

PSI:

PHYSICAL SCIENCE INVESTIGATION



Teacher's Lesson Description

Title	Bottled Up
Brief Description of Videos	In these videos, students will watch as Danté demonstrates that temperature has an affect on the movement of gas molecules and therefore, an affect on the pressure inside and outside of a closed system.
Time Needed	1 or 2 class periods
Ohio Science Benchmarks Addressed	Earth and Space Sciences, 6-8 Benchmark C and E Physical Science, 6-8 Benchmarks A Science Inquiry, 6-8 Benchmarks A and B
Ohio Grade Level Indicators Addressed	Earth and Space Sciences Benchmark C <ul style="list-style-type: none">• 7th Grade Earth Systems Indicators 1, 3, and 9 Earth and Space Sciences Benchmark E <ul style="list-style-type: none">• 8th Grade Earth Systems Indicator 13 Physical Science Benchmark A <ul style="list-style-type: none">• 6th Grade Nature of Science Indicator 1• 8th Grade Forces and Motion Indicators 1 and 3 Scientific Inquiry Benchmark A <ul style="list-style-type: none">• 7th Grade Doing Scientific Inquiry Indicators 1 and 2 Science Inquiry Benchmark B <ul style="list-style-type: none">• 6th Grade Doing Scientific Inquiry Indicators 3 and 4• 7th Grade Doing Scientific Inquiry Indicators 5 and 6

<p>Concepts Developed</p>	<p>Students will be able to explain that:</p> <ul style="list-style-type: none"> • Air has mass and volume • Mass is the amount of “stuff” in an object. • Volume is the amount of space a substance or an object takes up • The volume, or space air molecules occupy, can be changed by changing temperature. • Changing the temperature of a gas molecule changes its speed. • Changing the speed of a gas molecule changes its pressure. • When the volume is unable to be increased or decreased, then pressure changes.
<p>Lesson Rationale</p>	<p>Students understand that:</p> <ul style="list-style-type: none"> • The kinetic theory of motion is a scientific model that helps explain the behavior of molecules as they change states from a solid to a liquid to a gas. • Using this model, we can explain how changing the temperature of gas molecules will change their speed of movement. • This change in movement in a given volume changes the pressure exerted by the gas. • Since we cannot see gas molecules, we must observe the affect of the change in temperature and thus movement of molecules in the response of the balloon in a closed system.
<p>Background Knowledge for Teachers</p>	<p>Review the “teacher video” segment and student video segments.</p> <ul style="list-style-type: none"> • Temperature changes the movement of molecules causing them to go from a solid to a liquid and then to a gas state. This is known as phase change.

	<ul style="list-style-type: none"> • Gas molecules of nitrogen, oxygen, carbon dioxide, water vapor, etc in air are affected by temperature change. • Adding heat increases the movement of the molecules and reducing heat slows the movement of the molecules. • This change in movement changes the pressure of the air in the atmosphere. • We can measure this change in pressure in a closed system. • In the demonstration, increasing temperature changed the air pressure causing the balloon to inflate. The air pressure on the outside of the closed system was lower than the air pressure on the inside. This increased pressure caused the balloon to inflate to the outside of the flask • In the demonstration, decreasing temperature changed the air pressure causing the balloon to deflate. The air pressure on the outside of the closed system was higher than the air pressure on the inside. This decreased pressure caused the balloon to deflate to the inside of the flask.
Classroom Procedures	<p>Students will watch the video and record their observations. These observations should include a prediction about what they expect to happen:</p> <ul style="list-style-type: none"> • when temperature increases, • when temperature decreases <p>Students should draw a diagram with each prediction that demonstrates their understanding of where the pressure is higher and where it is lower in the closed system. (Arrows are a good representation or writing the letters L and H to show differences.)</p> <p>Now students will perform this simple lab to support or refute their predictions.</p>

Zip It Up Laboratory

Problem: Does the location of air affect the ability to push or pull a baggie in and out of a jar?

Background Knowledge:

- Air has mass
- Air takes up space
- Air exerts a pressure all around us
- Regardless of temperature, air pressure can be increased and decreased

Procedure:

1. Place a plastic baggie (sandwich size) over a glass jar and push it into the jar.
2. Put a rubber band around the bag so that it is secure.
3. Pull the center of the bag upwards.
4. Record your observations.
5. Fill the plastic baggie with air and place it over a glass jar.
6. Put a rubber band around the bag so that it is secure.
7. Push the center of the bag into the jar.
8. Record your observations.

Observations:

Make a T-chart. The independent variable is the position of the baggie (inside the jar and outside the jar.) The dependent variable is the observations made

Conclusion:

Students should be able to draw a diagram of the baggie and jar and correctly label high- and low-pressure areas. Students should complete two diagrams of the baggie and jar. These diagrams should demonstrate the high pressure and low pressure relationships when the balloon inflates inside the jar, and when it inflates outside the jar.

Materials Needed

1. Jar
2. Sandwich baggie
3. Rubber band
4. Laboratory journal

Science Connections

- Air moves from high to low pressure.
- Pneumatic devices use air pressure to do work.
- Weather
- Bernoulli's Principle

<p>Additional Web Resources</p>	<p>Balloon in a Bottle at Steve Spangler http://www.stevespanglerscience.com/content/science-video/balloon-in-a-bottle</p> <p>Ohio State University WOW Project http://wow.osu.edu/experiments/gases/balloon.html</p> <p>Science Net Links: Temperature Changes Everything http://www.sciencenetlinks.com/lessons.cfm?DocID=167</p> <p>Dragonfly Science Television: How do Hovercrafts use air pressure? http://pbskids.org/dragonflytv/show/hovercraft.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> <p>Search the National Science Digital Library: http://nsdl.org/</p> <p>Find more science teaching lessons at Teacher's Domain: http://www.teachersdomain.org/</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