AIR PRESSURE

Background Information for Activity Leaders

Overview

Children will explore air pressure by demonstrating how the weight of air molecules affects common objects.

Key Concepts

- There are lots of molecules in the air above and around us. The weight of all this air exerts pressure on objects.
- **Pressure** is a push or force against a surface. **Air pressure** is the **force** exerted on a surface by the **weight** of tiny particles or molecules of air.
- The air pressure on the Earth's surface is what we're used to. In fact, we're so used to it that we forget we're actually feeling air pressure all the time.
- Earth's atmosphere is pressing against each square inch of you with a force of 14.7 pounds per square inch (1 kilogram per square centimeter or 1 atmosphere).
- Objects with more surface area experience more pressure than objects with a smaller surface area.
- The air and fluids inside your body balance out the pressure outside, so your body stays nice and firm.

Air pressure pushes in.

Air and body fluids push out.

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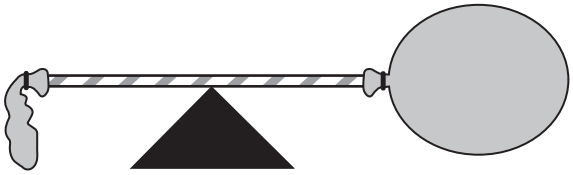
What to Expect

- Children will be able to notice that air molecules, although invisible to them, have properties.

- Some children may wonder how they can weigh air. Suggest that they use two balloons to investigate whether air adds weight to a balloon. Children can balance a straw on a triangular cube to find its center. Then, they can try to balance a deflated balloon and a inflated balloon attached on either side of the straw.



Common Misconceptions

- Children will use the terms weight and pressure interchangeably. These two terms are not the same. Weight refers to a downward force caused by gravity. Pressure is a force applied to a surface. The force of air pressure is caused by the weight of the air particles. The more particles in a given area, the greater the air pressure will be. That is why the unfolded newspaper, which has the largest area, is harder to move than the folded newspaper that has a smaller area.

- *Children may think: "Air must be nothing because I can't see it and I can't feel it."*

  Air is made up of small particles that have mass/weight and take up space. For example, the air in tires holds up a car. It is important to know a car's tire pressure. The tire pressure is measured in psi, or pounds per square inch, and is the force exerted by the air in the tire on every square inch of the inside of the tire.

- *Children may think: "Air can't cause anything to happen because it has no weight."*

  Air has mass/weight. One air particle alone doesn't appear to weigh much but the pressure exerted by all the particles' weight adds up. Air pressure is the weight of the atmosphere directly above us, pushing down on our heads and bodies. The air pushes sideways, too, at the same pressure. Air pressure can't be felt because we become accustomed to its force However, you can feel your body adjusting to changes in pressure when your ears 'pop' as you go up on an airplane or a mountain road. Your body adjusts the pressure in your middle ear so that the eardrum doesn't rupture.

AIR PRESSURE

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Data Collection Sheet

Name:_____ **Date:**_____

WONDER Since we can't see air pressure, how can we explore what it does?

RECORD Draw or write about what you observe.

Data Table: Air Pressure Observations

sheet of newspaper folded in half	full page of newspaper

CONCLUDE What did you discover about air pressure?

_____

_____

AIR PRESSURE

Activity Leader's Guide

Set Up the Expedition

Materials:

