Objectives
When you have completed this lab you should be able to:
1. describe the fundamental difference between glass and crystalline material.
2. tell the following apart:
   a. natural glass
   b. rock made of intergrown microscopic crystals
   c. rock made of intergrown crystals that are big enough to see
   d. rock made of a mixture of microscopic crystals and crystals big enough to see
3. look at an igneous rock and determine whether it (a) crystallized slowly deep underground or (b) came out of a volcano as lava and then crystallized quickly on the Earth’s surface.
4. identify six types of igneous rocks and, as appropriate, add adjectives to the names.

Activity #1: Judging the Sizes of Crystals in a Rock and Distinguishing Crystalline Material from Glass

A. **Materials:**
   - coarse brown (raw) sugar
   - golden brown sugar
   - butterscotch candy
   - Rocks Q, R, V, W
   - 10x magnification hand lenses

B. **Activity:** Using the magnifying hand lens, closely examine the sugar, the candy and the rocks. Note the presence or absence of crystals. Note the sizes of any crystals present.

C. **Questions:**
   1. Draw lines connecting each substance with the appropriate description.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>coarse brown (raw)</td>
<td>Made of unordered atoms; contains no crystals</td>
</tr>
<tr>
<td>sugar</td>
<td></td>
</tr>
<tr>
<td>golden brown sugar</td>
<td></td>
</tr>
<tr>
<td>butterscotch candy</td>
<td>Made of tiny microscopic crystals</td>
</tr>
<tr>
<td>Rock Q</td>
<td></td>
</tr>
<tr>
<td>Rock R</td>
<td>Made of “large” crystals, big enough to distinguish with the naked eye</td>
</tr>
<tr>
<td>Rock V</td>
<td></td>
</tr>
<tr>
<td>Rock W</td>
<td>Made of a mixture of large and tiny crystals</td>
</tr>
</tbody>
</table>
2. Which of the rocks (Q, R, V and W) are plutonic? Which are volcanic? Explain the reasoning behind your answers.

3. Describe how each rock formed. Include in your description the type of environment in which the rock formed (i.e. deep underground, on the Earth's surface) and how quickly it cooled and solidified.

   a. Rock Q

   b. Rock R

   c. Rock V

   D. Rock W
### Activity #2: Classification of Igneous Rocks

**Introduction:** Geologists classify igneous rocks by their texture and composition. The chart below shows the igneous rock classification system that we will use for this class.

#### Classification of Igneous Rocks (all rock names are in bold face)

<table>
<thead>
<tr>
<th>Composition</th>
<th>Felsic (High in Silica)</th>
<th>Mafic (Low in Silica)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Color</strong></td>
<td>Cream, Pink, or Light Gray</td>
<td>Dark Gray to Black</td>
</tr>
<tr>
<td><strong>Plutonic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(All grains large enough to distinguish with the naked eye)</td>
<td><strong>Granite</strong></td>
<td><strong>Gabbro</strong></td>
</tr>
<tr>
<td><strong>Volcanic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Most grains microscopic)</td>
<td><strong>Rhyolite</strong></td>
<td><strong>Basalt</strong></td>
</tr>
<tr>
<td><strong>Volcanic Glass</strong></td>
<td><strong>Obsidian:</strong> very shiny; breaks into smooth curved surfaces with very sharp edges; often dark gray, black or red, despite its felsic composition.</td>
<td></td>
</tr>
<tr>
<td>(disordered mass of atoms; not crystalline)</td>
<td><strong>Pumice:</strong> so full of holes it looks frothy; very low density; may float on water.</td>
<td></td>
</tr>
</tbody>
</table>

#### Special Textures of Some Volcanic Rocks

These texture names are used as adjectives added to the rock names. For example, you might have a porphyritic basalt.

- **Porphyritic:** a mixture of microscopic crystals and crystals large enough to see.
- **Vesicular:** containing large rounded holes (frozen gas bubbles)**

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* Almost all igneous rocks have some mafic (black) minerals in them. Thus many “felsic” rocks have a speckled appearance. That's why we use “overall” rock color (the color of the rock when you see it from a distance) to name the rock. The whole rock is not considered mafic unless it is all dark gray to black (or black and green if it contains the mineral olivine).

