



# Composite Materials

## 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 2006 • 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)

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1. Do the following:

- a. Explain the precautions that must be taken when handling, storing, and disposing of resins, reinforcements, and other materials used in composites. Include in your discussion the importance of health, safety, and environmental responsibility and awareness. \_\_\_\_\_

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- b. Describe what a material safety data sheet (MSDS) is and tell why it is used. \_\_\_\_\_

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2. Do the following:

- a. Explain what are composite materials. \_\_\_\_\_

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Include a brief history of composites and how they have developed. \_\_\_\_\_

- b. Compare the similarities and differences between composites and wood, aluminum, copper, and steel. Explain the physical, electrical, mechanical, corrosive, flammability, cost, and other such properties. For each of these raw materials, give one example for how it can be shaped and used for a specific application.

**Composites**

Physical properties: \_\_\_\_\_  
Electrical properties: \_\_\_\_\_  
Mechanical properties: \_\_\_\_\_  
Corrosive properties: \_\_\_\_\_  
Flammability: \_\_\_\_\_  
Cost: \_\_\_\_\_  
Other properties. \_\_\_\_\_  
How can it be shaped and used for a specific application. \_\_\_\_\_  
\_\_\_\_\_

**Wood**

Physical properties: \_\_\_\_\_  
Electrical properties: \_\_\_\_\_  
Mechanical properties: \_\_\_\_\_  
Corrosive properties: \_\_\_\_\_  
Flammability: \_\_\_\_\_  
Cost: \_\_\_\_\_  
Other properties. \_\_\_\_\_  
How can it be shaped and used for a specific application. \_\_\_\_\_  
\_\_\_\_\_

**Aluminum**

Physical properties: \_\_\_\_\_  
Electrical properties: \_\_\_\_\_  
Mechanical properties: \_\_\_\_\_  
Corrosive properties: \_\_\_\_\_  
Flammability: \_\_\_\_\_  
Cost: \_\_\_\_\_  
Other properties. \_\_\_\_\_  
How can it be shaped and used for a specific application. \_\_\_\_\_  
\_\_\_\_\_

**Copper**

Physical properties: \_\_\_\_\_

Electrical properties: \_\_\_\_\_

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

Corrosive properties: \_\_\_\_\_

Flammability: \_\_\_\_\_

Cost: \_\_\_\_\_

Other properties. \_\_\_\_\_

How can it be shaped and used for a specific application. \_\_\_\_\_

\_\_\_\_\_

**Steel**

Physical properties: \_\_\_\_\_

Electrical properties: \_\_\_\_\_

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

Corrosive properties: \_\_\_\_\_

Flammability: \_\_\_\_\_

Cost: \_\_\_\_\_

Other properties. \_\_\_\_\_

How can it be shaped and used for a specific application. \_\_\_\_\_

\_\_\_\_\_

3. Describe how composite materials are made. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Then do the following:

- a. Discuss three different composite reinforcement materials, their positive and negative characteristics, and their uses. Obtain the MSDS for each one and discuss the toxicity, disposal, and safe-handling sections for these materials.

**Composite Reinforcement Material 1:** \_\_\_\_\_

Positive Characteristics \_\_\_\_\_

Negative Characteristics \_\_\_\_\_

Uses. \_\_\_\_\_

Toxicity \_\_\_\_\_

Disposal \_\_\_\_\_

Safe-Handling \_\_\_\_\_

**Composite Reinforcement Material 2:** \_\_\_\_\_

Positive Characteristics \_\_\_\_\_

Negative Characteristics \_\_\_\_\_

Uses. \_\_\_\_\_

Toxicity \_\_\_\_\_

Disposal \_\_\_\_\_

Safe-Handling \_\_\_\_\_

**Composite Reinforcement Material 3:** \_\_\_\_\_

Positive Characteristics \_\_\_\_\_

Negative Characteristics \_\_\_\_\_

Uses. \_\_\_\_\_

Toxicity \_\_\_\_\_

Disposal \_\_\_\_\_

Safe-Handling \_\_\_\_\_

- b. Discuss three different resins used in composites, their positive and negative characteristics, and their uses. Obtain the MSDS for each one and discuss the toxicity, disposal, and safe-handling sections for these materials. Include thermoset resins and thermoplastic resins in your discussion.
- c. For each of the three resins you chose for requirement 3b, think of a new application that might be worth developing.

**Resin 1:** \_\_\_\_\_

Positive Characteristics \_\_\_\_\_

Negative Characteristics \_\_\_\_\_

Uses. \_\_\_\_\_

Toxicity \_\_\_\_\_

Disposal \_\_\_\_\_

Safe-Handling \_\_\_\_\_

New Application \_\_\_\_\_

**Resin 2:** \_\_\_\_\_

Positive Characteristics \_\_\_\_\_

Negative Characteristics \_\_\_\_\_

Uses. \_\_\_\_\_

Toxicity \_\_\_\_\_

Disposal \_\_\_\_\_

Safe-Handling \_\_\_\_\_

New Application \_\_\_\_\_

**Resin 3:** \_\_\_\_\_

Positive Characteristics \_\_\_\_\_

Negative Characteristics \_\_\_\_\_

Uses. \_\_\_\_\_

Toxicity \_\_\_\_\_

Disposal \_\_\_\_\_

Safe-Handling \_\_\_\_\_

New Application \_\_\_\_\_

4. With your parent's permission and your counselor's approval do ONE of the following:

- a. Visit a company that manufactures or repairs products made with composites. Discuss what you learn with your counselor. \_\_\_\_\_

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- b. Find three composites-related Web sites. Share and discuss what you learn with your counselor.

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5. Do the following:

- a. Use composite materials to complete two projects, at least one of which must come from the Composite Materials merit badge pamphlet. The second project may come from the pamphlet OR may be one you select on your own that has been approved by your counselor in advance.

Project 1 \_\_\_\_\_

Project 2 \_\_\_\_\_

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- b. With your counselor's assistance, find an appropriate site where the projects can be safely completed under your counselor's supervision and/or the supervision of an adult approved by your counselor who is knowledgeable about composites.

- c. With your counselor, determine how the finished projects will be evaluated. Using those guidelines, evaluate the completed projects with your counselor. \_\_\_\_\_

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6. Find out about three career opportunities in composite materials.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

Pick one and find out 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/Composite\\_Materials#Requirement\\_resources](http://www.meritbadge.org/wiki/index.php/Composite_Materials#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.--