

electricity & magnetism **science**

Overview

Students learn about electricity by building and testing circuits. Using batteries, bulbs and wires, students construct simple circuits and test the effects of various modifications. Through such tests, they discover that a circuit requires a closed pathway for electricity and that some materials conduct electricity and others do not. They learn that an electric current can affect a nearby magnet and that this property of electricity is used in making electromagnets and motors. Potential dangers are examined, as students learn about the safe use of electricity.

General Learner Expectations

Students will:

5–5 Demonstrate safe methods for the study of magnetism and electricity, identify methods for measurement and control, and apply techniques for evaluating magnetic and electrical properties of materials.

Specific Learner Expectations

Students will:

1. Recognize and appreciate the potential dangers involved in using sources of electrical currents:
 - a. understand that household electrical currents are potentially dangerous and not a suitable source for experimentation
 - b. understand that small batteries are a relatively safe source of electricity, for experimentation and study, but that care should be taken to avoid short circuits
 - c. understand that short circuits may cause wires to heat up, as well as waste the limited amount of energy in batteries.
2. Describe and demonstrate example activities that show that electricity and magnetism are related:
 - a. demonstrate that electricity can be used to create magnetism
 - b. demonstrate that a moving magnet can be used to generate electricity.
3. Demonstrate and interpret evidence of magnetic fields around magnets and around current-carrying wires, by use of iron filings or by use of one or more compasses.
4. Demonstrate that a continuous loop of conducting material is needed for an uninterrupted flow of current in a circuit.
5. Distinguish electrical conductors—materials that allow electricity to flow through them— from insulators—materials that do not allow electricity to flow through them.
6. Recognize and demonstrate that some materials, including resistors, are partial conductors of electricity.
7. Predict the effect of placing an electrical resistance in a simple circuit; e.g., in a circuit with a light bulb or electric motor.
8. Recognize that the amount of electricity we use in our homes is measured in kilowatt hours.
9. Interpret and explain:

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- a. the reading on a household electrical meter
 - b. efficiency labels on electrical appliances.
10. Draw and interpret, with guidance, circuit diagrams that include symbols for switches, power sources, resistors, lights and motors.

mechanisms using electricity **science**

Overview

Students build electrical devices for a variety of purposes, using knowledge gained in the previous topic. Tasks that students are assigned may include such things as making a switch from scrap materials, making a device to control the speed of a motor, making a burglar alarm and lighting three bulbs from one source. Through work on these tasks, students learn the role of various components and control devices that are part of an electrical system. At the same time, they develop skills of problem solving and teamwork.

General Learner Expectations

Students will:

5–6 Construct simple circuits, and apply an understanding of circuits to the construction and control of motorized devices.

Specific Learner Expectations

Students will:

1. Identify example applications of electrical devices in the school and home environment, and classify the kinds of uses. Categories of electrical use may include such things as: heating, lighting, communicating, moving, computing.
2. Design and construct circuits that operate lights and other electrical devices.
3. Recognize the importance of switches and other control mechanisms to the design and operation of electrical devices, and identify purposes of switches in particular applications.
4. Construct and use a variety of switches.
5. Design and construct vehicles or other devices that use a battery-powered electric motor to produce motion; e.g., model cars, hoists, fans.
6. Design and construct a burglar alarm.
7. Demonstrate different ways of lighting two lights from a single power source, and compare the results. Students should recognize that wiring two bulbs in series makes both bulbs glow less brightly than if the bulbs are wired in parallel. Students may demonstrate this knowledge operationally and do not need to use the terms series and parallel.
8. Demonstrate different ways of using two batteries to light a bulb, and compare the results. Students should recognize that wiring the batteries in series causes the bulb to glow brighter than it would if parallel wiring were used.
9. Given a design task and appropriate materials, invent and construct an electrical device that meets the task requirements.