

Lesson plan for *Balloons and Buoyancy* : How do gases in different containers behave in gases fluids?

Time for activity 35 minutes

Learning Goals: Students will be able on a molecular level to

1. Explain why a rigid sphere would float or sink.
2. Determine what causes helium balloon to rise up or fall down in the box.
3. Describe the differences between the hot air balloon, rigid sphere, and helium balloon.
4. Explain why a hot air balloon has a heater.

Background:

My students used Gas Properties to help develop a molecular model during a heat and thermodynamics unit earlier in the semester. They were introduced to buoyancy through the text. In particular, they did some simple problems finding buoyant force of an object floating or suspended in a fluid like a boat on water, a solid object in a liquid, and gas balloons in air. They did a Density sim activity <https://phet.colorado.edu/en/contributions/view/3406> and a Buoyancy sim activity, <https://phet.colorado.edu/en/contributions/update-success/3408>

Balloons and Buoyancy Introduction:

I talked about how pressure is a result of the molecules colliding with the container. I think this caused some extra confusion because many of the student answers about why some things float and some sink had references to pressure as opposed to density. I think next time, I'll omit this discussion.

Also, the sim can run very slowly if there are molecules. Several times, I saw students' computers running very slowly and I discovered that they had left previous tabs running with high numbers of molecules or temperature. I made an announcement after a few students starting having difficulty rather than add another tip.

Lesson:

The first year I did this lesson 2010, the Density and Buoyancy sims did not exist and the students had some difficulties. I am hopeful that doing the other activities will make this go better for them.

Post-Lesson There are clicker questions to follow.