



# Model Design and Building

## 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 2004 • This workbook was updated in June 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 this **workbook** to: [Workbooks@USScouts.Org](mailto:Workbooks@USScouts.Org)  
Comments or suggestions for changes to the **requirements** for the **merit badge** should be sent to: [Merit.Badge@Scouting.Org](mailto:Merit.Badge@Scouting.Org)

1. Study and understand the requirements for personal safety when using such modelmaker hand tools as knives, handsaws, vises, files, hammers, screwdrivers, hand drills and drill bits, pliers, and portable power tools, and when to use proper protective equipment such as goggles when grinding or drilling.

Knives: \_\_\_\_\_  
\_\_\_\_\_

Handsaws: \_\_\_\_\_  
\_\_\_\_\_

Vises: \_\_\_\_\_  
\_\_\_\_\_

Files: \_\_\_\_\_  
\_\_\_\_\_

Hammers: \_\_\_\_\_  
\_\_\_\_\_

Screwdrivers: \_\_\_\_\_  
\_\_\_\_\_

Hand drills and drill bits: \_\_\_\_\_  
\_\_\_\_\_

Pliers, \_\_\_\_\_  
\_\_\_\_\_

Portable power tools: \_\_\_\_\_  
\_\_\_\_\_

When to use proper protective equipment such as goggles when grinding or drilling: \_\_\_\_\_  
\_\_\_\_\_

Know what precautions to take when using flammable or hazardous products such as glue, epoxy, paint, and thinners.\_\_\_\_  
\_\_\_\_\_

Discuss these with your counselor before you begin your modelmaking project and tell why they are important. \_\_\_\_\_

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

2. Explain the uses for each of the following types of models: architectural, structural, process, mechanical, and industrial.

Architectural: \_\_\_\_\_

Structural: \_\_\_\_\_

Process: \_\_\_\_\_

Mechanical: \_\_\_\_\_

Industrial: \_\_\_\_\_

Do research into the different types of materials that could be used in making these models. \_\_\_\_\_

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

3. With your counselor's advice, select a subject from requirement 4 for your model project (no kits).

Subject: \_\_\_\_\_

Prepare the necessary plans to the proper scale.

Make a list of materials and a list of the required tools.

Materials:

<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____

Tools:

<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____

This model should be your own original work.

Tell why you selected this subject. \_\_\_\_\_

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

4. Do ONE of the following:

- a. Make an architectural model. Build a model of a house to a scale of 1/4" = 10" (50:1 metric). Discuss with your counselor the materials you intend to use, the amount of detail required, outside treatment (finish, shrubbery, walks, etc.), and color selections. After completing the model, present it to your counselor for approval.
- b. Build a structural model. Construct a model showing corner construction of a wood-frame building to a scale of 1 1/2" = 10" (8:1 metric). All structures shown must be to scale. Cardboard or flat sheet wood stock may be used for sheeting or flooring on the model. Review with your counselor the problems you encountered in gathering the materials and supporting the structure. Be able to name the parts of the floor and wall frames, such as intermediate girder, joist, bridging, subfloor, sill, sole plate, stud, and rafter.
- c. Make a process model. Build a model showing the plumbing system in your house. Show hot and cold water supply, all waste returns, and venting to a scale of 3/4" = 10" (15:1 metric). Talk to your counselor about how to begin this model, and present the scale and the materials you will use. After completion, present the model to your counselor, and be prepared to discuss any problems you had building this model.
- d. Complete a mechanical model. Build a model of a mechanical device that uses at least two of the six simple machines. After completing the model, present it to your counselor. Be prepared to discuss materials used, the machine's function, and any particular difficulty you might have encountered.
- e. Make an industrial model. Build a model of an actual passenger-carrying vehicle to a scale of 1" = 10" or 1/2" = 10" (10:1 or 25:1 metric). Take the dimensions of the vehicle and record the important dimensions. Draw the top, front, rear, and sides of the vehicle to scale. From your plans, build a model of the vehicle and finish it in a craftsmanlike manner. Discuss with your counselor the most difficult part of completing the model.

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

- 5. Build a special-effects model of a fantasy spacecraft that might appear in a Hollywood science-fiction movie. Determine an appropriate scale for your design - one that makes practical sense. Include a cockpit or control area, living space, storage unit, engineering spaces, and propulsion systems. As you plan and build your model, do the following:
  - a. Study aircraft, submarines, and naval ships for design ideas.
  - b. Arrange and assemble the parts.
  - c. Sketch your completed model.

- d. Write a short essay in which you discuss your design, scale, and materials choices. Describe how you engineered your model and discuss any difficulties you encountered and what you learned. \_\_\_\_\_

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- 6. List at least six occupations in which modelmaking is used and discuss with your counselor some career opportunities in this field.

Occupations	Career Opportunities
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

**Requirement resources can be found here:**  
[http://www.meritbadge.org/wiki/index.php/Model\\_Design\\_and\\_Building#Requirement\\_resources](http://www.meritbadge.org/wiki/index.php/Model_Design_and_Building#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.