



# AUTO MECHANICS

## Merit Badge Requirements

*\*NOTE: Access to an automobile or truck (with an owners manual) is needed to meet some of the 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 badge.
- 2) Explain how an internal combustion engine operates and the differences between gasoline and diesel engines.
- 3) Demonstrate your knowledge of general maintenance. Do the following:
  - A) Demonstrate how to check the fluid level of the following:
    - \* Brake fluid
    - \* Engine Oil
    - \* Coolant
    - \* Power steering fluid
    - \* Windshield washer fluid
    - \* Transmission fluid (automatic & standard)
  - B) Check battery fluid, if possible, and the condition of battery terminals.
  - C) Show the location of fuse boxes and the size of fuses, and demonstrate the proper replacement of burned-out fuses.
  - D) Review the maintenance chart in the owner's manual. Explain the requirements and time limits.
  - E)
    - 1) Choose a car cleaner and wax product for the vehicle. Explain clear-coat paint and the precautions necessary for care. Clean and wax the vehicle, both inside and out.
    - 2) Use a vinyl and rubber protectant (on vinyl tops, rubber door seals, sidewalls, etc.) and explain the importance of this protectant.
  - F) Demonstrate how to check the condition and tension of belts and hoses.
  - G) Demonstrate the following:
    - 1) Check the lighting in the vehicle, including instrument, warning, and exterior bulbs.
    - 2) Check headlight alignment.
  - H) Demonstrate how to check the vehicle exhaust system.
- 4) Demonstrate your knowledge of tires. Do the following:
  - A)
    - 1) Explain the difference between tire and vehicle manufacturer's information specifications and demonstrate where to find those specifications.
    - 2) Demonstrate how to check pressure and properly inflate a tire.
    - 3) Using the manufacturer's jack supplied with the vehicle:
      - \* Demonstrate how to engage the jack correctly on the vehicle.
      - \* Demonstrate how to change a tire correctly.
  - B)
    - 1) Explain the difference between bias-belted tires and radial-belted tires.
    - 2) Diagram and explain in writing how to rotate bias-belted and radial-belted tires.
    - 3) Using the manufacturer's guidelines, rotate the tires on the vehicle.
  - C)
    - 1) Explain the caster, camber, and toe-in adjustments on wheel alignment.
    - 2) Explain why wheel alignment is important to the life of a tire.
  - D) Explain the purpose of the lateral-wear bar indicator.
  - E) Explain how to dispose of old tires properly.
- 5) Demonstrate your knowledge of engine lubrication. Do the following:
  - A) Explain the purpose of motor oil.
  - B) Explain where to find the recommended type and amount of oil to be used in the vehicle engine.
  - C) Explain the difference in viscosity (10W/30 versus SAE 30).
  - D) Perform an oil change and oil filter change on the vehicle.
  - E) Explain how to dispose of the used oil and filter properly.
- 6) Cooling system. Do the following:
  - A) Explain the need for coolant in the cooling system.
  - B) Flush and change the engine coolant in the vehicle according to the manufacturer's instructions.
  - C) Explain how to dispose of used coolant properly.

*Requirements continued on next page*

- 7) Demonstrate your knowledge of a fuel system. Do the following:
- A) Explain how the air and fuel system work together.
  - B) Explain how a carburetor works and how a fuel-injection system works.
  - C) Explain how an on-board computer works with the fuel injection system. Show where the computer is located.
  - D) Explain why it is necessary to have an air filter and a fuel filter. Locate them and change them according to the manufacturer's recommendations.
  - E) Explain what fuel additives are, for both the carburetor and the fuel injection systems.
- 8) Demonstrate your knowledge of 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 spark plug gap and, if practical, change the spark plug. (Use an engine with spark plugs that can be reached without tilting the engine.)
  - D) Demonstrate how to connect jumper cables on your battery properly. Explain how to jump-start a vehicle.
  - E) Explain the difference between electronic and points ignition systems.
- 9) Demonstrate your knowledge of a 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.
  - F) Explain the gear ratio of the differential.
- 10) Demonstrate your knowledge of a 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 checking conditions of a vehicle brake system. After checking the brake system, make recommendations for repairs (if necessary).
- 11) Explain the purpose, importance, and limitations of passive restraints.

