



# Electricity

## Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet.

The work space provided for each requirement should be used by the Scout to make notes for discussing the item with his counselor, not for providing the full and complete answers. Each Scout must do each requirement.

No one may add or subtract from the official requirements found in **Boy Scout Requirements** (Pub. 33216 – SKU 34765).

The requirements were last issued or revised in 2005 • This workbook was updated in March 2012.

Scout's Name: \_\_\_\_\_ Unit: \_\_\_\_\_

Counselor's Name: \_\_\_\_\_ Counselor's Phone No.: \_\_\_\_\_

<http://www.USScouts.Org> • <http://www.MeritBadge.Org>

Please submit errors, omissions, comments or suggestions about improving this workbook to: [Workbooks@USScouts.org](mailto:Workbooks@USScouts.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. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

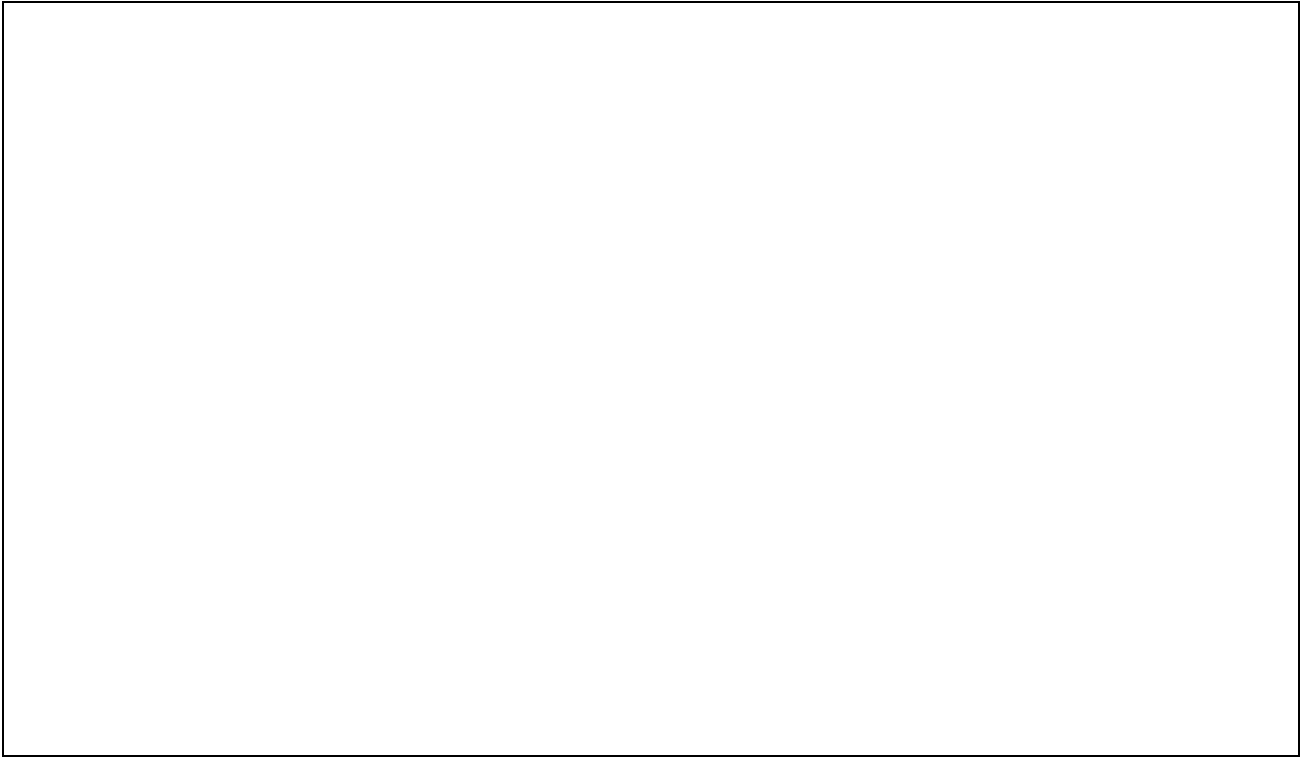
2. Complete an electrical home safety inspection of your home, using the checklist found in this (the merit badge) pamphlet or one approved by your counselor. Discuss what you find with your counselor. (See the *Sample Home Electrical Inspection Checklist* at the end of this workbook.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 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. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_



