

## What can air do when it presses on things?

### Teaching and Learning Focus

In Investigation Question 2 students saw the air pressing on water, keeping it out of the cup. This investigation shows students that air presses on other things, and ultimately that it presses on all things that are in the air. Understanding this provides a building block toward developing an understanding of air pressure. You could have groups do this, or you may want to do it as a demonstration using student volunteers. Be sure to try this yourself ahead of time to insure that your wood samples are thin enough. Observe all safety precautions.

### Materials Needed

- 2 strips of very thin balsa wood (about 1.5 inches wide and 20 inches long)-no more than one-eighth inch in thickness.
- Multiple page section of newspaper
- Small hammer or mallet
- Work table
- Safety goggles for you and your students

### Safety

This investigation question contains potential safety hazards and should always be done under adult supervision. Ensure that all safety procedures are followed. You may feel that parts of this investigation are best done as a teacher demonstration. Use of goggles is required.

### Setting the Scene

Repeating (or reviewing) the activity from Investigation 2 provides a way to introduce Investigation 3. The students' attention can be focused on the water being held out of the cup. The discussion can move to the air being what keeps the water out, and from there to the idea that the air is pressing on the water. This to the realization that air presses on other things, too.

### Presenting the Investigation Question

Introduce your students to the investigation question: "*What can air do when it presses on things?*"

Have your students discuss the question in pairs, then in groups, and then as a whole class. Record their answers on the flipchart.

Have your students brainstorm ideas about how this investigation question could be investigated.

1. Design an experiment that could be used to test the investigation question.
2. What materials would be needed?
3. What would you have to do?
4. What would be measured?
5. How long would the experiment take?

### Assessing What Your Students Already Know

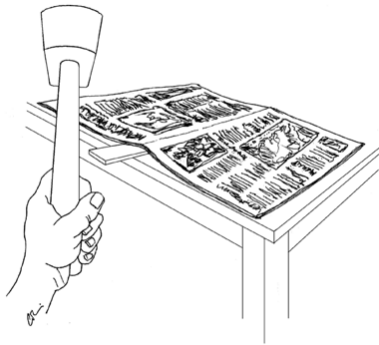
The idea of air pressing on things, or air pressure, may be quite new to most of your students. They will more likely know that contained air within a balloon, basketball, bicycle tire, etc., pushes on the inside of these inflatables. They may even think of this as air under pressure. However, the idea that air exerts pressure on the outsides of objects from every direction is a tough concept to understand.

Spend some time reviewing Investigation 1 and 2. Remind your students how air was contained with a balloon in Investigation 1 and inside the underwater cup in Investigation 2. Ask them to consider the following questions, first in pairs then groups then as a whole class:

- When have you seen air pushing on things? (*Some may give air pushing on boat sails or windmills as examples, which are examples of wind movement not air pressure. Do not correct them at this stage.*)
- How do you know it was air that was pressing on things? (*Your students may come up with a range of possibilities here. Their responses will alert you to the level of understanding they currently have. Accept them without judgment at this point.*)

## Exploring the Concept

1. First, have everyone put on the safety goggles. Lay one of the strips of balsa wood on a table edge with about a third of its length sticking out from the table top.
2. Ask your students to predict what they think will happen when you strike the protruding length of wood with the hammer or mallet. Have them write or draw this on paper and also write the reasons for their predictions. (*Some may think that the wood will break. Others might suggest that it will flip up into the air.*)
3. Give the protruding wood a firm tap with the hammer, and it should flip the whole piece into the air. (*You might want to do this step to avoid the wood flying too far.*)
4. Ask for ideas about breaking the wood in two pieces using the hammer. (*Some will suggest that if you hold your hand down on the part lying on the table, you can break the protruding piece off with a hammer stroke. Have a volunteer hold the piece down firmly while you tap off the end.*)
5. Now, using the second strip of balsa, show the students that you are going to cover the part of the strip lying on the table top with just 3 sheets of newspaper.
6. Have your students first discuss and then predict what will happen when the wood is struck by the hammer or mallet. They should draw or write down their predictions and also give the reasons for them. (*They may predict that the paper will tear or that the paper will work like hands to hold the wood down so that just the protruding end will break off.*)
7. Hit the wood with the hammer or mallet. (*The air pressure on the paper holds down the wood on the table enough so that the end can be lopped off with the hitting stroke.*)
8. Have your students look again at their predictions. (*Did what happened confirm or refute their predictions? Do the explanations for their predictions appear to be valid or not?*)



9. Set three books in a stack on the table. Then, place the balsa wood on top of the books so that one end protrudes as it did off the bare table. Set the newspaper on the other end of the balsa. In this case, the paper will be above the table (*although it is likely to sag down enough to touch the table.*) Have students predict what will happen if you hit the balsa now, and then do it. (*The balsa would should flip the paper up without breaking.*) Explain that in this case, the air was pressing down on the paper as it did before, but because there was also air below the paper, the air pressure was also pressing upward, so the pressure was balanced on both sides. When the newspaper is smooth on the table, there is only air pressure on top, which is enough to hold the wood down such that the end is broken off.

## Applying Students' Understanding

Ask your students to make a drawing of this setup that resulted in the successful break and, using arrows find a way to show what happened and why. (*What you are looking for is them showing arrows pointing down onto the surface of the newspaper to represent the air pressure.*)

## Revisiting Investigation Question 3

Complete this investigation by asking your students to reflect on this question and how their answers may have changed as a result of this investigation. What do they know now that they did not know before?

When air presses on things it exerts a force that can hold things down. That force can be balanced in all directions if there is air all around the object as it was when the balsa wood was on the stacked books. Air can also hold things to a ceiling or wall when the right kind of device is used (e.g., with suction cups).

## Weather Unit Sections

Introduction

Air

What is there between you and me?

How can you tell air is "something?"

**What can air do when it presses on things?**

Revisit the concept of Air

Temperature

Wind

Clouds

Weather

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