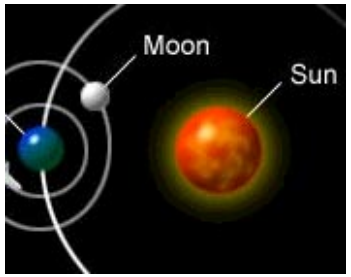
Lesson Plans Library 9-12 > Physical Science

Animating Motion



Grade Level 9-12

Subject Area physical science

Curriculum Focus

space science, engineering, physics, math

Duration 2 hours

Objective

Students will apply their knowledge of object motion by animating sequences of pictures that model a set of physical conditions, such as the orbital motion of planets and satellites, the effects of gravity on a falling body, and motions of objects in inertial (moving) frames of reference.

Materials

scissors, photo-copier

Motivation

In this activity students will:

- Animate the orbital motions of the Earth, the space shuttle, and the Moon based on calculations of the velocity of each object (Challenge #1).

- Animate the motion of a falling object based on calculations of acceleration due to the force of Earth's gravity (Challenge #2).
- Animate the motion of a car, truck, and plane based on relative motions in a particular reference frame (Challenge #3).

Background

In a universe full of motion, change is inevitable. Luckily, we find that some motions—like a planet orbiting the sun—are relatively constant and repetitive, and obey natural laws that we can come to understand through measurement and mathematical principles. Kinematics is a branch in the study of physics which deals with the quantitative descriptions of motion. Understanding the motions which characterize certain objects allows us to deduce where objects might have been in the past and where they may be in the future, based just on our observation of the object's motion in the present.

Formulae help us quantitatively express an object's motion. For example, if an object is moving with a constant speed, we express the object's motion as the rate of change of the object's position "d" with respect to change in time "t," and give that rate a name called speed "s." We can reduce this definition for speed to the simple formula:

$$\text{Speed} = \frac{\text{Change in position}}{\text{Change in time}} \qquad \text{or} \qquad s = \frac{\delta d}{\delta t}$$

Drawing pictures can help us understand the relationships between the motions of different objects. Even better, a series of pictures can tell us qualitatively where an object is moving and where it has been.

Procedure

Try each of the challenges listed here to practice graphing and animating the motions of objects:

Challenge #1

Challenge #2

Challenge #3

Credits

Ted Latham, a physics teacher at Watchung Hills Regional High School in Warren, New Jersey.