



# Automotive Maintenance

## Merit Badge Workbook



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

This Workbook can help you organize your thoughts as you prepare to meet with your merit badge counselor.

You still must satisfy your counselor that you can demonstrate each skill and have learned the information.

You should use the work space provided for each requirement to keep track of which requirements have been completed, and to make notes for discussing the item with your counselor, not for providing full and complete answers.

If a requirement says that you must take an action using words such as "discuss", "show", "tell", "explain", "demonstrate", "identify", etc, that is what you must do.

**Merit Badge Counselors may not require the use of this or any similar workbooks.**

No one may add or subtract from the official requirements found in Boy Scout Requirements (Pub. 33216 – SKU 621535).

The requirements were last issued or revised in 2013 • This workbook was updated in September 2016.

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)

**You will need access to a car or truck and its owner's manual to meet some requirements for this merit badge.**

1. Do the following:
  - a. Explain to your counselor the hazards you are most likely to encounter during automotive maintenance activities, and what you should do to anticipate, help prevent, mitigate, or lessen these hazards.


- b. Discuss with your counselor the safety equipment, tools, and clothing used while checking or repairing a motor vehicle. \_  
Safety equipment: \_\_\_\_\_


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Tools:


Clothing:


Use this equipment, tools, and/or clothing (when needed or called for) in meeting the requirements for this merit badge.

2. **General Maintenance, Safety, and Registration.** Do the following:

- a. Review the maintenance chart in the owner's manual. Explain the requirements and time limits.


- b. Demonstrate how to check the following:

- 1. Brake Fluid
- 2. Engine Oil
- 3. Coolant
- 4. Power steering fluid
- 5. Windshield washer fluid
- 6. Transmission fluid
- 7. Battery fluid (if possible) and condition of the battery terminals

- c. Locate the fuse boxes; determine the size of fuses.
  - Demonstrate the proper replacement of burned-out fuses.
- d. Demonstrate how to check the condition and tension of belts and hoses.
- e. Check the lighting in the vehicle, including instrument, warning, and exterior bulbs.
- f. Locate and check the air filter.

- g. Explain the purpose, importance, and limitations of safety belts and passive restraints.

Purpose:


Importance:


Limitations:


- h. Find out the requirements for the state inspection in your state, including how often a vehicle needs to be inspected.


- i. Explain the importance of registering a vehicle and find out the annual registration fee for renewing your family car's registration.


3. **Dashboard.** Do the following:

- a. Explain the function of the fuel gauge, speedometer, tachometer, oil pressure, and engine temperature gauge.

Fuel gauge:


Speedometer:


Tachometer:


Oil pressure:


Engine temperature gauge:


Point out each one on the instrument cluster.

b. Explain the symbols that light up on the dashboard and the difference between the yellow and red symbols.


Explain each of the indicators on the dashboard, using the owner's manual, if necessary.


4. **Tires.** Do the following:

- a. Explain the difference between tire manufacturer's and vehicle manufacturer's specifications and show where to find them.


- b.  Demonstrate how to check pressure and properly inflate a tire.
- Check the spare tire and make sure it is ready for use.
- c. Explain why wheel alignment is important to the life of a tire.


Explain camber, caster, and toe-in adjustments on wheel alignment.

Camber:	
Caster:	
Toe-in:	

- d. Explain the purpose of the lateral-wear bar indicator.


- e. Explain how to dispose of old tires in accordance with local laws and regulations.


5. **Engine.** Do the following:

- a. Explain how an internal combustion engine operates.


Tell the differences between gasoline and diesel engines.


Explain how a gasoline-electric hybrid vehicle is powered.


- b. Explain the purpose of engine oil.




Disposal:


7. **Fuel system.** Do the following:

- a. Explain how the air and fuel systems work together and why it is necessary to have an air filter and fuel filter.

