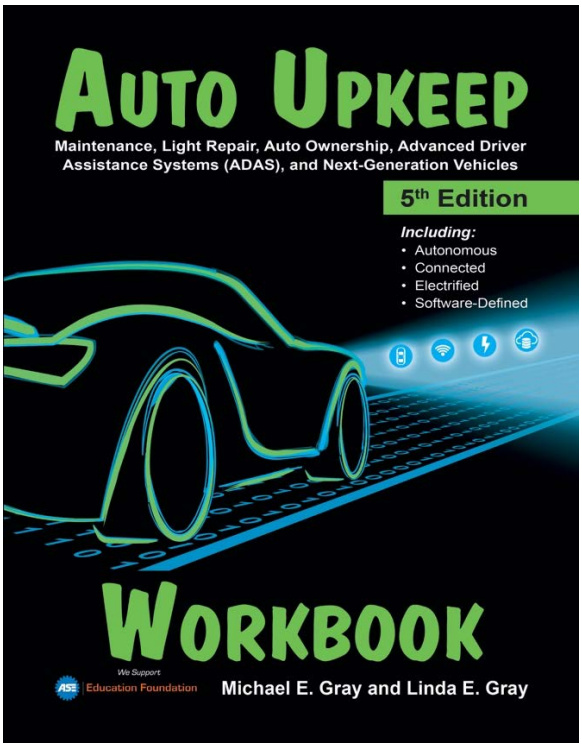
Auto Upkeep

5th Edition



Workbook

Sample Pages

Rolling Hills Publishing
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Auto Upkeep Workbook: Maintenance, Light Repair, Auto Ownership, Advanced Driver Assistance Systems (ADAS), and Next-Generation Vehicles (Including: Autonomous, Connected, Electrified, and Software-Defined)

5th Edition
Michael E. Gray and Linda E. Gray

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Email: info@autoupkeep.com Website: www.AutoUpkeep.com

Preface and Curriculum Resources

Introduction

The *Auto Upkeep Workbook* contains Internet-based and hands-on activities that are extensions of the text. The *Auto Upkeep* text and activities provide the fundamental knowledge and experience in owning and maintaining an automobile.

Textbook

Auto Upkeep is available in hardcover binding.

ISBN: 978-1-62702-050-3 (hardcover)

Workbook

Activities and study questions that correlate with the book's content can be accessed in the *Auto Upkeep Workbook*.

ISBN: 978-1-62702-051-0 (paperback)

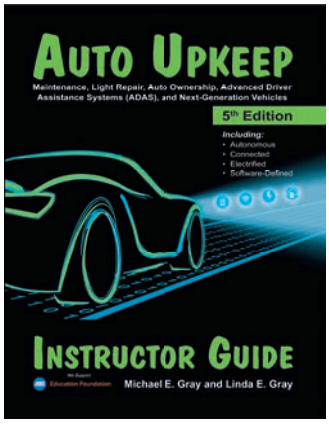
eBook

Auto Upkeep eTextbook and *eWorkbook* options are available at **www.AutoUpkeep.com/ebooks**.

Instructor Guide

The *Auto Upkeep Instructor Guide* is a comprehensive resource that assists in delivering the curriculum.

ISBN: 978-1-62702-059-6 (paperback)



Instructor Resources

The *Auto Upkeep Instructor Resources* include online files that assist instructors in curriculum implementation. Instructors at educational institutions that have adopted the curriculum may obtain access at **Academy.AutoUpkeep.com** through an instructor course. Email **info@autoupkeep.com** to request access. The resources on the Auto Upkeep Academy website include the following:

- Course Syllabus Outline
- Competency Profile
- ASE Education Foundation Correlation Matrix
- PowerPoint Slides
- Activities
- Lesson Plans
- Study Questions
- Chapter Tests and Final
- Answer Keys
- Self-Assessment Forms
- Readability Worksheets
- LMS Common Cartridge File
- Printable Certificates
- Learning Extensions

Additional Resources

Additional *Auto Upkeep* resources can be experienced online at **www.AutoUpkeep.com**.

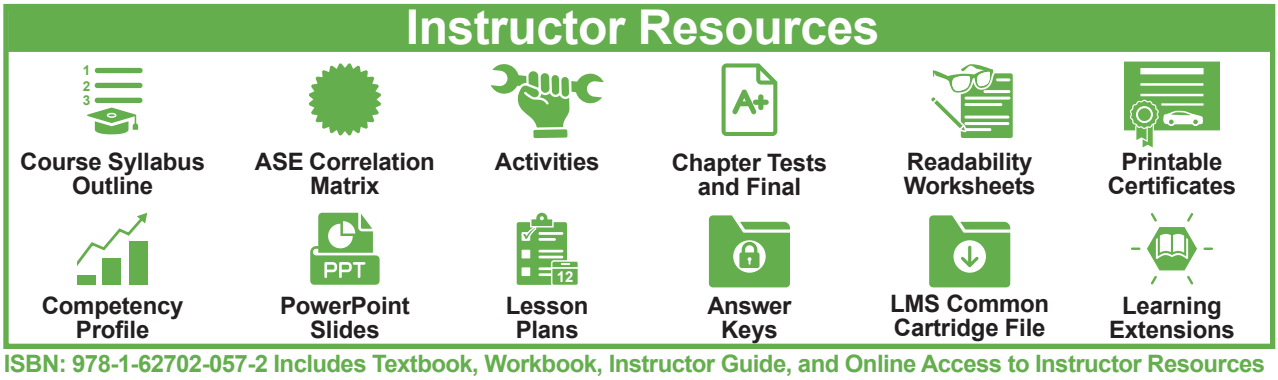
Auto Upkeep Academy

Auto Upkeep Academy options are available at **Academy.Autoupkeep.com**.

