Automotive Maintenance

Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet (book). No one can add or subtract from the Boy Scout Requirements #33216. Each Scout must do each requirement. Merit Badge Workbooks and more: Online Resources. Send comments to the workbook developer: craig@craiglincoln.com. Requirements revised: 2009, Workbook updated: May 2009.

Scout's Name: _____ Unit: _____

Counselor's Name: _____ Counselor's Ph #: _____

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

1. 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 _____
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. _____

_____

_____

_____

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. _____

_____

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. _____

_____

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. _____

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's engine. _____

6. Cooling system Do the following:

A. Explain the need for coolant in the cooling system. _____

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:

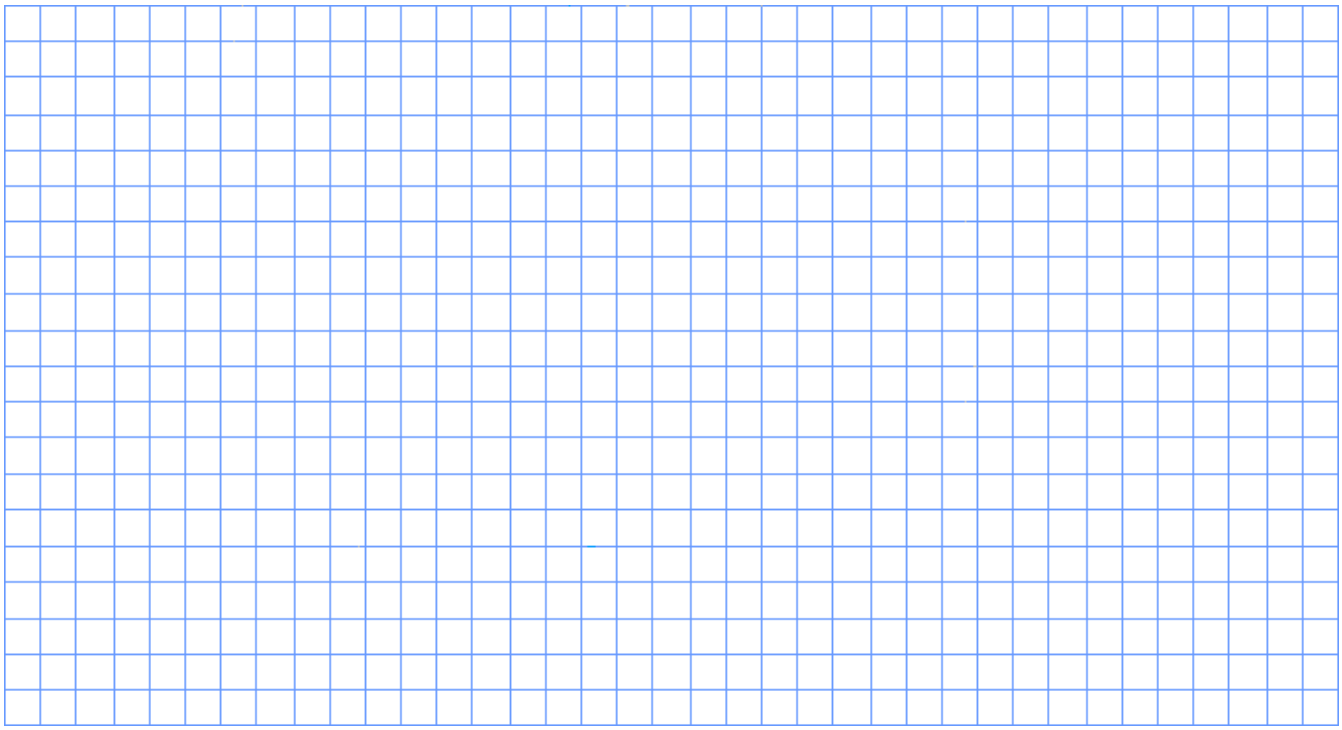
A. Explain how the air and fuel systems work together _____

and why it is necessary to have an air filter and 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. _____



B. Explain the cylinder engine sequence. _____

C. Explain the purpose of the spark gap. _____

D. Demonstrate how to change the spark plugs in any internal combustion engine (lawn mower, dirt bike, motorcycle). ___

E. 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. _____

_____

_____

C. Explain the types of automatic transmission fluid. _____

_____

_____

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

_____

_____

E. Explain the difference between front-wheel, _____

_____

_____

rear- wheel, _____

_____

_____

and 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. _____

_____

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.

