



Electricity

Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet (book). No one can add or subtract from the Boy Scout Requirements #33215. Merit Badge Workbooks and much more are below: [Online Resources](#).

Send comments to: craig@craiglincoln.com. Requirements revised: 2004, Workbook updated: February 2008.

Scout's Name: _____ Unit: _____

Counselor's Name: _____ Counselor's Ph #: _____

1. Demonstrate that you know how to respond to electrical emergencies by doing the following:

a. Show how to rescue a person touching a live wire in the home. _____

b. Show how to render first aid to a person who is unconscious from electrical shock. _____

c. Show how to treat an electrical burn. _____

d. Explain what to do in an electrical storm. _____

e. Explain what to do in the event of an electrical fire. _____

2. Complete an electrical home safety inspection of your home, using the checklist found in this pamphlet or one approved by your counselor. Discuss what you find with your counselor. ([Sample Home Electrical Checklist](#).)

3. Make a simple electromagnet and use it to show magnetic attraction and repulsion. ([Sample Plans](#)) _____

4. Explain the difference between direct current _____

and alternating current. _____

5. Make a simple drawing to show how a battery and an electric bell work.

6. Explain why a fuse blows or a circuit breaker trips. _____

Tell how to find a blown fuse or tripped circuit breaker in your home. _____

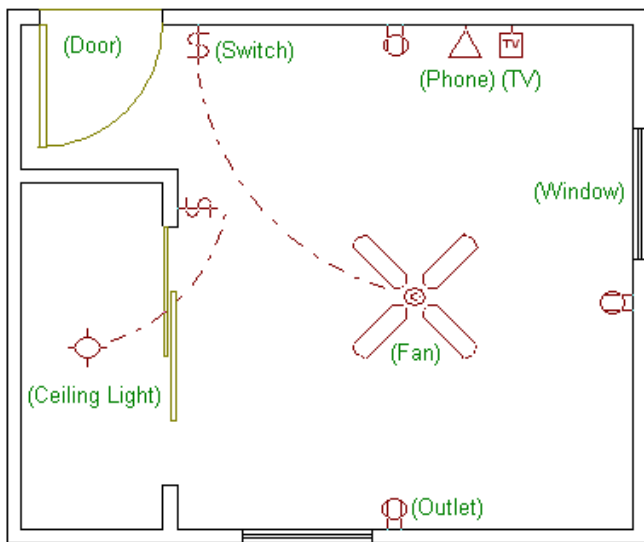
Show how to safely reset the circuit breaker. _____

7. Explain what overloading an electric circuit means. _____

Tell what you have done to make sure your home circuits are not overloaded. _____

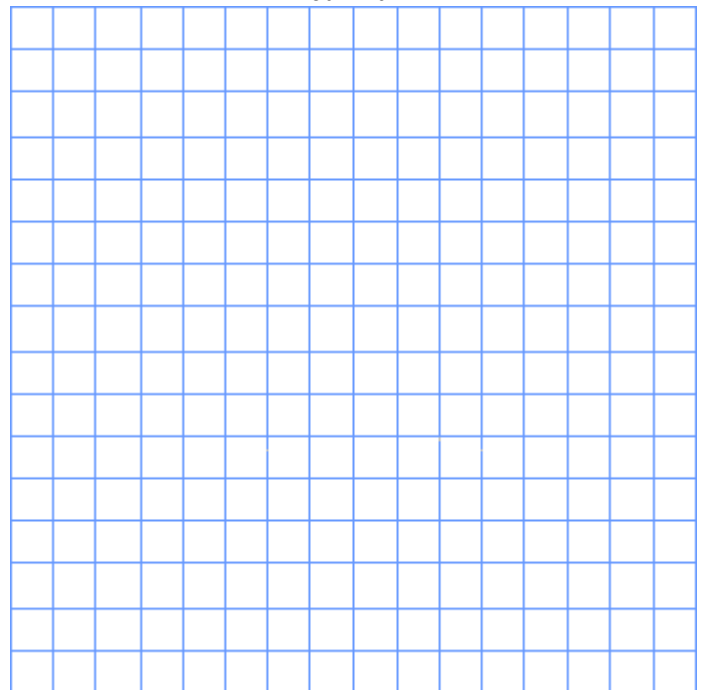
8. On a floor plan of a room in your home, make a wiring diagram of the lights, switches, and outlets. Show which fuse or circuit breaker protects each one.