ASE Education Foundation Correlations

The *Auto Upkeep* curriculum correlates to the entry level tasks within the 2024 ASE Education Foundation Maintenance and Light Repair (MLR) task list. A correlation matrix can be accessed in the workbook and at **www.AutoUpkeep.com/standards**.

We Support
ASE | Education Foundation



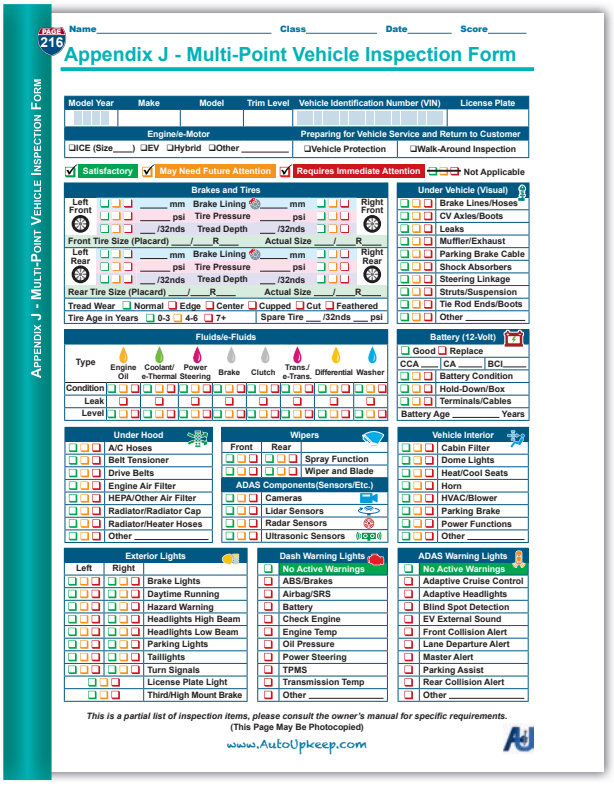
ISBN: 978-1-62702-057-2 Includes Textbook, Workbook, Instructor Guide, and Online Access to Instructor Resources

Limited Photocopies

Limited Photocopy Permission

With the purchase of this workbook, permission is granted by Rolling Hills Publishing, LLC to make copies from the following list of appendix pages for unlimited use in the classroom:

- Safety Rules
- Activity Completion Record
- Domains of Learning
- Competency Profile/Task List
- Daily Reflection Log
- Article, Website, or Video Review Form
- Career Exploration Form
- Work Order/Repair Invoice
- Vehicle Walk-Around Inspection Form
- Multi-Point Vehicle Inspection Form
- Order Information



Appendix J - Multi-Point Vehicle Inspection Form

Name_____ Class_____ Date_____ Score_____

Appendix J - Multi-Point Vehicle Inspection Form

Model Year	Make	Model	Trim Level	Vehicle Identification Number (VIN)	License Plate

Engine/e-Motor: ☐ICE (Size____) ☐EV ☐Hybrid ☐Other _____

Preparing for Vehicle Service and Return to Customer: ☐Vehicle Protection ☐Walk-Around Inspection

☑ Satisfactory ☑ May Need Future Attention ☑ Requires Immediate Attention ⊟⊟⊟ Not Applicable

Brakes and Tires

Left Front	☐☐☐	____ mm	Brake Lining	____ mm	☐☐☐ Right Front
	☐☐☐	____ psi	Tire Pressure	____ psi	☐☐☐
	☐☐☐	___ /32nds	Tread Depth	___ /32nds	☐☐☐
Front Tire Size (Placard) ___/___R___				Actual Size ___/___R___	
Left Rear	☐☐☐	____ mm	Brake Lining	____ mm	☐☐☐ Right Rear
	☐☐☐	____ psi	Tire Pressure	____ psi	☐☐☐
	☐☐☐	___ /32nds	Tread Depth	___ /32nds	☐☐☐
Rear Tire Size (Placard) ___/___R___				Actual Size ___/___R___	

Tread Wear ☐ Normal ☐ Edge ☐ Center ☐ Cupped ☐ Cut ☐ Feathered

Tire Age in Years ☐ 0-3 ☐ 4-6 ☐ 7+ Spare Tire ___ /32nds ___ psi

Under Vehicle (Visual)

☐☐☐	Brake Lines/Hoses
☐☐☐	CV Axles/Boots
☐☐☐	Leaks
☐☐☐	Muffler/Exhaust
☐☐☐	Parking Brake Cable
☐☐☐	Shock Absorbers
☐☐☐	Steering Linkage
☐☐☐	Struts/Suspension
☐☐☐	Tie Rod Ends/Boots
☐☐☐	Other _____

Fluids/e-Fluids

Type	Engine Oil	Coolant/ e-Thermal	Power Steering	Brake	Clutch	Trans./ e-Trans.	Differential	Washer
Condition	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐
Leak	☐	☐	☐	☐	☐	☐	☐	☐
Level	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐

Battery (12-Volt)

☐ Good ☐ Replace

CCA ____ CA ____ BCI____

☐☐☐	Battery Condition
☐☐☐	Hold-Down/Box
☐☐☐	Terminals/Cables

Battery Age _____ Years

Under Hood

☐☐☐	A/C Hoses
☐☐☐	Belt Tensioner
☐☐☐	Drive Belts
☐☐☐	Engine Air Filter
☐☐☐	HEPA/Other Air Filter
☐☐☐	Radiator/Radiator Cap
☐☐☐	Radiator/Heater Hoses
☐☐☐	Other _____

Wipers

Front	Rear	
☐☐☐	☐☐☐	Spray Function
☐☐☐	☐☐☐	Wiper and Blade

ADAS Components(Sensors/Etc.)