How the air and fuel systems work together


Why it is necessary to have an air filter:

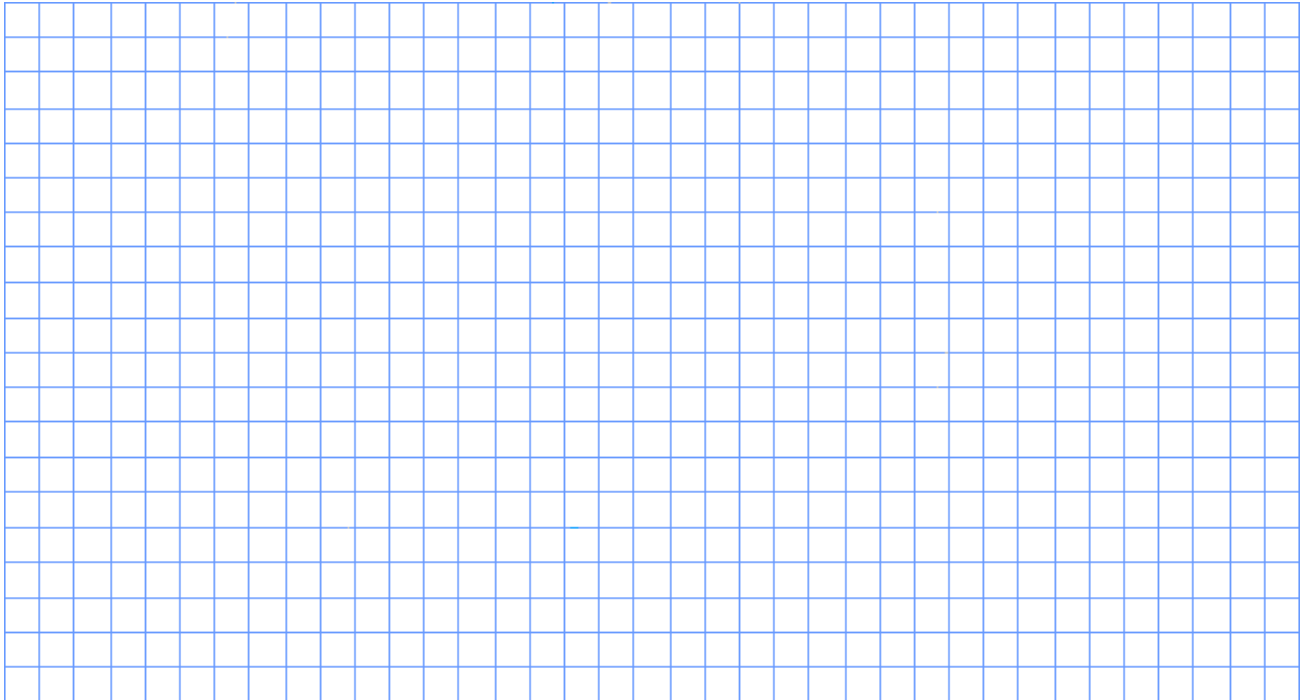

Why it is necessary to have a fuel filter.


- b. Explain how a how a fuel injection system works and how an on-board computer works with the fuel injection system.




8. **Ignition and electrical systems.** Do the following:

a. Diagram and explain the parts of the electrical system.



A rectangular box containing ten horizontal lines for writing an explanation of the electrical system parts.

b. Explain the cylinder engine sequence.

