

Leader's Guide Learning About Air, Second Edition

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LEARNING ABOUT AIR

Program Summary

Students are introduced to the concept of 'Air' and its various uses and properties. The program examines: the essentials of oxygen for living and growing; the variety of properties air is made up of; concept of air having weight and taking up space; different situations air pressure is used in; and how air can form resistance and also be used as an energy source.

Pre-screening Preparation:

- Preview the program before screening it for the students; this allows you to establish any pause points for discussion
- A pre-screening activity has been included for students to prepare them, and give you an understanding of their prior knowledge in order to build upon it.
- The post-screening science activities further extend students' understanding.
- These activities could also be used as an assessment tool. Background information is also provided to assist with explanations if required.

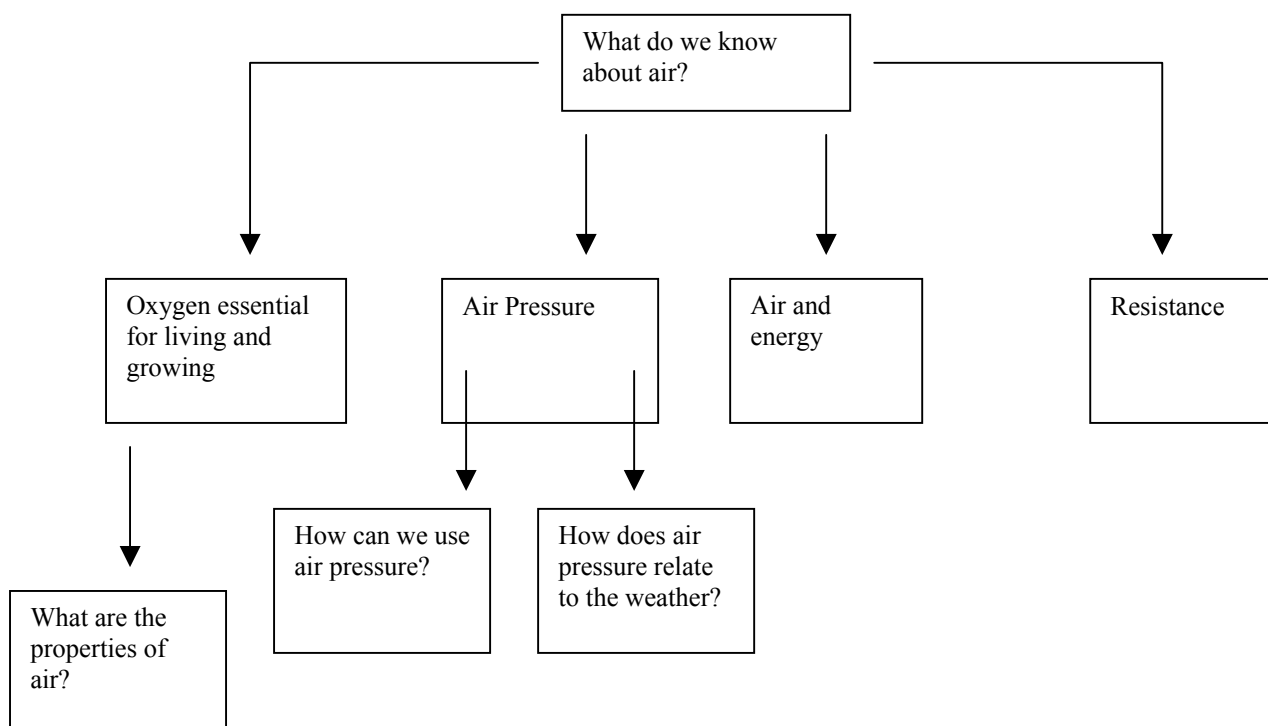
Viewing the Program

When screening the program for your class, if you feel it is necessary to stop and clarify a point, give further examples or define terms – then do so. The full value of the program will come from how you use it for your individual grade.

Pre-screening Activity

Cluster Diagram

Have students work in small groups to create a diagram such as the following using 'air' as the key word. Have the groups brainstorm to link what they see as key components related to air and then write questions related to the key components. This can be a powerful tool for developing student investigation. If your students have not used this tool before then it may be necessary to lead them in the exercise.



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Post-screening Activity

Air Resistance - Parachutes

Purpose

To understand what air resistance is and where it is found

Objective

To observe parachutes of different designs experiencing resistance as they move through the air

Materials

Plastic bags, cotton material, polyester material, string, paper clips, modeling clay, scissors

Procedure

Discuss - What is air resistance? How does it work? What can affect it? Relate back to program.

Students working in groups

- Have students cut out squares of material to specific lengths.
- Students should all cut parachute strings of the same length. Lengths can be adjusted at a later time when extending the experiment.
- Create the parachute using the fabric or plastic and string. Attach a small sphere of modelling clay to each chute as the “parachutist.”
- Using appendix A, experiment with various sized chutes predicting which one will have the most resistance. Observe and explain your observations.

How can we change the experiment to test theories discussed in the introduction?

- Test chutes of the same size with differing weights (different-sized “parachutists” made of clay)
- Test chutes of different sizes with same weight
- Test chutes made of different material

When the experiments are complete, discuss the findings as a group. Listen to terminology being used as it is a good indicator as to a students overall understanding.

Air Pressure

Purpose

To show students the effects of air pressure

Objective

The students will be able to identify air pressure and how it affects objects.

