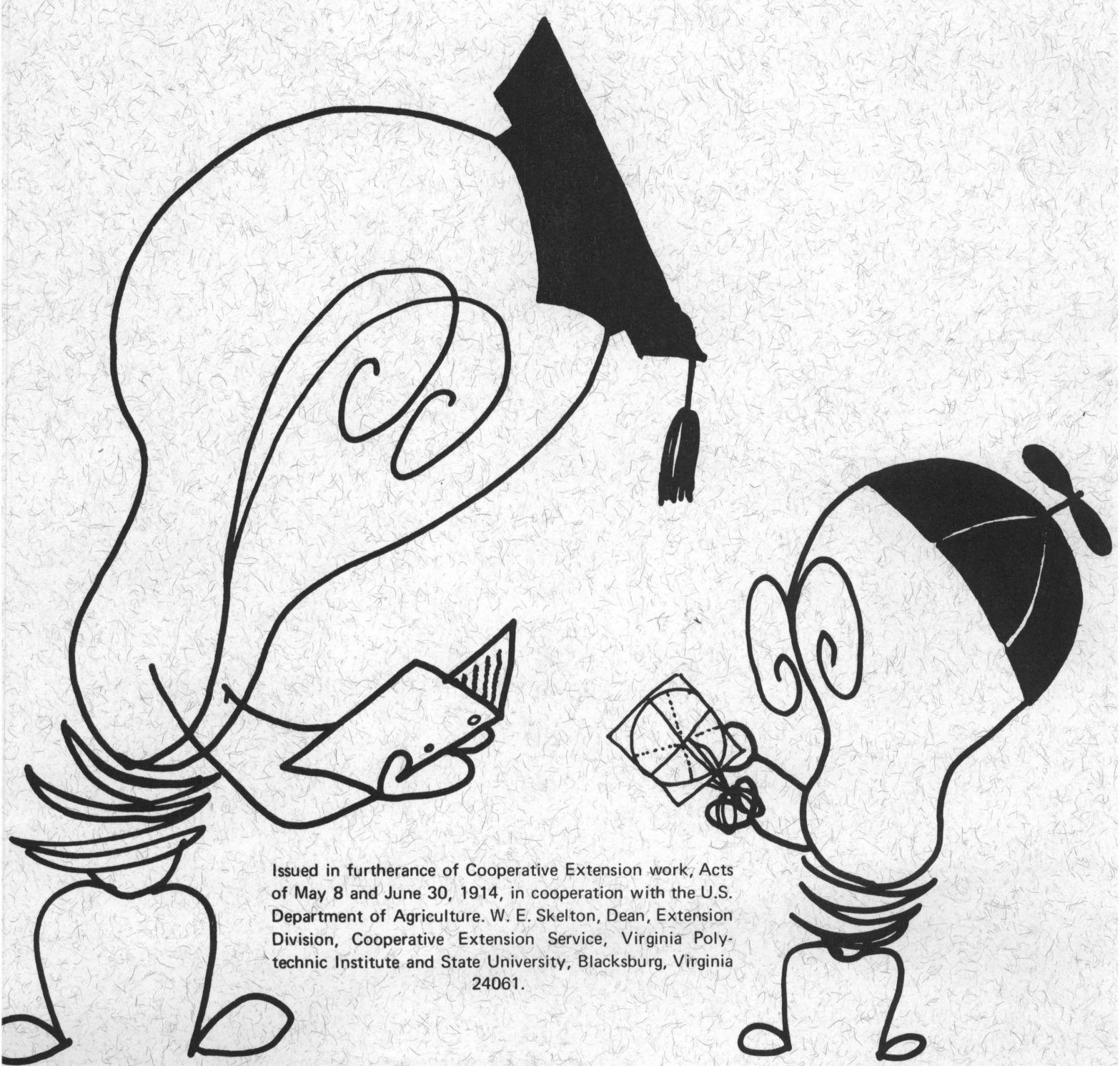
EXTENSION DIVISION
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