☐☐☐	Cameras
☐☐☐	Lidar Sensors
☐☐☐	Radar Sensors
☐☐☐	Ultrasonic Sensors

Vehicle Interior

☐☐☐	Cabin Filter
☐☐☐	Dome Lights
☐☐☐	Heat/Cool Seats
☐☐☐	Horn
☐☐☐	HVAC/Blower
☐☐☐	Parking Brake
☐☐☐	Power Functions
☐☐☐	Other _____

Exterior Lights

Left	Right	
☐☐☐	☐☐☐	Brake Lights
☐☐☐	☐☐☐	Daytime Running
☐☐☐	☐☐☐	Hazard Warning
☐☐☐	☐☐☐	Headlights High Beam
☐☐☐	☐☐☐	Headlights Low Beam
☐☐☐	☐☐☐	Parking Lights
☐☐☐	☐☐☐	Taillights
☐☐☐	☐☐☐	Turn Signals
	☐☐☐	License Plate Light
	☐☐☐	Third/High Mount Brake

Dash Warning Lights

☐	No Active Warnings
☐	ABS/Brakes
☐	Airbag/SRS
☐	Battery
☐	Check Engine
☐	Engine Temp
☐	Oil Pressure
☐	Power Steering
☐	TPMS
☐	Transmission Temp
☐	Other _____

ADAS Warning Lights

☐	No Active Warnings
☐	Adaptive Cruise Control
☐	Adaptive Headlights
☐	Blind Spot Detection
☐	EV External Sound
☐	Front Collision Alert
☐	Lane Departure Alert
☐	Master Alert
☐	Parking Assist
☐	Rear Collision Alert
☐	Other _____

This is a partial list of inspection items, please consult the owner's manual for specific requirements.

(This Page May Be Photocopied)

www.AutoUpkeep.com

Web Research

Web Navigation

Many activities in the *Workbook* include navigating to websites that are not owned or maintained by *Auto Upkeep*. If the webmasters of these domains change links or home pages, please look for similar navigational items to complete the activity.

Instructor Website Review

Due to the nature of the Internet, search phrases listed throughout the workbook may direct students to unanticipated content. If this text is used in an educational institution, it is recommended that the instructor review websites before sending students to them.

Keyword Search

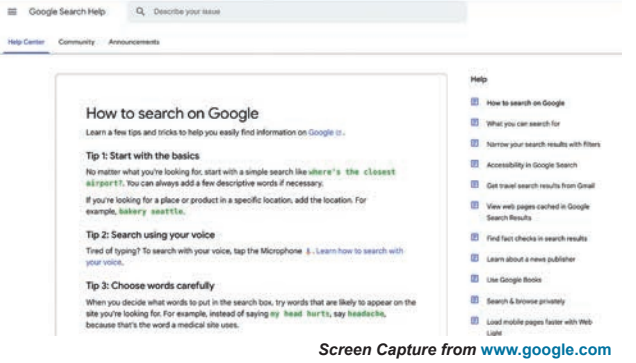
If the website has changed and you cannot find the information you want, use a search engine such as Google to locate updated content. A search with the proper keywords will usually get you to where you want to go.

Specific Site Search

One way to narrow your web search is to use a site search. If you want to search a specific topic on a particular website, use the keywords followed by the website. For example, *incentives and rebates site:kbb.com*.

More Tips and Tricks

Google has put together a *Tips and Tricks* page that helps you effectively search the Internet. Complete an Internet search using *Search Tips & Tricks – Inside Search – Google* as the search phrase to find that page.



Screen Capture from www.google.com

Features of the Workbook

QR (Quick Response) Codes - Scan to easily access additional chapter resources online.

Objectives - What you should know and be able to do upon completion of the chapter and activities.

Activity Icons - Tips on using activity icons.

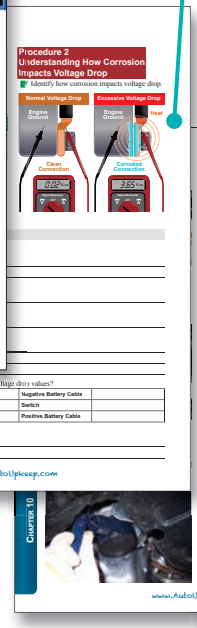
Web Exploring - Expand learning through key terms and internet search phrases.

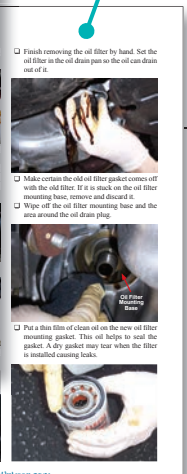
Think Safety - Key safety tips related to the procedures in each chapter.

