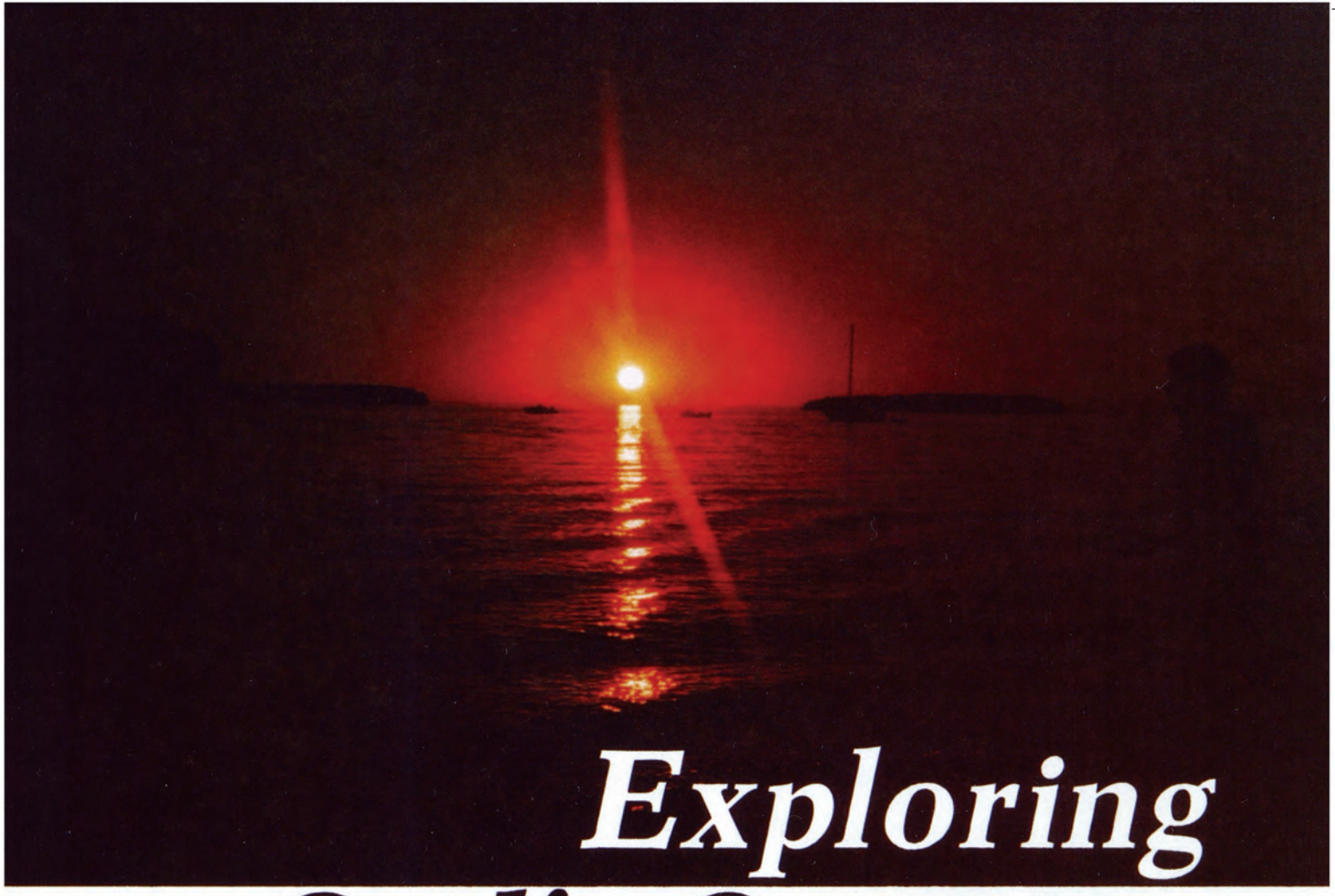

Exploring God's Creation

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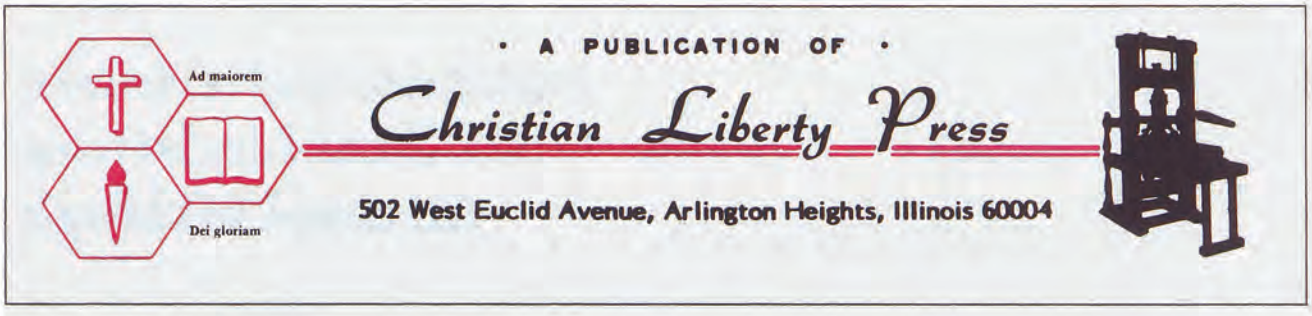


Contents

Chapter 6
Magnetism

Does your refrigerator have magnets stuck to it? What is a magnet? Why does it stick to the refrigerator but not your bedroom wall?

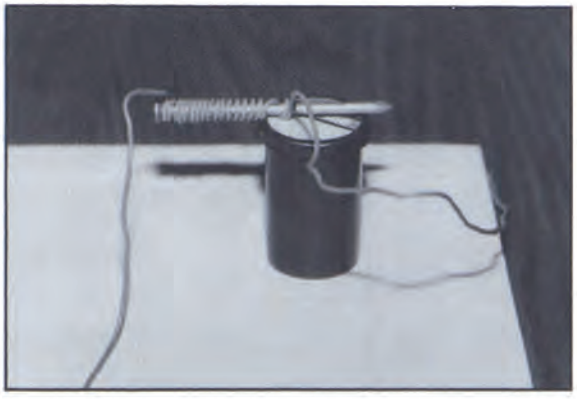
Does your family have a portable checker or chess set? Will the pieces stick to a cardboard checkerboard?

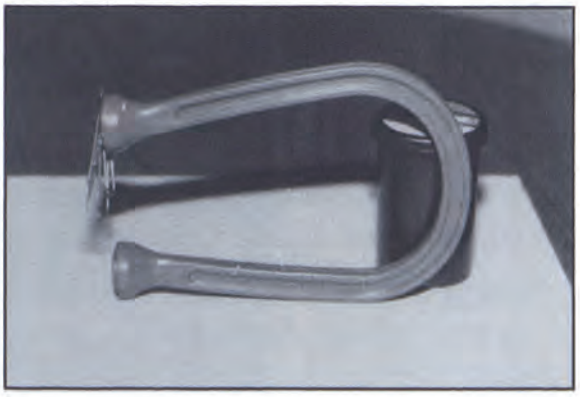
Learning about God's World

You need:

- a camping lantern battery
- a piece of iron about 6" long and less than 1" thick
- a piece of electric wire about 7 feet long
- some needles and pins
- a permanent magnet (any shape)

The wire must be the kind that has plastic around it. Wind the wire around the piece of iron at least twenty times. Leave about 12" of wire at both ends for attaching to the battery.





