Name: _____

# LAB 14. PRESSURE AND BUOYANCY

## Introduction

Some things float. Some things sink.

## Activities

These are in different stations around the room. They can be done in any order. Unfortunately, they don't all take the same amount of time, so practice patience.

### 1. Fountain

#### *Materials*

Bucket; water; tin cans or plastic bottles with holes in the sides

#### *Exploration*

Fill a can or bottle with water. Observe the streams of water from the holes in the side. Describe how the streams behave as the water drains from the bottle or can. Explain your observations.

### 2. Displacement and Buoyancy

#### *Materials*

Four density cubes, Vernier calipers, clamp stand, overflow can, spring force meter, graduated cylinder

#### *Exploration*

1. Fill an overflow can with water. Catch the water until it stops draining.
2. Measure and record the dimensions of a density cube with the Vernier calipers.
3. Calculate and record the volume of the density cube.
4. Hang the force meter from a rod. Hang the density cube from the hook of the force meter. Record its hanging weight. (It won't be much. These cubes are small.)
5. Place the overflow can under the density cube. Hold the graduated cylinder to catch the water that will flow from the spout of the overflow can. Slowly lower the rod supporting the force meter and cube so that the cube goes beneath the surface of the water.
6. Catch the water that flows from the overflow can into the graduated cylinder. Record its volume.
7. Record the hanging weight of the cube that is now under water.
8. Repeat with the remaining density cubes.

**Density cubes**

| Description | Dimensions | Hanging weight | Submerged weight | Displaced volume |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## 3. Sinking and Floating

### *Materials*

Plasticine lump, overflow can, graduated cylinder

### *Exploration*

1. Select a lump of plasticine to use for this activity. Measure and record the mass of the lump. For the rest of the activity, do not add or take away any plasticine from the lump.
2. Roll the plasticine into a ball. Fill an overflow can to the brim with water, so that water overflows from its spout. Allow the water to overflow until it is finished. *Gently* place the ball of plasticine in the overflow can and collect the water that flows from the can into a graduated cylinder. Record the volume of water collected.
3. Retrieve the clay from the bottom and mold it into a shape that allows it to float. Sketch or describe this shape in your data section.
4. Refill the overflow can with water. Gently place the plasticine boat into the overflow can and collect the water that flows from the can into a graduated cylinder. Record the volume of water collected. (If the "boat" sinks, keep trying.)

Mass: _____

Volume of water displaced: Lump _____ Boat _____

## 4. Water Balloons

### *Materials*

Water balloons, bucket of water, sponge

### *Exploration*

1. Hold a water balloon in your hand. Heft it. Suppress the urge to toss it at someone.
2. Gently place the water balloon in the bucket of water. What does it do?

3. Hold the balloon just under the surface of the water. Release the balloon. What does it do?

4. Hold the balloon just above the bottom of the bucket. Release the balloon. What does it do?

## 5. Diver

### *Materials*

2-L bottle, test tube

### *Exploration*

1. Fill a 2-L bottle with water. Also fill the test tube with water. Quickly invert the test tube into the mouth of the 2-L bottle so that a small bubble of water is trapped in the test tube. If you wish, allow more air into the test tube by briefly lifting it above the surface of the water and then lowering it back down. The object is to have enough air in the tube for it to float. Let go of the test tube. If it sinks, take it out of the bottle (as tidily as possible) and repeat the process, this time allowing a larger air bubble into the test tube.
2. With the test tube floating in the 2-L bottle, top off the bottle so that it is as full of water as possible. Cap the bottle tightly.
3. Squeeze the bottle in your hands. If you squeeze hard enough, you should be able to make the test tube sink. If you cannot, remove the test tube, refill it with water, and again float it in the bottle using a smaller air bubble.
4. Figure out how it works. Summarize your explanation.

## 6. Gases

Gases flow just like liquids, but the molecules in a gas are far enough apart to be free of the cohesive forces that bind a liquid's molecules. Gases expand and contract to fill the available space. Solids and liquids are relatively incompressible, whereas gases can be compressed easily.

### *Equipment*

deep basin full of water, two transparent cups, floating object

### *Exploration*

1. Pouring air: place one glass underwater, fill it with water, and invert it. Invert the other glass, and submerge it trapping air inside. Pour air from one glass to the other by slowly tipping the air-filled glass and catching the air with the water-filled one. Compare and contrast to pouring water in air.

2. Float a small object on the surface of the water. Invert a cup over it and push the cup down into the water. What happens to the water level and the position of the object inside the cup compared to the water level in the rest of the tub?

3. Pull some water above its level. With the floating object under an inverted cup, trap a 1–2 cm column of air in the cup. Lift the cup so that its inverted opening is still under water. Describe the water surface and the floating object.

## Getting Credit

Show the instructor your data for each of the activities and satisfactorily answer every single one of the instructor's insightful questions.