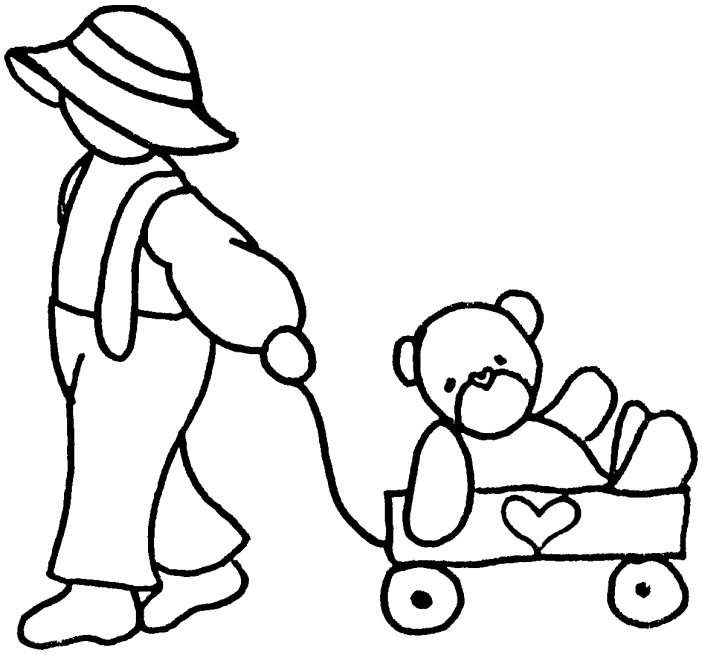
Applied Science

Our Technological World

FOURTH GRADE

BUILT ENVIRONMENT



3 WEEKS
LESSON PLANS AND
ACTIVITIES

APPLIED SCIENCE
OVERVIEW OF FOURTH GRADE

SCIENCE AND MATH

WEEK 1.
PRE: *Exploring conceptual science.*
LAB: *Predicting volume.*
POST: *Measuring linear and curved surfaces.*
WEEK 2.
PRE: *Collecting and analyzing data.*
LAB: *Comparing qualitative and quantitative data.*
POST: *Exploring optical illusions.*
WEEK 3.
PRE: *Comparing and contrasting the subfields of science.*
LAB: *Investigating human senses by collecting data.*
POST: *Comparing and contrasting inventors and scientists.*

PHYSICS

WEEK 4.
PRE: *Comparing electricity and magnetism.*
LAB: *Designing an electric circuit.*
POST: *Investigating the historical development of electricity.*
WEEK 5.
PRE: *Exploring magnetism.*
LAB: *Describing the force produced by a magnet.*
POST: *Exploring the uses of magnetism.*

TECHNOLOGY

WEEK 6.
PRE: *Investigating the electronic industry.*
LAB: *Constructing circuit boards.*
POST: *Comparing parallel and series circuits.*
WEEK 7.
PRE: *Investigating electromagnetism.*
LAB: *Designing an electromagnet.*
POST: *Exploring electrical power.*

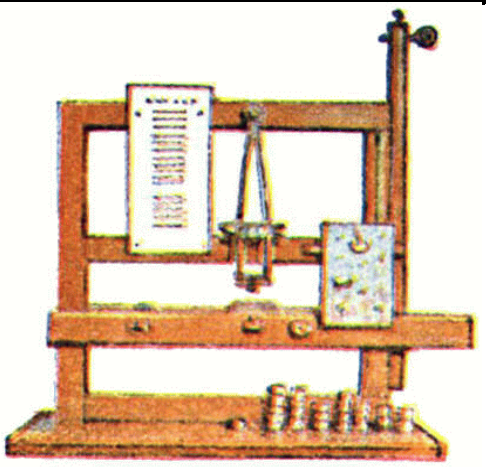
BUILT ENVIRONMENT

WEEK 8.
PRE: *Exploring communications.*
LAB: *Discovering methods of communication.*
POST: *Exploring the uses of electromagnets.*

APPLIED SCIENCE - BUILT ENVIRONMENT (4)

PRE LAB

Students use a worksheet to study the Morse Code.



OBJECTIVES:

1. Investigating how a telegraph works.
2. Exploring communications.

VOCABULARY:

telegraph
transmit

MATERIALS:

worksheet
telegraph model (see below)

BACKGROUND:

The telegraph is one of the earliest uses of the electromagnet. This unit is in "built environment" because the series of experiments that are discussed below have changed how humans interact. Emphasize that these are relatively recent developments. Telegraphy is a communication system using the medium of electromagnetic phenomena. Information is transmitted in written, printed, or pictorial form. Facsimile Transmission (FAX) is a form of telegraphy. The use of FAX machines have increased within the last decade years due to improved telephone "fiber optic" wires. The fax machine converts the image into light pulses, which is send through fiber optic wire. The receiving fax machine then decodes the pulses of light into a copy of the document on a photosensitive paper. The facsimile was first outlined in a British patent of Alexander Bain in 1843. The high information density that can be carried telegraphically and the importance of the printed record provides a service that cannot be given by the telephone.

