



Model Design and Building

Scouts BSA · Hobbies

Name

Started

Completed

Models help people test ideas before building the real thing, from bridges to buildings to movie spaceships. You'll plan, design, and build a model of your own. It's a great way to mix creativity with careful planning.

Requirements

Every official requirement, in plain language. Check the official wording when you sign off (scouting.org/merit-badges/model-design-and-building/). Tips and examples are ideas, not extra requirements.

- ☐ **1** Before starting your project, discuss all safety procedures with your counselor for both traditional and computer-assisted design and building, and explain why each one matters
- Tip:** Learn to use hobby knives, glue, and paint safely. Cut away from your body and work in a ventilated space.
- Example:** Show your workspace: a cutting mat, a sharp hobby knife with a cap, cutting away from your fingers, glue and paint used near an open window, and safety glasses when sanding or cutting plastic.

- ☐ **1a** Explain how to stay safe with modelmaking hand tools and when to use protective equipment

- ☐ **1b** Explain good digital safety habits when using design software and digital fabrication tools

- ☐ **1c** Explain the precautions to take with flammable or hazardous materials

2 Types of models and materials

Tips for this section: Look at different kinds of models in a hobby shop, museum, or online and notice what each one is used for.

Example for this section: Compare model types: an architectural model shows what a building will look like, a structural model tests how a bridge carries weight, a process model shows how something like a water plant works, and a mechanical model shows moving parts.

- ☐ **2a** Explain what architectural, structural, process, mechanical, and industrial models are used for

- ☐ **2b** Explain to your counselor how traditional or computer design tools (or both) help create plans, simulate function, visualize models, and help build or fabricate parts

- ☐ **2c** Describe for your counselor the traditional and modern materials and ways of fabricating these models, both physical and digital

- ☐ **3** With your counselor's advice, pick one of the requirement 4 model types as your subject. It must be your own original design, not a kit

Tip: Bring sketches and a list of materials to your counselor so you can agree on a plan before you build.

Example: Bring your counselor a plan: what you'll build, the scale (like 1 inch equals 1 foot), a sketch from the top and side, a materials list, and a timeline. Agree on it before you cut anything.

- ☐ **3a** Draw the plans you need at the correct scale

- ☐ **3b** List the materials

- ☐ **3c** List the tools you'll need

- ☐ **3d** Explain why you chose this subject (the model must be your own original work)

- ☐ **3e** Discuss with your counselor whether you'll use computer design tools on the project

- ☐ **4** Build ONE model below, by hand and/or with computer design. Before you start, discuss your approach with your counselor, including any CAD or 3D modeling software, and present your plans and finished model to your counselor (choose 1 of 5 below)

Tip: Pick something you care about, like a house you'd love to design or a gadget built from simple machines, and measure carefully as you build.

Example: An architectural model of a house at 1/4 inch to 1 foot: draw the floor plan and elevations, cut foam board walls with door and window openings, add the roof, and finish the outside with walks and shrubs. It shows whether your design works before anyone builds it.

- ☐ **4a** Architectural: design and build a house model at 1:48 (1/4 in. = 1 ft). Start with floor plans and elevations, and include doors, windows, and structural parts. Discuss with your counselor your materials, level of detail, exterior treatment (finish, shrubs, walks), and colors. You may 3D print or laser-cut parts from your computer design. Present your design and finished model to your counselor

- ☐ **4b** Structural: build a 1:8 (1 1/2 in. = 1 ft) model of a wood-frame building corner. First lay out the floor and wall frame parts, such as intermediate girder, joists, bridging, subfloor, sill, sole plate, studs, and rafters, then build from it in cardboard, foam board, or wood. Review the parts with your counselor and discuss challenges in design, building, materials, and support

- ☐ **4c** Process: plan a model of your home's plumbing at 1:16 (3/4 in. = 1 ft) or a scale you agree on, showing hot and cold supply, all drains, and vents. Talk with your counselor about how to start, the scale, and your materials, then build it from tubing, straws, printed parts, or similar. Present it to your counselor and be ready to discuss any problems

- ☐ **4d** Mechanical: build a working model of a device that uses two or more of the six simple machines. You may design and simulate it digitally first. After your counselor approves the design, build it from wood, plastic, 3D-printed parts, or similar. Present it and be ready to discuss the materials, how the machine works, and the challenges you faced

- ☐ **4e** Industrial: build a model of a real passenger vehicle at 1:12 or 1:24 (1 in. or 1/2 in. = 1 ft). Measure the real vehicle and draw or digitally model it from the top, front, rear, and sides. From those plans, build a physical model or produce it by digital rendering or 3D printing. Discuss with your counselor which parts were hardest

- ☐ **5** Design and build a fantasy spacecraft model fit for a sci-fi movie, using traditional and/or computer methods at a sensible scale you choose

Tip: Have fun with this one. Use everyday materials like bottle caps and old toy parts to make your spacecraft look detailed.

Example: For a fantasy spacecraft, start with a plastic bottle body, add wings from cardboard, and cover it with details called greebles, like bottle caps, game pieces, and bits of old toys. Paint it gray, then add weathering with a dry brush.

- ☐ **5a** Study real aircraft, submarines, and naval ships for design ideas

- ☐ **5b** Design the separate components, such as the cockpit, living quarters, engines, and storage

- ☐ **5c** Make a final sketch or rendering of the whole model from several angles

- ☐ **5d** Discuss with your counselor your design process, scale choice, materials (physical or digital), how you engineered the model, the difficulties you hit, and what you learned

- ☐ **6** Research one career related to model design: training and education, costs, job outlook, pay, duties, and advancement. With a parent's or guardian's OK you may search online or at a library, interview a pro, or visit a workplace. Discuss your findings with your counselor and what makes the career appealing

Tip: Ask an architect, engineer, or model maker how they use models in their job.

Example: Ask how models are used at work: an architect who builds foam models for clients, an engineer who 3D prints test parts, or a model maker who builds miniature sets for movies and museums.