

## OVERVIEW

Newton's Laws of Motion relate object to forces to motion. Newton's First Law, often known as the Law of Inertia, describes objects with no velocity (at rest) and objects with a constant velocity. The First Law has practical applications seen every day.

## ITV SERIES

*Physical Science*: Program 7, Newton's First Law

## LEARNING OBJECTIVES

Students will be able to

- ◆ define inertia
- ◆ state Newton's First Law of Motion
- ◆ identify cases as examples of Newton's First Law and explain how the Law applies in those cases

## SC MATH/SCIENCE STANDARDS MET

This lesson meets SC Standards in Science and Mathematics. Under Science, students will use the process skills of inference and communication. Under Mathematics, students use sub-topics under Matter and Energy (Area III, Strand 1); and patterns, relationships and functions.

## MATERIALS

Needed per class

Station 1

√ 40 large washers

Station 2:

√ 2 beakers

√ 2 index cards

√ 2 large washers

Station 3:

√ 2 rubber place mats (thin and slick)

√ 2 heavy blocks of wood (approximately 2 lbs.)

Station 4:

√ 1 wooden cylinder 6" in height

√ 1 rolling vehicle able to carry the cylinder (truck)

## PRE-VIEWING ACTIVITIES

Prepare TASK CARDS for each of the four stations.

### For Station 1, the card should read:

At your station are washers. Point your elbow upwards and place a stack of washers on the end. Quickly swing your arm down and catch the washers! Write down your observations during the times when group members caught the washers, and also when group members dropped them.

### For Station 2, the card should read:

Take an index card and cover the top of the beaker. Place a washer on top of the card. Be very careful and thump the card with your finger - to flick it out from under the washer. Try the experiment more than once. Write down what happens to the index card and what happens to the washer.

### For Station 3, the card should read:

Take the large block and place it on the place mat. Pull the place mat very slowly for two or three feet. Write down your observations. Try the same experiment again, this time pull the place mat quickly. What do you observe this time?

### For Station 4: the card should read:

Place the cylinder in the vehicle upright (very tall). Move it at a constant speed. What happens to the cylinder? Speed the vehicle up on your second trial. What did the cylinder do this time? On your third trial, move the vehicle quickly and then stop it suddenly. What happened to the cylinder this time?

Divide the class into four groups. Send each group to a lab station. Impose a NO TALKING rule at this time. Ask students to read the TASK CARD at their station, and follow the task listed. Allow students three to four minutes to do this. Ask students to put the lab equipment down, and write the observations as requested by the TASK CARD. Give students three to four minutes for writing. Rotate groups.

## FOCUS FOR VIEWING

To give students a specific responsibility for viewing, students will be given a sheet of terms and fill in the blank statements to identify and complete during the video. The video contains ten demonstrations of inertia. Students will be assigned to describe a particular demonstration, prompted on the terms sheet. (i.e. students A, B, and C will describe the first demonstration, students D, E, and F will describe the second, etc.)

## VIEWING ACTIVITIES

Start the video *Physical Science* Program 7: Newton's First Law. Cue up to the opening credits. Inform students of the eccentricity of the speaker. You may wish to view the video a second time at a later moment without pausing. Students enjoy watching and listening to the speaker. View video.

View until: Speaker stacks a wooden block on top of a second block at the phrase "... moreover it wishes to remain at rest twice as much." PAUSE

Say, "Let's examine the two cases. One block wants to remain at rest; two blocks want to remain at rest twice as much. Does this tell you anything about mass and inertia?"

Resume video. View until: same scene, at the phrase "...mass is synonymous." PAUSE

Ask, "What is a synonym? What word is synonymous with inertia?" PAUSE

Resume video. View until: same scene at the phrase "... that's what it wants to do." PAUSE

Ask, "What is Newton's First Law?" Inform students "You are about to see ten different demonstrations involving inertia. Pay particular attention to all, but remember to describe YOUR demonstration."

Resume video. View until: speaker strikes second white parcel. He does not speak during this action. Ask, "What happened when he struck the first box? What happened when he

struck the second box? If he hit the boxes with the same force, what caused the different reactions?" PAUSE

Resume video. View until: same scene at the phrase "...measure of a mass is its inertia."

Resume video. View until: speaker takes a drink of water then says "... thus do we demonstrate Newton's First Law in two parts."

Ask, "In the first part, the block was still. What part of Newton's Law is being tested? In the second part. Was the block still? What part of Newton's Law was is being tested here?" PAUSE

Resume video. View until: speaker puts a rod into a loop in the string and states "... I'm going to break the lower string." PAUSE

Ask students to think of the inertia of the ball. "What will happen if he pulls the string quickly? What will happen if he pulls the string slowly?"

Resume video. View until: speaker holds the string by hand and states "I'll do it by hand." PAUSE

Ask, "How will inertia affect the ball if he pulls the string gently? How will inertia affect the ball if he pulls quickly? PAUSE

Resume video. View until: speaker places a thin board under an open page of newspaper and states "... by a sudden impulsive blow on the end of the stick." PAUSE

Ask, "Will the board move the paper?"

Resume video. View until: speaker takes another drink of water. No verbal cue is given at this point. PAUSE

Ask, "Compare the mass of the wood and the mass of the paper. What was the heavy mass that didn't want to move?"

Resume video. View until: speaker is behind the truck with the block. The key phrase is "... it wants to stay there." PAUSE

## 1998 SC Teacher Training Institute for Math, Science and Technology

Ask, "Predict the action of the block with slow forward motion. Predict the action of the block with quick forward motion. Predict the action of the block if the truck stops quickly."

Resume video. View until: speaker drinks water after the coin demonstration. The key phrase is "... simplicity in a sense of Newton's First Law."  
PAUSE

Ask, "Why doesn't the stack fall?"

This ends the video segment.

Return groups to the lab stations. Ask students to read their observations to each other. They may talk quietly during this activity.

Students explain the experiment at their station by using terms of mass, inertia, and Newton's First Law.

Rotate groups until students have been to all stations.

### **ACTION PLAN**

Begin discussion on other applications of Newton's First Law. Include seat belt usage and the Seat Belt law in South Carolina, and the Child Safety Seat law.

Examine motor vehicle operation. How would a car slide on a curve (icy or wet)?

NASA uses Inertial dampers on spacecraft. What is an inertial damper? What is its purpose?

### **EXTENSIONS**

Students will have a competition between themselves. Each student must design a shoe box that will contain a raw egg. The boxes will be taped shut (to prevent mess) and dropped from a second floor window. Students may use any materials found at home to complete this project. Encourage students to test projects prior to the due date, and encourage experimentation to find the best protective container. For all who accomplish the first level, have an award, and try to drop the survivors from further heights to eliminate as many as possible.

**ACTIVITY SHEET 1:  
Viewing Checklist**

Define inertia \_\_\_\_\_

Another word for inertia is \_\_\_\_\_

Moving objects want to \_\_\_\_\_

Still objects want to \_\_\_\_\_

Newton's First Law states:

Return groups to the lab stations. Ask students to read their observations to each other. They may talk quietly.

Demo #1

Demo #2

Demo #3

Demo #4

Demo #5

Demo #6

Demo #7

Demo #8

Demo #9

Demo #10

Master Teacher Bill Willard

**ACTIVITY SHEET 2:  
Lab Analysis**

Station 1 Observations

Station 2 Observations

Station 3 Observations

Station 4 Observations

**POST-VIEWING ACTIVITY**

Station 1:

Station 2:

Station 3:

Station 4:

Questions?