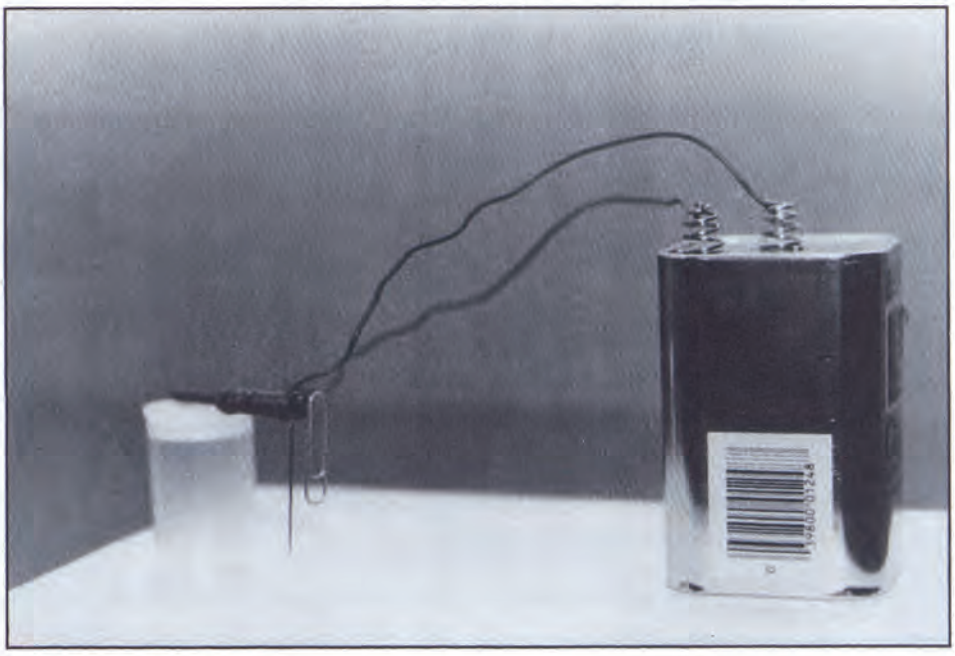
When you are done, attach one end of the wire to one side of the battery.

Put some needles and pins about 1" from one end of the piece of iron. Does anything happen? Leave the needles and pins and the piece of iron where they lie. Attach the other end of the wire to the other side of the battery. Does anything happen now?

Let's see if the piece of iron turned into a magnet. With one wire off the battery, hold the iron near the pile of needles and pins. Anything? Attach the wire again. What now? Take one wire off the battery again.

Pick one needle from your pile. Hold it over the pile of needles and pins. Does anything happen?

Connect your electric magnet and hang the needle from one end of it. Move the needle close to the pile of needles and pins. What happens?



Did the needle turn into a magnet? Let's check. Disconnect the magnet again. Hold the needle over the pile again. What happened?

Is it the electricity? Let's check. Get a permanent magnet. Hang your needle from this magnet. Move the needle close to the pile again. Now what happens?

Iron and steel are a little special. They turn into magnets when a magnet touches them or is near enough to them. When the magnet goes away, they stop acting like magnets.