RB-108
Reprint June 1976

4-H Electric Project
Leader's Guide

Electro 2



Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. W. E. Skelton, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

4-H ELECTRIC PROJECT LEADER'S GUIDE

FOR

ELECTRO 2

by

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Effective 4-H Electric project work is the end product of careful planning. It is desirable to plan all phases of the program for the year to include:

(1) What is to be done

(2) How it will be done

(3) Who will be responsible for doing it

(4) Where it will be done

(5) When it will be done

The requirements for successful project completion are outlined in the front of Electro 2. You will note some learning experiences are required and others are optional. Plan project training for the required items. Select other topics for inclusion in the program based upon the needs and interests of the members. Provide sufficient training to enable members to complete the project.

The following information and suggestions will help you plan and teach each phase of your project training program.

INTRODUCTION

Electricity is a vital force in homemaking, business, industry, and agriculture. It is important for boys and girls to have an understanding of some of the principles of electricity, its application, and potentials. They also need to acquire knowledge on the use and care of electrical equipment.

Objectives

1. To introduce Electro 2 and stimulate interest in the project
2. For members to learn the services electricity provides and how it helps in other projects

Preparation for Meetings

1. Procure a copy of Electro 2 for each member
2. Obtain a copy of the leaflet "Virginia 4-H Electric Program" for each member

Presentation

1. Review what members learned in Electro 1
2. Outline the exciting things they will learn and do in Electro 2

3. Consider showing an electrical movie of interest to this age group such as "The Mighty Atom"
4. Explain how electricity works for us by providing light, heat, cold, power, and entertainment
5. Explain how electricity helps in other projects

Member Participation

1. Have members explain what they learned in Electro 1
2. Members answer questions in project book
3. Complete questions No. 1 and 2 in record book prior to next meeting
4. Ask members to discuss their answers to questions in No. 3 above at next project meeting

Answers

What Goes Where: lighting - table lamp, ceiling fixture, floor lamp

heating - toaster, hand iron, range, percolator, frypan

cooling - attic fan, refrigerator, food freezer, room air conditioner, window fan

power - food mixer, clock, portable drill, washing machine, floor polisher

entertainment - television, radio

How Electricity Helps in Other Projects:

Dairy - 3, 11, 12, 14

Foods - Nutrition - 1, 2, 3, 11, 17

Home Improvement - 4, 5, 6, 8, 10, 11, 16

Housecare - 1, 2, 3, 4, 5, 10, 11, 15, 17

Laundry - 7, 8, 10, 11

Poultry - 9, 11

LET'S EXPLORE ELECTRICITY

A study of electricity and its uses involves an understanding of certain terms. A knowledge of basic terms and their use will make electric project activities more meaningful and enjoyable. Boys and girls will use simple electrical terms throughout their careers in the Electric project. This unit will help members understand the nature of electricity, conductors, insulators, simple circuits, volts, amperes, and watts. This training will provide a basis for the instruction that follows in Electro 2.

Objectives

1. To introduce simple electrical terms
2. To become acquainted with "open" and "closed" circuits

Additional Information

Scientists have searched for the smallest particle in nature. At one point, they thought the atom was the smallest particle. Later they learned atoms contain still smaller protons and electrons. Uranium has 92 protons in the nucleus and 92 electrons swinging around the nucleus. Some materials have less than five protons and electrons in an atom.

Some equipment such as a water heater and a large motor require a pressure of 240 volts. An electric range must have both 120 and 240 volts to operate properly. Appliances operate best at their rated voltage. It is a sign of low voltage if light bulbs are dim, the TV picture shrinks, equipment heats slowly, and motors are sluggish.

Preparation for Meetings

1. Assemble samples of conductors and insulators to show at meeting
2. Assemble material as follows to demonstrate "open" and "closed" circuits:

   1 - 1½ volt No. 6 dry cell battery
   1 - miniature socket with solder terminals
   1 - 1½ volt flashlight bulb
   1 - midget knife switch
   4 ft. - bell wire
   Tools - knife, pliers, and screwdriver

   It is desired that a set of the above materials be provided for each two members.

