

Mohs' Hardness

Overview: Today you'll learn how to test the mineral hardness, which is really a test of the strength of the bonds that hold the atoms together inside the mineral sample. This scale was first developed by Friedrich Mohs in 1812, and still is in use today.

What to Learn: By the end of this lab, you will be able to line up rocks according to how hard they are by using a specific scale. The scale goes from 1 to 10, with 10 being the hardest minerals.

Materials

- Steel nail
- Penny
- Small plate of glass (optional)
- Rock samples (minerals in the video: talc, selenite, calcite, fluorite, apatite, feldspar, quartz)

Experiment

1. Number your samples on the data table and place each rock on the table. If you have the same samples listed above, you can scratch each rock with every other rock to find where they are on the Mohs' Hardness Scale, where 1 is the softest and 10 is the hardest:

Mohs' Scale of Hardness

1. Talc
2. Selenite
3. Calcite
4. Fluorite
5. Apatite
6. Feldspar
7. Quartz
8. Topaz
9. Corundum
10. Diamond

When doing this type of test, note that some minerals are so soft that they don't leave a scratch, but rather a powdery trail on the harder mineral (this is what we did with the Streak Test, as the tile has a hardness of 7). Make sure you know how to tell the difference!

2. If you don't have one of each from the following scale (at least up to quartz), then you'll need to do this experiment a different way – the way most geologists do it in the field. Here's how:
3. Scratch one of the rocks with your fingernail. If you can leave a mark, then write "Y" in the second column of the data table. Now skip over to the last column and estimate the hardness to be less than 2.5.
4. If you can't scratch it with your fingernail, try using the mineral to scratch a copper penny. If it doesn't leave a mark on the penny, skip over to the last column and estimate the hardness to be between 2.5-3.5.
5. If it does leave a scratch on the penny, then try scratching the mineral with a steel nail. If the nail leaves a scratch, skip over to the last column and estimate the hardness between 3.5-5.5.

6. If you can't scratch the sample with the nail, see if the mineral can make a scratch on the plate glass. Glass has a hardness of 6-7. If it doesn't make a scratch on the glass, then it's between 5.5-6.5. If it does, it's higher than 6.5. For example quartz will make a scratch on the plate, and its hardness has been recorded at 7.

Mohs' Hardness Data Sample

Sample	Scratched by a Fingernail? <i>If yes, then <2.5</i>	Can it scratch a Copper Penny? <i>If no then 2.5-3.5</i>	Scratched by a Steel Nail? <i>If yes then 3.5-5.5</i>	Can it scratch Plate Glass? <i>If not, then 6-7 If yes, then >7</i>	Estimate the Hardness <i>(1-10)</i>

Reading

The sample's hardness is determined by trying to scratch and be scratched by known materials, like pennies, steel, glass, and so forth. If the material leaves a mark on the mineral, then we know that the material *is harder than the mineral is*. We first start with a fingernail since it's easy to use and very accessible. If it leaves a mark, that means that your fingernail is harder than the mineral and you know it's pretty soft. Talc is one of the softest minerals, making it easy to scratch with your fingernail.

However, most minerals can't be scratched with a fingernail, so we can try other objects, like copper pennies (which have a hardness of 2.5-3.5), steel nail (3.5-5.5), steel knife (5.5), and even quartz (7). The most difficult part of this experiment is keeping track of everything, so it's a great opportunity to practice going slowly and recording your observations for each sample as you go along.

Exercises

1. If a mineral scratches a penny but doesn't get scratched by a nail, can you approximate its hardness?
2. Give examples of the hardest and softest minerals on the Mohs' Scale.
3. Is feldspar harder or softer than quartz?

Answers to Exercises: Mohs' Hardness

1. If a mineral scratches a penny but doesn't get scratched by a nail, can you approximate its hardness? (Over 5.5)
2. Give examples of the hardest and softest minerals on the Mohs' Scale. (Diamond = 10, Talc = 1)
3. Is feldspar harder or softer than quartz? (Softer. Feldspar = 6, Quartz = 7)