

# How to See the Invisible

[Back to search results >](#)

## Middle School Science: How to See the Invisible

Subject:

Science

Grades:

6, 7, 8

### To The Teacher:

One of the truly hardest ideas to get across to students is the existence of the unseen world of atoms and molecules. You can't see or touch the particles of a gas. In these demonstrations you will work with two gases: air and carbon dioxide.

First you will work with air, since it is the easiest to gas to work with.

To ordinary experience when you look at air, nothing is there. This lesson plan and activities and demonstrations are designed to show how chemists know that air is composed of a gas without necessarily knowing anything about what is in the gas.

In normal language, when you say the word fluid, what you usually mean is a common liquid. However to chemists, a fluid can also mean either a liquid or a gas.

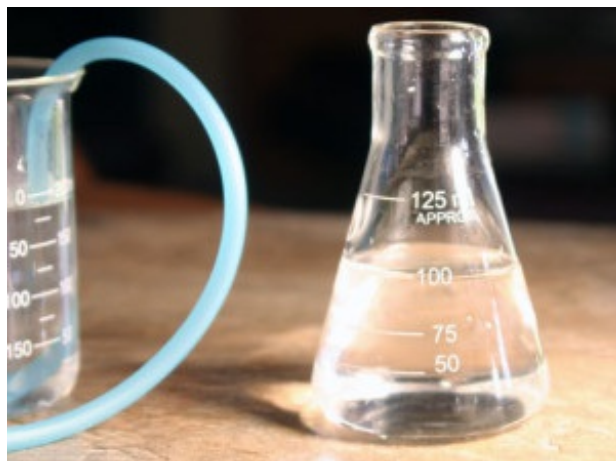
The term fluid refers to properties associated with a fluid.

Fluids flow from container to container. A liquid assumes the shape of the container. A gas on the other hand, has no fixed volume or shape.

The hands on activities can be treated as either lab activities or demonstrations which depend on time and the availability of equipment.

### Prepare the Students:

- Remind the students about the three most important phases of matter: solid, liquid, and gas
- Ask them to make obvious comparisons between them and cite ordinary examples of each
- Start a discussion about air, the thing around all of us we can't actually see.
- Ask students what they think of air and what might be inside of it.
- Remind them that a gas can be thought of as individual non-interacting particles like ping pong balls in a



box.

- Gas pressure can be thought of as the number of ping pong balls striking a surface all at once

The first activity is to demonstrate that air has mass.

1. Take a dry 125 mL Erlenmeyer flask and rubber stopper.
2. Obtain the mass to the nearest 0.01 grams.
3. Set up a beaker large enough to comfortably contain the flask with water on a ring stand.
4. Place the beaker on a wire mesh heating pad with water in the beaker.
5. Remove the stopper from the flask. Immerse the flask inside the beaker.
6. Heat the beaker and flask in the beaker to at least a simmer for ten minutes.
7. Remove the hot flask from the water with tongs and quickly stopper the hot flask with the same stopper used earlier when the mass was obtained.
8. Dry off the flask to be sure no water remains on the outside.
9. Wait for the flask to cool and obtain the mass again

The students should find that the “empty” flask weighs less the second time they weigh it. Some students may think it’s silly to take the mass of an empty flask twice. When I had college students perform this lab, many of them thought they were doing something wrong when the flask weighed less after the reaction. Whether you tell them or want students to find out for themselves is optional. I found a surprise has better teaching value.

The second activity is to demonstrate the air outside of an object has mass and force.

- 1) Prepare a hot water bath with a beaker and ring stand above a Bunsen burner.
- 2) Prepare an ice water bath adjacent to the hot water bath.
- 3) With a plastic 15 oz. or 12 oz. plastic soda bottle, remove the cap and hold the soda bottle immersed in the hot water bath with the open top kept above the height of the hot water.
- 4) When the bottle has been heated for 10 minutes, remove it from the water and quickly screw the cap on right away.
- 5) Immediately immerse the bottle into the ice water bath.

The plastic soda bottle will implode and be crushed by the weight of the atmosphere. I have seen this work with a 22 gallon oil drum. From the first experiment students saw an empty flask had something in it.

The second experiment shows students the empty space around the plastic bottle contains something that can crush it.

The third activity is designed to demonstrate not all gases are the same.

- 1) Place a lit candle on a table or counter top in a beaker with clay to steady it.
- 2) In the bottom of a small beaker place approximately a teaspoon of baking soda, ( $\text{NaHCO}_3$ ). Chill the vinegar before the reaction.
- 3) Pour 5 mL of vinegar on top of the powder.
- 4) As soon as frothing starts, immediately cover the top of the beaker with a watch glass or inverted petri

dish.

5) After the frothing stops, carefully decant the beaker over the flame being careful not to spill any liquid collected at the bottom of the beaker.

When it appears you have poured nothing from the beaker onto the candle, the flame of the candle should magically go out. Here your students will see an empty beaker can contain something able to smother a flame.

### **Concepts for Understanding:**

- Gases occupy space and have mass
- The atmosphere has mass and occupies space
- Different gases have different properties: lighter/heavier, color/invisible
- Chemists use indirect means to observe things they can't see

Resources:

FillFlask100mL\_LP20132014 [\[DOWNLOAD\]](#),

51b64790398a80.25120338\_Snap\_Into\_Action1\_larkin\_middleschoolscience [\[DOWNLOAD\]](#)