### Requirement 1

What kind of safety equipment is used while checking or repairing a motor vehicle? \_\_\_\_\_

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What kinds of tools are used while checking or repairing a motor vehicle? \_\_\_\_\_

\_\_\_\_\_

What kind of clothing is used/worn while checking or repairing a motor vehicle? \_\_\_\_\_

\_\_\_\_\_

\_\_\_ Use this equipment, tools, and clothing when completing the other requirements for this badge

### Requirement 2

Explain how an internal combustion engine operates: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

What are the differences between gasoline and diesel engines? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Requirement 3

Do the following with your counselor (or qualified adult) present. Have them initial each task when it has been properly completed.

Check the fluid level of the following:

\_\_\_ Brake Fluid

\_\_\_ Engine Oil

\_\_\_ Coolant

\_\_\_ Power steering Fluid

\_\_\_ Transmission Fluid

\_\_\_ Check the battery fluid, if possible, and the condition of battery terminals.

\_\_\_ Show the location of the fuse boxes and the size of the fuses.

\_\_\_ Demonstrate the proper replacement of burned-out fuses.

\_\_\_ After reviewing the maintenance requirements in the owners manual, use this area to explain the requirements and time limits: \_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Scout Name: \_\_\_\_\_ Unit #: \_\_\_\_\_ Date: \_\_\_\_\_

Choose a car cleaner and wax product for the vehicle. What did you choose? \_\_\_\_\_

Why? \_\_\_\_\_

Explain clear-coat paint and the precautions necessary for care: \_\_\_\_\_

\_\_\_ Clean and wax the vehicle, both inside and out.

\_\_\_ Use a vinyl and rubber protectant.

\_\_\_ Explain the importance of the vinyl and rubber protectant: \_\_\_\_\_

\_\_\_ Demonstrate how to check the condition and tension of belts and hoses.

\_\_\_ Check the lighting in the vehicle, including instrument, warning, and exterior bulbs.

\_\_\_ Check headlight alignment.

\_\_\_ Demonstrate how to check the vehicle exhaust system.

#### **Requirement 4**

Explain the difference between tire and vehicle manufacturer's information specifications: \_\_\_\_\_

Where do you find these specifications? \_\_\_\_\_

\_\_\_ Demonstrate how to check pressure and properly inflate a tire.

\_\_\_ Using the manufacturer's jack supplied with the vehicle, demonstrate how to engage the jack correctly on the vehicle.

\_\_\_ Using the manufacture's jack supplied with the vehicle, demonstrate how to change a tire correctly.

Explain the difference between bias-belted tires and radial-belted tires: \_\_\_\_\_

Using the space provided on the following page, diagram and explain in writing how to rotate bias-belted and radial-belted tires.



Bias-Belted



Radial-Belted

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\_\_\_ Using the manufacturer's guidelines, rotate the tires on the vehicle.

Explain the caster adjustment on wheel alignment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the camber adjustment on wheel alignment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the toe-in adjustment on wheel alignment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Why is wheel alignment important to the life of a tire? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What is the purpose of the lateral-wear bar indicator? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Scout Name: \_\_\_\_\_ Unit #: \_\_\_\_\_ Date: \_\_\_\_\_

Explain how to dispose of old tires properly: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### **Requirement 5**

What is the purpose of motor oil? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Where do you find the recommended type and amount of oil to be used in the vehicle engine? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the difference in viscosity (10W/30 versus SAE 30): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_ Perform an oil change and oil filter change on the vehicle.

How do you properly dispose of the used oil and filter? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### **Requirement 6**

Why do you need coolant in the cooling system? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_ Flush and change the engine coolant in the vehicle according to the manufacturer's instructions.

Explain how to dispose of used coolant properly: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### **Requirement 7**

Explain how the air and fuel system work together: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain how a carburetor works: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain how a fuel-injection system works: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Scout Name: \_\_\_\_\_ Unit #: \_\_\_\_\_ Date: \_\_\_\_\_

Explain how an on-board computer works: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_ Show where the on-board computer is located.

Explain why it is necessary to have an air filter: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain why it is necessary to have a fuel filter: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_ Locate the air filter and change it according to the manufacturer's recommendations.