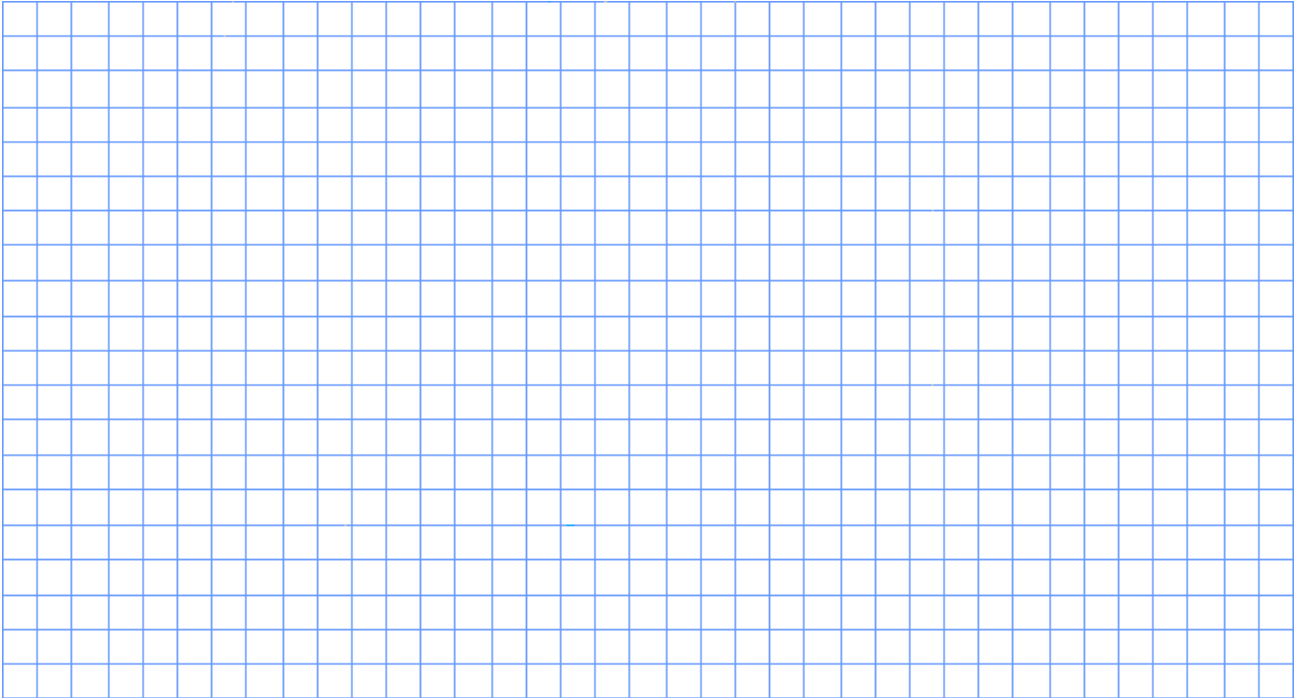
A rectangular box containing five horizontal lines for writing an explanation of the cylinder engine sequence.

- c. Explain the purpose of the spark gap.


- d.  Demonstrate how to safely connect jumper cables to your car battery.

9. **Drive Train.** Do the following:

- a. Diagram the drive train and explain the different parts.




b. Explain the difference between automatic and standard transmissions.

Automatic


Standard


c. Explain the types of automatic transmission fluid.


d. Explain the types of lubricants used in a standard transmission and in the differential.

Transmission:


Differential:


e. Explain the difference between front-wheel, rear-wheel, and four-wheel drive.

Front-wheel drive


Rear-wheel drive


Four-wheel drive


10. **Brake System.** Do the following:

- a. Explain the brake system (including anti-lock systems) and how it operates.


- b. Explain the differences between disc and drum systems.

Disc


Drum


- c.  Demonstrate how to check the condition of a vehicle's brake system.

After checking make recommendations for repairs (if necessary).


11. Do TWO of the following:

- a. Determine the value of three different vehicles you are interested in purchasing. One must be new and one must be used; the third vehicle can be new or used. For each vehicle, find out the requirements and cost of automobile insurance to include basic liability and options for collision, comprehensive, towing, and rental car. Using the three vehicles you chose and with your merit badge counselor's assistance, complete the operation/maintenance chart provided in the merit badge pamphlet. Use this information to determine the operating cost per mile for each vehicle, and discuss what you learn with your counselor.

New vehicle:	
Value:	
Cost of automobile insurance:	
Operating cost per mile:	
Used vehicle:	
Value:	
Cost of automobile insurance:	
Operating cost per mile:	
Third vehicle:	
Value:	
Cost of automobile insurance:	
Operating cost per mile:	
What you learned	

- b. Choose a car cleaner and wax product for a vehicle you want to clean.

Cleaner:	
Wax:	

Explain clear-coat paint and the precautions necessary for care.


- Clean the vehicle, both inside and out, and wax the exterior.

Use a vinyl and rubber protectant (on vinyl tops, rubber door seals, sidewalls, etc.) and explain the importance of the protectant.


