

ELECTRIC AND MAGNETIC PHENOMENA

Electric and magnetic phenomena are related and have many practical applications.

STANDARDS¹

- Students know* how to predict the voltage or current in simple direct current DC electric circuits constructed from batteries, wires, resistors, and capacitors.
- Students know* how to solve problems involving Ohm's law.
- 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 .
- Students know* the properties of transistors and the role of transistors in electric circuits.
- Students know* charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
- 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.
- Students know* how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.
- Students know* changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
- Students know* plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.

FRAMEWORK EQUATIONS²

- $I = q/t$
 $V = PE/q$
 - $I = V/R$
 $C = q/V$
 - $P = IV$ • $P = I^2R$ • $P = V^2/R$
 - $F = kq_1q_2/r^2$
- I current
 q charge
 t time
 V electric potential; voltage
 PE potential energy
 R resistance
 C capacitance
 F force
 k $9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$
 r distance between charges

1. *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve.* This sheet does not include starred, "opportunities to learn" standards.

2. *California Science Framework for K 12 Public Schools.* Some equations were modified for this sheet to better align with conventional notation.

This sheet was prepared by Dean Baird www.phyz.org and is not a publication of the California Department of Education.