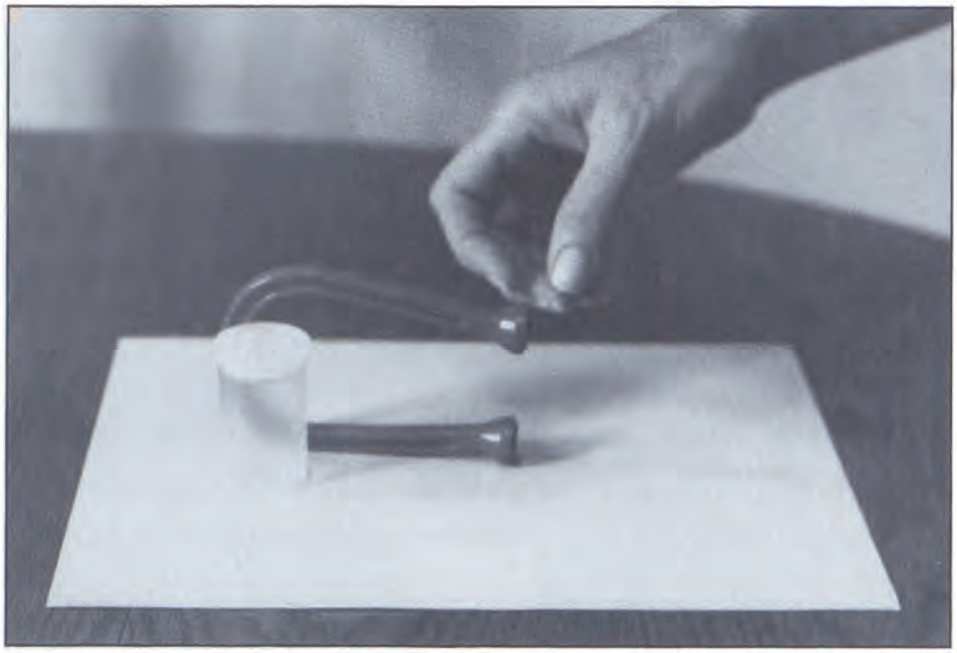
Let's Make a Permanent Magnet

Get a good steel needle. Turn on your electric magnet. You are going to rub the needle on one end of the magnet, but listen first and make sure you understand how to rub. The rubbing is a little tricky.

First we need to pick a direction on the needle. Let's say we will start by the eye and work toward the point.

When we rub, we will touch the end by the eye first. Then we will rub by pulling the needle along the end of the iron. The last part of the needle to touch the magnet will be the point.

Then we will lift the needle and not let it touch the magnet. We will bring the eye of the needle back over the magnet. Then we will touch the eye end to the magnet and rub toward the point again. Can you count to 50? Do this fifty times.



The more you rub, the better your needle magnet will be. The more carefully you rub in one direction only, the stronger your needle magnet will be. The stronger the magnet you rub with, the stronger your new magnet will be.

Check it out. Does your needle magnet pick up pins by itself now?

Chapter 7
Fire and Heat

Fire

Many of God's gifts can be used wisely or foolishly—for good or evil. Fire is one such gift. We must always remember to be careful with it. If we build a fire in a safe way and in a safe place, the fire will give us heat and light. The heat keeps us warm and healthy. When there is no daylight, the light of a fire lets us see the work God has given us to do.

If we carelessly build a fire in a dangerous place, or forget to be careful with it, the fire can hurt us or burn up what is precious to us.

Is there a fire in your home right now? You may say, "We do not have a fireplace." Well, what keeps your house warm in the winter?

Probably, there is a heater or a furnace of some kind, somewhere in your house. Certain kinds of furnaces burn oil. Some burn coal. Others burn natural gas (not gasoline, but a true gas as opposed to a solid or liquid). And some run on electricity. Electric furnaces work like big toasters to keep your house nice and toasty warm.

If you have electric heat, you are right to say, "We do not have a fire in our home." (Of course, we also must be careful with electric heat. It too can cause fires.) We will look at electricity in the next chapter.

Fires need three things to burn: fuel, heat, and a certain kind of fresh air. Take away one of these things and the fire will go out.

You may have seen a fire burn itself out by using up all the wood (or fuel) in a fireplace. Have you ever blown out a candle? If so, you moved the fire away from its fuel, and it went out.

We put out many fires with water, cooling the fire and removing the air.

Learning about God's World

You need:

- some candles with holders
- a glass (not a plastic one—it may melt or catch fire!)
- matches with an adult to light them

Let's put out a fire by taking away its air. Light a few candles, as the boy in the picture has. Hold the glass two or three inches above one flame. (Hold the glass too low, it will get hot. Hold the glass too high, you will have a long wait.) While you watch, the flame will get lower and go out.

Now move the glass slowly and carefully, keeping it straight upside down, over another burning candle. Did this candle go out faster? Then move the glass over a third candle and try the same thing. Faster again?

Did you ever put your head under your bed covers a long time, until it was hard to breathe? You used up all the fresh air. The candle just did the same thing. It used up all the fresh air in the glass.

Check it out. Turn the glass right side up and swing it around a little to fill it with fresh air. Put it over another lighted candle. Did it take longer, like the first time again? It should.

