

Measure for Measure: Weight & Energy

Grade Level: 9-12

Subject: Physical Science

Duration: One or two class periods

Objectives

Students will

- select a sport,
- research the forces of nature that affect the sport, and
- present their findings to the class.

Materials

- Paper and pencils
- Newsprint and markers
- Computer with Internet access
- *Measure for Measure: Weight and Energy* video and VCR or DVD and DVD player

Procedures

1. Begin the lesson by showing the segment entitled “Roller Coaster Physics.” 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. Now the students will apply the forces of nature to a sport of their choice. Working individually or in pairs, have students choose a sport and write one or two paragraphs similar to those above. Encourage them to add drawings or photographs that illustrate the point.
4. Allow students time to work on this project in class. The following Web sites provide information about the physics of sports.

www.exploratorium.edu/sports/

www.blackmagic.com/ses/surf/papers/physicsofsurf2.html

www.thehoya.com/sports/020703/sports5.cfm

www.physics.about.com/od/sportphysics/

www.geocities.com/thesciencefiles/physicsof/basketball.html

5. During the next class period, ask the students to explain which forces affect the sports and how they do so.

6. Conclude the lesson by asking students what they learned about forces and the role they play in sports. Did they learn anything that surprised them? Has the activity encouraged students to explore other forces of nature?

Evaluation

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

- **Three points:** Students participated actively in class discussions; explained accurately how forces affect a sport and included pictures to illustrate the concepts; and made a clear and interesting presentation to the class.
- **Two points:** Students participated in class discussions; explained somewhat accurately how forces affect a sport and included some pictures to illustrate the concepts; and made a competent presentation to the class.
- **One point:** Students participated minimally in class discussions; had difficulty explaining how forces affect a sport and did not include pictures to illustrate the concepts; and made an incomplete 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

The National Academy of Sciences provides guidelines for teaching science and a coherent vision of what it means to be scientifically literate for students in grades K–12. To view the standards, visit this Web site:

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

This lesson plan addresses the following national standard:

- Physical science: Motions and forces; Transfer of energy

Credit

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