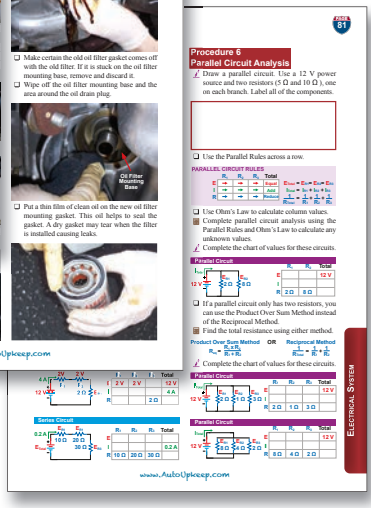
Illustrations - To clarify concepts and develop further understanding.

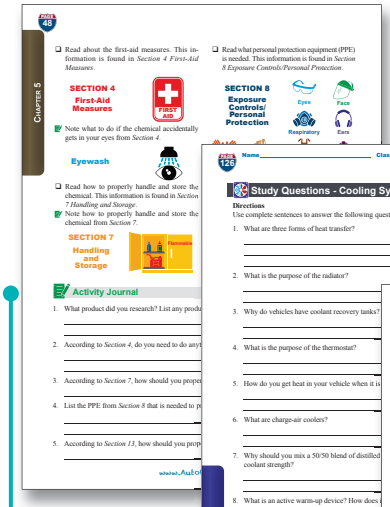
Procedures - Step-by-step learning experiences.

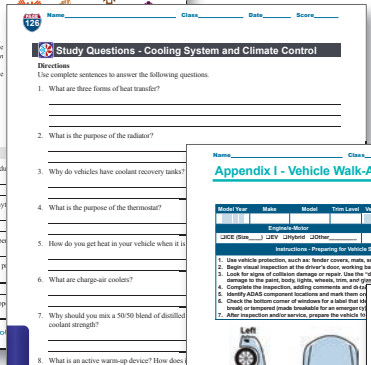
Calculations - Integrating practical mathematics.

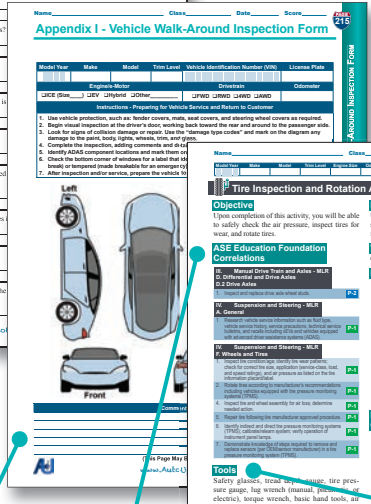


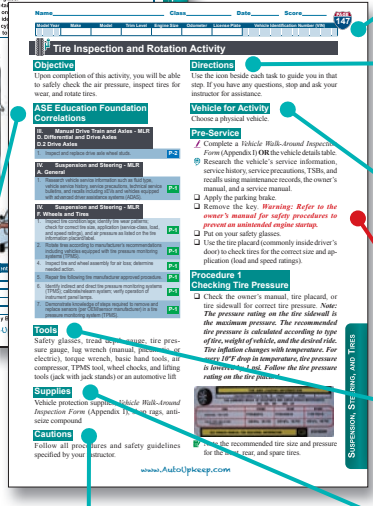












Vehicle Details Table - Table where you organize vehicle details for the procedure.

Directions - Information on how to make a record of the tasks completed in the procedures.

Vehicle for Activity - Vehicle used in the procedure.

Warnings - Potential hazard alerts requiring safety precautions to avoid personal injury.

Tools - A list of tools and equipment you will need to complete the activity.

Supplies - A list of supplies you will need to complete the activity.

Activity Journal - Take notes as you complete the procedures.

Study Questions - Developed to reflect on learning.

Appendix - Resources that may be duplicated to enhance learning.

ASE Education Foundation Correlations - A list of 2024 ASE Education Foundation MLR entry level tasks that correlate to the chapter.

Cautions - Reference to precautions specific to each activity.

Edge Index - Chapters are color coded and organized with an edge index to help you navigate the following:

- **Foundational (Top)** -These chapters will give you a solid automotive foundation to build upon.
- **Consumer and Advanced Technology (Middle)** - These chapters will help you become a more informed automotive consumer and expand awareness of advancing electric and next-generation technologies.
- **Automotive Systems (Bottom)** - These chapters will teach you how the systems of the automobile work together.

Table of Contents

CHAPTER 1
Introduction and How Cars Work

CHAPTER 2
Buying an Automobile

CHAPTER 3
Automotive Expenses

CHAPTER 4
Repair Facilities

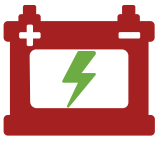
CHAPTER 5
Safety Around the Automobile

CHAPTER 6
Tools, Fasteners, and Equipment

CHAPTER 7
Auto Care and Cleaning

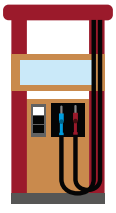
CHAPTER 8
Fluid Level Check

CHAPTER 9
Electrical System



CHAPTER 10
Lubrication System

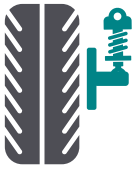
CHAPTER 11
Fuel System



CHAPTER 12
Cooling System and Climate Control

CHAPTER 13
Ignition System

CHAPTER 14
Suspension, Steering, and Tires



CHAPTER 15
Braking System

CHAPTER 16
Drivetrain

CHAPTER 17
Exhaust and Emission System

CHAPTER 18

Alternative Fuels and Designs

CHAPTER 19

Automotive Accessories

CHAPTER 20

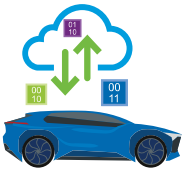
Common Problems and Roadside Emergencies