3. Select appliances to show information found on nameplates.

Presentation

1. Explain material in Electro 2 on "What is Electricity?"
2. Show and explain conductors and insulators. Have members indicate in their project books the materials listed are conductors and insulators.
3. Demonstrate "open" and "closed" circuits as explained in project book. Refer to project book for information on how to remove insulation from wire. Have members do each step if supplies are available.
4. Ask members to find the nameplate on appliances.
5. The use of meters will make the discussion on electrical terms more "alive" and interesting. If you have a voltmeter, ammeter, and wattmeter, show their use as you present each respective term.

Member Participation

1. Have members identify certain conductors and insulators.
2. Members working in pairs make "open" and "closed" circuits if supplies are available.
3. Answer the questions in project book.

4. Members prepare a demonstration on some phase of "Let's Explore Electricity" for next meeting.

5. Answer question No. 3 in record book.

Answers to Questions

Conductors: Brass, salt water, cast iron, steel, copper, aluminum, silver

Insulators: Paper, air, wood, mica, glass, plastic, rubber, bakelite, porcelain

Pick: True - 2, 3, 4, 5, 6, 10

False - 1, 7, 8, 9

Choose: 1 - copper, 2 - plastic, 3 - two wires, 4 - open circuit, 5 - causes the flow of electrons, 6 - electrical pressure, 7 - the rate of flow of electricity, 8 - rate of using electricity, 9 - multiplies volts by amperes, 10 - 1200

ELECTRIC WATCHDOGS

Fuses and circuit breakers are used in a wiring system for one purpose -- safety. It is important for members to understand the types of circuit protective devices ("Electric Watchdogs") and how they function. This will give them an appreciation of a vital element in electrical safety.

Objectives

1. To learn the types of circuit protective devices
2. To understand the function of fuses and circuit breakers

Additional Information

When a plug fuse blows on a 15 - ampere circuit, some people replace it with a 20, 25, or 30 ampere fuse. That is over-fusing and it is an unsafe practice. Others tamper with fuses or place a penny behind them to restore service. That is like tieing down a safety valve. Over-fusing is bad, but tampering with fuses is worse.

How do you choose the proper size of fuse or circuit breaker? It's done mainly on the basis of wire size. A wire gets hotter as the flow of current increases. Overheated wires can cause the insulation to harden and flake off. The wires may become bare in spots. You have a short circuit when bare wires touch and this might start a fire.

The wires cannot get hot enough to cause damage if the proper size fuse or circuit breaker is used. Numbers are used to express wire size. Small numbers mean large wire. For example, No. 10 wire is larger than No. 14 wire. So, wire size and fuse or circuit breaker size are partners as shown on page 5.

Wire Size	Largest Size of Fuse or Circuit Breaker to Use
No. 14	15 amperes
No. 12	20 amperes
No. 10	30 amperes
No. 8	40 amperes

Preparation for Meetings

1. Procure different sizes of plug and cartridge single element fuses.
2. Obtain various sizes of 2-element plug fuses with threads like an ordinary lamp bulb. Also, secure various sizes of 2-element plug fuses with adapters. Obtain one 2-element cartridge fuse.
3. Arrange to borrow a main switch box with plug and cartridge fuses and one which uses circuit breakers.

Presentation

1. Explain why "Electric Watchdogs" are important and that fuses and circuit breakers are the weakest link in the wiring system.
2. Explain fuse size as expressed in amperes
3. Discuss single element plug and cartridge fuses and how they function
4. Explain 2-element plug and cartridge fuses and how they function with overloads and short circuits. Demonstrate how you cannot over-fuse a circuit equipped with a plug fuse adapter and a 2-element fuse.
5. Discuss circuit breakers and how they operate.
6. It would be helpful to show how a fuse blows if demonstration equipment is available.