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: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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. \_\_\_\_\_

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**Requirement resources can be found here:**  
[http://www.meritbadge.org/wiki/index.php/Electricity#Requirement\\_resources](http://www.meritbadge.org/wiki/index.php/Electricity#Requirement_resources)

## 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.

## Important excerpts from the [‘Guide To Advancement’](#), No. 33088:

Effective January 1, 2012, the ‘Guide to Advancement’ (which replaced the publication ‘Advancement Committee Policies and Procedures’) is now the *official* Boy Scouts of America source on advancement policies and procedures.

- **[ Inside front cover, and 5.0.1.4 ] — Unauthorized Changes to Advancement Program**  
**No council, committee, district, unit, or individual has the authority to add to, or subtract from, advancement requirements.**  
(There are limited exceptions relating only to youth members with disabilities. For details see section 10, “Advancement for Members With Special Needs”.)
- **[ Inside front cover, and 7.0.1.1 ] — The [‘Guide to Safe Scouting’](#) Applies**  
Policies and procedures outlined in the ‘Guide to Safe Scouting’, No. 34416, apply to all BSA activities, including those related to advancement and Eagle Scout service projects. [Note: Always reference the online version, which is updated quarterly.]
- **[ 7.0.3.1 ] — The Buddy System and Certifying Completion**  
Youth members must not meet one-on-one with adults. Sessions with counselors must take place where others can view the interaction, or the Scout must have a buddy: a friend, parent, guardian, brother, sister, or other relative —or better yet, another Scout working on the same badge— along with him attending the session. When the Scout meets with the counselor, he should bring any required projects. If these cannot be transported, he should present evidence, such as photographs or adult certification. His unit leader, for example, might state that a satisfactory bridge or tower has been built for the Pioneering merit badge, or that meals were prepared for Cooking. If there are questions that requirements were met, a counselor may confirm with adults involved. Once satisfied, the counselor signs the blue card using the date upon which the Scout completed the requirements, or in the case of partials, initials the individual requirements passed.
- **[ 7.0.3.2 ] — Group Instruction**  
It is acceptable—and sometimes desirable—for merit badges to be taught in group settings. This often occurs at camp and merit badge midways or similar events. Interactive group discussions can support learning. The method can also be attractive to “guest experts” assisting registered and approved counselors. Slide shows, skits, demonstrations, panels, and various other techniques can also be employed, but as any teacher can attest, not everyone will learn all the material.

There must be attention to each individual’s projects and his fulfillment of *all* requirements. We must know that every Scout — actually and *personally*— completed them. If, for example, a requirement uses words like “show,” “demonstrate,” or “discuss,” then every Scout must do that. It is unacceptable to award badges on the basis of sitting in classrooms *watching* demonstrations, or remaining silent during discussions. Because of the importance of individual attention in the merit badge plan, group instruction should be limited to those scenarios where the benefits are compelling.

- **[ 7.0.3.3 ] — Partial Completions**  
Scouts need not pass all requirements with one counselor. The Application for Merit Badge has a place to record what has been finished — a “partial.” In the center section on the reverse of the blue card, the counselor initials for each requirement passed. In the case of a partial completion, he or she does not retain the counselor’s portion of the card. A subsequent counselor may choose not to accept partial work, but this should be rare. A Scout, if he believes he is being treated unfairly, may work with his Scoutmaster to find another counselor. An example for the use of a signed partial would be to take it to camp as proof of prerequisites. Partial completions have no expiration except the 18th birthday.