CHAPTER 21

Electric Vehicles

CHAPTER 22

Next-Generation Vehicles



Introduction and How Cars Work

Photo: Library of Congress

Photo: NPS - Yellowstone National Park

Objectives

After reading the *Auto Upkeep* text and completing the following activities, you will be able to:

- Identify early automotive contributors.
- Differentiate between vehicle manufacturers, makes, models, and trim levels.
- Describe how cars work.
- Locate and use an online owner's manual.

Activity Icons

Use the icon beside each task to guide you in that step. If you have any questions, stop and ask your instructor for assistance.

- ❑ Mark off the **check box** icon when completed.
- When you see a **journal icon** next to the task, write the information in the activity journal.
- When you see a **pen icon** next to the task, fill in the blank lines, boxes in an illustration, or additional form identified.
- When you see a **resource icon**, use related resources at **www.autoupkeep.com/resources** or by scanning the QR Code at the top of this page.
- When you see the **video icon**, watch related videos at **www.video.autoupkeep.com**.
- When you see the **search icon**, search for the requested information on the Internet.
- When you see the **calculator icon**, complete the calculation.

Chapter 1 Activities

- Study Questions
- Workplace Skills Activity
- Car Identification and Preparing for Vehicle Service Activity
- Owner's Manual Activity

Web Exploring

Key Terms/Internet Search Words

Search online to investigate any of the following key terms or phrases. Summarize your findings in a research paper.

- Automotive Manufacturers
- Automotive Milestones
- Carl (Karl) Benz
- Cugnot Steam Traction Engine
- Diesel Engines
- Ferdinand Porsche
- Four-Stroke Engine
- Gasoline Engines
- Henry Ford
- How Cars Work
- Internal Combustion Engine
- Leonardo da Vinci Automobile
- Model T
- Nicholas Cugnot
- Nikolaus Otto
- Ransom Olds First Assembly Line
- Vehicle Identification Number
- Volkswagen Beetle
- What is MPGe

Name_____ Class_____ Date_____ Score_____

Study Questions - Introduction and How Cars Work

Directions

Use complete sentences to answer the following questions.

1. What was the earliest self-powered road vehicle?

2. Who was credited with the world's first practical motorcar?

3. What is the difference between force, work, power, and energy?

4. What are the strokes in a four-stroke internal combustion engine? What is the difference between a gasoline and a diesel engine?

5. What two units of measurement are used to classify engine sizes?

6. What is an engine configuration? List several examples.

7. What does the acronym VIN represent? What information is coded into the VIN?

8. What is the difference between a manufacturer and make?

9. What are the systems of the automobile?

10. What types of careers exist in the automotive industry?

Workplace Skills Activity

Objective

Upon completion of this activity, you will be able to identify important workplace skills and understand why they are integral to professionalism.

ASE Education Foundation Correlations

Workplace Skills - Personal Standards

1. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand.
2. Dresses appropriately and uses language and manners suitable for the workplace.
3. Maintains personal hygiene appropriate for the workplace.
4. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.
5. Demonstrates honesty, integrity, and reliability.

Workplace Skills - Work Habits/Ethics

1. Complies with workplace policies/laws.
2. Contributes to the success of the team, assists others and requests help when needed.
3. Works well with all customers and coworkers.
4. Negotiates solutions to interpersonal and workplace conflicts.
5. Contributes ideas and initiative.
6. Follows directions.
7. Communicates effectively, both in writing and verbally, with customers and coworkers.
8. Reads and interprets workplace documents; writes clearly and concisely.
9. Analyzes and resolves problems that arise in completing assigned tasks.
10. Organizes and implements a productive plan of work.
11. Uses scientific, technical, engineering and mathematics (STEM) principles and reasoning to accomplish assigned tasks.
12. Identifies and addresses the needs of all customers, providing helpful, courteous, and knowledgeable service and advice as needed.
13. Respectful of tools and property used in school and workplace environment.
14. Contributes to an inclusive environment where every coworker and customer feels welcomed, heard, and valued.

Tools

None

Supplies

None.

Cautions

Follow all procedures and safety guidelines specified by your instructor.

Directions

Use the icon beside each task to guide you in that step. If you have any questions, stop and ask your instructor for assistance.

Procedure

- ❑ Read through the *ASE Education Foundation Correlations for Personal Standards and Work Habits/Ethics* listed at the beginning of this activity. To build understanding, your class can be thought of as a workplace and classmates as coworkers. ***Note: Workplace skills are required at all levels of ASE accreditation.***
- ❑ Perform all activities in this workbook with an understanding of the importance of high personal standards.
- Explain in a paragraph why it is important to maintain high personal standards in the workplace. ***Note: You may write your paragraph using a word processor.***

Personal Standard Examples

- ❑ Perform all activities in this workbook with an understanding that work habits and ethical practices are integral to professionalism.
- Explain in a paragraph why it is important to maintain positive work habits and ethics in the workplace. ***Note: You may write your paragraph using a word processor.***

Work Habits and Ethics Examples

- Complete the activity journal self-assessment *Workplace Skills Competency Chart*.
- Identify at least one workplace skill that you could improve and write about what you can do to move toward mastery of that skill.