Morse

In England in 1747, Sir William Watson, demonstrated that an electric current could be transmitted through wire. However, Samuel Morse (1791 - 1872) is credited with the invention of the useable telegraph and the Morse code. This invention helped communication developed into the industry that is used today. In 1843, the first telegraph in the U.S. was installed from Baltimore to Washington. The first message was "What hath God Wrought". The Morse code is a series a dashes (long) and dots (short) signals, that basically represents a break in a

circuit. The evolution of the telegraph technology we have today included many different designs. Impress upon your students that even after an invention is made, the product must be constantly revised to create a better product.

Another inventor, Guglielmo Marconi (1874 -1937), was the inventor of radiotelegraphy. In 1900, Marconi filed his famous patent No. 7777 which used a transmitter to transmit signals without a wire. It was commonly called the "wireless" telegraph. It concentrated electrical energy into a beam, so it could travel over long distances. This invention allowed transmission of information over long distances without expensive cable. Europe could now send messages to America. The communication revolution began.

Marconi

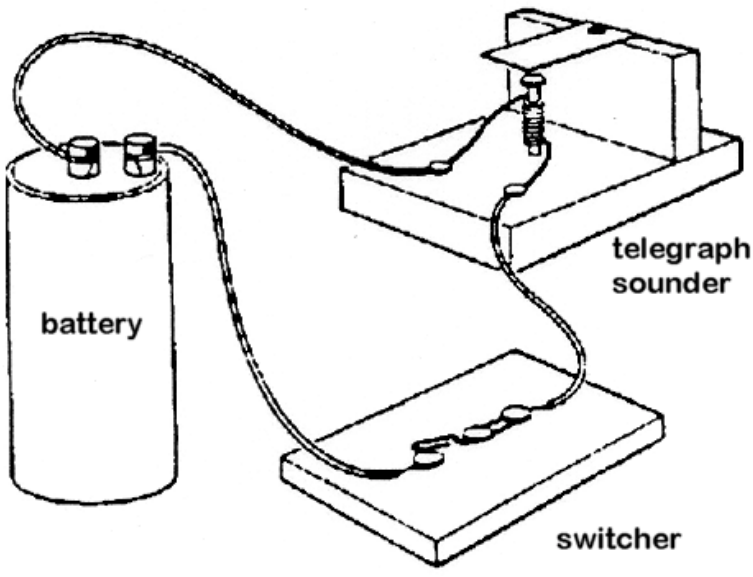
PROCEDURE:

1. The Morse Code is enclosed on the worksheet. Have students create some messages on a paper. The elementary telegraph circuit consists of a key that makes and breaks the connection between a source of current and the line according to the signaling code and the pulses of current passing through the line.

2. Use the information below to create a model of a telegraph. Demonstrate how it is used. It is difficult for students to make their own because of the use of the electromagnetic, but the demonstration will help students recognize the use of the electromagnet.

MATERIALS:

steel nail (about 8 cm long)
300 cm of insulated copper wire
battery with total of 6 volts
7 metal (steel) thumbtack



DIRECTIONS: Make an electromagnet from the nail by winding wire around the nail. Hammer this nail with the wire around it into the center of a soft piece of wood, about 10 cm by 25 cm. Fasten the two wires that come from the electromagnet to the board by means of thumbtacks as shown

in the diagram. Push another thumbtack about 3 mm from one edge of a strip of cardboard that measures about 4 cm by 8 cm, and bend the pin over to keep it from falling out. Fasten the other end of this cardboard strip with another thumbtack to a piece of wood which is about 3 mm higher than the head of the nail. Fasten this smaller piece of wood (which now has the cardboard with the tack on it) to the larger strip so that the head of the independent thumb tack faces the nail head and is about 3 cm above it. The telegraph sounder is complete.

Connect the switch and battery to the telegraph sounder. When you press the switch, you close the circuit and allow current to flow from the battery through the electromagnet. The thumbtack, as it is made of magnetic material will now be attracted to the head of the nail. When this happens, you will hear a click. As soon as you release the switch, the thumbtack will snap back. Push the switch once more, and the tack will come down again with a click. The telegraph is now working!

MORSE CODE

A . _	J . _ _ _	S . . .
B _ . . .	K _ . _	T _
C _ . _ .	L . _ . .	U . . _
D _ . .	M _ _	V . . . _
E .	N _ .	W . _ _
F . . _ .	O _ _ _	X _ . . _
G _ _ .	P . _ _ .	Y _ . _ _
H	Q _ _ . _	Z _ _ . .
I . .	R . _ .	

