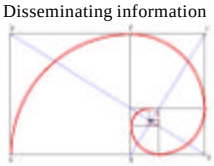
Disseminating information



into our community

University of California Berkeley

Applied Design Engineering Project Teams (ADEPT)

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Particle Party Balloons – Volume Experiments

Objective/Purpose:

Students observe additional experiments concerning the relationship between volume and buoyancy. These experiments should emphasize:

1. Volume as well as mass has an effect on whether objects float
2. Gases like hot air or helium don't make things float because of their own mass, but because they change the volume of the balloons that they fill.

Prep—Time: ~30 minutes

Lesson Time: ~60 minutes

Material List:

Per Student-

- Volume POE worksheet

Shared among classes-

- One large and one small hot air balloon with the same shape (see module Hot Air Balloons)
- Camp stove, stovepipe, matches, and propane for filling hot air balloons (see module Hot Air Balloons)
- Helium tank (~10 lb)

Per Class

- 6 12" rubber balloons
- 1 "squiggly" balloon (have extras!)
- String
- Small cardboard scraps

Topic:

Properties of gases, density, buoyancy

Grade Level: 7-9

Pre-Requisites:

Particle model of matter

- Know that matter, including gases, is made up of particles
- Know that gas particles are widely separated and not bound together like liquids or solids, but can be compressed into a smaller space.

Density

- Some familiarity with the relative density of physical objects

Lesson Process Summary:

✍Preparation For The Lesson

1. For experiment 2: Build two hot air balloons with the same shape and different volumes. See module Hot Air Balloons for instructions.
2. Rent Helium tank
3. Practice experiment 3 (see below)

✍Prior to Session

1. For experiment 1: Fill 5 balloons with different volumes of helium, with at least one small enough that it will not float.
2. For experiment 3: Fill a "squiggly" style balloon with helium until the first four "lumps" are full. Loosely tie a string to the balloon from the uninflated "lumps," and cut the string so that the balloon just barely floats. A scrap of attached to the string cardboard may also help.

✍Procedure for Session

1. Distribute worksheets.
2. Ask students to fill out their predictions for experiments 1 & 2.
3. Outdoors, select 5 volunteers. Tell each of them to hold onto a balloon until you say to release, and pass out the helium filled balloons.
4. Call for attention and tell the volunteers to release the balloons together.
5. Set up and light the camp stove. Fill the different sized hot air balloons, and compare their flight.
6. Returning to classroom, have students write down their observations from experiments 1 & 2.
7. Show students the squiggly balloon, and that it floats. Ask them to make predictions for it's behavior when you squeeze the balloon to reduce its volume. While they are writing, trim the string to make sure the balloon is still floating (an adjustment is usually needed because helium slowly leaks from this type of balloon).
8. Untie the string (not the balloon) and squeeze the helium from the fourth lump into the first three lumps. Use the string to tie off the fourth lump so that it can not reinflate. The balloon should now sink, without the amount of helium inside changing. This takes some practice to do smoothly, without popping the balloon or squeezing helium out of the balloon entirely. Done well, the balloon can alternate once or twice between floating and sinking.
9. Have students write down their explanations for the results of the three experiments, using a particle model for gases. Remind students that it's not the mass of hot air or helium that matters, but the extra volume that gives to an object (with little extra mass) that causes it to float.