Activity Journal

1. Why is it important to maintain high personal standards in the workplace?

2. Why is it important to maintain positive work habits and ethics in the workplace?

3. Complete the following *Workplace Skills Competency Chart* as a self-assessment.

Score/Mastery

A	B	C	D	F
Master	Proficient	Apprentice	Novice	No Attempt
4	3	2	1	0

Grade Scale			
4.0 = A	3.0 = B	2.0 = C	1.0 = D
3.7 = A-	2.7 = B-	1.7 = C-	0.7 = D-
3.3 = B+	2.3 = C+	1.3 = D+	0 = F

Workplace Skills Competency Chart

Personal Standards

1. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand.
2. Dresses appropriately and uses language and manners suitable for the workplace.
3. Maintains personal hygiene appropriate for the workplace.
4. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.
5. Demonstrates honesty, integrity, and reliability.

Work Habits/Ethics

1. Complies with workplace policies/laws.
2. Contributes to the success of the team, assists others and requests help when needed.
3. Works well with all customers and coworkers.
4. Negotiates solutions to interpersonal and workplace conflicts.
5. Contributes ideas and initiative.
6. Follows directions.
7. Communicates effectively, both in writing and verbally, with customers and coworkers.
8. Reads and interprets workplace documents; writes clearly and concisely.
9. Analyzes and resolves problems that arise in completing assigned tasks.
10. Organizes and implements a productive plan of work.
11. Uses scientific, technical, engineering and mathematics (STEM) principles and reasoning to accomplish assigned tasks.
12. Identifies and addresses the needs of all customers, providing helpful, courteous, and knowledgeable service and advice as needed.
13. Respectful of tools and property used in school and workplace environment.
14. Contributes to an inclusive environment where every coworker and customer feels welcomed, heard, and valued.

4. Identify at least one workplace skill that needs improvement. Describe what you can do practically (e.g., arrive on time, be organized), ethically (e.g., do the right thing, respectful), or behaviorally (e.g., optimistic attitude, listen carefully) to move toward mastery of that skill.

Model Year	Make	Model	Trim Level	Engine Size	Odometer	License Plate	Vehicle Identification Number (VIN)

Car Identification and Preparing for Vehicle Service Activity

Objective

Upon completion of this activity, you will be able to correctly identify an automobile by manufacturer, model year, make, model, and trim level. You will also prepare a vehicle for service and return to the customer.

ASE Education Foundation Correlations

Foundational Tasks - Preparing for Vehicle Service

1. Identify information needed and the service requested on a repair order.
2. Identify purpose and demonstrate proper use of vehicle protection such as: fender covers, mats, seat, and steering wheel covers.

Foundational Tasks - Preparing Vehicle for Customer

1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).

Tools

None

Supplies

Vehicle protection supplies, *Vehicle Walk-Around Inspection Form* (Appendix I)

Cautions

Follow all procedures and safety guidelines specified by your instructor.

Directions

Use the icon beside each task to guide you in that step. If you have any questions, stop and ask your instructor for assistance.

Vehicle for Activity

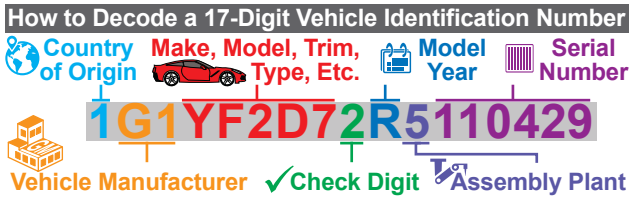
Choose any physical vehicle.

Procedure

- ❑ Prepare the vehicle for service. Install fender covers, mats, seat, and steering wheel covers.
- Note why vehicle protection is necessary.
- ❑ Locate the vehicle certification label.

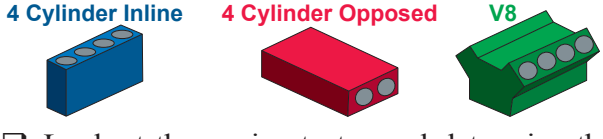
- Identify the vehicle's date of manufacture and the manufacturer on the certification label.
- ❑ Look inside the vehicle for the odometer reading and outside for other vehicle details.
- Note the make, model, trim level, odometer, and license plate in the vehicle details table.
- ❑ Look in the front windshield and find the VIN.

- Note the VIN in the vehicle details table.



- ❑ Open the hood. If unsure how to open the hood, refer to the owner's manual. A release latch should be under or near the steering column.
- ❑ Push the safety latch on the outside once the hood is popped.
- ❑ Locate the vehicle emission control information (VECI) sticker, usually under the hood.
- Note the model year in the vehicle details table.
- Explain the vehicle type, if it has an engine (e.g., gasoline or diesel) and/or e-motor(s).
- Note the engine size (e.g., 1.8 L) in the vehicle details table.