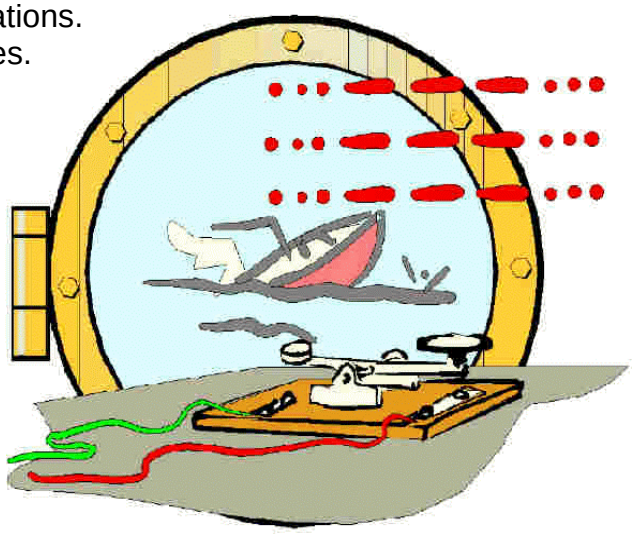
APPLIED SCIENCE - BUILT ENVIRONMENT (4)

LAB

Students communicate using the Morse Code.

OBJECTIVE:

1. Discovering methods of communications.
2. Exploring how society communicates.



VOCABULARY:

circuit
communication
Morse Code
telegraph

MATERIALS:

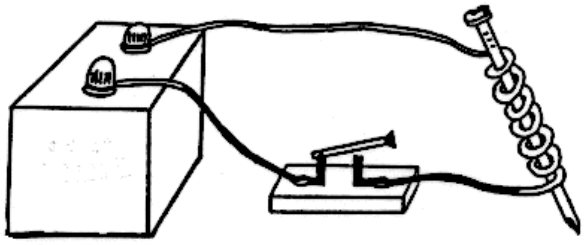
alligator clips
lamp holder
battery pack and batteries
bulb
metal tacks or push pins or switches
paper clips
piece of cardboard

BACKGROUND:

Communication was made possible by a telegraph. Sending information through a wire was big step forward in developing our current communication system. Although the telegraph, as represented in this lab, is not used as much as it was, its other uses such as the transmission of documents (FAX machines) have invaded the business market. The principle of the telegraph is still used, students just don't realize the impact to our society

PROCEDURE:

1. Emphasize that electromagnets are very important, as discussed in previous activities. This lab gives students hands-on experience with an electromagnet and knowledge about how it works.



2. First, draw the following diagram on the board to refresh student's memory of an electromagnet.

3. Use the model of the telegraph to demonstrate how it works, especially if this material was omitted in the PRE LAB. Go over how a telegraph was built and try to communicate with students using the Morse code. Use simple words.

4. Following directions on the lab sheet, students will make a switch using tacks, a paper clip, and cardboard. They should then use the alligator clips, a bulb, a bulb holder, battery, and switch to make a set up as shown in the diagram. Press the bent metal switch down on the tack. Release it. When the switch is pressed, the circuit is complete and the light flashes on. When the switch is released, the circuit is broken; the switch will spring up and away from the screw and the light will go off.

5. Students can practice the Morse code using this "mini" light telegraph. Make sure students know that there is no electromagnet in this exercise. A real telegraph can transmit information much farther than the simple circuit light telegraph because of the electromagnet which pulses a "sounder."

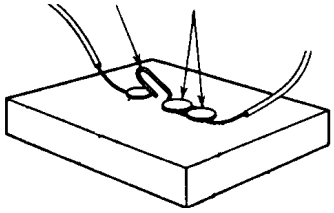
APPLIED SCIENCE - BUILT ENVIRONMENT (4)

PROBLEM: How can you transmit signals using a circuit?

PREDICTION:_____

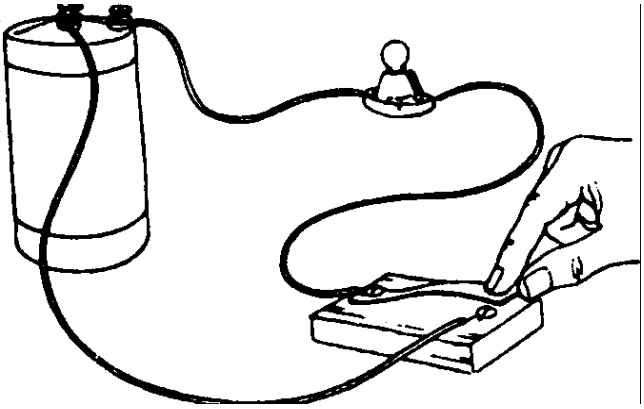
EXERCISE I: MAKING A SWITCH

MATERIALS: 1 metal tack, 1 metal push pin, 3 paper clip, thick cardboard or piece of wood



PROCEDURE: Use a tack that is only metal. Put two paper clips and one push pin on one side of the base (wood or thick cardboard) as in diagram. Open up the paper clips before you attach them. Place the other paper clip down on the opposite side with the metal tack. Bend the paper clip that will make contact with the tack so that you have to force it down to make a connection (see diagram). You now have a switch.