- Use a vinyl and rubber protectant

Explain the importance of the protectant.


- c. Locate the manufacturer's jack Use the jack to demonstrate how to engage the jack correctly on the vehicle, then change a tire correctly.

- d. Perform an oil filter and oil change on a vehicle.

Explain how to properly dispose of the used oil and filter.


12. Find out about three career opportunities in the automotive industry.

1. 
2. 
3. 

Pick one and find out about 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/Automotive Maintenance#Requirement resources](http://www.meritbadge.org/wiki/index.php/Automotive_Maintenance#Requirement_resources)

### Operation Maintenance Chart

The Auto Maintenance Merit Badge Pamphlet is missing the required Operation Maintenance Chart! Here is a sample chart that you might consider using until the BSA chart is published. The following is based on the interactive true cost of ownership calculator at Edmunds.com: <http://www.edmunds.com/apps/cto/CTOIntroController>

<b>New Vehicle</b>	Monthly costs	Calculations for: Year: _____ Make/Model: _____
Total Purchase Price	\$	Including taxes, dealer fees, etc.
Financing (Payment)	\$	Assuming 3% of Price: <b>Price</b> X 0.03 (financing rates and terms vary greatly)
Depreciation	\$	Assuming 1% of Price: <b>Price</b> X 0.01 (new vehicles depreciate more)
Insurance	\$	A young male might average \$150 for a new car with comprehensive & collision
Tax & Fees	\$	Annual license and registration, fees, etc. ÷ 12 (typically near \$10/month)
Gas	\$	=\$/gallon ÷ Miles/gallon X _____ Miles/month (1,000 miles/month is average)
Maintenance/Repairs	\$	Batteries, brakes, hoses, exhaust system, tires, engine, etc (\$100/month?)
Total	\$	= Financing + Depreciation + Insurance + Taxes + Gas + Maintenance
÷ Monthly Miles	÷	miles Use same assumption as for gas. 1,000 miles/month is average.
= Cost per mile	=	The IRS assumes 56 cents/mile in 2013.

<b>Used Vehicle</b>	Monthly costs	Calculations for: Year: _____ Make/Model: _____
Total Purchase Price	\$	Including taxes, dealer fees, etc.
Financing (Payment)	\$	Assuming 3% of Price: <b>Price</b> X 0.03 (financing rates and terms vary greatly)
Depreciation	\$	Assuming 1% of Price: <b>Price</b> X 0.01 (new vehicles depreciate more)
Insurance	\$	A young male might average \$150 for a new car with comprehensive & collision
Tax & Fees	\$	Annual license and registration, fees, etc. ÷ 12 (typically near \$10/month)
Gas	\$	=\$/gallon ÷ Miles/gallon X _____ Miles/month (1,000 miles/month is average)
Maintenance/Repairs	\$	Batteries, brakes, hoses, exhaust system, tires, engine, etc (\$100/month?)
Total	\$	= Financing + Depreciation + Insurance + Taxes + Gas + Maintenance
÷ Monthly Miles	÷	miles Use same assumption as for gas. 1,000 miles/month is average.
= Cost per mile	=	The IRS assumes 56 cents/mile in 2013.

<b>Third Vehicle</b>	Monthly costs	Calculations for: Year: _____ Make/Model: _____
Total Purchase Price	\$	Including taxes, dealer fees, etc.
Financing (Payment)	\$	Assuming 3% of Price: <b>Price</b> X 0.03 (financing rates and terms vary greatly)
Depreciation	\$	Assuming 1% of Price: <b>Price</b> X 0.01 (new vehicles depreciate more)
Insurance	\$	A young male might average \$150 for a new car with comprehensive & collision
Tax & Fees	\$	Annual license and registration, fees, etc. ÷ 12 (typically near \$10/month)
Gas	\$	=\$/gallon ÷ Miles/gallon X _____ Miles/month (1,000 miles/month is avg.)
Maintenance/Repairs	\$	Batteries, brakes, hoses, exhaust system, tires, engine, etc (\$100/month?)
Total	\$	= Financing + Depreciation + Insurance + Taxes + Gas + Maintenance
÷ Monthly Miles	÷	miles Use same assumption as for gas. 1,000 miles/month is average.
= Cost per mile	=	The IRS assumes 56 cents/mile in 2013.