Member Participation

1. Give members an opportunity to examine various types of fuses and circuit breakers.
2. Answer questions in project book.
3. Members prepare an illustrated talk on an "Electric Watchdog" topic for next meeting.
4. Answer question No. 4 in the record book.

Answers to Questions

1 - (5), 2 - (12), 3 - (7), 4 - (1), 5 - (2), 6 - (6), 7 - (10), 8 - (11), 9 - (9), 10 - (14), 11 - (3), 12 - (8), 13 - (4), 14 - (15), 15 - (13)

ELECTROMAGNETS

Magnetism is the key to many uses of electricity. Accordingly, it is important for members to understand some of the basic principles of magnetism. They will have an opportunity to build simple electromagnets and experiment with them. The knowledge gained will be helpful in future 4-H Electric Project activities.

Objectives

1. To acquaint members with how to build simple electromagnets.
2. To teach the basic principles of magnetism.

Additional Information

Refer to Electro 3 for more facts about electromagnets.

Preparation for Meetings

1. Assemble supplies to demonstrate how to make an electromagnet, a permanent magnet, and a buzzer, as outlined in Electro 2. If steel knitting needles are not available, you can use steel welding rod.
2. Procure supplies so members working in pairs can make an electromagnet and a permanent magnet. Provide for each member to make a buzzer. The No. 18 insulated wire can be re-used in making the 3 items if desired.
3. Make the 3 items prior to the meeting and test them to be sure they perform properly.

Presentation

1. Review what members learned about permanent magnets in Electro 1.
2. Explain basic facts about electromagnets and why they are important.
3. Demonstrate how to make a simple electromagnet using a nail, 10 turns of wire, and a single battery. Have members work in pairs and follow your instructions in making the electromagnet. Follow the same procedure in making a stonger electromagnet using 50 turns of wire and 2 batteries.
4. Demonstrate how to make a permanent magnet of a knitting needle. Have members work in pairs and make 2 permanent magnets and test them as outlined in Electro 2.
5. Demonstrate how to make a buzzer and have each member make one.
6. Explain how the buzzer operates.

Member Participation

1. Ask all members to make and test the 3 items above.
2. Encourage them to learn more about electromagnets and report it in their record book.
3. Members prepare an illustrated talk or demonstration on electromagnets for the next meeting.

REPAIR SERVICE CORDS

Portable lamps and appliances are often out of service because of defective service cords. Members can easily learn to replace faulty attachment plugs, service cords, and lamp sockets. They enjoy this type of training and it provides the skills needed to repair service cords at home. This helps families keep lamps and appliances in service and reduce repair bills. The training also promotes electrical safety, since defective service cords can be hazardous.

Objectives

1. To familiarize members with types of service cords, attachment plugs, and sockets.
2. To teach members how to make simple repairs to service cords.

Additional Information

There are more than 20 types of flexible service cords. The more common ones are discussed in Electro 2. "Type letters" are often used to designate different types of cords. The "type letters" for the ones included in the project book are as follows:

1. Braided parallel cord - Type PO
2. Parallel cord - Type SP has rubber insulation and Type SPT has thermoplastic insulation.
3. Junior hard service cord - Type SJ has rubber covering and SJT has thermoplastic covering. Types SJO and SJTO are resistant to oil.
4. Hard service cord - Type S has rubber covering and ST thermoplastic covering. Types SO and STO are resistant to oil.
5. Heater cord - Type HPD
6. Parallel heater cord - Type HPN

Several appliances are now supplied with a 3-prong grounding-type attachment plug. The long prong is for grounding purposes which is a safety feature. Repair of service cords with this type of attachment plug will be included in another project book. Electro 2 is concerned only with the replacement of attachment plugs with 2 parallel prongs.

