

Tenacity

Overview: How well does a mineral or rock hold itself together? If you've ever dropped a light bulb on the ground, you know it's easy to break. But why doesn't a water bottle break as easily? The light bulb is more brittle than the water bottle. Minerals are the same way... some are more brittle than others, and it's all measureable.

What to Learn: Tenacity is a measure of how resistive a mineral is to breaking, bending, or being crushed. When you exceed that limit, fracture is how the mineral creaks once the tenacity (or tenacious) limit has been exceeded.

Materials

- Hammer (if your piece of coal is large)
- Rock samples (in the video: copper, mica, selenite, sulfur)

Experiment

1. Label and number each of your samples with your data table.
2. Use a hammer and try to break the copper sample. Make sure you do this on a hard surface (like the concrete) so you don't damage your floor or table!
3. To test for brittleness, like for sulfur, do a scratch test to see if it leaves a fine powder. Use your streak plate if you think your specimen has a hardness of less than 7.
4. For sectile tenacity, like with mica, carefully insert a knife into the mineral to see if it goes through. If the knife can penetrate through the sample (be careful with this!), then it's sectile.
5. To check for flexibility, like mica and selenite, use only slight pressure so you don't break your sample. Notice if the sample springs back or retains its new shape when released.
6. Complete the data table with your observations.

Tenacity Data Table

| Sample | Color | Observations |
|--------|-------|---|
| | | <i>(Brittle, Sectile, Malleable, Ductile, Flexible-Inelastic, Flexible-Elastic)</i> |
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Reading

Tenacity is a measure of how a mineral behaves when under stress, like being crushed, bent, torn, or hammered. Minerals will react differently to each type of stress. Minerals can have more than one type of tenacity, since it's possible for a mineral to have different (or several at the same time) reactions to the stress. Here's a way to classify their response to stress:

- Brittle: The sample crumbles or turns into a powder. Most minerals are brittle, like quartz.
- Sectile: These minerals can be separated with a knife, like wax, like gypsum.
- Malleable: When you hammer the mineral and it flattens instead of breaks, it's malleable like silver and copper.
- Ductile: A mineral that can be stretched into a wire is called ductile. All true metals are ductile, like copper and gold.
- Flexible-Inelastic: When you bend a mineral and release it, it stays in the new shape. It was flexible enough to bend, but it didn't snap back into its original shape when released, like copper.
- Flexible-Elastic: When you bend a mineral and release it, it springs back into its original shape. Minerals that are flexible-elastic are fibrous, like chrysotile serpentine.

Exercises

1. What are four different types of tenacity?
2. How is elastic different from inelastic tenacity?
3. How many types of tenacity can a mineral have?

Answers to Exercises: Tenacity

1. What are four different types of tenacity? (ductile, malleable, flexible-elastic, and brittle)
2. How is elastic different from inelastic tenacity? (elastic minerals spring back into shape when released)
3. How many types of tenacity can a mineral have? (as many as they need to!)