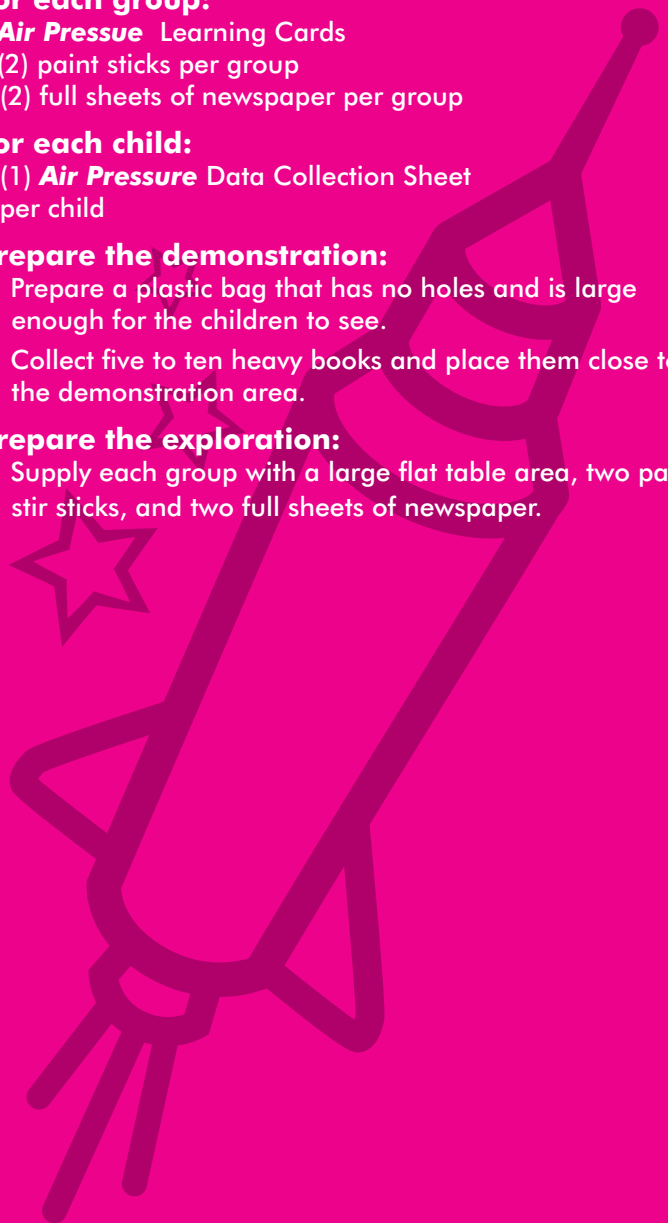
For the activity leader:
- (5-10) medium to large books
- (1) plastic bag

For each group:
- ***Air Pressue*** Learning Cards
- (2) paint sticks per group
- (2) full sheets of newspaper per group

For each child:
- (1) ***Air Pressure*** Data Collection Sheet per child

Prepare the demonstration:
1. Prepare a plastic bag that has no holes and is large enough for the children to see.
2. Collect five to ten heavy books and place them close to the demonstration area.

Prepare the exploration:
1. Supply each group with a large flat table area, two paint stir sticks, and two full sheets of newspaper.



Engage

Group Size: 4-6 children
Time: 20 minutes

1 Gather the children together.

Ask:
"What is air made up of?" Children may know that air is a mixture of many different gasses, including nitrogen, oxygen, carbon dioxide, and water vapor. All these gasses mixed together are referred to as air.

Say:
"Air is made up of many small particles." Move your hands around like you are catching some of these particles.

Ask:
"How can I catch some of these particles using this plastic bag?" Follow the children's suggestions, until you have "caught" some air inside the bag. Some children may suggest using a balance or scale to weigh the air.

Ask:
"Does air weigh anything? How can we find out?" Children may think air weighs nothing. Encourage them to remember these ideas for further investigation.

2 Ask for a volunteer to help with the next demonstration. Give the volunteer a book to hold.

Say:
"Is this book very heavy?" One book alone is not heavy. As you add books, one by one, ask:

"What about now? Is this stack of books heavy?" The weight of many books together can be very heavy.

Ask:
"Just like the books, each tiny particle that makes up the air does not weigh much on its own. Added together they weigh a lot."

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Ask:
"Air particles around us stretch upward for more than 350 miles (563 km). That's a lot of weight, or force from the air pushing down on us. We call this force air pressure. Can you feel the air pressure? Why not?" We don't feel the air pressure because we are used to it. The air and fluid inside our bodies pushes out with an equal force.

Explore

3 If you are working with more than 4-6 children, divide the children into groups. Distribute the Data Collection Sheets and the Learning Cards.

Say:
"Let's investigate air pressure."

4 Allow children enough time to complete the WONDER, EXPLORE, RECORD, EXPAND and CONCLUDE sections of their Learning Card.