\_\_\_ Locate the fuel filter and change it according to the manufacturer's recommendations.

Explain what fuel additives are for the carburetor: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain what fuel additives are for the fuel injection system: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### **Requirement 8**

Use the area below to diagram (draw & label) and explain the parts of the electrical system.

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\_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Scout Name: \_\_\_\_\_ Unit #: \_\_\_\_\_ Date: \_\_\_\_\_

Explain the cylinder engine sequence: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the spark plug gap: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_ If practical, change the spark plug.

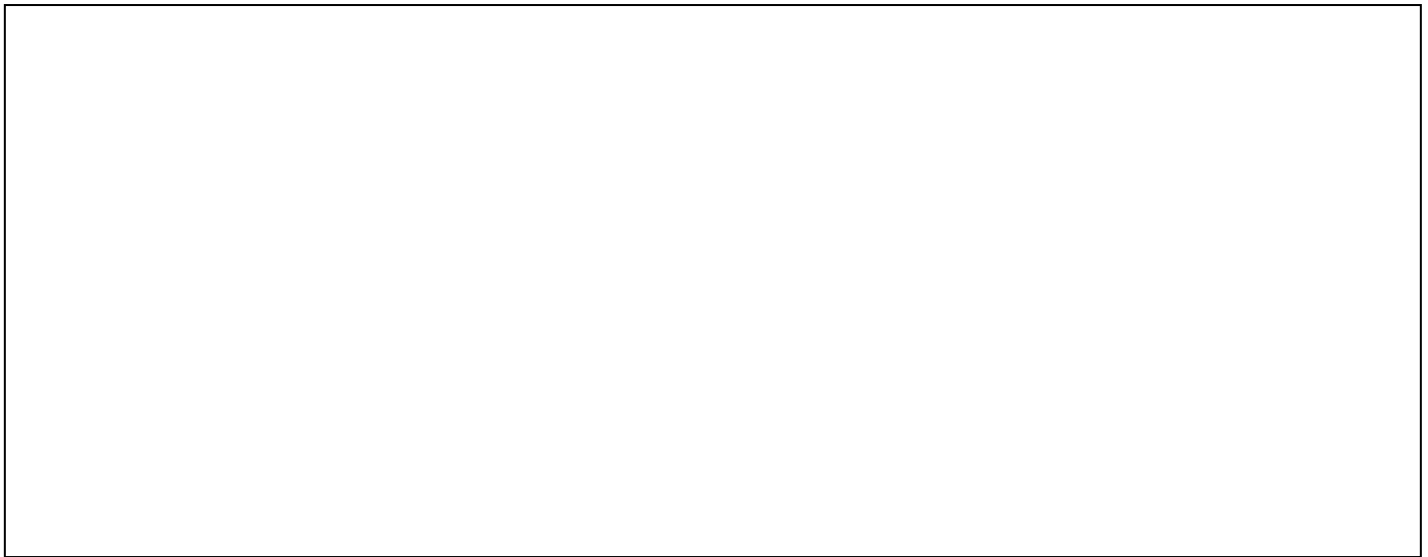
\_\_\_ Demonstrate how to connect jumper cables on your battery properly.

Explain how to jump-start a vehicle: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the difference between electronic and points ignition systems: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### **Requirement 9**

Use the area below to diagram (draw & label) and explain the drive train.



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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Scout Name: \_\_\_\_\_ Unit #: \_\_\_\_\_ Date: \_\_\_\_\_

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: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the difference between front-wheel, rear-wheel, and four-wheel drive: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the gear ratio of the differential: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Requirement 10**

Explain the brake system (including anti-lock systems) and how it operates: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain the difference between disc and drum systems: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_ Demonstrate checking conditions of a vehicle brake system.

After checking the brake system, make recommendations for repairs (if necessary): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Scout Name: \_\_\_\_\_ Unit #: \_\_\_\_\_ Date: \_\_\_\_\_

## Requirement 11

Explain the purpose of passive restraints: \_\_\_\_\_

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Explain the importance of passive restraints: \_\_\_\_\_

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Explain the limitations of passive restraints: \_\_\_\_\_

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