

Discovery Science Library: The Basics

Physical Science

Teacher's Guide

Grade Level: 6–8

Curriculum Focus: Physical Science

Lesson Duration: Three class periods

Program Description

From friction and roller coasters to energy transfer and constant speed, introduce middle school students to a wide variety of physical science topics with these segments drawn from Discovery Channel School's award-winning series.

Lesson Plan

Student Objectives

- Watch the segments “Friction and “Constant Speed” in *Discovery Science Library: The Basics: Physical Science*
- Write a paragraph explaining how friction and gravity affect four sports.
- Draw a picture illustrating the effect of friction and gravity on these sports.

Materials

- *Discovery Science Library: The Basics: Physical Science* video
- Newsprint and markers
- Computer with Internet access
- Paper and pencils
- Markers and colored pencils

Procedures

1. Begin the lesson by asking students if they are familiar with the terms “friction” and “gravity.” Write their ideas on a sheet of newsprint. Then explain to students that gravity is a force that keeps objects in motion, and friction works in opposition to gravity to help objects stop. Together these forces affect the way almost everything moves on Earth.
2. Tell students that they will explore how friction and gravity affect the way sports are played. Working with a partner, have students focus on the following sports:

- auto racing
 - skiing
 - skating
 - bicycling
3. To begin their research, have students watch the segments “Friction” and “Constant Speed.” In addition, the following Web sites have information on this topic:
 - <http://home.nc.rr.com/enloephysics/sports.htm>
 - <http://www.ic.sunysb.edu/Stu/cbrody/skiing.htm>
 4. After students have finished watching the program and completed their research, ask them to write a paragraph describing how friction and gravity affect the way these sports are played. Make sure students include an illustration showing the effect of the forces on each sport.
 5. To help students organize their paragraphs, have them use the following points as a guide:
 - Name of the sport
 - Factors in the sport: For example, to go fast, to stop quickly, to travel consistently for a long period of time, or a combination
 - How friction and gravity affect the sport
 - How people control the forces
 6. During the next class period, ask students to share their ideas. Make sure they understand that in a sport such as skating, athletes want to decrease friction so that they will go faster. In biking, however, athletes control how fast they go by pedaling faster or pedaling slower. Reiterate that the forces of friction and gravity affect all sports.
 7. Conclude the lesson by asking students what they learned about forces and sports. How will this knowledge affect the way they participate in sports? Can it help them become better athletes?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students were highly engaged in class and small-group discussions and produced clear and accurate paragraphs and illustrations, with all the requested components.
- 2 points: Students participated in class and small-group discussions and produced adequate paragraphs and illustrations, with most of the requested components.
- 1 point: Students participated minimally in class and small-group discussions and produced incomplete paragraphs and illustrations, with little or none of the requested components.



Vocabulary

acceleration

Definition: The rate at which an object increases speed

Context: In a bicycle race, riders pedal faster for greater acceleration.

air resistance

Definition: The force on an object pulling it upward; the greater the surface area of an object, the greater the air resistance

Context: The surface area of a leaf is greater than that of an acorn, so air resistance is greater, and the leaf falls more slowly than the acorn.

force

Definition: A push or pull working on an object

Context: Kicking a soccer ball is an example of a force.

friction

Definition: The force between two substances rubbing against each other

Context: Ice skaters add a thin layer of water to the ice to decrease friction and move faster.

gravity

Definition: The force working on objects that pulls them toward each other

Context: The force of gravity keeps roller coasters moving down a steep hill.

Academic Standards

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/>.

This lesson plan addresses the following national standards:

- Physical Science – Understands forces and motions
- Language Arts – Viewing: Uses a range of strategies to interpret visual media

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K-12 to promote scientific literacy. To view the standards, visit this Web site:

<http://books.nap.edu/html/nses/html/overview.html#content>.



This lesson plan addresses the following science standards:

Grades 5-8

- Physical Science: Motions and forces
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>

DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

Play Video—This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index—Here the video is divided into sections indicated by video thumbnail icons; brief descriptions are noted for each one. Watching all parts in sequence is similar to watching the video from start to finish. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

Standards Link—Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources—This screen gives the technical support number and Web site address.

Video Index

Segment 1: Light and Heat (5 min.)

Learn about light and how it travels and take a look at visible light waves. Find out how heat is transferred through conduction, convection, and radiation.



Pre-viewing question

What are the colors of visible light?

Answer: Students may know the acronym ROYGBIV for red, orange, yellow, green, blue, indigo, and violet.

Post-viewing question

How is heat transferred through conduction, convection, and radiation?

Answer: Conduction refers to the transfer of heat from one substance to another. Convection is the transfer of heat through the circulation of fluids. Radiation is the transfer of heat when two objects are not touching, such as radiation from the sun hitting the ground.

Segment 2: Friction (7 min.)

Find out that friction is the force between two substances rubbing together. Learn how it can be controlled and when it is desirable to increase or decrease friction.

Pre-viewing question

What do you know about friction?