Expand

5 Ask the children to follow the EXPAND instructions on their Learning Card. This section will require individual work guided by the activity leader when necessary.

Conclude

6 Gather the children together and ask the following questions:

"What happened to the folded sheet of newspaper when you hit the exposed wood with your hand?" The newspaper moved or jumped off of the wooden stick.

"What happened to the unfolded sheet of newspaper when you hit the exposed wood with your hand?" The newspaper did not really move at all.

"What force was keeping the paper from moving?" Air pressure was pushing down on the surface area of the paper.

"What was different about the two experiments?" After giving the children an opportunity to discuss their ideas, guide the discussion towards the difference in surface area of each paper. The folded newspaper has less folded area than the unfolded paper.

"Why was it hard to lift the unfolded sheet of newspaper when you brought your hand down on the wood?" There was more surface area in which a greater number of air particles could push down on the newspaper. There was more air pressure pushing down than force from the wood pushing up.

"What do you wonder about air?" Give children an opportunity to discuss what they wonder about. Then help guide them towards a way to discover an answer.

"How could you try to answer your question?" Answers will vary.

7 **Say:**
"Congratulations! You have earned your 'Ask Me About Air' stamp. You are ready to tell people about properties of air."

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AIR PRESSURE

Expedition Learning Card

How can air pressure be seen and felt?

pressure
weight
force

Explore how air exerts pressure on the surface of objects.

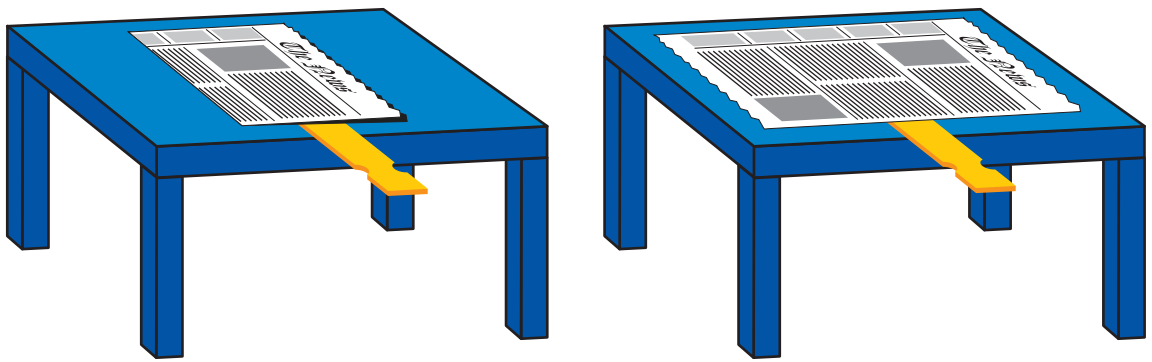
1 WONDER

Since we can't see air pressure, how can we explore what it does?

Record your ideas on your Data Collection Sheet.

2 EXPLORE

1. Place a paint stick on the table so about one-third of it extends over the edge.
2. Place one sheet of folded newspaper on the paint stick and press them against the table until the paper is as flat as possible.
3. Now hit the extended portion of the paint stick with your hand. Try to make the paper fly into the air.
4. Repeat steps 1-3 using one sheet of unfolded newspaper.



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Expedition Learning Card

3 RECORD Notice everything you can about what happens with each piece of paper and the paint stick.

Draw or write your observations on your Data Collection Sheet.

4 EXPAND What do you know about air pressure? What do you want to know?

- Make two lists:
  1. all the things you know about air pressure
  2. all the things you would like to know about air pressure
- Choose one thing from the second list that you want to explore.
- Make a plan to investigate your question.

Write or draw your plan on the back of your Data Collection Sheet.

5 CONCLUDE What did you discover about air and air pressure?

Draw or write what you discovered on your Data Collection Sheet.

Discovery

Why did we do that?

- The air around Earth extends upward over 350 miles from the Earth's surface.
- The air is made of small particles or molecules.
- The weight of the particles add up, representing a lot of weight.

Congratulations!

You have earned your "Ask Me About Air" stamp! Now you are ready to tell people about air!

APEX SCIENCE