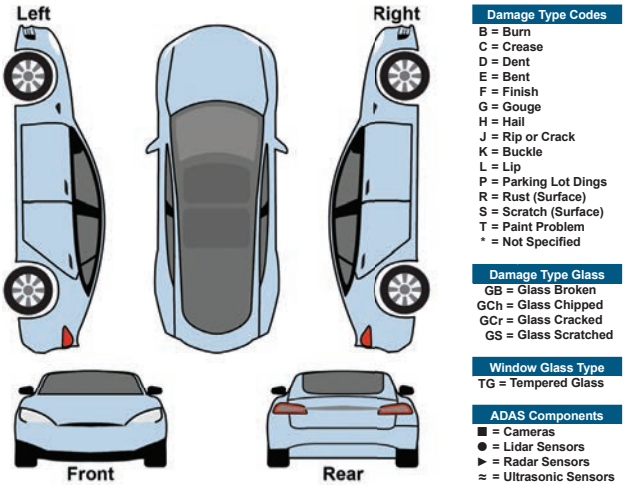
- Identify the engine's design configuration.



- ❑ Look at the engine to try and determine the number of cylinders. Identifying the number of spark plugs may help. Most engines have one spark plug per cylinder, but some have two.
- Note the number of cylinders, if applicable.

- ❑ Close the hood.
- Explain why a technician should complete a walk-around inspection before performing vehicle service.
- ❑ Obtain a copy of the *Vehicle Walk-Around Inspection Form* (Appendix I). ***Note: Appendix pages may be photocopied.***
- Use the information gathered in this activity to fill in the vehicle details on the *Vehicle Walk-Around Inspection Form*.
- ❑ Begin your walk-around inspection at the driver's door. Work back toward the rear of the vehicle and around to the passenger side.
- Mark damage codes on the *Vehicle Walk-Around Inspection Form* to identify any issues with the paint, body, lights, wheels, trim, and glass.
- Provide a description of damages on the *Vehicle Walk-Around Inspection Form*. ***Note: A walk-around inspection adds value to a technician's service and helps build customer trust.***
- Add comments and details as needed to the *Vehicle Walk-Around Inspection Form*.

Vehicle Walk-Around Inspection Form **(Appendix I)**



- Mark ADAS component locations and inform customer to keep them clean for safety.
- Explain how the vehicle should look when it is returned to the customer after service.

Activity Journal

1. Why is it important to protect the vehicle from damage and keep it clean while performing service?

2. What is the date of manufacture and the vehicle manufacturer?

3. What type of engine and/or e-motor(s) does the vehicle have?

4. Explain why the model year, according to VECI sticker, might not be the same as the date of manufacture.

5. What is the engine size, type, and configuration? How many cylinders does the engine have?

6. Why is it important to perform a walk-around inspection in preparation for vehicle service?

7. How should a vehicle look when returning it to the customer?

Model Year	Make	Model	Trim Level	Engine Size	Odometer	License Plate	Vehicle Identification Number (VIN)

Owner's Manual Activity

Objective

Upon completion of this activity, you will be able to locate and use an online owner's manual.

ASE Education Foundation Correlations

Foundational Tasks - Shop and Personal Safety

13. Identify vehicle systems which pose a safety hazard during service such as: supplemental restraint systems (SRS), electronic brake control systems, stop/start systems, and remote start systems.
14. Identify vehicle systems which pose a safety hazard during service due to high voltage such as: xEV drivetrains, lighting systems, ignition systems, A/C systems, injection systems, etc.

I. Engine Repair - MLR
II. Automatic Transmission and Transaxle - MLR
III. Manual Drive Train and Axles - MLR
IV. Suspension and Steering - MLR
VI. Electrical/Electronic Systems - MLR
VIII. Engine Performance - MLR
A. General

1. Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). **P-1**

VII. Heating, Ventilation, and Air Conditioning (HVAC) - MLR
A. General

1. Research vehicle service information, including refrigerant/oil/fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). **P-1**

Tools

Internet access

Supplies

Vehicle protection supplies, *Vehicle Walk-Around Inspection Form* (Appendix I)

Cautions

Follow all procedures and safety guidelines specified by your instructor.

Directions

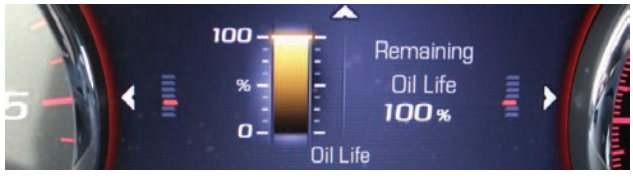
Use the icon beside each task to guide you in that step. If you have any questions, stop and ask your instructor for assistance.

Vehicle for Activity

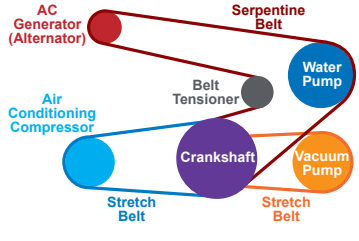
Choose any vehicle (physical **OR** online).

Procedure

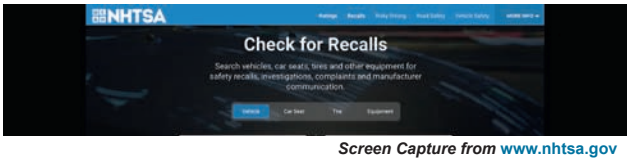
- Complete a *Vehicle Walk-Around Inspection Form* (Appendix I) **OR** the vehicle details table.
- Search online for a copy of the owner's manual. For example, search *GMC Owner's Manual*.
- ❑ Look for the manufacturer's website.
- ❑ Navigate the online owner's manual to find your vehicle's specifications.
- Note the following vehicle specifications.
  - **Oil Type (API and SAE Ratings)** _____
  - **Oil Capacity** _____
  - **Fuel Tank Capacity** _____
  - **Minimum Fuel Rating** _____
  - **Engine Coolant Type** _____
  - **Brake Fluid Type** _____
  - **Transmission Fluid Type** _____
  - **Max Towing Capacity** _____
  - **Lug Nut Torque** _____
- ❑ Find the vehicle maintenance schedules.
- Note the following maintenance schedules.
  - **Change Engine Oil** _____
  - **Rotate Tires** _____
  - **Replace Spark Plugs** _____
  - **Flush Brake Fluid** _____
  - **Replace Engine Air Filter** _____
  - **Replace Cabin Air Filter** _____
  - **Replace Timing Belt** _____
- ❑ Use the manual to find out how to reset the engine oil life monitoring system.