Sample Bedroom Plan



Circuit: "SE Bedroom" 15 A

Your Plan



9. Do the following:

a. Read an electric meter _____

and, using your family's electric bill, determine the energy cost from the meter readings. _____

b. Discuss with your counselor five ways in which your family can conserve energy.

10. Explain the following electrical terms:

volt, _____

ampere, _____

watt, _____

ohm, _____

resistance, _____

potential difference, _____

rectifier, _____

rheostat, _____

conductor, _____

circuit, _____

and short circuit. _____

11. Do any TWO of the following: _____

- (a) Connect a buzzer, bell, or light with a battery. Have a key or switch in the line. _____
- (b) Make and run a simple electric motor (not from a kit). ([Sample Plans](#)) _____
- (c) Build a simple rheostat. Show that it works. _____
- (d) Build a single-pole, double-throw switch. Show that it works. _____
- (e) Hook a model electric train layout to a house circuit. Tell how it works. _____

Online Resources (Use any Internet resource with caution and only with your parent's or guardian's permission.)

Merit Badge Workbooks: usscouts.org -or- merithub.org ▶ **Merit Badge Books:** www.scoutstuff.org

Boy Scouts of America: <http://www.scouting.org/> ▶ [Requirements](#) ▶ [Intro to Merit Badges](#) ▶ [Guide to Safe Scouting](#)

Make a Simple Electromagnet Plans: ▶ [Best](#) ▶ [Great](#) ▶ [Great](#) ▶ [Good](#)

Make and Run a Simple Electric Motor Plans: ▶ [Best](#) ▶ [Great](#) ▶ [Good](#) ▶ [BoysLife](#) ▶ [4H Book](#)

 ▶ [Replace an Electrical Switch](#) ▶ [Replace an Outlet](#) ▶ [Test an Outlet](#) ▶ [Test GFCI](#) ▶ [Safety](#)

Electricity Kits Through the BSA: www.scoutstuff.org Boston Museum Sci: <http://www.mos.org/sln/toe/toe.html>

Energy Information Administration: <http://www.eia.doe.gov/> Home Energy Saver: <http://homeenergysaver.lbl.gov/>

HowStuffWorks.com: <http://www.HowStuffWorks.com> Inst. of Electrical and Electronics Engineers: <http://www.ieee.org>

Virtual museum: <http://www.ieee-virtual-museum.org> Nat. Energy Ed. Development Project: <http://www.need.org/>

N. American Electric Reliability Council: <http://www.nerc.com/> Safety World: <http://safety.sierrapacific.com>

Tech Topics: Electricity: <http://www.thetech.org/exhibits/online/topics/10a.html>

U.S. Department of Energy: <http://www.energy.gov> U.S. Dept of Energy Resources: <http://www.eia.doe.gov/kids/>

Sample Home Electrical Inspection Checklist

Outlets

- Check for outlets that have loose-fitting plugs, which can overheat and lead to fire. _____
- Replace any missing or broken wall plates. _____
- Make sure there are safety covers on all unused outlets that are accessible to children. _____

Line Cords

- Make sure cords are in good condition-not frayed or cracked. _____
- Make sure they are placed out of traffic areas. _____
- Make sure that cords are not nailed or stapled to the wall, baseboard or to another object. _____
- Make sure that cords are not under carpets or rugs or any furniture rests on them. _____

Extension Cords

- Check to see that extension cords are not overloaded & only be used on a temporary basis, not as permanent wiring. _____
- Make sure extension cords have safety closures to help protect children from shock hazards and mouth burns. _____

