# Fluids Part 1: How Do We Know Air Is There?

Understanding air is important in the study of science. For instance, air plays an enormous role in predicting and describing weather. Students often have difficulty because, although air is all around us, students do not see themselves interacting with it as they do butterflies, plants, simple machines, rocks, magnets…

Because students can't ordinarily see air or sense when they are touching it, we are at a real disadvantage when teaching about it. How do we help students understand the existence of air, other than by telling them, "trust us, it's there"? What *evidence* can we offer students?

In the next series of emails, we will examine air, often through comparisons with water, a substance very familiar to students that shares many common properties with air.

## Air is all around us

If we can't generally see, smell, or notice we are touching air, then how can we convince students of its existence?

One way is to start with a clear and observable concept:

> Two objects or substances cannot occupy the same space at the same time.

If a student sits in a chair, no one else can be in that seat concurrently. If a car is in a parking space, another vehicle is not going to fit there. Using water, we can do a demonstration that will provide evidence that even an "empty" glass has something in it.



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## "Trapped air" experiment


Right now, you can just do this as a "thought experiment." Later, try it out!

You'll need:

- a bucket of water
- a small glass
- some cotton balls
- glue

1. Add some food coloring to the water to make it more visible.
2. Glue a few cotton balls inside the bottom of a glass.
3. Invert the glass.
4. Now predict what you will observe happening to the cotton ball as you push the glass under the water, move it straight down, and then lift the glass straight out of the water.

## So what happened?

If you were able to visualize the activity to do the "thought experiment," what did you predict would be the state of the cotton ball?

If you were to perform the experiment, you would discover that the cotton ball did not get wet, even though the glass was under water. Why is this so?

It seems that something was preventing the water from getting to the cotton ball, and that something is air. The seemingly empty glass actually is filled with air. And if you push the glass straight down and lift it straight out of the water, the air has no way to get out once the glass is in the water. The air can't leave the cup, because the water is in the way. Likewise,



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the water cannot enter the seemingly empty glass, because air is in there. Remember, **two substances or objects cannot occupy the same space at the same time.** The dry cotton is evidence that something (air) is occupying the space inside the glass and, unless the air is moved out, the water can't get into the glass.

If you wanted water to get into the glass, what would you do?

You would tip the glass so that the air can flow, letting the water in.

Even a toddler playing at a water table has discovered that to fill a container underwater, you must tip it. By tipping the glass, you are releasing the trapped air and letting water enter the glass.

## Upcoming

Next week we will continue this exploration of air
by examining the shared properties of water and air.

*In the meantime, consider these questions:*

1. Since we stated that the primary focus of this series is air, why is this email titled: **Fluids 1**?
2. Based on what you have learned in this e-mail, how would you modify major understanding 3.1a? (see below)

## What do the standards say?

In the Elementary Core Curricula, Standard 4, The Physical Setting,

Major Understandings state:

- 3.1a *Matter takes up space and has mass. Two objects cannot occupy the same place at the same time.*





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