One must be new _____

Cost of automobile insurance _____

Operating cost per mile _____

and one must be used; _____

Cost of automobile insurance _____

Operating cost per mile _____

the third vehicle can be new or used. _____

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. _____

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. _____

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. _____

Pick one _____

and find out about the education, training, and experience required for this profession. _____

Discuss this with your counselor, and explain why this profession might interest you. _____

Online Resources: *(Use any Internet resource with caution and only with your parent's or guardian's permission.)*

Boy Scouts of America: ► scouting.org ► Guide to Safe Scouting ► Age-Appropriate Guidelines ► Safe Swim Defense ► Scout ► Tenderfoot ► Second Class ► First Class Rank Videos ► Safety Afloat

Boy Scout Merit Badge Workbooks: usscouts.org -or- meritbadge.org **Merit Badge Books:** www.scoutstuff.org

Requirement Resources

These resources and much more are at: http://meritbadge.org/wiki/index.php/Automotive_Maintenance

1. Tools Necessary for Auto Repair – Safety
2.b.1. Video: How to Check Brake Fluid Levels
2.b.2. Video: Checking Car Motor Oil Level
2.b.3. Video: How to Check Engine Coolant Levels
2.b.4. Video: How to Check Power Steering Fluid Levels
2.b.5. Video: How to Check Windshield Washer Fluid Levels
2.b.6. Video: How to Check Transmission Fluid
2.b.7. Video: How to Check a Car Battery for Corrosion
2.c. Video: How to Replace Automotive Fuses
2.d. Video: Checking Car Drive Belts
2.e. Video: Check and Replace Lights
2.f. Video: How to Change a Car Air Filter
3. Dashboard Gauges
4.a. Video: How to Interpret Car Tire Ratings
4.b. Tire Pressure Tread Wear - Video: Checking Car Tire Pressure - Video: How to Put Air in a Tire
4.c. Video: How to Diagnose an Alignment Problem.
5. How Car Engines Work - Engine Diagram
6. How Car Cooling Systems Work - Cooling System Diagram
7. Fuel System Diagram
8. See the Automotive Maintenance Workbook for graph paper to make your diagrams.
Video: How Automobile Ignition Systems Work - Video: How to Change Spark Plugs - Video: How to Jump Start a Car
9. See the Automotive Maintenance Workbook for graph paper to make your diagrams.
Video: How Automatic Transmissions Work -
Video: How Manual Transmissions Work - Drive Train Diagram
10. Video: How Engine Brakes Work - Video: How to Inspect Car Brakes
ABS Brakes Diagram - Conventional Brakes Diagram - Difference between ABS and Conventional Brakes
11.a. See the Automotive Maintenance Workbook for the Operation Maintenance chart you need to calculate the cost of ownership of vehicles.
True cost of ownership calculator
11.b. Video: Car Detailing - Waxing - Video: Exterior Car Detail Tips
11.c. Video: How to Change a Car Tire
11.d. Video: How to Change Your Own Oil

General Resources:

http://autorepair.about.com/
http://autos.yahoo.com/maintain/repairqa/
http://www.ehow.com/information_1005-car-maintenance.html
http://www.doityourself.com/scat/automaintenanceandca

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

	Monthly costs	Calculations for: Year: _________ Make/Model: ________________________
Total Purchase Price	$	Including taxes, dealer fees, etc.
Financing (Payment)	$	Assuming 3% of Price: **Price** X 0.03 (financing rates and terms vary greatly)
Depreciation	$	Assuming 1% of Price: **Price** 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 58.5 cents/mile in 2008 though that estimate may be a low.

	Monthly costs	Calculations for: Year: _________ Make/Model: ________________________
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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 58.5 cents/mile in 2008 though that estimate may be a low.