

PSI:

PHYSICAL SCIENCE INVESTIGATION



Teacher's Lesson Description

Title	Fast Food
Brief Description of the Videos	Dante pulls a table cloth out from under a place setting and strikes a tray with cardboard tubes and eggs struck with a broom handle. The eggs fall into glasses of water below the tray.
Time Needed	1 class period
Ohio Science Benchmarks Addressed in This Activity	Physical Science 6-8 Benchmark B Scientific Inquiry 6-8 Benchmark B Scientific Ways of Knowing Benchmark A, B
Ohio Grade Level Indicators Addressed in This Activity	Physical Science Benchmark B 8 th Grade Forces and Motion Indicator 3 Scientific Inquiry Benchmark B 6 th Grade Doing Scientific Inquiry Indicator 3 7 th Grade Doing Scientific Inquiry Indicator 6 Scientific Ways of Knowing Benchmark A 8 th Grade Nature of Science Indicator 1 Scientific Ways of Knowing Benchmark B 7 th Grade Ethical Practices Indicator 1, 2 8 th Grade Ethical Practices 2
Concepts Developed	Students will be able to explain that: <ul style="list-style-type: none">▶ Unbalanced forces are necessary to move objects▶ Inertia is not a force, but it is a property of the laws of motion for matter.

	<ul style="list-style-type: none"> ▶ An object's Inertia is a function of its mass ▶ An object at rest will remain at rest, unless an unbalanced force acts on it
Lesson Rationale	<p>When we see objects together, we assume they will stay together, but when forces act on only some of the objects, only those objects move. The concept of Inertia is new to students and causes them to rethink their assumptions. Using other table cloths and dishes of different mass will result in different results-often destructive. Investigations in inertia frequently involve considerations of gravitational forces and frictional forces. These activities allow students to experience how the forces of friction and gravity affect results.</p>
Background Knowledge for Teachers	<p>Newton's First Law of motion also known as Law of Inertia states that an object will remain at rest or in a uniform motion along a straight line unless it is acted on by an external net force. This means that an object at rest will stay at rest until a force causes it to move. At the same time, an object in motion will stay in motion until a force acts on it and causes its velocity to change in magnitude and/or direction. The Law of Inertia has two parts and can be confusing to students. Review the "teacher video" and student video segments. Newton's First Law of Motion is sometimes referred to as the Law of Inertia. Inertia is a property of matter and not a force. Review Newton's First Law and identify which part is being demonstrated. In this episode, Dante demonstrates how objects at rest will change position when forces act upon them. Some of the motion is due to "horizontal" forces and friction. Other motion is due to the force of gravity. After viewing the video, students can discuss where forces are at work and where there is little contact so that frictional forces have little effect. Lighter objects (low mass-low inertia) will be affected by small forces and the results can be destructive. One might assume that using the heavy, expensive tableware is a disaster waiting to happen. In fact, lighter weight, inexpensive tableware is more affected by the small forces of friction and less by gravitational forces trying to "pull them down" to the table.</p>
Classroom Procedures	<p>Before viewing the video segments, have students create a T-chart, or use the one that is posted at the PSI Web site. Head the two columns with the terms "Observation" and "Inference". Have the students fill out the chart as the video is played. They should write down their predictions when asked for and then record what actually happened. Solicit questions about "what happened and why" in an attempt to understand Inertia better. Replay the video, or use the slow-motion segments to increase students' experience and abilities of observation. As a follow up activity,</p>

	<p>students can actually measure the coefficient of friction between two objects using spring scales, and the lesson found at this site: http://www.school-for-champions.com/science/experiments/expfriction_sliding_coeff_scale.htm These two Web sites have fairly good descriptions of how to set up the classroom investigations. http://www.wikihow.com/Pull-a-Tablecloth-from-Under-a-Place-Setting</p> <p>Here is another example of the Egg-Drop Investigation http://www.msichicago.org/education/educator-resources/classroom-activities/educator-info/activities/drop-eggs-into-cups/</p>
Materials Needed	<p>To try the events shown on the video, obtain some heavy tableware-cup or glass, plate, bowl and a tablecloth. The tablecloth should be slippery, thin and small enough to remove with a sharp pull. The second demonstration is trickier and potentially messier. Obtain a bristle broom, eggs, paper cylinders, a cafeteria tray or cookie sheet (with a lip), glasses, water and a table. Be sure to hand part of the tray outside the table edge and have the broom handle strike the edge of the tray as close to “vertical” as possible. Be careful to make a clear zone around the area so that no one is struck by flying or falling objects.</p>
Science Connections	<p>Ask students to identify situations where this knowledge of Inertia and forces can be applied in daily life. They may suggest the use of seat belts in cars and safety harnesses at amusement parks, as well as air bags in cars. Many students do not understand that the passengers in a car are traveling just as fast as the car. If the car comes to a sudden stop, but the people don’t, they can be “thrown” forward, many times with damaging results. Students may also identify places where friction is a useful force (cars turning corners) or a harmful force (slipping on ice). Asking students to identify other examples of friction as “friend or foe” will help you determine those students who are making connections between friction and the tendencies of inertia that people and matter possess when stationary or moving. Relative to the second part of the Law, if objects are already moving, discuss the ways to stop or slow them. Safety in many situations will be impacted by greater knowledge of inertia.</p>
Additional Web Resources	<p>There are several entertaining inertia experiments listed in the PDF document found at this Web site:</p>

<http://faculty.uncfsu.edu/grahi/inertiaexp.pdf>

There are some more suggestions for inertia and friction investigations at this site:

http://www.at-bristol.org.uk/Newton/experiment.htm#1st_law

Some good investigations and background knowledge on inertia and friction are available here:

http://www.practicalphysics.org/go/Collection_58.html

For students who want to study more about these concepts through an interactive Web site, visit:

<http://www.glenbrook.k12.il.us/GBSSCI/PHYS/CLASS/newtlaws/u211b.html>

There are a number of activities at the National Science Teachers Association Web Site:

http://www3.nsta.org/main/news/stories/science_and_children.php?news_story_ID=49103

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