Preparation for Meetings

1. Obtain samples of various types of service cords.
2. Secure samples of different types of attachment plugs.
3. Assemble samples of various kinds of sockets.
4. Arrange to provide each member with an attachment plug, 2 ft. of parallel service cord, and a lamp socket.
5. Provide a knife, screwdriver, and electricians pliers for each 2 members
6. Ask your Extension Agent to loan you a set of charts on simple electrical repairs.

Presentation

1. Explain why members should learn to repair service cords.
2. Show and discuss types of service cords and their application.
3. Discuss features of different attachment plugs. Use large charts.
4. Distribute 2 ft. length of service cord and attachment plug to each member and a set of tools for each 2 members.
5. Demonstrate how to replace an attachment plug a step at a time and have members perform each step. Use large charts.

6. Show and explain types of lamp sockets.
7. Demonstrate how to replace a socket a step at a time and how members perform each step. Use large charts.
8. Check and correct any errors in doing the repairs.
9. The members will now have a short service cord. Ask each member to screw a light bulb into the socket, plug in the attachment plug, and see that it works. This gives members confidence in doing simple repairs.

Member Participation

1. "Learning by doing" is essential in teaching repair of service cords. That is why supplies should be available for each member.
2. Have members inspect service cords at home and list the defective ones found in project book.
3. Members prepare an illustrated talk or demonstration on service cord repair for next meeting.
4. Encourage members to report repairs made in their record book.

THE MAGIC OF LIGHT

There are hundreds of types and sizes of incandescent light bulbs. They operate on the same principle as Edison's first lamp. Members need to understand the construction and operation of incandescent light bulbs. They should also be familiar with the common types of light bulbs used in and around the home. This basic knowledge will be helpful as they study home lighting in future project work.

Objectives

1. To understand the construction and operation of incandescent light bulbs.
2. To become familiar with common types of incandescent light bulbs used in the home.

Additional Information

What happens if the voltage supplied to a light bulb is higher or lower than its "rated" voltage? At higher voltage the bulb will give more light and use more electricity, but it will "burn out" sooner. The reverse is true with lower voltage. The light output and wattage will be lower, but the bulb will last longer. Most light bulbs are designed for a life 750 to 1,000 hours. The voltage at the socket should be within 3 volts of the "rated" voltage of the lamp. So, when bulbs burn out too soon, the voltage rating of the bulbs may be too low. When bulbs last a long time, the voltage rating of the lamps may be too high.

Manufacturers have a code to designate the shape and size of a bulb. For example, what does A-19 mean? The "A" designates the shape and the 19 indicates the diameter of the bulb. The 19 means the lamp is 19-one-eights of an inch in diameter (19 x 1/8 = 2 3/8 inches). An R-40 is a reflector bulb 5 inches in diameter (40 x 1/8 = 5 inches).

Preparation for Meetings

1. Obtain a candle and an oil lamp.
2. Procure a socket for each of the 5 sizes of light bulb bases.
3. Assemble bulbs of various types, shapes, sizes, and finishes. One of these should be a 3-way bulb and another should be a clear bulb.
4. Obtain a short extension cord with a lamp socket on one end. You can prepare the socket so bulbs can be quickly inserted to demonstrate their lighting effect. Take the socket apart. Locate a short length of steel rod slightly smaller in diameter than the socket body. Secure the steel rod in a vise. Insert socket body over steel rod and tap outside of socket with a hammer to flatten the threads in the socket. Rotate socket body as you tap outside of socket with hammer to keep socket round. Reinstall and check to see if metal socket projects beyond insulating shell. If it does, disassemble, and cut off end of socket with tin snips and reinstall socket. This modified socket permits you to demonstrate bulbs by simply pushing them into the socket. This saves the time required to screw bulbs into and out of the socket.

Presentation

1. Explain why artificial lighting is important.
2. Give a brief history of lighting. Light the candle and oil lamp to show forerunners of electric light.
3. Explain how a light bulb works and acquaint the members with its parts.
4. Show and name the various bulb bases.
5. Show and explain 3-way bulbs, information on end of light bulbs, shapes of bulbs and the glass in them.
6. Discuss types of finishes on bulbs and demonstrate the lighting effect they produce.
7. Show a darkened bulb and explain what caused it.

