Electricity

Merit Badge Study Guide

• Organize thoughts to prepare • Take notes • Keep track of progress

Merit badge counselors may not require the use of this or any other workbook. Scouts must still demonstrate that have learned the material and can perform each required skill. If a requirement directs you to discuss, show," "tell, explain, demonstrate, identify, or anything similar, the requirement must be completed as written. No one may add to or remove anything from the official requirements listed in Scoutbook or on scouting.org/skills/merit-badges.

The requirements were revised in 2025 • This guide was updated in December 2025.

Scout's Name: _____ Unit: _____

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

Read the merit badge pamphlet.

1. Demonstrate that you know how to respond to electrical emergencies by doing the following:
   - (a) Explain how to turn off power for a particular circuit and the whole house in the event of an emergency.
   - (b) Demonstrate how to rescue a person touching a live wire in the home.
   - (c) Describe how to safely get out of a car in an accident if you suspect a utility wire is on the car.
   - (d) Show how to render first aid to a person who is unconscious from an apparent electrical shock.

     Notes:
   - (e) Show how to treat an electrical burn.

     Notes:

- (f) Explain what to do in the event of an electrical fire.

- (g) Explain what to do if caught out in the open during an electrical storm.

2. Complete an electrical home safety inspection of your home, using the checklist found in the *Electricity* merit badge pamphlet or one approved by your counselor. Discuss what you find with your counselor. See checklist at end of worksheet

Notes

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

4. Do the following:
   - (a) Explain the difference between direct current and alternating current, the advantages and disadvantages of each, and give a practical example of the use of each type.

	Advantages	Disadvantages	Practical example
Direct current			
Alternating current			

- (b) Explain three ways that electricity is produced.

1.
2.
3.

5. Make a simple drawing to show how a battery and an electric bell work. Describe the purpose of each of the components.

Describe the purpose of each of the components.

6. Do the following:

- (a) Define what overloading an electric circuit means.

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

- (b) Determine if there is an overload on a branch circuit by either getting the current draw from all the equipment plugged into the circuit or use the power equation to calculate the current draws.

Notes:

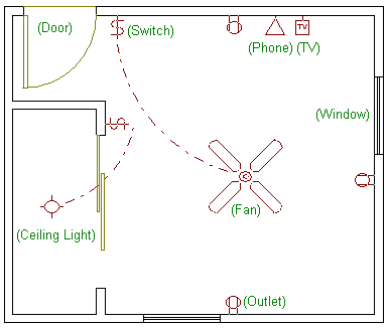
- (c) Explain why a fuse blows and a circuit breaker trips.

- (d) Tell how to find a blown fuse and a tripped circuit breaker in your home. Show how to safely reset the circuit breaker.

7. 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

Sample Bedroom Plan



Circuit: "SE Bedroom" 15 A

8. Do the following:

- (a) Read a meter associated with an electric bill. Determine the total power used since the bill, and the cost of that power.

- (b) Explain other charges on the bill that were taxes or fees.

- (c) Discuss with your counselor five ways your family can conserve energy.

1.		
2.		
3.		
4.		
5.		

9. Explain the following:

- (a) Electrical terms - Current, energy, power, resistance, and voltage

Current	
Energy	
Power	
Resistance	
Voltage	

- (b) Units of measure - Ampere (amps), ohms, volts, watts, and watt-hours

Ampere (amps)	
ohms	
volts	

watts	
Watt-hour	

- (c) Electrical conditions - Generating source with example, ground, open circuit, overvoltage, potential difference, and short circuit

Ground	
Open circuit	
Overvoltage	
Potential difference	
Short circuit:	

- (d) Equipment and their use - circuit, conductor, Ground Fault Circuit Interrupter (GFCI), insulator, inverter, rectifier, rheostat, substation, surge protection, solar panel, transformer, transmission and distribution systems, and wind turbine.

Circuit	
Conductor	
Ground Fault Circuit Interrupter (GFCI)	
Insulator	
Inverter	
rectifier	
rheostat	
substation	

surge protection	
solar panel	
transformer	
transmission and distribution systems	

10. Do 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 (from a kit is acceptable, if approved by your counselor ahead of time).
    - (c) Build a simple rheostat. Show that it works.
    - (d) Build a single-pole, double-throw switch. Show that it works.
    - (e) Explain how 3-way switch wiring works in a lighting circuit.
    - (f) Connect two lights together in a series circuit along with a battery and a switch. Then connect the same circuit in parallel. Discuss the differences in the two circuits.

Notes

11. Careers. Do ONE of the following:

- (a) Identify three career opportunities that would use skills and knowledge in electricity.

1.
2.
3.

Pick one and research the training, education, certification requirements, experience, and expenses associated with entering the field. Research the prospects for employment, starting salary, advancement opportunities, and career goals associated with this career. Discuss what you learned with your counselor and whether you might be interested in this career

Career: _____

Training	
Education	
Certification Requirements	
Experience	
Expenses associated with entering field	
Prospects for employment	
Starting salary	
Advancement opportunities	
Career goals associated with this career	

☐ Discuss what you learned with your counselor and whether you might be interested in this career.

Notes:

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.

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.