



Electricity

Merit Badge Workbook



This workbook can help you but you still need to read the merit badge pamphlet.
This Workbook can help you organize your thoughts as you prepare to meet with your merit badge counselor

Merit Badge Counselors may not require the use of this or any similar workbooks.

You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
You should use the work space provided for each requirement to keep track of which requirements have been completed, and to make notes for discussing the item with your counselor, not for providing full and complete answers.

If a requirement says that you must take an action using words such as "discuss", "show", "tell", "explain", "demonstrate", "identify", etc, that is what you must do.

No one may add or subtract from the official requirements found in Scouts BSA Requirements (Pub. + 33216) and/or on Scouting.org.

The requirements were last issued or revised in 2021 • This workbook was updated in November 2023.

Scout's Name: _____ Unit _____ Date Started _____

Counselor's Name: _____ Phone No.: _____ Email: _____

Please submit errors, omissions, comments or suggestions about this **workbook** to: Workbooks@USScouts.Org

Comments or suggestions for changes to the **requirements** for the **merit badge** should be sent to: Merit.Badge@Scouting.Org

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.

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2. Complete an electrical home safety inspection of your home, using the checklist found in this (the merit badge) pamphlet or one approved by your counselor. Discuss what you find with your counselor.
(See the Sample Home Electrical Inspection Checklist at the end of this workbook.)

- ☐ 3. Make a simple electromagnet and use it to show magnetic attraction and repulsion.
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.

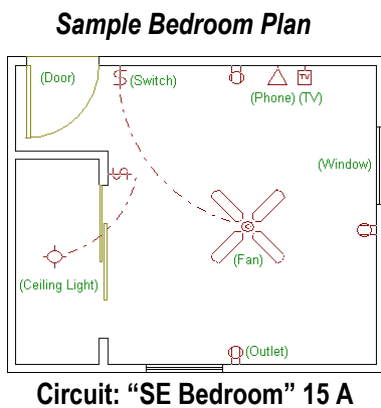
Tell how to find a blown fuse or tripped circuit breaker in your home.

- ☐ 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. Make a floor plan wiring diagram of the lights, switches, and outlets for a room in your home. Show which fuse or circuit breaker protects each one.

Your Plan

This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light blue horizontal and vertical lines. There are no margins, text, or other markings on the page.

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.

1.	
2.	
3.	
4.	
5.	

10. Explain the following electrical terms: volt, ampere, watt, ohm, resistance, potential difference, rectifier, rheostat, conductor, ground, circuit, and short circuit.

Volt;

Ampere;

Watt:

Ohm;

Resistance:

Potential
difference:

Rectifier:

Rheostat:

Conductor:

Ground:

GFCI

Circuit:

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).
- ☐ 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.

When working on merit badges, Scouts and Scouters should be aware of some vital information in the current edition of the *Guide to Advancement* (BSA publication 33088). Important excerpts from that publication can be downloaded from <http://usscouts.org/advance/docs/GTA-Excerpts-meritbadges.pdf>.

You can download a complete copy of the *Guide to Advancement* from <http://www.scouting.org/filestore/pdf/33088.pdf>.

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 off power to the entire house.

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.

Sample Home Electrical Inspection Checklist (page 2)**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.