INDIANA expeditions with Rick Crosslin

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LESSON PLAN FOR AIR PRESSURE

Episode Five 205 – Indiana Weather (Earth Science)

Indiana experiences some of the most brutal weather found anywhere in the United States, and then, it really gets weird! Host Rick Crosslin introduces you to people who LIVE for weather and finds out what's really the most dangerous to Hoosiers. Is it tornadoes, floods, maybe blizzards? The answer will surprise you. And what's with those crazy people who actually chase (and catch) potentially deadly storms? Learn why the bizarre weather patterns Indiana's experienced in recent years may be a true sign of the times.

Funded by:
Dr. Laura Hare Charitable Trust
Indiana Department of Education – Center for School Improvement and Performance
Veolia Water Indianapolis

Overview
Students will gain an understanding of air pressure and Bernoulli's Principle.

Background information
To understand weather we must understanding the physics of gasses like air. Physics is the study of moving objects and air is an object that moves. Air is made of matter and all matter takes up space and has mass. In this lesson students explore some of the properties of air as it moves and as its pressure changes. Moving air follows the laws of nature that are studied in this lesson.

Connections to the Indiana Academic Standards for Science, Grades 4 - 7
4.1.1, 4.1.3, 4.1.6, 4.2.2, 4.2.4, 4.3.2
5.1.1, 5.1.3, 5.2.3, 5.2.7, 5.2.8
6.1.2, 6.2.4, 6.2.8, 6.3.17, 6.3.22
7.1.5, 7.3.16, 7.3.18, 7.7.2

Science Process Skills

- Calculating
- Communicating
- Hypothesizing and predicting
- Inferring
- Interpreting data
- Measuring
- Posing questions
- Testing ideas

Estimated Time Requirement

One 45- minute session

Materials for building the air pressure experiments

- Two *new* toilet plungers
- One strip of paper, approximately 5 x 15 centimeters
- One sheet of paper, folded in half horizontally to form a tent
- Ruler
- String
- Two empty and clean soda cans
- Three plastic newspaper bags
- Scissors
- Tape

Objectives

Students will be able to:

identify the effects of air pressure on objects ,
explore Bernoulli's principle – *increasing the flow of a gas or a liquid decreases the pressure*

Procedure

Anticipatory set:

- Visit the website: www.IndianaExpeditions.org
- View the *Indiana Weather* Indiana Expeditions segment
- View the video lesson from the this episode

Soda Cans

Preparation prior to the lesson: Prepare the soda can experiment

- Collect and rinse two soda cans
- Hang the cans equal distance from the ruler by tying the can tabs with string

Bernoulli Bag

Preparation prior to the lesson: Prepare the newspaper bag experiment

- Collect three clean newspaper bags
- Cut the bottom out of two of them
- Tape them together to form one large bag
- Make sure the new bag has one opening and a closed ending

Lesson sequence:

- Inform the students that today they are all going to learn about air pressure by conducting several activities.
- Discuss properties of air. Include the following:
    - Air is made of matter,
    - All matter takes up space and has mass – air takes up space and has mass
    - Air can be a force – from a push
    - More air is more air pressure
    - Less air is less air pressure
    - Air pressure is the "press" of air
    - Discuss Bernoulli's principle - *increasing the flow of a gas or a liquid decreases the pressure*
    - The atmosphere is made of air that follows physics laws

Press of Air – Air Pressure

Demonstrate the power of air in the atmosphere. This demonstration shows how air takes up space and has a press. When air is pushed out of the plunger – and it is sealed – the atmosphere pushes down on the outside of the plunger. The mass of the air pushed is strong enough to make it difficult to pull up the plunger.

- Press the plunger down on a flat surface and create a seal
- Try to pull the plunger off of the surface
- Push the sides of the plunger in to remove if necessary
- Press both of the plungers together to create a seal
- Try to pull the plungers apart
- Slide them in opposite directions to separate if necessary
- Ask two students to squeeze the two plungers together. Have them pull them apart. Be careful to "spot" the students. As the plungers come apart they will fall back with great force.

Bernoulli's Principle: Air Flow – Reducing Air Pressure

Increasing air flow by blowing in a focused manner will decrease the pressure where the air is moving. The following demonstrations show how the atmosphere will fill in the "low" pressure area once the air stops flowing. In each demonstration the air pressure pushes down when the air is stopped blowing. These demonstrations work best when the air is blown with force in a small focused area.

Paper Strip

- Take the strip of paper and hold it near your mouth
- Blow air across the top of it, observe the results

Paper Tent

- Place the folded sheet of paper on a flat surface
- Blow air through the fold, observe the results
- The paper tent will collapse – and then rebound when the blowing stops

Crashing Soda Cans

- Lift the ruler so the soda cans are hanging with a few centimeters apart

- Blow a strong burst of air between the soda cans, observe the results
- The cans will bounce together as the air pressure decreases and the atmosphere pushes the can together

Bernoulli's Bag

- Squeeze all of the air out of the prepared newspaper bag
- Predict how many breaths it will take to fill the newspaper bags with air
- Put your mouth to the newspaper bag and exhale completely, repeat until the bag is full of air, record how many breaths it took.
- Squeeze all of the air out of the newspaper bag
- Hold the newspaper bag away from your mouth, approximately 12 centimeters
- Blow as hard as you can into the center of the bag, observe the results
- The bag will inflate larger by blowing farther away from the opening. The increased air flow will decrease the pressure. The atmosphere will "push" more air into the bag.

Closure:
Upon completion of these activities ask the students how Bernoulli's principle is applied in each of the demonstrations. Ask them to make diagrams and explain how the air pressure changes.

Suggested Student Assessment
Objectives:

Ask students to write and/or illustrate what they did during each activity, and what they learned from their participation in the activity.

Extending the Lesson
Ask students to research who discovered the Bernoulli's Principle and how it is applied in technology. Ask students to conduct a demonstration showing this principle with other simple household objects.

Source of Lesson
Rick Crosslin
Adapted from various experiences and teacher demonstrations at the Hoosier Association of Science Teachers, Inc. annual science conference.

To learn more, visit the website at **www.IndianaExpeditions.org**