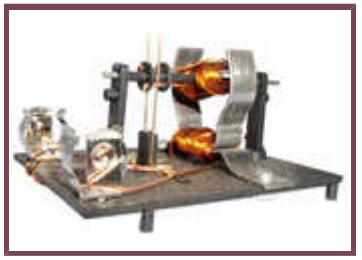
All About Electric Motors

Download Full Lesson Plan

(Full teacher resource documents are included)



Lesson Focus

Electric Motors: their principles and everyday uses. Note: This lesson plan is designed for classroom use only, with supervision by a teacher familiar with electrical and electronic concepts.

Lesson Synopsis

Students learn the basic principles of electric motors and explore everyday uses. They build a working model of an electric motor for classroom use, using an inexpensive kit. Then, they work as an "engineering" team to determine the changes they would need to make to the motor to adapt it to power a hairdryer.

Age Levels: 10-18

Objectives

- Learn basic principles of electric motors.
- Apply theory to everyday uses of electric motors.
- Build a working model of an electric motor for classroom use.

Anticipated Learner Outcomes

As a result of this activity, students aged 10-14 should develop an understanding of:

- Principles of electric motors
- Principles of magnetism
- Principles of electric currents Students should also apply theory to everyday uses of electric motors, and expand their knowledge of motor design and operation.

Introduction: Electric Motors

The following are basic educational principles of electric motors:

- Magnets both attract and repel each other. Like poles repel, opposite poles attract.
- An electric current produces a magnetic field. The strength and direction of the magnetic field varies according to the strength and direction of the electric current.
- Simply winding a wire that carries an electric current around an iron bar creates a magnet that can be switched on and off. Also, the strength and direction of the magnetic poles can easily be controlled by changing the strength and direction of the electric current.
- **Principles of Magnetism** Magnetism is a force of nature that attracts and repels. Unlike gravity, which only attracts and which affects all objects, only some types of materials can be magnetized so that they exert magnetic force, and only some materials are affected by that force—mostly metals like iron and nickel. When an object becomes magnetized and exerts magnetic force, it is called a magnet. A magnet has a magnetic pole at each end, one called the north pole and one called the south pole. Like poles repel, and opposite poles attract. That is, a north pole attracts another magnet's south pole but repels a north pole, and south attracts north but repels south. The Earth is actually a giant magnet, which is why it has north and a south magnetic poles, and why the south pole of a small magnet (such as the tip of the needle on a magnetic compass) will always point north. The magnetic force around a magnet forms a magnetic field. The field is made up of lines of force that run from the north pole to the south pole. When opposite poles are brought together, their lines of force join, but when like poles are brought together the lines of force push each other away.
- **Electromagnets** Scientists long wondered if the attractive and repulsive forces of electricity and magnetism were related. In 1820 Danish physicist Hans Christian Ørsted discovered that a wire with an electric current flowing through it produced a magnetic field. In fact, wrapping a wire around an iron core and running a current through it produces a strong magnetic effect; this is called an electromagnet. British scientist Michael Faraday then discovered that a wire moving through a magnetic field developed a current running through it. This is called induction.
- **Applying Magnetic and Electric Principles Into Motor Design** These discoveries led to the invention of electric generators and electric motors. An electric generator turns motion (which could be caused by a steam engine, by wind power, or whatever) into electricity. An electric motor turns electricity back into motion. These two machines are the basis of modern electric power.

Lesson Activities

Outline

1. Introductions
2. Overview of basic motor principles

    1. Principles of magnetism
    2. Electromagnets
    3. Applying magnetic and electric principles into motor design.
3. Cooking up a motor
4. Now you try it
5. Classroom instruction ideas
6. Questions and answers
7. Teacher feedback

Resources/Materials

- Teacher Resource Documents (attached)
- Inexpensive toy electric motor kit, available from Science First, 800-799-8301 or www.sciencefirst.com. See attached product description.
- Resources not included in kit: sandpaper, cellophane tape, scissors or wire cutting pliers, batteries, small screwdriver

Alignment to Curriculum Frameworks

Curriculum alignment sheet is included in PDF.

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