Heat

You need:

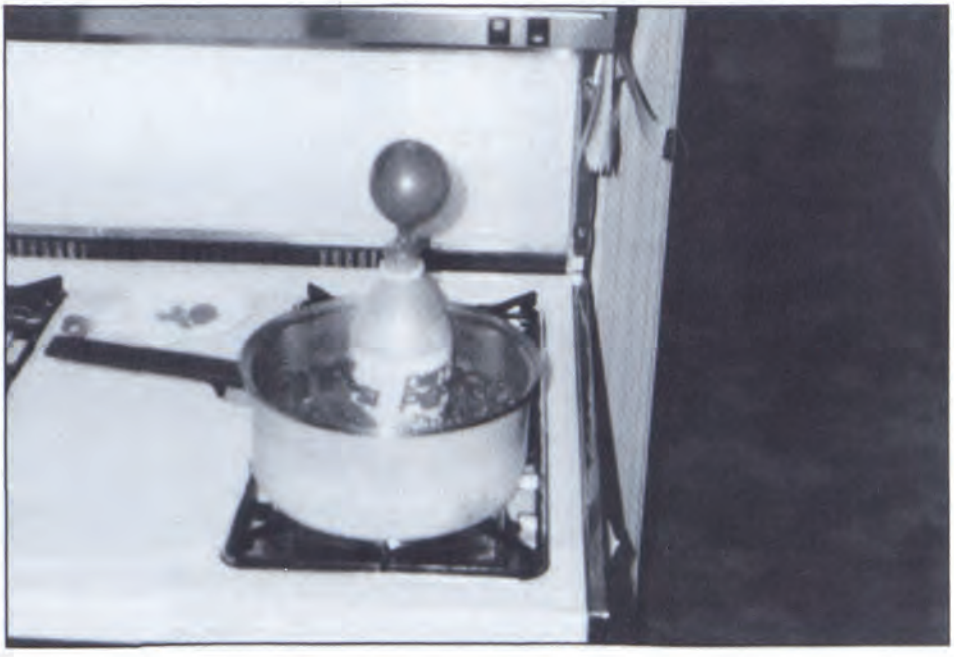
- saucepan, 2 to 4 quarts
- 1 or 2 quarts of water
- glass soda pop bottle, 12 or 16 ounces (empty)
- balloon

Fire gives us heat. A pan on the stove becomes hot when the very tiny parts of the pan become very excited and begin moving very fast. How can the pan stay together? Well, that is something about solids. (Remember solids, liquids, and gases?) In a solid, the tiny parts stay in one place, but they can move back and forth a little way.

Try this. Fill a medium-sized pan half full with water and set it on the stove to boil. Meanwhile put a balloon over the top of a soda pop bottle.

Set the bottle in the hot water. What happens?

The balloon begins to fill because the air inside the bottle moves around so much that it pushes against the balloon and stretches it. Put the bottle in the refrigerator for a while and watch the balloon shrink back again.



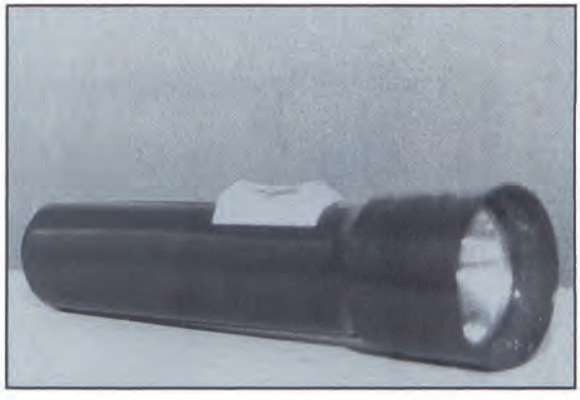
Chapter 8
Electricity

There are three kinds of electricity.

One kind comes from a battery. It is called **direct current.** We usually use direct current only for small pieces of equipment. Flashlights run on direct current from batteries. Some radios can run on direct current from batteries. Larger pieces of equipment like refrigerators would need very big batteries!

