**COSEE Hands-On Activities**

**USA Science & Engineering Festival**

**Grouping: Physical Oceanography**

**Lesson/Activity:** Shrinking Balloons

Teaching Physical Concepts in Oceanography: An Inquiry Based Approach (Activity 2.5, Pressure)

<http://www.tos.org/hands-on/teaching_phys.html>

**Materials**

* Vacuum container used for food preservation (found in kitchen-appliance stores)
* Pressure apparatus (2-liter soda bottle fitted with a hand pump that is used for keeping soda bottles carbonated and can be found in many grocery stores)
* Two balloons of the same size (one filled with air, the other with water)
* Marshmallows (Peeps are students’ favorites) and any other items to be tested (e.g., tangerine, cherry tomato)

**Instructions**

1. Predict what would be the effect of reduced pressure on each of the balloons.
2. Place the balloon filled with air in the vacuum container and evacuate the air from the container by using the hand pump. What happens to the balloon? Release the valve, allowing air to get back into the container. What happens to the balloon now?
3. Repeat this experiment with the balloon that is filled with water. Does the effect of pressure differ between the two balloons? Why?
4. Based on your observations, what do you think will happen to the marshmallow (and any other items to be tested) when you evacuate the container?
5. Test your prediction.
6. Release the valve and observe the marshmallow. Explain your observations.
7. Explore the second pressure apparatus. Compare/contrast your observations on the behavior of the balloon filled with air in this apparatus to the behavior of the balloon filled with air in the vacuum container. What is the difference between this apparatus and the vacuum chamber?

**Explanation**

Objects that contain air cavities expand when the pressure around them decreases, as occurs when evacuating air from the vacuum container (Figure 2.5, top left panel). Because water is, to a large extent, an incompressible fluid, the size of the balloon containing water will be the same under low pressure and under atmospheric pressure. A cherry tomato will behave similar to the water balloon as it does not contain air pockets. A tangerine or a marshmallow, on the other hand, contains air pockets, and will expand when placed in a vacuum. When the valve is released, air rushes back into the container, increasing the pressure (until it reaches atmospheric pressure), and the tangerine and marshmallow will shrink, but not necessarily to their original sizes because the structure of the material has been altered in the process (e.g., merging of air cavities in the marshmallow).