

MERIT BADGE SERIES



AUTOMOTIVE MAINTENANCE



BOY SCOUTS OF AMERICA®

STEM-Based

BOY SCOUTS OF AMERICA
MERIT BADGE SERIES

AUTOMOTIVE MAINTENANCE



"Enhancing our youths' competitive edge through merit badges"



BOY SCOUTS OF AMERICA®



Automotive Maintenance

You will need access to a car or truck and its owner's manual to meet some requirements for this merit badge. If you do not have your own vehicle, you should work with your merit badge counselor or other trusted adult to obtain access to a vehicle and the owner's manual for that vehicle.

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

- (c) Locate the fuse boxes; determine the type and 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 vehicle for proper operation of its lights, including the interior overhead lights, instrument lights, warning lights, and exterior bulbs.
 - (f) Locate and check the air filter(s).
 - (g) Explain the purpose, importance, and limitations of safety belts and passive restraints.
 - (h) Find out the requirements for your state's emissions and safety inspections (as applicable), 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. Point each one out 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 tire 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 caster, camber, and toe-in adjustments on wheel alignment.
 - (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) Discuss the purpose of engine oil. Explain the API service code, the SAE number, and the viscosity rating.
 - (c) Explain where to find the recommended oil type and the amount of oil to be used in the vehicle engine.
6. **Cooling System.** Do the following:
- (a) Explain the need for coolant in the cooling system, and the importance of selecting the correct coolant type for a given vehicle.
 - (b) Explain how to flush and change the engine coolant in the vehicle, and how to properly dispose of the used coolant.

7. **Fuel System.** Do the following:
- Explain how the air and fuel systems work together and why it is necessary to have an air filter and fuel filter.
 - Explain how a fuel injection system works and how an onboard computer works with the fuel injection system.
8. **Ignition and Electrical Systems.** Do the following:
- Diagram and explain the parts of the electrical system.
 - Explain the engine's firing order.
 - Explain the purpose of the spark gap.
 - Demonstrate how to safely connect jumper cables to your car battery.
9. **Drive Train.** Do the following:
- Diagram the drive train and explain the different parts.
 - Explain the difference between automatic and standard transmissions.
 - Explain the types of automatic transmission fluid.
 - Explain the types of lubricants used in a standard transmission, and in the differential and transfer case.
 - Explain the difference between front-wheel, rear-wheel, and four-wheel drive.
10. **Brake System.** Do the following:
- Explain the brake system (including antilock systems) and how it operates.
 - Explain the differences between disc and drum systems.
 - 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:
- 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.
 - Choose a car cleaner and wax product for a vehicle you want to clean. 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 this protectant.
 - Locate the manufacturer's jack. Use the jack to demonstrate how to engage the jack correctly on the vehicle, then change a tire correctly.
 - 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. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Automotive Maintenance Resources

Scouting Literature

Aviation, Electronics, Engineering, Inventing, Model Design and Building, Space Exploration, Traffic Safety, Truck Transportation, and Welding merit badge pamphlets

For more information about or to order Scouting-related resources, see <http://www.scoutstuff.org> (with your parent's permission).

Books

Editors of Popular Mechanics. *Popular Mechanics Complete Car Care Manual*, Hearst, 2005.

Florence, Mike, and Rob Blumer. *The Everything Car Care Book: How to Maintain Your Car and Keep It Running Smoothly*. Adams Media, 2002.

Dinkel, John. *Road & Track Illustrated Automotive Dictionary*. Bentley, 2000.

Jackson, Mary. *Car Smarts: An Easy-to-Use Guide to Understanding Your Car and Communicating With Your Mechanic*. Avalon Travel Publishing, 1998.

Kennedy, Michael. *Career Opportunities in the Automotive Industry*. Facts on File, 2005.

Krebs, Michelle. *Careers Without College: Cars*. Peterson's, 1999.

Newton, Tom. *How Cars Work*. Black Apple Press, 1999.

Ramsey, Dan. *The Complete Idiot's Guide to Car Care and Repair*. Alpha Books, 2003.

Sclar, Deanna. *Auto Repair for Dummies*. IDG Books Worldwide, 2008.

Weber, Robert M. *Opportunities in Automotive Service Careers*. McGraw-Hill, 2001.

Organizations and Websites

Cars.com

Website: <http://www.cars.com>

Car Talk

Website: <http://www.cartalk.com>

Edmunds

Telephone: 855-893-7396

Website: <http://www.edmunds.com>

Insurance Institute for Highway Safety

Telephone: 703-247-1500

Website: <http://www.iihs.org>

Kelley Blue Book

Website: <http://www.kbb.com>

NADA Guides

Website: <http://www.nadaguides.com>

National Institute for Automotive Service Excellence

Website: <http://www.ase.com>

SaferCar.gov

Toll-free telephone: 888-327-4236

Website: <http://www.safercar.gov>

Acknowledgments

The Boy Scouts of America is extremely grateful to George Arrants, Automotive Youth Educational Systems Inc., for his assistance with this *Automotive Maintenance* merit badge pamphlet. The AYES partners with 14 auto manufacturers and with schools to encourage young people to consider a career in the automotive industry.

Thanks to the following for their assistance: Matt Bown, American Honda Motor Company; Charles Klasman, BMW of North America; Robert Slovey, General Motors Corporation; Joe Van Bodegon, Mercedes-Benz USA; Chris Mason, Raytheon Company; and Robin Ferguson, University of Missouri.

The BSA is grateful to the Birdville Independent School District and the BISD's Career and Technology

Department for allowing us to use their Shannon Center facility in Haltom City, Texas, for a photo shoot. In particular, thanks to Olin Harrington, an automotive technology instructor there, for his assistance with photography. We are also thankful for the generosity of BP Lubricants/Quaker State, which provided supplies for a photo shoot.

The BSA thanks Delmar Learning, a part of Cengage Learning Inc., for allowing us to use a number of their automotive-related illustrations in this pamphlet. In particular, a big thank-you to Dave Boelio for his facilitation.

The Boy Scouts of America is grateful to the men and women serving on the Merit Badge Maintenance Task Force for the improvements made in updating this pamphlet.

Photo and Illustration Credits

Chrysler LLC/Dodge, courtesy—page 59

HAAP Media Ltd., courtesy—pages 58 (*bottom*) and 82

Howstuffworks.com, courtesy—page 29

©Jupiterimages.com—cover (*windshield wiper, tire pressure gauge, air filter, tool box, spark plug*); pages 11 (*left, bottom*), 20 (*top*), 23 (*all except jack stands*), 30 (*top*), 42 (*top*), 45 (*both*), 48, 49 (*bottom*), 53, 58 (*top*), 64 (*all*), 70, 73 (*bottom*), 74 (*all*), 76, 78–79, 81, and 91–93 (*all*)

Library of Congress Prints and Photographs Division, courtesy—page 10

Mercedes-Benz USA, courtesy—page 69

NADAGuides.com, courtesy—page 88