#8599

ACCELERATION

Grade Levels: 8-12
15 minutes
CAMBRIDGE EDUCATIONAL 1999
2 Instructional Graphics Enclosed

DESCRIPTION

An animated cave man helps viewers understand the relationships between speed, velocity, and acceleration. Clearly defines and demonstrates these terms. Also explores the contributions of Galileo and Newton before reviewing.

ACADEMIC STANDARDS

Subject Area: Physical Sciences

- Standard: Understands forces and motion
  - Benchmark: Knows that laws of motion can be used to determine the effects of forces on the motion of objects (e.g., objects change their motion only when a net force is applied; whenever one object exerts force on another, a force equal in magnitude and opposite indirection is exerted on the first object; the magnitude of the change in motion can be calculated using the relationship F=ma, which is independent of the nature of the force)

INSTRUCTIONAL GOALS

1. To understand acceleration.
2. To demonstrate speed, velocity, and acceleration.
3. To introduce basic equations.
4. To explore the contributions of Galileo and Newton to acceleration, gravity, and motion.
5. To determine the weight of an object.

BACKGROUND INFORMATION

To understand the basics of acceleration, speed and velocity must be first understood. *Speed* is the change of an object's position over time. Speed is a *scalar* quantity, which means it has magnitude and no direction. Whatever direction an object moves, its speed will remain the same.

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Velocity is speed in a specific direction. Velocity is a *vector* quantity, which means it has magnitude and direction.

As a result, *acceleration* is the change in velocity over time. If something speeds up, it is accelerating. It if slows down, it has a negative acceleration, which is sometimes referred to as *deceleration*. Acceleration is a vector, so it has a magnitude and direction. If there is a change in an object's direction, the acceleration changes. The rate at which objects accelerate as they fall is called the acceleration due to gravity. The acceleration due to gravity will have a negative effect on things moving upward.

Newton's Second Law of Motion states that force is equal to mass times acceleration, or:

f = m x a

Force is a push or pull on an object. *Mass* is the measure of an object's resistance to change in speed or direction. By using Newton's Second Law of Motion, we can determine the force exerted on an object if we know its mass and acceleration. A common variation of Newton's Second Law of Motion can be used to determine the weight of an object. *Weight* is the gravitational pull on an object. Because weight is the pull of gravity, we can substitute the "a" in the equation with "g," the acceleration due to gravity. Therefore, the equation can be read as weight equals mass times acceleration, or:

w = m x g

VOCABULARY

1. acceleration
2. deceleration
3. force
4. gravity
5. mass
6. Newton's Second Law of Motion
7. scalar quantity
8. speed
9. vector quantity
10. velocity
11. weight

AFTER SHOWING

Discussion Items and Questions

1. What is the common unit for speed in the English system? In the metric system?
2. How can speed be expressed in equation form?
3. Whatever direction an object movies, does the speed remain the same?
4. In what terms can direction be expressed?

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5. What is the equation for velocity?
6. How can acceleration be expressed in equation form?
7. If something starts from rest, what is its initial velocity? If it comes to a stop, what is its final velocity?
8. What is the most commonly used units for acceleration?
9. Complete the worksheet of review questions. (See INSTRUCTIONAL GRAPHICS.)

RELATED RESOURCES

Captioned Media Program

- Mass #8811

World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid-safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

- **YOUR WEIGHT ON OTHER WORLDS**

http://www.exploratorium.edu/ronh/weight/index.html

Find out what you might weigh on Mars, Jupiter, the Sun, and other planets! The difference between weight and mass are explained, as well as the relationship between gravity and mass and distance.

- **MEN OF MATHEMATICS, PHYSICS AND ASTRONOMY**

http://octopus.phy.bg.ac.yu/web_projects/giants/giants.html

Click on "Sir Isaac Newton" and get a detailed biography of this English physicist and mathematician. Includes "Influence of the scientific revolution," his career, "Universal gravitation," and other points in his life.

INSTRUCTIONAL GRAPHICS

- REVIEW QUESTIONS
- ANSWERS TO REVIEW QUESTIONS

REVIEW QUESTIONS

1. _____ is the change in an object's position over time.
2. Speed is a _____ quantity, meaning no matter which direction an object moves, its speed will remain the same.
3. Velocity depends on direction, so it is a _____ quantity.
4. Speed can be expressed in equation form as: _____.
5. Some common units for speed are miles per hour in the English system and _____ per hour in the metric system.
6. When something speeds up, this is known as _____.
7. Acceleration, like velocity, is a vector quantity, so when discussing acceleration, we need to specify a _____.
8. One person who was instrumental in increasing our understanding of acceleration was a 16th-century scientist named _____.
9. The acceleration due to gravity on Earth is _____ meters per second squared.
10. Newton's Second Law of Motion states that force is equal to _____ times acceleration.

Answers to REVIEW QUESTIONS

1. **Speed** is the change in an object's position over time.
2. Speed is a **scalar** quantity, meaning no matter which direction an object moves, its speed will remain the same.
3. Velocity depends on direction, so it is a **vector** quantity.
4. Speed can be expressed in equation form as: **s = d / t**.
5. Some common units for speed are miles per hour in the English system and **kilometers** per hour in the metric system.
6. When something speeds up, this is known as **acceleration**.
7. Acceleration, like velocity, is a vector quantity, so when discussing acceleration, we need to specify a **direction**.
8. One person who was instrumental in increasing our understanding of acceleration was a 16th-century scientist named **Galileo**.
9. The acceleration due to gravity on Earth is **9.8** meters per second squared.
10. Newton's Second Law of Motion states that force is equal to **mass** times acceleration.