

Robots:

Look Out! We're Surrounded

California Science Content Standards

The Science Standards for Grades Six through 12 that pertain to the subject matter for this Science on Saturday presentation have been summarized here for use by teachers. The numbering and lettering that are used in the [California State Science Standards](#) have been preserved in order that teachers can refer to them in context.

Grade Eight

Focus on Physical Science

Forces

2. Unbalanced forces cause changes in velocity.

As a basis for understanding this concept, students know:

- a. a force has both direction and magnitude.
- b. when an object is subject to two or more forces at once, the effect is the cumulative effect of all the forces.
- c. when the forces on an object are balanced, the motion of the object does not change.
- d. how to identify separately two or more forces acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.
- e. when the forces on an object are unbalanced the object will change its motion (that is, it will speed up, slow down, or change direction).
- f. the greater the mass of an object the more force is needed to achieve the same change in motion.
- g. the role of gravity in forming and maintaining planets, stars and the solar system.

Investigation and Experimentation

9. Scientific progress is made by asking meaningful questions and conducting careful investigations.

As a basis for understanding this concept, and to address the content the other three strands, students should develop their own questions and perform investigations. Students will:

- a. plan and conduct a scientific investigation to test a hypothesis.
- b. evaluate the accuracy and reproducibility of data.

- c. distinguish between variable and controlled parameters in a test.
- d. recognize the slope of the linear graph as the constant in the relationship $y=kx$ and apply this to interpret graphs constructed from data.
- e. construct appropriate graphs from data and develop quantitative statements about the relationships between variables.
- f. apply simple mathematical relationships to determine one quantity given the other two (including speed = distance/time, density = mass/volume, force = pressure x area, volume=area x height).
- g. distinguish between linear and non-linear relationships on a graph of data.

Grades Nine Through Twelve

"Standards without asterisks represent those that all students are expected to achieve in the course of their studies. Standards with asterisks represent those that all students should have the opportunity to learn."

Motion and Forces

- 1. Newton's laws predict the motion of most objects.
As a basis for understanding this concept, students know:
 - b. when forces are balanced no acceleration occurs, and thus an object continues to move at a constant speed or stays at rest (Newton's First Law).
 - c. how to apply the law $F=ma$ to solve one-dimensional motion problems involving constant forces (Newton's Second Law).
 - d. when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and opposite direction. (Newton's Third Law).

Conservation of Energy and Momentum

- 2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.
As a basis for understanding this concept, students know:
 - a. how to calculate kinetic energy using the formula $E=(1/2)mv^2$.
 - f. an unbalanced force on an object produces a change in its momentum.

Electronic and Magnetic Phenomena

- 5. Electric and magnetic phenomena are related and have many practical applications.
As a basis for understanding this concept, students know:
 - a. how to predict the voltage or current in simple direct current electric circuits constructed from batteries, wires, resistors, and capacitors.

b. how to solve problems involving Ohm's law.

Investigation and Experimentation Standards

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other four strands, students should develop their own questions and perform investigations. Students will:

a. select and use appropriate tools and technology (such as computer-linked probes, spread sheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

b. identify and communicate sources of unavoidable experimental error.

c. identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.

d. formulate explanations using logic and evidence.

e. solve scientific problems using quadratic equations, and simple trigonometric, exponential, and logarithmic functions.

f. distinguish between hypothesis and theory as science terms.

j. recognize the issues of statistical variability and the need for controlled tests.

l. analyze situations and solve problems that require combining and applying concepts from more than one area of science.