Physics -- Grades 9, 10, 11, and 12

California State Science Content Standards

Covered in:

Hands-on science labs, demonstrations, & activities. Investigation and Experimentation.

Presented by Climate Change Education .org during

Mobile Climate Science Labs

• Professional development for teachers
• In school presentations
• Climate science and hands-on education *specialists* presenting alongside teachers and teaching assistants
• Presentations at CSTA, NSTA, AAAS conferences
• For school field trips, as presented at local science museums

As aligned with existing science content standards, adopted 1997
Referencing: *Science Framework for California Public Schools*
http://www.cde.ca.gov/ci/sc/cf/documents/scienceframework.pdf
Adopted by the California State Board of Education
Published by the California Department of Education

Enabling teachers and schools to provide outstanding education called for in the standards under *Investigation and Experimentation* sections.
Requirements for a minimum of 20-25% hands-on education in science.

Index of Standards Alignment—other grades, courses and standards:
http://climatechangeeducation.org/labs/k12_standards/index.html

Themes: http://climatechangeeducation.org/labs/themes/index.html

In the following, sections of standards noted are part of one or more lab theme. Sections highlighted in green are a *primary focus* of one or more hands-on science lab.

Updated April 27, 2011

PHYSICS

Standard Set 1 Motion and Forces

Standard Set 2 Conservation of Energy and Momentum

Standard Set 3 Heat and Thermodynamics

3. b. *Students know* that the work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature (first law of thermodynamics) and that this is an example of the law of conservation of energy.

3. c. *Students know* **the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as *thermal energy*. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.**

3. d. *Students know* that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly.

3. g.* *Students know* how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.

Standard Set 4 Waves

4. Waves have characteristic properties that do not depend on the type of wave.As a basis for understanding this concept:

4 a. *Students know* **waves carry energy from one place to another.**

4. c. *Students know* **how to solve problems involving wavelength, frequency, and wave speed**.

4. e. *Students know* **radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second).**

Standard Set 5 Electric and Magnetic Phenonema

5. Electric and magnetic phenomena are related and have many practical applications.As a basis for understanding this concept:

5. a. *Students know* how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.

5. b. *Students know* how to solve problems involving Ohm's law.

5. c. *Students know* any resistive element in a DC circuit dissipates energy, which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula Power = IR (potential difference) × I (current) = I^2R.

5. d. *Students know* the properties of transistors and the role of transistors in electric circuits.

5. f. *Students know* magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.

5. h. *Students know* changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.