## **Important excerpts from the Guide To Advancement - 2015, No. 33088 (SKU-620573)**

### **[1.0.0.0] — Introduction**

The current edition of the *Guide to Advancement* is the official source for administering advancement in all Boy Scouts of America programs: Cub Scouting, Boy Scouting, Varsity Scouting, Venturing, and Sea Scouts. It replaces any previous BSA advancement manuals and previous editions of the *Guide to Advancement*.

### **[Page 2, and 5.0.1.4] — Policy on 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 special needs. For details see section 10, "Advancement for Members With Special Needs".

### **[Page 2] — 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.

### **[7.0.3.1] — The Buddy System and Certifying Completion**

A youth member must not meet one-on-one with an adult. 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. If merit badge counseling or instruction includes any Web-based interaction, it must be conducted in accordance with the BSA Social Media Guidelines (<http://www.scouting.org/Marketing/Resources/SocialMedia>). For example, always copy one or more authorized adults on email messages between counselors and Scouts.

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 verification. 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.

Note that from time to time, it may be appropriate for a requirement that has been met for one badge to also count for another. See "Fulfilling More Than One Requirement With a Single Activity," 4.2.3.6.

### **[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, fairs, clinics, 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.

It is sometimes reported that Scouts who have received merit badges through group instructional settings have not fulfilled all the requirements. To offer a quality merit badge program, council and district advancement committees should ensure the following are in place for all group instructional events.

- A culture is established for merit badge group instructional events that partial completions are acceptable expected results.
- A guide or information sheet is distributed in advance of events that promotes the acceptability of partials, explains how merit badges can be finished after events, lists merit badge prerequisites, and provides other helpful information that will establish realistic expectations for the number of merit badges that can be earned at an event.
- Merit badge counselors are known to be registered and approved.
- Any guest experts or guest speakers, or others assisting who are not registered and approved as merit badge counselors, do not accept the responsibilities of, or behave as, merit badge counselors, either at a group instructional event or at any other time. Their service is temporary, not ongoing.
- Counselors agree to sign off only requirements that Scouts have actually and personally completed.
- Counselors agree not to assume prerequisites have been completed without some level of evidence that the work has been done. Pictures and letters from other merit badge counselors or unit leaders are the best form of prerequisite documentation when the actual work done cannot be brought to the camp or site of the merit badge event.
- There is a mechanism for unit leaders or others to report concerns to a council advancement committee on summer camp merit badge programs, group instructional events, and any other merit badge counseling issues—especially in instances where it is believed BSA procedures are not followed. See "Reporting Merit Badge Counseling Concerns," 11.1.0.0.
- 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.

It is permissible for guest speakers, guest experts, or others who are not merit badge counselors to assist in the counseling process. Those providing such assistance must be under the direction of a registered and approved counselor who is readily available onsite, and provides personal supervision to assure all applicable BSA policies and procedures—including those related to BSA Youth Protection—are in place and followed.

### **[7.0.3.3] — Partial Completions**

A Scout need not pass all the requirements of one merit badge with the same counselor. It may be that due to timing or location issues, etc., he must meet with a different counselor to finish the badge. 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, the counselor does not retain his or her 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 unit leader 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 Scout's 18th birthday. Units, districts, or councils shall not establish other expiration dates for partial merit badges.

### **[7.0.4.8] — Unofficial Worksheets and Learning Aids**

Worksheets and other materials that may be of assistance in earning merit badges are available from a variety of places including unofficial sources on the Internet and even troop libraries. Use of these aids is permissible as long as the materials can be correlated with the current requirements that Scouts must fulfill. Completing "worksheets" may suffice where a requirement calls for something in writing, but this would not work for a requirement where the Scout must discuss, tell, show, or demonstrate, etc. Note that Scouts shall not be required to use these learning aids in order to complete a merit badge.