The second kind is called **alternating current.** It runs our refrigerators and powers our lights. Some radios plug into the wall outlet and run on alternating current. Some radios can run either on batteries or on house current. Alternating current is very much like direct current. It comes into our houses through heavy wires that we can see on utility poles in our neighborhood.

Direct current and alternating current both flow along wires. Both can light up a light bulb.



The third kind is called **static electricity.** It is very different from the other two. Nothing runs on static electricity. It does not flow along wires. It cannot light up a light bulb. It is the kind that makes "static cling" that you may have seen on television commercials, where they show clothes that stick together.

Learning about God's World

You need:

- a balloon
- a piece of fuzzy cloth (a sweater will do nicely)

Static electricity can make things behave like magnets. Let's look at some of them. Stand near a wall. Rub the balloon on the cloth a few times. Quickly touch the balloon to the wall and gently let go. Did it stick? If not, try it again. (This works best in dry weather, or in the winter.)

Stand near a mirror and rub the balloon on the cloth. Look in the mirror. Now hold the balloon over your head. What happens to your hair?

Is there a really dark closet in your house? Take the balloon and cloth into the closet and watch closely when you rub. Did you see sparks? What color were they?

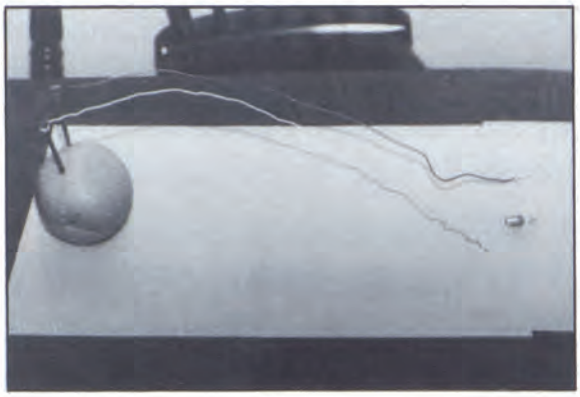
The color may actually be any of several colors. It will help develop the student's powers of observation to be given this specific question.

Learning about God's World

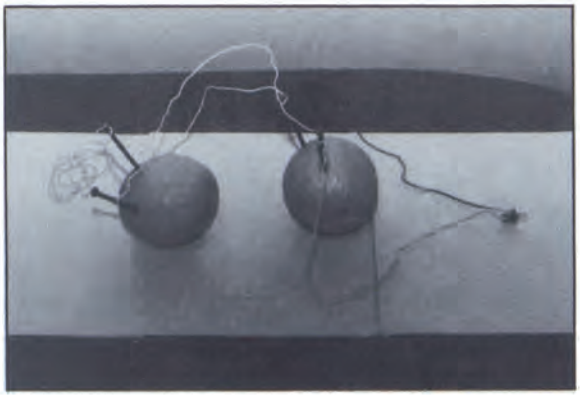
You need:

- two lengths of insulated copper wire, each about 12 ″ long
- two large steel nails
- an orange, possibly two or three
- a small flashlight bulb

Stick the two nails into opposite ends of the orange. Strip an inch of insulation from the ends of both wires and wrap one end of each around a nail. Wrap the unattached end of one wire around the light metal sleeve at the base of the flashlight bulb. Touch the end of the other wire to the dot on the bottom of the bulb. Do you see a faint glow?



No glow? Try a darker room. (There is not a lot of current here.) Still none? Connect a series of oranges like this:



You will not need to empty the refrigerator to get enough current to light the bulb.