Member Participation

1. Members examine a clear light bulb and identify its parts.
2. Give members an opportunity to look at various types of light bulbs.
3. Answer questions in project book.
4. Members prepare illustrated talk or demonstration on some phase of "The Magic of Light" for next meeting.

Answers to Questions

1 - 80%, 2 - carbon, 3 - it has a high melting point, 4 - reduces evaporation of filament, 5 - incandescent lamp, 6 - medium, 7 - 200-watt bulb gives more light, 8 - 2 filaments, 9 - inside coated bulb, 10 - PAR bulb, 11 - insects can't see yellow light, 12 - evaporation of filament.

LIGHTER HOMEWORK

Every boy and girl needs a well-lighted study center. It can make seeing easier, prevent undue eyestrain, and reduce fatigue. Research on study lighting has revealed the requirements for this seeing task. The lighting must meet

certain standards of quantity and quality. Likewise, the light source must be properly placed. Four-H members need to understand the importance of good study center lighting and how it can be achieved.

Objectives

1. To develop an appreciation for good study center lighting.
2. To learn how to set up an approved study center.

Additional Information

Light intensity is measured in footcandles. A footcandle is the illumination on a surface a distance of one foot from a uniform point source of one candle. Light meters are available which measure footcandles of light.

Studies have shown the entire study area should be illuminated with no less than 70 footcandles of light at any point. The Better Light Better Sight lamp is the only one which meets the light intensity standards. The refractor or lens bowl on the BLBS lamp causes a wide spread of light over the study area. Other types of lamps, which provide proper diffusion and are appropriately placed, often provide much better study conditions than members are now using.

Preparation for Meetings

1. Procure a Better Light Better Sight study lamp.
2. See that a table or desk is available at meeting to set up study center.
3. Arrange for samples of the 4 diffusers for lamps shown in Electro 2.
4. Obtain a light colored blotter for table or desk and a yardstick to make measurements.
5. Plan to show another study lamp preferably with A or B diffuser.
6. Order the required lamp kits if members plan to build lamps.

Presentation

1. Show and explain features of a BLBS study lamp. Emphasize height, refractor, perforated metal disc and shade dimensions and features.
2. Demonstrate the 4 diffusers used in other lamps. Show the density of shadows caused by each as an indicator of their relative effectiveness as a disfuser.
3. Show and explain the features of a study lamp with one of the 4 diffusers. A lamp with a CLM or bowl-shaped glass diffuser (A or B) is preferable.
4. Demonstrate how to set up a good study center using a BLBS lamp.
5. If members build lamps, have them follow your instructions a step at a time. Check and correct errors in the various steps. The skills learned in "Repair of Service Cords" will be helpful.

Member Participation

1. Members practice setting up a study center.
2. Build a study lamp if kits were ordered.

3. Members prepare illustrated talk or demonstration on some phase of study lighting for next meeting.
4. Encourage members to report what they learned and did on study lighting in their record book.

LET'S GO ON A TRIP

Tours can be an effective phase of 4-H Electric project training. Trips are usually interesting and exciting events for members. Tours give them an impression of the many and varied uses of electricity. They also provide members an opportunity to see applications of principles learned in the Electric Project.

Objectives

1. To acquaint members with a variety of uses of electricity.
2. To show applications of principles learned.

Preparation for and Conducting Tours

1. Refer to Page 5 of the General 4-H Electric Project Leader's Guide and to the 4-H Electric Program Handbook for suggestions on planning and conducting tours.

Member Participation

1. Encourage members to ask questions during the tour.
2. Instruct members to list each location visited and the electrical equipment observed at each stop.
3. Advise members they will be asked questions about the electrical equipment they see on the tour at the next project meeting.
4. Members report on the tour in their record books.