

Air: A First Look

1 videocassette..... 16 minutes

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1560 Sherman Ave. Suite 100

Evanston, IL 60201

1-800-323-9084

www.unitedlearning.com

www.unitedstreaming.com



CREDITS

Author and Producer: Peter Cochran Peter

Principal Videography: Scheer Randy Kaye

Narrator: Michael Worosz Dr.

Consultant: Alan McCormick

Produced for Rainbow Educational Media by
Cochran Communications

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INTRODUCTION

Young students are naturally curious about the world around them. Air is an essential and familiar part of that world. The video program *Air: A First Look* focuses students' attention on some of the essential characteristics of air, including: air is necessary for life; air is a gas; air has weight and pressure; air takes up space; and air can be moved.

The video shows students engaged in a variety of activities that viewers themselves can duplicate at home or at school. In several places the video provides an opportunity for the teacher to pause the program so that students can predict what will happen. In this and other ways, students not only learn about air but also are encouraged to observe and explore their environment.

Grade level: This video is appropriate for grades 1 through 3.

Before viewing the video: Before showing the video, you may want to acquaint students with some of the key terms that will appear, including: *liquid*, *gas*, *solid*, and *pressure*. Write these terms on the chalk board and discuss them, referring if necessary to the glossary in this guide.

SUMMARY

The program begins by showing a girl in an open field observing the things that she can see or hear around her. It notes that there is something very much a part of her environment that she can't see or hear: air.

The video then shows a series of activities that demonstrate that air exists. A boy fills a plastic bag with air to show that air takes up space. Another student creates a balance scale with two balloons. Here, the video provides an opportunity for the teacher to pause the video to allow students to predict what will happen if the air is let out of one of the balloons. The video then shows the student letting air out of the balloon to show that air has weight.

In another activity, a girl puts tissue into an empty glass and puts the glass straight down into a tank of water. After taking the glass out of the tank, she removes the tissue, which is dry. The narrator explains that the tissue is dry because air in the glass prevented water from getting in.

Using a syringe, students do two more activities that involve moving air from one place to another. Again, the teacher has an opportunity to pause the program so students can predict what will happen.

The video then discusses how air is a gas and explains how a gas is different from a solid and a liquid.

The program describes how air fills the space around us and how the earth has a layer of air called the atmosphere. It explains that the air in the atmosphere has pressure, the force of air pushing against something.

A student demonstrates pressure by covering a glass filled with water with a card and then turning the glass upside down. Here, the teacher can pause the video to give students a chance to predict what will happen if the girl lets go of the card. The program then shows how the force of air against the card prevents the water from falling out.

The program describes how air pressure allows birds and planes to fly. It shows balloonists filling balloons with air and heating the air inside with burners. The lighter hot air rises along with the balloons .

The video shows that when the sun heats air, it rises. Cold air rushes in to take its place. This causes wind.

Finally, the program asks the students to imagine what it would be like to visit the moon, where there is no air. A brief summary reiterates some of the major points of the video.

OBJECTIVES

After viewing the program, students will be able to:

- recognize that air is necessary for life
- describe how the atmosphere that surrounds the earth is made up of air.
- describe air as a gas.
- explain that air has pressure.
- explain that hot air rises and cool air sinks.

REVIEW QUESTIONS

1. Describe some ways to show that air exists even though you can't see or hear it. *Answers will vary. Examples in the program include: filling a bag with air to show that air takes up space; creating a balance scale with balloons; sticking a glass with tissue in it straight down into water to show how air prevents water from getting in; using a syringe to move air from one place to another.*

2. Why is air different from a solid like a rock or a liquid like water?
Air is a gas. It doesn't have any kind of shape, and it fills up the space all around us.
3. What is the atmosphere?
The atmosphere is a thin layer of air that surrounds the earth.
4. What is air pressure?
Air pressure is the force of air pushing against something.
5. How can a bird fly?
Because of the shape of their wings, pressure builds up under the wings and lifts the bird.
6. How does a hot air balloon work?
The balloon is filled with air, and air is then heated. As the air is warmed, it rises.
7. What happens when the sun heats air?
As air is warmed near the ground, it rises. Cooler air moves in to take its place.
8. What is wind?
Wind is moving air.

ACTIVITIES IN THE VIDEO: STOP POINTS

At several points in the video, the teacher can stop the program to let students make predictions about an activity or experiment. If you have the right materials, your students can do the activity shown in the video. If they do this, it is still useful to ask them to predict what will happen as they perform the activity.

1. Balance Scale Using Balloons

Materials:

- balloons
- stick (A yard or meter stick will work.)
- rubber bands, to attach balloons to the stick
- string, to suspend the stick
- pins

It may be easier to suspend the stick from the back of a chair rather than from a table as shown in the video. The chair prevents the stick from swinging around but doesn't interfere with the operation of the scale.

If students don't understand how a balance scale works, ask them to think of a seesaw. Ask them what happens when both people on the seesaw weigh about the same. Ask them what happens if one person is much heavier than the other.

When puncturing one of the balloons with a pin, be sure to have students do it near the knot. This way the balloon won't pop.

