

PSI:

PHYSICAL SCIENCE INVESTIGATION



Teacher's Lesson Description

Title	Breaking News
Brief Description of Videos	In this video, students will watch as Danté demonstrates that air has mass and exerts a force that we call air pressure. This force can be used to do work. In this lesson students will develop an understanding of the need to identify and control variables.
Time Needed	1 or 2 class periods
Ohio Science Benchmarks Addressed	Scientific Inquiry, 6-8 Benchmarks A and B Scientific Ways of Knowing, 6-8 Benchmark A Physical Sciences, 6-8 Benchmark B
Ohio Grade Level Indicators Addressed	Scientific Inquiry Benchmark A <ul style="list-style-type: none">• 6th Grade Doing Scientific Inquiry Indicator 1• 7th Grade Doing Scientific Inquiry Indicator 1, 2, 3 and 4 Scientific Ways of Knowing Benchmark A <ul style="list-style-type: none">• 8th Grade Nature of Science Indicator 1 Physical Sciences Benchmark B <ul style="list-style-type: none">• 8th Grade Forces and Motion Indicator 3
Concepts Developed	Students will be able to explain that: <ul style="list-style-type: none">• The weight of air exerts a force called pressure.• Forces are balanced or unbalanced.• Unbalanced forces can move things.• Scientific investigations involve variables that should be identified and controlled.

Lesson Rationale	Students should be provided with multiple opportunities to engage in the scientific inquiry process. This particular investigation deals with forces that students encounter everyday, but might not recognize or understand.
Background Knowledge for Teachers	<p>Review the “teacher video” segments and student video segments.</p> <ul style="list-style-type: none"> • Air pressure is approximately 14.7 pounds per square inch (with slight changes due to temperature and altitude). It would be acceptable to use an estimate of 15 pounds per square inch. • Balanced forces occur at the beginning of the demonstration when the stick and paper are at rest. • Unbalanced forces occur whenever the stick or paper move due to a force being exerted by hitting or pressing on (or lifting) the paint stick. You may want to investigate beforehand to see what happens if you hit the stick from below. • To estimate the mass of the column of air resting on the paper, calculate the area of the paper in square inches (length X width) and multiply by 14.7 (or 15) pounds per square inch.
Classroom Procedures	<p>Questions that students will be asked to respond to while watching the video: Once Dante has the paper and stick in the set up, he asks; “What do you think will happen next?” He then hits the stick and watches it break. The he says; “Wow! Look what happened! The only thing on top of it was a sheet of paper. Can you explain why the stick broke the way it did?”</p> <p>Now here is an extension that can be used for further exploration.</p> <p>This lesson is designed to be an exploration using scientific inquiry. Students view the video, make observations, pose and formulate testable questions that they will investigate.</p> <ol style="list-style-type: none"> 1. Have student share their written observations from the video. Tell the students that they are going formulate testable questions to explore (“What if”...is a good way to pose these questions.) 2. List the students “what if” questions. As a class, determine which questions are testable.(single independent variables)

3. Divide students into groups of 3 or 4 (depending on available materials and space).
4. Each group should explore a different independent variable. TEACHER NOTE: Using the write-up template as a guide, discuss the independent and dependent variables with students. For example, DOES (INDEPENDENT VARIABLE) AFFECT (DEPENDENT VARIABLE)? Also consider whether there are any other variables that can be controlled, or if there are any constant conditions in place.
5. Example: DOES (THE SIZE OF THE PAPER) AFFECT (THE STICK BREAKING)?
6. Possible independent variables are paper size (1/2 page, 1/4 page. etc.), paper direction, distance of stick over the edge of the table, type of paper material (print, glossy inserts), hitting the stick from below, instead of from above, amount of force imparted in attempting to break the stick, thickness of the stick, geometric shape of the paper, among others.
7. Student groups will share their testable question and formulate a hypothesis statement. Next, the group demonstrates their experiment for the class in a sequence determined by the teacher.
8. Conduct further teacher-led questions/discussions about how air pressure affected their outcome.
9. Next, teacher will guide student to calculate the amount of pressure on full and partial sheets of newspaper.
10. Close the lesson by having students watch the video again and validate or refute some of Danté's claims about air pressure.

Present students with this final question for reflection and closure:

“So what should we say about the conditions that must be present for the stick to break? Under what conditions would you think that the stick can't be broken?”

Materials Needed	<p>1-gallon size paint stirring sticks (available at your local paint and home improvement stores).</p> <p>5-gallon paint stirrer stick or 1x2x18 inch long pine block or similar “striking” device</p> <p>Newspapers (variety of newspaper print and advertising inserts), some with tears or holes in the surface.</p> <p>Rulers or Measuring Tapes for calculations of area and length.</p> <p>ANSI approved safety glasses or goggles.</p> <p>Data Recording Sheets, calculators (if preferred), pencils and pens.</p>
Science Connections	<p>These activities can be connected to</p> <ul style="list-style-type: none"> • concepts of balanced and unbalanced forces, • geometry and measurement, • tools and experimental design for investigating science. • identifying and understanding independent, dependent and controlled variables.
Additional Web Resources	<p>Sargent Welsh Teacher Resources: Inertia on Your Side http://resources.sargentwelch.com/lesson-plans/inertia-on-your-side/</p> <p>Teachers Domain: Balloon Columns http://www.teachersdomain.org/resources/phy03/sci/phys/matter/zballoon/index.html</p> <p>Exploratorium: Weighing a Car Using Air Pressure http://www.exploratorium.edu/snacks/tired_weight/index.html</p> <p>Search for more Web pages related to this topic at the Ohio Resource Center http://www.ohiorc.org/for/science/Default.aspx</p> <p>Classroom Safety: http://membership.acs.org/c/ccs/pubs/chemical_safety_manual.pdf</p>

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Ohio Science Standards Abbreviations:

ES – Earth/Space Science

SI – Scientific Inquiry

LS – Life Sciences

ST – Science and Technology

PS – Physical Sciences

SW – Scientific Ways of Knowing

