



# Engineering

## 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 2009 • This workbook was updated in April 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. Select a manufactured item in your home (such as a toy or an appliance) and, under adult supervision and with the approval of your counselor, investigate how and why it works as it does. \_\_\_\_\_

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

Find out what sort of engineering activities were needed to create it. \_\_\_\_\_

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

Discuss with your counselor what you learned and how you got the information. \_\_\_\_\_

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

2. Select an engineering achievement that has had a major impact on society. \_\_\_\_\_

\_\_\_\_\_

Using resources such as the Internet (with your parent's permission), books, and magazines, find out about the engineers who made this engineering feat possible, the special obstacles they had to overcome, and how this achievement has influenced the world today. Tell your counselor what you have learned. \_\_\_\_\_

Engineers: \_\_\_\_\_

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

Obstacles: \_\_\_\_\_

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

Influence: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Explain the work of six types of engineers.

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

Pick two of the six and explain how their work is related.

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

4. Visit with an engineer (who may be your counselor or parent) and do the following: \_\_\_\_\_

a. Discuss the work this engineer does and the tools the engineer uses. \_\_\_\_\_

Work: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Tools: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b. Discuss with the engineer a current project and the engineer's particular role in it. \_\_\_\_\_

Project: \_\_\_\_\_  
\_\_\_\_\_  
Engineer's role: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

c. Find out how the engineer's work is done and how results are achieved. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
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- d. Ask to see the reports that the engineer writes concerning the project. \_\_\_\_\_
- e. Discuss with your counselor what you learned about engineering from this visit. \_\_\_\_\_

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5. Do ONE of the following:

- a. Use the systems engineering approach to make step-by-step plans for your next campout. \_\_\_\_\_

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List alternative ideas for such items as program schedule, campsites, transportation, and costs.

Schedule: \_\_\_\_\_

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Campsites: \_\_\_\_\_

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Transportation: \_\_\_\_\_

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Costs: \_\_\_\_\_

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Tell why you made the choices you did and what improvements were made. \_\_\_\_\_

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- b. Make an original design for a piece of patrol equipment. \_\_\_\_\_  
Use the systems engineering approach to help you decide how it should work and look. \_\_\_\_\_

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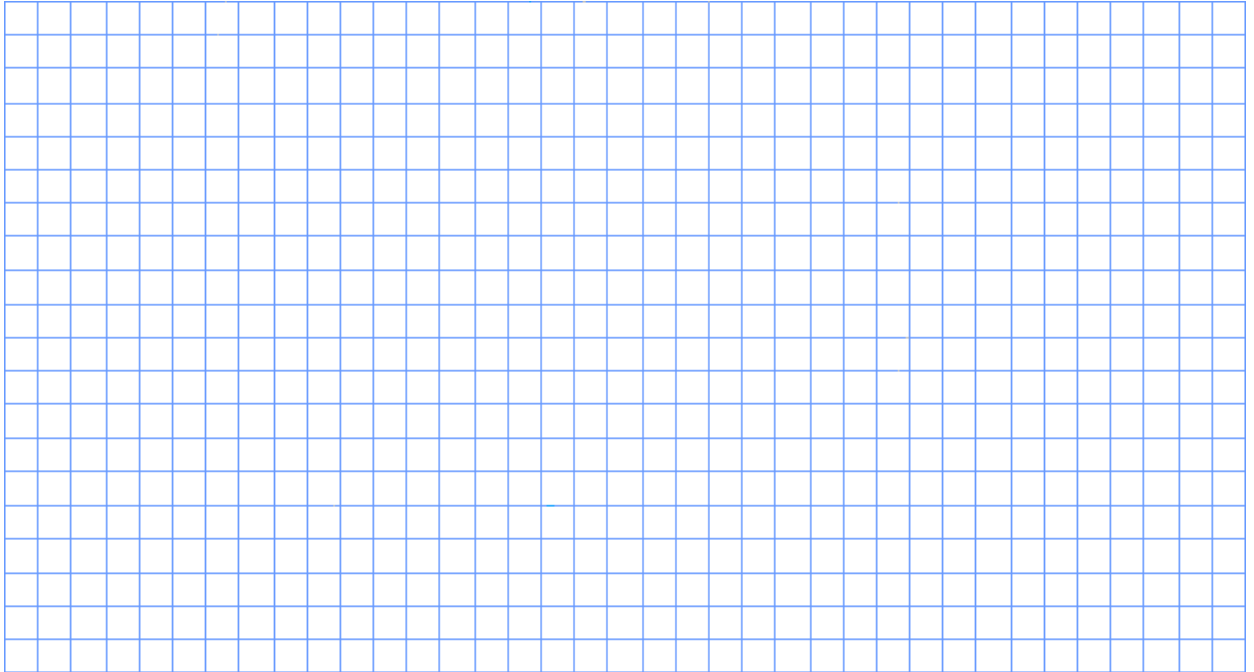


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Draw plans for it.



Show the plans to your counselor, explain why you designed it the way you did, and explain how you would make it. \_\_\_\_\_

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\_\_\_\_\_

6. Do TWO of the following:

- a. **Transforming motion.** Using common materials or a construction set, make a simple model that will demonstrate motion. Explain how the model uses basic mechanical concepts like levers and inclined planes to demonstrate motion. Describe an example where this mechanism is used in a real product.
- b. **Using electricity.** Make a list of 10 electrical appliances in your home. Find out approximately how much electricity each uses in one month. Learn how to find out the amount and cost of electricity used in your home during periods of light and heavy use. List five ways to conserve electricity.
- c. **Understanding electronics.** Using an electronic device such as a mobile telephone or portable digital media player, find out how sound travels from one location to another. Explain how the device was designed for ease of use, function, and durability.
- d. **Using materials.** Do experiments to show the differences in strength and heat conductivity in wood, metal, and plastic. Discuss with your counselor what you have learned.
- e. **Converting energy.** Do an experiment to show how mechanical, heat, chemical, solar, and/or electrical energy may be converted from one or more types of energy to another. Explain your results. Describe to your counselor what energy is and how energy is converted and used in your surroundings.



9. Find out about three career opportunities in engineering. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Pick one and research the education, training, and experience required for this profession. \_\_\_\_\_

Career: \_\_\_\_\_

Education: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Training: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Experience: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Discuss this with your counselor, and explain why this profession might interest you. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

## 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. Partials have no expiration except the 18th birthday.