Field Trips

- Earth-moving equipment at a large construction site nearby can give your student an opportunity to see how some of the simple machines are put to use: a steam shovel uses a combination of a pulley and a lever; a bulldozer's shovel is a wedge.
- If there is a person known to your child who is wheelchair-bound, or if you can locate such a person willing to take the time, you may arrange for your student to interview the person about the difference a ramp makes at corners and at building entrances. The personal application of mechanical principles can make the lesson memorable.
- A water purification plant, dam, or reservoir in your area may be equipped to give public tours. The points to look for and the questions to ask would be those that concern how the flow of water is controlled and the problems water flow presents for the work.
- A gas supplier could be an instructive visit for your student. Not all owners would welcome the interruption, and their receptiveness may depend on how busy the season is when you telephone. If a foreman at the shop can talk about the problems of handling a gas, the experience will be especially memorable.
- At oil refineries, the sludgy liquid petroleum is heated and separated into gasoline, kerosene, paraffin, and so on in tall cracking towers. The lighter gases are piped off higher up. A tour may not be a practical possibility, but nearly as much may be learned by a good long look from the road as from an inside tour.
- Mercury, being both a metal and a liquid, has a unique usefulness: silent electrical switches can be made with it. Being a metal, mercury conducts electricity very well; being a liquid, mercury can flow away from two bare ends of wires inside the switch so that electricity can't pass between them. (Air is a very poor conductor of electricity.) Mercury switches are not as widely available as they once were, but a long-established hardware or electrical-goods store nearby may have one your students may see.
- Your local electric utility may provide tours of its electric generating plant or at least allow a visit so that your students may see how electricity is produced. With luck, they may have some informational brochures written at your students' level. If the generating plant is near to you, in it you may observe how a magnet is spun past wires to generate electricity. Your student may learn in a memorable way about the caution one must have around electricity and may begin to develop an appreciation for electricity as a valuable gift.
- A visit to a fire station is always an experience that students find exciting. Fire fighters are usually glad to explain to young people what their work is and can explain many facts about water pressure in the hose, the properties of various kinds of fires, and how different kinds of fires are controlled and extinguished.

Unit 1 Review

With each fill-in, follow this procedure: (1) read each sentence twice with the answer; (2) tell the student to listen for your pause and say the word that belongs; (3) read the sentence again and pause instead of saying the **boldface** word in red. The student is to say the word that completes the sentence correctly.

1. A machine is something that makes work **easier.**
2. I have a scale that balances. If I move the weight on one side farther from the center, that side will go **down.**
3. Water is a **liquid,** and ice is a **solid.**
4. A liquid will turn to a gas if it is **heated.**
5. When salt **dissolves** in water, we can get the salt back by drying up the water.
6. When two things join to make a new thing, we call that a **chemical change.**
7. Gold is a **metal.**
8. Two things that metals do well are **carry heat** and **carry electricity.**
9. One thing a liquid has that a gas does not have is **a surface.**
10. A metal that is a liquid is **mercury.**
11. A magnet will not pick up **plastic.**
12. The needle on a compass is a **magnet.**
13. To burn, fire needs **air, heat,** and **fuel.**
14. Heat will make the tiny parts of a pan **move back and forth.**
15. The three kinds of electricity are **direct current, alternating current,** and **static electricity.**
16. A dangerous form of static electricity is **lightning.**

Unit 1 Checkout

Answer the questions.

1. Name something that a magnet will not pick up.

2. Name two things a fire needs to burn.

3. Name one thing that metals do well.

Fill in the blanks.

4. I have a scale that balances. If I move the weight on one side closer to the center, that side will go _____.
5. The three kinds of electricity are direct current, alternating current, and _____.
6. One thing a liquid has that a gas does not have is _____.
7. A machine is something that _____.
8. A liquid will turn to a _____ if it is heated.
9. The needle on a compass is a _____.
10. Water is a liquid, and ice is a _____.
11. A dangerous form of static electricity is _____.

Circle **Yes** or **No.**

12.	A metal that is a liquid is mercury.	**Yes**	**No**
13.	When salt dissolves in water, we can get the salt back by drying up the water.	**Yes**	**No**
14.	When two things join to make a new thing, we call that dissolving.	**Yes**	**No**
15.	Gold is a metal.	**Yes**	**No**
16.	Heat will make the tiny parts of a pan fly apart.	**Yes**	**No**

Assist the student with the reading and writing, but leave the student free to choose answers alone. Decline to supply answers kindly. The answers are on page 124.