Caves

This exercise shows dissolution, a chemical weathering process, which forms caves. Rocks are dissolved by carbonic acid (formed when rain mixes with CO2 in air and soil) that seeps into the ground. The voids that are left behind are caves.

Supplies:

- 6 sugar cubes per cave
- 6 ounces modeling clay
- 2-liter bottle with top removed (or a see-through bowl)
- Toothpicks
- Spray bottle
- Warm water
- Pen or pencil
- Lined paper

Steps:

1. Pile the sugar cubes inside the bottle or bowl so the pile's base touches the sides of the container.
2. Cover the cubes with a layer of modeling clay, about 0.5 cm thick. The base cubes pressed up against the sides should remain uncovered by clay, so you can see the caves as they form.
3. Punch holes through the top of the clay with toothpicks, enabling water to flow down into the cubes.
4. Spray the top with warm water, starting your cave creation process. Allow the water to seep through.

How are "sugar caves" created? Sketch the process as the cave evolves, and sketch the finished cave. How do clay and sugar resemble parts of the earth?

Water Expansion

https://sealevel.jpl.nasa.gov/files/archive/activities/ts1pcac2.pdf

Supplies:

- Empty, clear, 750-mL glass bottles with long necks
- 0° to 100° C thermometer
- Gas burner or electric hot plate
- Metric ruler
- Cooking pans for water
- String

Steps:

Safety: Do NOT let the water boil. Be careful of hot materials. Suspend the thermometer in the water using a string or the like.

1. Mark the point on a bottle that is about 7 cm from its top, where the thin neck of the bottle has a reasonably constant diameter.
2. Estimate the diameter of the interior of the neck, so you can calculate the volume.
3. Fill the water to below the top of the neck of the bottle.
4. Hang the thermometer in the bottle using a string.
5. Cool the water, using ice, to 10° or 20°.
6. Place the bottle apparatus in the cooking pan, and pour some water in the cooking pan.
7. Heat the water.
8. Record the height of the water inside the bottle after each 10° rise of water temperature.
9. Create a table with the height of the water, the change of height, and the change in volume at 30°, 40°, 50°, up to 80° or 90° (at which point, stop the experiment). Also, calculate and graph the percent change in volume per degree increase in temperature.

Research how this expansion relates to the rise in ocean level due to hotter temperatures and climate change. How much has the sea level changed in the last decade because of change in average atmospheric temperature? How much might it change in the next fifty years? How might this affect cities such as Venice, New Orleans, Miami, Los Angeles? (Pick a few relevant cities.)

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