This activity shows that air has weight. Point out to your students that the air in the room they are in probably weighs more than each of them.

2. Moving Air

Materials:

- aquarium or tank
- large syringe and tubing
- small jar (A spice jar is about the right size.)

In this activity it may be helpful to have the students think about the earlier demonstration in the video. When air was removed from the jar, water took its place. In this demonstration air is being moved into the jar, pushing the water out.

3. Pressure and Water in a Glass

Materials:

- water
- glass
- 4-inch by 5-inch index card
- bucket to catch water if it spills

This is an easy activity to perform. It is important, however, that the student keep the glass straight up and down before letting go of the card. If the glass is tilted, the water will spill.

Some students may have difficulty understanding why the force of air keeps the card from falling away. It may help to ask them to think of the force of air pushing up against a parachute.

ADDITIONAL ACTIVITIES

1. Vacuum Pump and Air Pressure

Equipment and materials:

- vacuum pump and bell jar (Most high school science labs have these.)
- balloon

Put a slightly inflated balloon in the bell jar and seal the jar. Explain to students that there is air pressure in the balloon pushing against the inside of the balloon. There is also air pressure in the bell jar pushing against the outside of the balloon.

Then tell students that you are going to remove most of the air from the jar, but not from the balloon. Ask them to predict what will happen to the balloon. If

necessary, help them understand that removing air from the jar will mean that the pressure inside the balloon pushing outward will now be much greater than the pressure outside pushing in.

Turn on the pump. The balloon will expand as the air is removed from the jar.

This activity can also be done with a marshmallow. The marshmallow has pockets of air similar to balloons, and the marshmallow will expand as the air in the bell jar is removed.

2. Air Expands When Heated and Contracts When Cooled.

When the balloonists in the video heat the air inside their balloons, the air expands. Hot air takes up more space than the same amount of cold air.

There is a simple way to demonstrate this. Have your students blow up a balloon. Using a tape measure, measure the balloon's circumference. Then put the balloon in a refrigerator. Approximately 30 minutes later take the balloon out and measure the circumference again, noting any difference. Then put the balloon in a warm place and, after 30 minutes, measure the circumference once more.

Discuss with the students how hot air is lighter than the same volume of cold air (or cold air taking up the same amount of space). This is why hot air rises or floats on colder air.

3. Breathing and Lung Capacity

The following activity gives students a rough sense of how much air their lungs can hold.

Materials:

- aquarium or tank
- plastic bottle
- flexible tube

Have a student put the bottle in the tank and tilt it to let air in the bottle out and water in. The student should then hold the bottle straight down.

Insert one end of the tube into the bottle . Then ask another student to take a deep breath and exhale into the other end of the tube.

The air exhaled will displace the water in the bottle. By examining the amount of air in the bottle, the student can get a rough measure of his or her lung capacity.

GLOSSARY

air: invisible mixture of gases that surrounds the earth

atmosphere: layer of air surrounding the earth

breathe: to inhale air into the lungs and exhale it

gas: state of matter in which a substance has no definite shape or volume

liquid: state of matter in which a substance flows and takes the shape of the container into which it is put

pressure: force of air pushing on something

solid: state of matter in which a substance has a definite shape and volume

syringe: device that can be used to draw in or eject a liquid or gas

wind: moving of air in the atmosphere

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RELATED VIDEOS FROM RAINBOW

The Fabulous Five: Our Senses

Magical Mother Nature: The Four Seasons

A First Look: Solids, Liquids, and Gases *and* Water

SCRIPT

Title: *Air: A First Look*

Narrator

Go outside and stand very still. Think of all the things that you see and hear.

Girl

"I see clouds...and trees.

I hear a bird."

Narrator

There is something else that is all around you... something you can't see or hear, but you can feel it blowing against your face.

Girl

"Air!"

Narrator

Air is all around us. We need this air to live. If you tried holding your breath, you couldn't do it for very long because we need air to breathe.

All the different kinds of animals and plants that make up our world need air. Without air there wouldn't be birds flying in the sky, or trees growing at the edge of a field. Without air, there wouldn't be you.

Even though we can't see or hear air, there are things you can do to prove it exists just as surely as water in an ocean or sand on a beach exists.

You can show that air takes up space. Open a plastic bag and swing it around or try to catch the air in the wind. Then close it up quickly. You've trapped air inside the bag. You can't see the air but it fills the bag just as much as if it were filled with groceries, or paper, or old cans.

There are other things you can do to show that air exists. You can show that air has weight.

You can make a kind of scale using a strip of wood. Attach a balloon to each end of the strip, which you can hang from a table or chair. Make sure the balloons are filled with about same amount of air.

If the balloons with the air inside them weigh about the same, they balance each other like this; but what do you think will happen if you let some of the air out of the blue balloon on the right?

Your teacher can pause the video here to let you answer this question. Otherwise the program will resume in 10 seconds.

Teacher can stop the video here.

Narrator

What will happen to the balance scale if you let air out of one of the balloons? To find out, prick a small hole near the knot.

