

PROPERTIES OF AIR

"What is it that you can touch But cannot feel; That has no size or shape But still is real?"

Students will **understand** that air, although invisible, is not "nothingness."

Students will **realize** that air takes up room, has weight, and exerts pressure.

Students will **work** cooperatively and **practice** the scientific method.

PROCEDURE:

1) Give the attached **pre-test** a day or two before you start this lesson, to assess what your students already know. You may want to discuss some of the responses as a class.

2) Divide the students into groups of four or less.

3) Have students collect and assemble pages for individual lab books. Briefly read through directions and have students fill out hypothesis section for each station. Students may also do this as they visit each station, but I have noticed they tend not to do it before doing the experiment! Also, health and safety should be discussed--using clean straws, cleaning out jars for station G, handling glass containers carefully, etc.

4) **Set up 6 stations as follows.** The materials for these stations are inexpensive and readily available. Students should rotate around the stations about every 10 minutes until all stations have been visited. Students should fill out their lab books at each station as they perform the experiments.

Station A: #1 & 2 (Note: I have tried these 2 experiments with students and they are difficult to get good results from, so I have combined the two, hoping that students will get at least one of them to work. Also, have clean straws available for each student.)

Station B: #3 (set up 2 bowls for a group of 4)

Station C: #4 (set up 2 pans)

Station D: #5 (set up 2 dowels)

Station E: #6 (best to do over sink; have 2 cups available)

Station F: #7 & 8 (these are very quick experiments, so I have combined them.)

Station G: #9 & 10 (Note: #9 is sometimes difficult to do--try a thin coat of Vaseline to help seal edges) Also, for health considerations on #10, have clean straws available for each student as well as several clean jars that can be washed between groups.

Station H: At this station, students can catch up on their lab books and decorate their lab book covers.

5) Station cleanup; finish lab books

6) Closure: Class discussion of conclusions-- this should elicit that air takes up room (**stations A, B, & C**), air has weight (**station D**), and air has/exerts pressure (**stations E, F, & G**). Turn in lab books.

7) **Post-test** the following day.

ATTACHMENTS:

PRE-TEST QUESTION

What do you know about air? Write as much as you can think of.

POST-TEST QUESTION

Based on the experiments we have done, what do you know about air?

Individual Lab Books
with instructions for each station activity

(Students will create a lab book. The lab book should have a page per station with the following: hypothesis, observations and conclusions included on each page.)

STATION A - Steps 1 & 2

Step 1

Equipment needed:

- pop bottle
- small funnel
- straw
- modeling clay
- cupful of water

Seal the funnel tightly into the neck of the bottle with modeling clay. Pour the cup of water into the funnel quickly.

HYPOTHESIS: What will the water do?

Pass the straw through the funnel into the bottle. Suck out a mouthful of air.

OBSERVATIONS: What did you see the water do?

Step 2

Equipment needed:

- wide-necked bottle or jar with an air-tight lid
- straw
- modeling clay
- small balloon
- thread

Blow the balloon up just enough to fit very loosely in the bottle. Tie a thread around the neck of the balloon so the air will not escape. Drop the balloon into the bottle.

HYPOTHESIS: What do you think will happen to the balloon?

Punch a hole in the lid and insert the straw; seal it with modeling clay. Screw the lid on the bottle. Suck some of the air out of the bottle through the straw and clamp your finger over the top of the straw to prevent air from rushing back into the bottle.

OBSERVATIONS: What did you see happening to the balloon?

Look at your observations for **Step 1**. Where is the air and what did it do?

Look at your observations for **Step 2**. Why did this happen?

STATION B

Equipment needed:

- water glass
- cork
- large glass bowl
- facial tissue

Fill the bowl about 3/4 full of water. Drop the cork on top of the water.

HYPOTHESIS: What do you think will happen to the cork?

Turn the glass upside down over the cork and push the glass down until it touches the bottom of the bowl.

OBSERVATIONS: What did you see happen to the cork?

Remove the cork and glass. Stuff facial tissue into the bottom of the glass.

HYPOTHESIS: What do you think will happen to the tissue?

Turn the glass upside down and push it to the bottom of the bowl.

OBSERVATIONS: What did you see happen to the tissue?

Where is the air in these experiments and what is it doing?

CONCLUSIONS: Was your hypotheses correct? Yes No

STATION C

Equipment needed:

- two water glasses
- large dishpan or other container filled with water

Place one glass into the container of water so that it fills with water. Place a second glass into the water upside down so that the air does not escape.

HYPOTHESIS: What are the bubbles made of?

Carefully tilt the air-filled glass UNDER the water-filled glass. Try to catch the bubbles with the water-filled glass.

OBSERVATIONS: What happens to the water-filled glass as you catch the bubbles?

Now practice pouring the bubbles back and forth between the glasses. Can you do it without losing any bubbles? !

CONCLUSIONS: What does this tell you about air?

STATION D

Equipment needed:

- wooden dowel rod or tinker toy stick about a foot long
- string, one yard
- two balloons exactly the same size

Blow up the balloons to the same size, and tie them at their neck with a piece of string. Tie one balloon to each end of the dowel rod. Attach another piece of string to the center of the dowel and suspend it from a convenient place. Balance the dowel. Prick one balloon with a pin.

HYPOTHESIS: What do you think will happen to the dowel rod when you poke the balloon?

What does the air in **each balloon** do when you poke a hole in one?

OBSERVATIONS: What did you see happen?

CONCLUSIONS: Where is the air contained as you begin this experiment? What does this tell you about air?

STATION E

Equipment needed:

- water glass
- piece of thin, flat cardboard

Fill glass to the top with water. Place the cardboard piece over the glass. Carefully turn the glass upside down, holding the cardboard tightly to the glass. Take your hand away from the cardboard.

HYPOTHESIS: What do you think will happen to the cardboard and the water in the glass?

Tilt the glass or hold it sideways.

OBSERVATIONS: What did you see happen?

CONCLUSIONS: Which exerts more pressure on the cardboard--water or air? How do you know?

STATION F - steps 1 & 2

Step 1

Equipment needed:

- straw or glass tube
- glass of water

Insert a straw all the way into a glass of water. Cover the top of the straw with your finger. Lift or tilt the straw out of the water.

HYPOTHESIS: What do you think will happen to the water in the straw as you lift it out?

Remove your finger from the straw.

OBSERVATIONS: What happened when you did this?

CONCLUSIONS: Which worked better for drawing water out of the jar?

Step 2:

Equipment needed:

- large medicine dropper or any kind of a tube with a suction bulb.
- large dishpan or other container filled with water

Put the dropper or tube in a pan of water and squeeze the attached bulb, forcing the air out of the tube. Release the bulb.

HYPOTHESIS: What do you think will happen to the tube once the air is forced out?

Lift the tube out of the water.

OBSERVATIONS: What happens to the water in the tube when you did this?

CONCLUSIONS: What does this tell you about air?