Answer: Some students may know that friction occurs when two substances rub against each other.

Post-viewing question

What are examples of increasing friction?

Answer: Answers will vary, but may include reducing driving speed, rubbing hands for warmth, or athletes using chalk on their hands to keep a discus or other object from slipping.

Segment 3: Calculating Average Speed (7 min.)

Watch two teams design cars to travel up steep terrain. Find out how to calculate acceleration and how to determine the winner of a tight race.

Pre-viewing question

Do you know how to calculate acceleration?

Answer: Answers will vary, but some students may know that the equation is change in speed divided by time.

Post-viewing question

Calculate the speed of each car as it crosses the finish line

Answer: Divide distance by the amount of time it took to travel that distance, which will tell you how fast in meters per second each car traveled in one second.

Segment 4: Roller Coasters (3 min.)

Discover how the laws of motion are put to work to build fast-moving roller coasters. Learn about early roller coasters and how they have changed over time.

Pre-viewing question

What was your most exciting roller coaster ride, and what made it memorable?

Answer: Answers will vary.

Post-viewing question

Why do some people prefer rides on roller coasters made of wood?

Answer: Wood bends and turns slightly differently each time the roller coaster travels downhill. Some people enjoy a roller coaster ride that is never quite the same.

Segment 5: The Eye (2 min.)

Learn about the parts of the human eye and how they work together so we can see. Discover why humans can see in color.

Pre-viewing question

Do you know what part of the eye lets in light?

Answer: Some students may know that the pupil expands and contracts to let in light.

Post-viewing question

Why can humans see in color?

Answer: Cones, or sensitive cells within the retina, are responsible for vision in color. Three types of cone cells work together, each stimulated by red, green, or blue.

Segment 6: Heat (3 min.)

Find out the three basic elements of fire and what it needs to burn. Learn about a flashover and why it is dangerous.

Pre-viewing question

Do you know the elements necessary for fire to burn?

Answer: Students may know that the three elements are fuel, oxygen, and heat.

Post-viewing question

What is a flashover?

Answer: A flashover is the temperature point at which heat is high enough to ignite all flammable material. A firefighter caught in a flashover cannot survive.

Segment 7: Electricity (4 min.)

Find out how the power of falling water transforms into electricity at Hoover Dam. Learn how villages in Brazil are gaining access to electricity.

Pre-viewing question

How does electricity affect your life?

Answer: Answers will vary, but students should know that electricity powers many useful items, including computers, home appliances, and power systems and we are extremely dependent on it.

Post-viewing question

Which country uses the most electricity?

Answer: The United States uses more electricity than any other country in the world.

Segment 8: Magnetism (4 min.)

Find out what causes the force of magnetism and which objects have magnetic properties. Learn about Earth's magnetic field and how it shields our planet from dangerous particles.

Pre-viewing question

What do you know about magnetism?

Answer: Answers will vary. Students may know that opposites attract and that the magnetic force is strongest at the poles.

Post-viewing question

How is a magnetic field created?

Answer: A magnetic field is created by the movement of electrons spinning around the nucleus of an atom.

Segment 9: Chemical Properties of Mixtures (5 min.)

Hear about the properties of mixtures. Find out how scientists have found a way to remove salt from seawater and how NASA is working to recycle water in space.

Pre-viewing question

What is a mixture?

Answer: A mixture is a combination of materials that retain their own properties.

Post-viewing question

What is desalination? What is its value?

Answer: Desalination is the process of extracting the salt from seawater, done through a process called reverse osmosis. The process allows people to drink seawater.



Segment 10: Polymers (6 min.)

Find out about polymers and where they are found in nature. Discover how plastics, which contain polymers, can be recycled and reused.

Pre-viewing question

What do you know about polymers?

Answer: Answers will vary; some students may know that polymers are large, complex molecules made from smaller molecules. Materials made from polymers are usually very strong.

Post-viewing question

What is unique about spider silk?

Answer: Spider silk is the strongest natural fiber.

Segment 11: Energy Transfer (2 min.)

Discover how energy can change form. Find out about the energy transfers that occur as mechanical energy becomes electrical energy

Pre-viewing question

What is energy transfer?

Answer: Answers will vary, but some students may know that energy can change from one form to another.

Post-viewing question

What energy transfers take place when electricity is generated at a hydroelectric plant?

Answer: As the water flows down the falls, potential energy becomes kinetic energy in the form of mechanical energy. When the turbines in a generator turn, mechanical energy is transformed into electrical energy.

Segment 12: Constant Speed (5 min.)

Observe bicyclists and sky divers work to maintain an optimal speed. Learn about the relationship between forces and counter forces and how this relationship affects speed.

Pre-viewing question

Do you think objects are ever completely at rest?

Answer: Students may know that because Earth is always moving, objects are always moving, as well.

Post-viewing question

How does the bicyclist riding without brakes slow down?

Answer: The bicyclist stops pedaling when it is time to slow down. Then the forces acting on the bicyclist are in balance.