Which balloon weighs more? The blue one with the air that has been let out...or the pink one with the air still inside?

Here's still another way to prove that air exists. Put a piece of tissue paper in the bottom of a glass. Stick the glass straight down into a tank full of water like this. Then, take the glass out and remove the tissue and see what feels like.

The tissue is dry. What Happened? Let's take another look.

The tissue is dry because the glass is full of air that prevents the water from getting in and making the tissue wet.

Another thing you can do with air is move it from one place to another. This jar is full of air, and the dish has water in it.

Using this instrument, called a syringe, you can move the air from the jar into the syringe. As the air moves out of the jar, water from the dish moves in to take its place.

Now try this . This jar is full of water, What do you think will happen to the water in the jar if you push the air from the syringe from the syringe into the jar?

Your teacher can pause the video here to let you answer this question.

Teacher can stop the video here.

Narrator

What will happen to the water in the jar when you push air from the syringe into the jar? As the air moves from the syringe to the jar, it pushes the water out.

Let's show that again. This time look closely at the bubbles. The bubbles you see are air. The air inside the bubbles is a gas.

Everything you see around you is either a solid, a liquid, or a gas. A rock is solid. You can touch it, even drop it, and it keeps its shape.

Water is a liquid. A liquid takes the shape of whatever container it is put into. If you put water from a pond into a jar, it will take the shape of the jar. Here the water doesn't quite fill the jar.

This jar looks empty, but actually it is full—full of air. Air is a gas. A gas doesn't have any kind of shape. You can't see air, but it fills up the space all around us just like it fills the jar.

The air around us makes up the atmosphere, a layer of air that surrounds the earth. This layer is very thin compared to the size of the earth.

Look at this globe. If this globe were the earth, the atmosphere would be only about as thick as this piece of cardboard.

The air in the earth's atmosphere has pressure. Pressure is the force of air pushing on something. Normally we don't notice this pressure pushing on us, but there is a simple way of showing that there is pressure.

Fill a glass with water and then put a card over the top. Turn the glass upside down. What do you think will happen when you let go of the card?

Your teacher can pause the video here to let you answer this question. Otherwise the program will resume in 10 seconds.

Teacher can stop the video here.

Narrator

Lets see what happens when you let go of the card.

The water stays in the glass. The water stays in the glass because the pressure or force of air on the card keeps the card from falling away.

Here's another way to see how powerful pressure can be. This tire is flat because there is very little air inside it.

Using a bicycle pump, this girl begins to fill the tire with air. As more and more air gets squashed into the same space the pressure increases, until she can't pump any more. When she feels the tire again, it is hard because of all the air in it.

The air in the atmosphere is thicker the lower you are. It is thickest around the level of the oceans, and the pressure is greatest here.

At the tops of tall mountains there is less air and less pressure.

As you go still higher, the air continues to get thinner and the pressure less, until—as you reach outer space—there is no air at all and no pressure.

The pressure of air in the atmosphere makes it possible for birds to fly. Because of the way wings are shaped, air under the wings builds up pressure and pushes up on the wings to lift the bird.

Airplanes have wings that work the same way. Airplanes are much heavier than birds and need powerful engines to help them fly.

We can fly in other ways, too. On a fall day in Vermont, several balloon pilots and their helpers stretch out their balloons along the ground.

Using fans, they fill the balloons with air. The air blown into the balloons is the same temperature as the air outside the balloons.

But then, using special burners, they heat the air inside. The hot air inside the balloon rises, just as smoke from a candle rises. The hot air floats on the colder outside air and lifts the balloon higher.

As one balloon goes up, another balloon nearby comes down as the air inside it cools. By heating the air inside the balloon, or by letting it cool, balloon pilots can control how a balloon goes up and down.

Just as a burner heats the air in a balloon, the sun heats the air in the atmosphere.

The air being heated by the sun is a little like water being heated on a stove. Here we've added sawdust to the water to show what happens more clearly. You can see the hot water from the bottom of the pot rising. Colder water from the top sinks to take its place.

In the same way, when the sun heats the land, hot air just above the ground rises, and cool air rushes in to take its place.

This causes air to move, and there is wind. A gentle wind may be just enough to rustle leaves or fly a kite.

A more powerful wind may warn of an approaching storm. Sometimes the wind is so powerful we have a violent storm called hurricane or even a tornado, a very scary kind of storm.

Air makes possible all the different changes of weather we see. Weather is caused by moving air...hot air and cold air...air that is dry and air that holds a lot of moisture or water.

Think about what it would be like to live in a place without air. The moon doesn't have air. When astronauts visited the moon years ago, they had to bring air with them to breathe.

Because there is no air on the moon, there is no wind. Because the moon doesn't have air, the astronauts didn't see birds or flowers or any other kinds of life.

Luckily for us, the earth is not like the moon.

Because the earth has air and this air moves, our weather changes constantly.

Because there is air, we can enjoy the feel of a breeze in our face,

or fly a kite.

Because of air, we can fly in an airplane, or
maybe even go up in a hot air balloon.

Air makes possible all the different kinds of life that
we see around us.

Because there is air, we too are full of life.

The End