Hisssssss!

**Purpose**
To examine the effect of volume on the pressure of gases.

**Materials**
Plastic soda bottle one-fourth filled with soda

**Procedure**
1. Standing outdoors, hold your thumb tightly over the mouth of the bottle. Point the mouth of the bottle away from yourself or anyone else. Keep your thumb securely in place until step 5.
2. Shake the bottle vigorously 10 or more times. Then look at the contents of the bottle and observe the bubble formation in the liquid.
3. When the bubbling stops, repeat step 2.
4. Repeat steps 2 and 3 three times for a total of six shakes.
5. After the last shaking, allow the bubbling to stop. Then while observing the bottle’s contents, slowly lift your thumb. Listen for any sound.

**Results**
During the first shaking, many bubbles form and rise to the surface of the liquid, forming foam which quickly goes away. Fewer bubbles form with each repeated shaking. When your thumb is lifted, a hissing sound is heard and many bubbles again form.
Hisssssss!

Why? Soda contains dissolved carbon dioxide gas. When the bottle of soda is shaken, the gas molecules collect and are visible as bubbles in the liquid. These bubbles are lighter than the liquid and rise to the surface of the liquid. Bubbles beneath the surface of the liquid are pockets of carbon dioxide surrounded by the liquid in the bottle. Bubbles above the surface of the liquid are made of carbon dioxide gas surrounded by a thin liquid skin that forms as the gas escapes from the liquid. When this skin breaks, its liquid contents fall to the surface of the liquid and the escaped gas mixes with the air above the surface. As more gas collects above the surface of the liquid, the pressure of the gas on the surface increases. As the pressure increases, it reduces the number of bubbles that can form. Opening the bottle reduces the pressure above the liquid, and more bubbles immediately form. The pressure is reduced because the gas is able to expand to the volume of the bottle plus the outdoor area the bottle is in. When the mouth is opened, the trapped gas in the bottle quickly escapes through the opening, as indicated by the hissing sound.