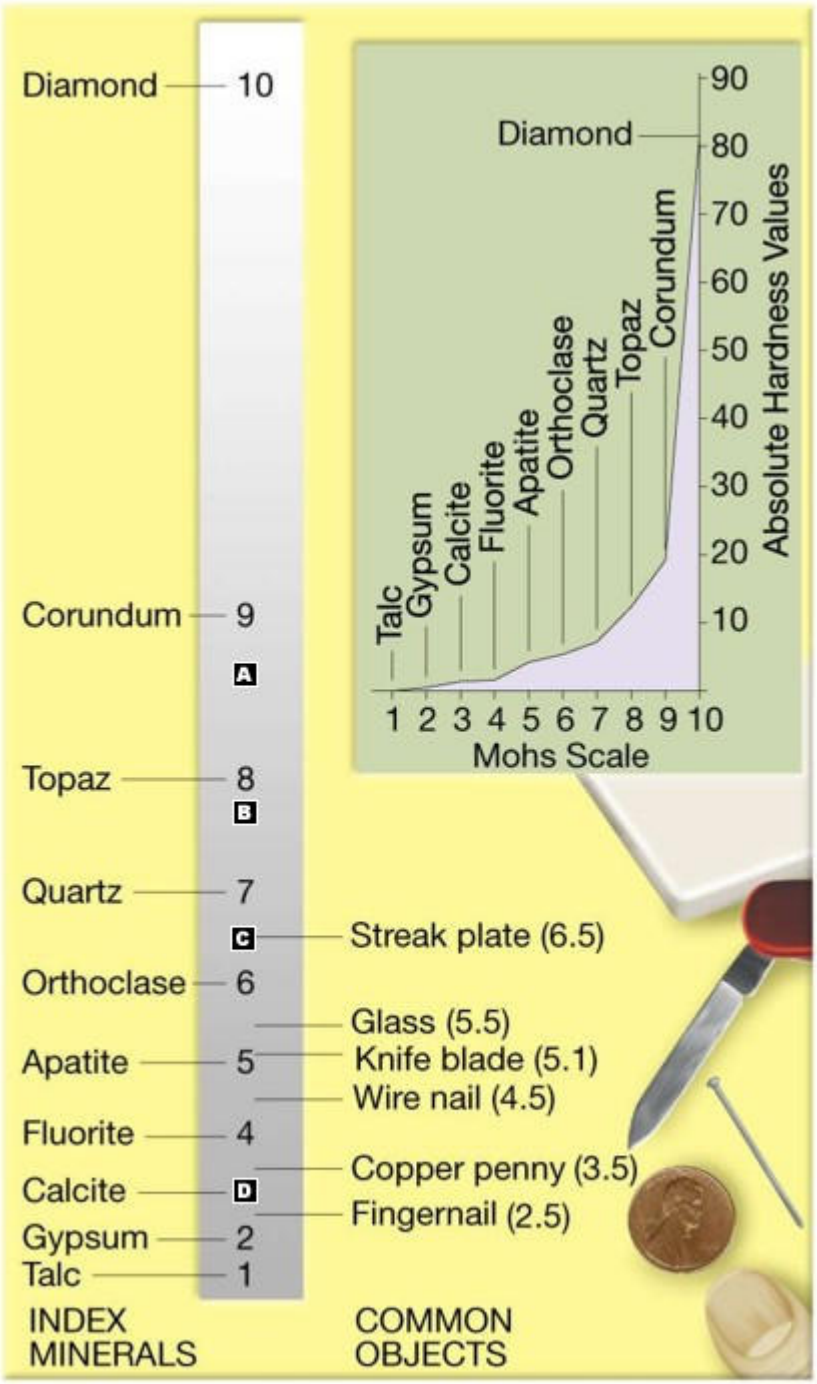
_____ 3. Mineral scratches quartz and topaz.

_____ 4. Mineral scratches quartz but not topaz.

5. Why are physical properties such as hardness useful to geologists to identify minerals?

6. What controls a mineral's property of hardness?

7. What does the term relative mean?



8. The Mohs scale of mineral hardness is a relative scale of what?