EXERCISE II:



PROCEDURE: Set up equipment to make a light telegraph as in the diagram below. Make sure the circuit is complete. Note that this is not a "real" telegraph. A telegraph is made of an electromagnet so it can intensify the signals sent over long distances.

Practice the letters of the Morse Code so you can recognize a dot (quick pulse) and a dash (long pulse), Test your partner.

Exercise 2. Practice sending the following words. Write it first in Morse Code.

H E L P	H E L L O

Exercise 3. Write a message in Morse Code. Send it to your neighbor. Have your neighbor send you a message. The message is:

_____

_____

in Morse Code

_____

My neighbor's message is:_____

CONCLUSIONS: What is the principle of a telegraph?

_____

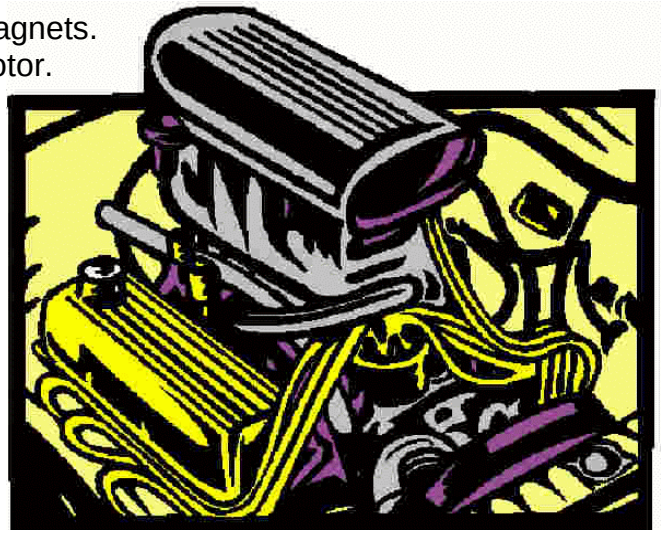
APPLIED SCIENCE - BUILT ENVIRONMENT (4)

POST LAB

Students use a worksheet to find electromagnets in our lives.

OBJECTIVE:

1. Exploring the uses of electromagnets.
2. Comparing a generator and motor.



VOCABULARY:

electromagnet
generator
motor

MATERIALS

worksheet

BACKGROUND:

The electric generator and electric motor are similar because they both use current electricity and magnetism. The electric motor is essentially an electromagnet that is made to rotate within a stationary magnet. Electric motors provide power for all types of machinery, including home appliances. Gas motors also use electromagnets, but they require a generator to create electrical sparks for the gas to run the motor. In a car motor, the electrical energy can be supplied by the generator. A generator converts one form of energy into another

Magnetic fields are the basis for electric bells, telephone receivers, radio and television speakers, tape recorders, and many other items. Electromagnets help control the intensity of signals as well as being a method of transmittal.

Modern telephone systems rely on electromagnets. The telephone receiver is basically an electromagnet with a U-shaped yoke having coils wound on each leg of the U. Passage of the electrical signal through the coils causes magnetic attraction of a soft-iron diaphragm supported a small distance from the ends of the U. The diaphragm generates sound waves as it moves back and forth. Improvement in magnetic materials has increased the sensitivity of the telephone receiver, but the basic design has remained unchanged.

The electromagnet has also played a primary role in research and is an indispensable tool in the quest to understand the universe by the use of electromagnetic waves.

PROCEDURE:

1. Use the enclosed sheet to have students find the electromagnet in the appliance.

2. Answers: 1. In a hand saw you can find an electromagnet in the motor. 2. In a toaster the electromagnet helps control the intensity of the coils. 3. The electromagnetic is found in the motor on this clothes dryer. 4. The electromagnetic is found in the speaker system and receiver system on a television. 5. There are no electromagnets in a coffee maker. 6. The receiver and speaker have electromagnets. 7. There are no electromagnets in a lamp. 8. The electromagnet is in the motor. 9. In an electric screwdriver, the motor contains the electromagnet .10. The motor of a car has an electromagnet. The radio or cellular phone would have an electromagnetic.

APPLIED SCIENCE - BUILT ENVIRONMENT (4) POST