Plugs

- Make sure your plugs fit securely into your outlets. _____
- Make sure no plugs have had the ground pin (the third prong) removed in order to make a three-prong fit a two-conductor outlet; this could lead to an electrical shock. _____
- Never force a plug into an outlet if it doesn't fit. _____
- Avoid overloading outlets with too many appliances. _____

Ground Fault Circuit Interrupters (GFCIs)

GFCIs can help prevent electrocution. When a GFCI senses current leakage in an electrical circuit, it assumes a ground fault has occurred. It then interrupts power fast enough to help prevent serious injury from electrical shock. GFCIs can be installed at the outlet, or as a replacement for the circuit breaker for an entire circuit at the fuse box.

- Kitchen
 Bathrooms
 Garage
 Laundry room
 Outdoors

- Test GFCIs according to the manufacturer's instructions monthly and after major electrical storms to make sure they are working properly. _____

Light Bulbs

- Check the wattage of all bulbs in light fixtures to make sure they are the correct wattage for the size of the fixture. _____
- Replace bulbs that have higher wattage than recommended; if you don't know the correct wattage, check with the manufacturer of the fixture. _____
- Make sure bulbs are screwed in securely; loose bulbs may overheat. _____

Circuit Breakers/Fuses

- Make sure circuit breakers and fuses are the correct size current rating for their circuit. If you do not know the correct size, have an electrician identify and label the size to be used. Always replace a fuse with the correctly specified size fuse. _____
- Make sure everyone in your home knows where the main breaker is located and how to shut of power to the entire house.

Sample Home Electrical Inspection Checklist (page 2)**Plug In Appliances**

- Make sure there are no plugged-in appliances where they might fall in contact with water. If a plugged-in appliance falls into water, NEVER reach in to pull it out—even if it's turned off. First turn off the power source at the panel board and then unplug the appliance. If you have an appliance that has gotten wet, don't use it until it has been checked by a qualified repair person. _____

Appliances

- If an appliance repeatedly blows a fuse, trips a circuit breaker or if it has given you a shock, unplug it and have it repaired or replaced. _____

Entertainment/Computer Equipment

- Check to see that the equipment is in good condition and working properly. Look for cracks or damage in wiring, plugs and connectors. _____
- Use a surge protector bearing the seal of a nationally recognized certification agency. _____

Outdoor Safety

- Electric-powered mowers and other electric tools should not be used in the rain, on wet grass or in wet conditions. _____
- Inspect power tools & electric lawn mowers before each use for frayed power cords, broken plugs & cracked or broken housings. If any part is damaged, stop using it immediately. Repair it or replace it. _____
- Always use an extension cord marked for outdoor use and rated for the power needs of your tools. _____
- Remember to unplug all portable power tools when not in use. _____
- When using ladders, watch out for overhead wires and power lines. Stay at least 10 feet from all overhead lines. _____

Lightning

- During an electrical storm, do not use appliances (i.e., hairdryers, toasters and radios) or telephones (except in an emergency); do not take a bath or shower; _____
- Keep batteries on hand for flashlights and radios in case of a power outage. _____
- Use surge protectors on electronic devices, appliances, phones, fax machines and modems. _____

Space Heaters

- Space heaters are meant to supply supplemental heat. Keep space heaters at least 3 ft. away from any combustible materials such as bedding, clothing, draperies, furniture and rugs. _____
- Don't use space heaters in rooms where children are unsupervised and remember to turn off and unplug when not in use. _____
- Do not use space heaters with extension cords; plug directly into an outlet on a relatively unburdened circuit. _____

Halogen Floor Lamps

- Halogen floor lamps operate at much higher temperatures than a standard incandescent light bulb. Never place a halogen floor lamp where it could come in contact with draperies, clothing or other combustible materials. _____
- Be sure to turn the lamp off whenever you leave the room for an extended period of time. _____
- Never use torchiere lamps in children's bedrooms or playrooms. Consider using cooler fluorescent floor lamps. _____