

It's All Downhill: Forces and Sports

Lesson Plan

Grade Level: 9-12

Curriculum Focus: Physics

Lesson Duration: One or two class periods

Student Objectives

- Select a sport.
- Research the forces of nature that affect the sport.
- Present their findings to the class.

Materials

- Discovery School video on *unitedstreaming: Measure for Measure: Weights and Energy*
Search for this video by using the video title (or a portion of it) as the keyword.

Selected clips that support this lesson plan:

- Riding Roller Coasters
- Rules of Physics

- Paper and pencils
- Newsprint and markers
- Computer with Internet access

Procedures

1. Begin the lesson by showing the “Roller Coaster Physics” segment. Tell students to pay close attention to how certain forces in nature affect the skiers going up and down the mountain.
2. Review how forces affect the skiers. Write the key concepts of kinetic and potential energy on the newsprint. The explanation you and the class develop should include the following:
 - As the skiers climb up the mountain, they convert chemical energy from their bodies into kinetic energy, or the energy of motion. They are also storing energy for future use, which is called potential energy. The higher the skiers go, the more potential energy they have.
 - As the skiers zoom down the mountain, much of the stored potential energy transforms into kinetic energy. To stop, turn, or control their speed, the skiers shift their weight so that friction – another force – goes to work.

3. Tell students they will apply the forces of nature to a sport of their choice. Working individually or in pairs, they will choose a sport and write one or two paragraphs similar to those above. Encourage them to add drawings or photographs that illustrate their points.
4. Allow students time to work on this project in class. The following Web sites provide information about the physics of sports:
 - <http://www.exploratorium.edu/sports/>
 - <http://www.blackmagic.com/ses/surf/papers/physicsofsrf2.html>
 - <http://www.thehoya.com/sports/020703/sports5.cfm>
 - <http://www.physics.about.com/od/sportphysics/>
 - <http://www.geocities.com/thesciencefiles/physicsof/basketball.htm>
5. During the next class period, ask students to share their sports and to explain which forces affect the sports and how they do so.
6. Conclude the lesson by asking students: What did you learn about forces and the role they play in sports? Did you learn anything surprising? Has the activity encouraged you to explore other forces of nature?

Assessment

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

- **3 points:** Students participated actively in class discussions; explained accurately how forces affect a sport and included pictures to illustrate the concepts; made a clear and interesting presentation to the class.
- **2 points:** Students participated in class discussions; explained somewhat accurately how forces affect a sport and included some pictures to illustrate the concepts; made a competent presentation to the class.
- **1 point:** Students participated minimally in class discussions; had difficulty explaining how forces affect a sport and did not include pictures to illustrate the concepts; made an incomplete presentation or no presentation to the class.

Vocabulary

chemical energy

Definition: Energy stored in chemical bonds, such as in foods or in a flame used to light a fire

Context: While playing baseball, your body transforms chemical energy stored in its cells into energy that you can use.

energy

Definition: The capacity for doing work, such as changing position or covering a certain distance

Context: Without energy, many forces taken for granted, such as fire and electricity, could not be activated.



force

Definition: The push or pull one object exerts on another so that an action can take place

Context: Throughout the day, we exert force on different objects: pressing with a pencil, lifting a backpack, and pulling a zipper up.

friction

Definition: The force of one surface rubbing against another, with the total effect being to decrease motion

Context: If you want ski quickly down a slope, adjust your weight so little friction exists between the skis and the snow.

kinetic energy

Definition: The energy of moving objects

Context: A skater gliding across an ice rink is demonstrating kinetic energy.

potential energy

Definition: Energy that is stored

Context: Sitting quietly, your body stores potential energy that can be used when you get up and move around.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards:

- Physical science: Motions and forces; Transfer of energy

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:

- Science – Physical Sciences: Understands the sources and properties of energy, Understands forces and motion
 - Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media
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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](http://www.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>

