Brittle vs. Ductile
Quick Activity

Brittle vs. Ductile

Teacher demonstration and introduction of ideas

1. In Geology, we talk about the *deformation* of materials, by which we mean the response of the material to being stretched, bent, squeezed, or otherwise stressed. You can demonstrate material deformation by using a rubber band (stretch and release) and a pencil (bend and release; bend too far -- snap!). When a material is stressed past its strength limit and breaks into separate pieces, as with the pencil, then the deformation is *brittle*.

2. Next, try some silly putty. *S-t-r-e-t-c-h* it with your hands. You can contort, or deform, the silly putty into extreme shapes without ever breaking it. The deformation is ductile, i.e. the silly putty has not broken into separate pieces.

3. Leave your large blob of silly putty prominently on table at front of room.

Student activity to investigate these concepts further

Materials:

- Silly putty
- Tootsie rolls
  TIP: The night before, put half the silly putty and all the tootsie rolls in the freezer. (Keep cold in a cooler prior to activity.) The other half of the silly putty should be at room temperature.

Procedure:

1. Give each student a blob of room-temperature silly putty. Ask the students to demonstrate ductile deformation of their silly putty. After they have some fun, ask them if they can make the silly putty behave in a brittle fashion. Some of them may get the idea of pulling quickly on the putty.

2. Hand out the cold silly putty. Have students try to deform it - it will break if very cold. Encourage students to continue deforming the putty; make observations of putty behavior as it slowly warms up. Once warm, have students pull quickly on the putty. What happens?

3. Hand out tootsie rolls. Have students deform tootsie roll in mouth - what happens as the tootsie roll heats up in their mouths?

4. **Question**:
   What controls/influences how materials behave when stressed?

Message:
Materials are not inherently brittle or ductile. The material response depends upon conditions of deformation - the temperature and the rate at which stress is applied!

Display:
Show rocks which have been deformed (the most obvious to children are layered rocks in which the layers have been deformed into folded shapes).

Discussion:
Most people think of rocks as brittle materials, i.e. ones which will break if hit hard (demo: break rock with hammer). This is because at Earth's surface, where it is relatively "cold", rocks mostly behave brittlely. Students may be familiar with blasting rocks to make highway or tunnels, or blasting in rock quarries. Some students may be familiar with old cemeteries, where old marble benches or markers have ductilely deformed under their own weight.

B. Point out your silly putty on front table - what has happened to it? It has flowed under own weight, which rocks can do too