Materials

Two hard-boiled eggs, matches, paper towel, small jar (opening large enough to let the egg almost pass through), thin wooden board (a strip of thin plywood or panelling that is 2 ft. long by 3 to 4 inches wide.), sheet of newspaper

Procedure

Begin class with the "Egg in the Bottle." Peel both hard-boiled eggs just before doing the demonstration.

1. Set a small piece of paper on fire and drop it into the bottle. Place one hard boiled egg gently on the opening of the bottle, small end first. The egg may "dance" and wobble on top of the opening. Then the egg will appear to be pulled into the bottle after the heated air from the fire has contracted.
2. Allow the students to explain why the egg went into the bottle. (As the air was heated, it began to expand. Some of the air escaped causing the egg to wobble. When the fire was extinguished, the air began to cool and contract. The egg seals the bottle. There is less air in the bottle causing unequal pressure to occur between the air in the bottle and the air outside the bottle. The greater air pressure on the outside pushes the egg into the bottle equalizing the air pressure inside and outside the bottle.)

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3. Define air pressure: air pushes on all surfaces that it touches. This push is called air pressure.
4. Allow students to explain how you could get the egg out of the bottle. Keep in mind the first demonstration.
5. Hold the bottle upside down with the small end of the egg in the bottle neck.
6. Tilt the bottle down until there is a small opening between the neck of the bottle and the egg.
7. Blow hard into the bottle making a closed seal with your mouth. Before you remove your mouth, tilt the bottle upside down.

Demonstrate the "Weight of Air."

8. Place one end of the thin board on a table with slightly less than half the board hanging off the edge.
9. Lay a sheet of newspaper over the part of the board on the table.
Allow students to predict what would happen if the protruding end was struck as hard as possible.
10. Strike the protruding board as hard as you can. The paper will not move. If you hit hard enough, the stick will break. This is due to the air pressure that is exerted downward. Since the paper is flat against the board and table, no air is beneath the paper to counteract the pressure from above.
11. Calculate the surface area of the newspaper. (Length by width)
Multiply the surface area by 14.5. The result will be the amount of air pressure exerted on the paper.
12. Have students predict what would happen if you pushed down on the board slowly.
13. Place your hand on the protruding piece of the board and slowly push down.

Checking Understanding

- What do we call the pressure that pushes on all surfaces it touches?
- Explain how the egg dropped into the bottle.
- Explain why the board did not move the paper.

Background Information

Air Properties- The Earth's atmosphere is a thin layer of gases that surrounds the Earth. It is composed of 78% nitrogen, 21% oxygen, 0.9% argon, 0.03% carbon dioxide, and trace amounts of other gases. This thin gaseous layer insulates the Earth from extreme temperatures; it keeps heat inside the atmosphere and it also blocks the Earth from much of the Sun's incoming ultraviolet radiation.

Air Pressure- Air pushes on all surfaces that it touches. Air at sea level exerts a pressure of approximately 14 1/4 pounds per square inch. Therefore on a piece of paper 10 inches square, the air exerts a pressure of 1,450 pounds on the top surface. The same pressure is also exerted on the opposite surface, counteracting the pressure on the other side.

Compressed air has enough force to drive machinery that does work. Workers use tools powered by compressed air. Students may have seen a pneumatic jack hammer in use. Builders use nail guns to push nails into wood using compressed air. 'Pneumatic' means operated by air. Special machines called 'compressors' are used to supply compressed air to machines. Compressors are used to blow up balloons and fill tires with air at the service station.

Air resistance- The larger the surface moving against the air, the more the air is displaced. Thus the moving object loses some of its energy to the air in order to make the air move, which slows down as a result.

How does air move?

You know that wind is moving air. But what causes the air to move? It's the uneven heating of the earth's atmosphere.

As the sun warms the earth's surface, the atmosphere warms too. Some parts of the earth receive direct rays from the sun all year and are always warm. Other places receive indirect rays, so the climate is colder. Warm air, which weighs less than cool air, rises. Then cool air moves in and replaces the rising warm air. This movement of air is what makes the wind blow.

Vocabulary

aerodynamics, atmosphere, atoms, compressed, contract, expand, matter, molecules, nitrogen, nonrenewable, oxygen, pneumatic, pressure, renewable, resistance

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Useful Websites

Note: Some activities will require a variety of resources and a lot of preparation.

Does Air Really Exist? (Activities)

<http://www.iit.edu/~smile/ph9006.html>

Air Movement Activity

<http://www.iit.edu/~smile/ph9529.html>

Air –Its presence and effects (Teacher controlled activities –for safety)

<http://www.iit.edu/~smile/ph9706.html>

Air resistance

http://www.uq.edu.au/School_Science_Lessons/year4.html#AirresistanceL

Wind Speed

http://www.uq.edu.au/School_Science_Lessons/year5.html#WindspeeddirectionL

Air Pressure

http://www.uq.edu.au/School_Science_Lessons/year5.html#AirPressureL

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Post-screening Activity - Parachutes

Parachutes

- What does a parachute do?

- Investigating Parachutes

Prediction: What will fall more slowly, the large parachute or the small parachute? Why?

Observe

Explain

Prediction What will happen when the weight is doubled or reduced by half? Why?

Observe

Explain

Prediction What will happen if the string is shortened or lengthened? Why?

Observe

Explain

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Length

11 Minutes

Audience level

Grades 5 – 8

Subject Area

Science

Catalog Number

#2948-EN-VID

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