** Note that ALL pumice is vesicular; thus we don't ever say “vesicular pumice” because that would be redundant.
one magnifying hand lens per person
12 pieces of 8.5" x 11" scrap paper

Activity: Use the 12 pieces of scrap paper to make a LARGE copy of this classification table, spread out on your lab table. It should look something like the table on the right—a simplified version of the Classification of Igneous Rocks on the previous page (with rock names in bold type). Place all 10 rocks on the appropriate pieces of paper. Have your instructor check your work.

<table>
<thead>
<tr>
<th></th>
<th>Felsic</th>
<th>Mafic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plutonic</td>
<td>Granite</td>
<td>Gabbro</td>
</tr>
<tr>
<td>Volcanic</td>
<td>Rhyolite</td>
<td>Basalt</td>
</tr>
<tr>
<td>Volcanic</td>
<td>Obsidian</td>
<td></td>
</tr>
<tr>
<td>Volcanic</td>
<td>Pumice</td>
<td></td>
</tr>
</tbody>
</table>

1. Write the name of each rock next to its letter:
   A. ___________________________ S. ___________________________
   B. ___________________________ U. ___________________________
   O. ___________________________ V. ___________________________
   Q. ___________________________ W. ___________________________
   R. ___________________________ X. ___________________________

More Activity: Some of the volcanic rocks have special textures. In other words, some of the volcanic rocks are vesicular and some are porphyritic (some may even be both). Examine all of the volcanic rocks and figure out which are vesicular, which are porphyritic, which are both, and which are neither.

2. List the letters of all the vesicular volcanic rocks: ___________________________

3. List the letters of all the porphyritic volcanic rocks: ___________________________
Activity #3: The Source of Volcanic Gas

Materials: One warm bottle of carbonated water (soda water)—on the front lab table
One warm bottle of water that is not carbonated—on the front lab table
Video segment of the eruption of Kileaua (Volcanoscapes: Pelé’s March to the Pacific)
Video segment of the eruption of Mt. St. Helens

Questions to Answer BEFORE Doing the Activity (While the Bottle is Still Sealed)

1. Compare the water in the two bottles. Can you see any difference? Can you determine which bottle contains carbonated water and which bottle contains plain water?

2. What do you predict will happen when the instructor opens the bottle of carbonated water? Why?

Activity (This activity will be performed by the lab instructor):

1. Watch the segment of the video on the eruption of Kileaua on the Big Island of Hawaii. This video shows a beautiful fountain-type of eruption.

2. Spread newspapers over the front counter.

3. Rapidly open the bottle of warm carbonated water.

Questions to Answer AFTERDoing the Activity

3. Describe what happened when the instructor opened the bottle.

4. Where did the gas bubbles come from?
5. Why did the gas bubbles form?

6. Examine a piece of vesicular basalt. The round holes are gas bubbles that formed when the rock was still a molten liquid. Was the gas that formed these bubbles made up of air that got into the lava or was it made up of gas that somehow came out of the lava? Explain.

More Activity (This activity will be performed by the lab instructor):

1. Watch the segment of the video on the eruption of Mt. St. Helens in the State of Washington. This video shows a violent explosive eruption in which lava sprayed up into the air as tiny rapidly-moving droplets that solidified in the air and rained down as gray volcanic ash. This eruption occurred suddenly, immediately after an earthquake shook loose the giant “plug” of rock that had been blocking the volcanic vent and allowed it to instantly slide down the volcano and open the vent.

2. Spread newspapers over the front counter.

3. Take a factory-sealed very warm bottle of carbonated water and shake it vigorously. Then rapidly open the bottle.

More Questions:

7. Describe what happened when the instructor opened the bottle.

8. What do you suppose could cause of a volcano to erupt explosively (like Mt. St. Helens) as opposed to quietly fountaining (like Kileaua)? Hint: it has something to do with pressure.