

Unit 04: Electricity & Magnetism NJ NGSS

Content Area: **Science**
Course(s): **Generic Course**
Time Period: **Marking Period 3**
Length: **4**
Status: **Published**

Standards

- Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4)
- Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5) • Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6)
- “Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents. (secondary to HS-PS2-5)
- When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

<http://www.state.nj.us/education/modelcurriculum/sci/physicsu4.shtml>

SCI.9-12.HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects).
SCI.9-12.HS-PS2-1	Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
SCI.9-12.HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
SCI.9-12.HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
SCI.9-12.HS-PS2-4	Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.

Essential Questions

- How does electromagnetism affect the way we live, work and play?
- How does electrical generation affect our planet?

Content / Skills

- Describe electromagnetic forces. (Accelerated)
- Differentiate between conductors and insulators. (Accelerated & CP)
- Compare and contrast charging by contact and by induction. (Accelerated & CP)
- Describe the properties of charge and static electricity. (Accelerated & CP)
- Calculate electric force using Coulomb's law. (Accelerated)
- Compare electric force with gravitational force conceptually. (Accelerated & CP)
- Compare electric force with gravitational force mathematically. (Accelerated)
- Draw and interpret electric field lines. (Accelerated & CP)
- Calculate problems using Ohm's law. (Accelerated & CP)
- Differentiate between direct and alternating current. (Accelerated & CP)
- Compare and contrast series and parallel circuit. (Accelerated & CP)
- Describe the magnetic field around a permanent magnet. (Accelerated & CP)
- Describe the orientation of Earth's magnetic field. (Accelerated & CP)
- Describe the magnetic field produced by a current. (Accelerated)
- Define and apply the concepts of electrical current and resistance. (Accelerated & CP)
- Define and apply the concept of electrical power. (Accelerated & CP)
- Create a simple circuit and test other designs. (Accelerated & CP)
- Interpret and construct circuit diagrams. (Accelerated & CP)
- Identify circuits as open or closed. (Accelerated & CP)
- Deduce the potential difference across the circuit load, given the potential difference across the battery terminals. (Accelerated & CP)
- Calculate the equivalent resistance for a circuit of resistors in series, and find the current in and potential difference across each resistor in the circuit. (Accelerated)
- Calculate the equivalent resistance for a circuit of resistors in parallel, and find the current in and potential difference across each resistor in the circuit. (Accelerated)
- Compare, contrast, and analyze series and parallel circuits. (Accelerated)
- Solve complex circuit problems. (Accelerated)
- Design, Build, and Test a complex circuit. (Accelerated & CP)
- Describe and define the properties of magnetism. (Accelerated & CP)
- Describe and define the properties of electromagnetism. (Accelerated)
- Define and apply the concept of magnetic force. (Accelerated & CP)
- Define and apply electromagnetic induction and Lenz's Law (Accelerated)
- Compare and contrast simple motors and generators. (Accelerated & CP)
- Analyze a transformer. (Accelerated & CP)