- ❑ Locate the manual's drive belt routing diagram.
- Use a blank sheet of paper to sketch how the drive belt routes on the engine.



- ❑ Locate the section in the manual that reviews the instrument warning lights (also called malfunction indicator lights).
- Note three instrument warning lights.
- ❑ Identify systems which pose a safety hazard during service such as: supplemental restraint systems (SRS), electronic brake control systems, stop/start systems, and remote start systems.
- Note vehicle systems that pose a safety hazard during service.
- Note warnings associated with the supplemental restraint system.
- ❑ Identify vehicle systems which pose a safety hazard during service due to high voltage such as hybrid/electric drivetrain, lighting systems, ignition systems, A/C systems, etc.
- Note systems which pose high-voltage safety hazards during service.
- ❑ Use the manual to locate the jacking points on the vehicle. This is the place where you would jack up the vehicle if you had a flat tire.
- Visit **www.autoupkeep.com/resources** for this chapter to find websites related to safety recalls and technical service bulletins (TSBs).
- Use the provided websites to search for *Recalls* and *TSBs* on your vehicle.



Screen Capture from www.nhtsa.gov

- Note any recalls or technical service bulletins.

Activity Journal

1. What are three warning (malfunction indicator) lights on the vehicle?

2. What systems pose a safety hazard during service?

3. Identify warnings associated with supplemental restraint systems.

4. What high-voltage systems pose a safety hazard during service?

5. Note any recalls or technical service bulletins (TSBs).

Appendix A - Safety Rules

Note: This list is not all-inclusive. Follow safety guidelines provided by OSHA, EPA, safety data sheets, your instructor, and tool, equipment, and chemical manufacturers.

Personal Protection

- Safety glasses are not optional. Wear them at all times when working on a vehicle. ***Note: Ordinary prescription glasses are not safety glasses. You can purchase approved prescription safety glasses with side shields.***
- Do not have bare feet or wear open toe sandals. Wear shoes that protect your feet.
- Loud noises can damage your hearing, so wear ear protection (e.g., earplugs or earmuffs).
- Keep your tools and hands free of grease and oil. Wearing mechanic gloves is smart, but do not wear gloves when moving parts are present. Keep your hands away from moving parts. Never use your hands to stop components that are moving.
- Remove your rings, watch, and other jewelry. If you have long hair, tie it back. It could get caught in moving parts. Do not wear loose or baggy clothing that could get caught in moving parts.
- Use the appropriate respirator when hazardous dust or airborne chemicals are present.
- Do not touch spark plug wires while the engine is running. Tens of thousands of volts are present.
- Never put your hands on or near the cooling fan. Many fans are electric and can start at anytime, even if the ignition is off.
- Do not work on a hot engine. Never open a hot radiator cap.
- Use proper lifting procedures to avoid injury. Use your legs, not your back.
- Be aware of vehicles with high voltage. See Chapter 21 to learn about high-voltage personal protection equipment (PPE). ***Warning: Be careful around high voltage. High voltage can kill. Identify high-voltage systems by their orange cables.***

Shop/Lab Procedures

- Know the location and operational procedures of fire extinguishers, first-aid kits, safety data sheets, eyewash stations, and a telephone. Dial 911 for emergencies. Have an evacuation route out of the shop identified.
- Someone must be sitting in the driver's seat whenever a car is started and/or running.
- The exhaust system of a running engine must be connected to a ventilation system if the vehicle is in an enclosed location such as a garage. ***Warning: Carbon monoxide is a colorless, odorless, and poisonous gas. Proper ventilation is required.***
- Always engage the parking brake to prevent the vehicle from moving.
- Put oily rags in an approved can for combustible materials.
- Always clean up spilled oil and grease off the floor. Sawdust, cat litter, and safety absorbent (floor dry) work well for this.
- Never pour chemicals, solvents, antifreeze, or oil down the sanitary drain. Put them in their proper containers to be recycled.
- Use an approved safety cabinet for flammable materials. Do not use gasoline to clean parts.
- OSHA states that compressed air shall not be used for cleaning purposes (parts or objects) except where reduced to less than 30 pounds per square inch (psi) and then only with effective chip guarding and appropriate personal protective equipment (PPE). Never (at any pressure or under any circumstances) use compressed air to clean off clothes or your body. Never point an airline toward your skin, your body, or another person.

Hand Tools, Power Tools, and Shop Equipment Safety

- Use the proper tool for each job. Make sure tools and equipment have all the proper guards installed. Operate tools and equipment according to the manufacturers' instructions. Do not put sharp or pointed tools in your pocket.
- Avoid tripping hazards. Stand creepers up and place floor jack handles in the up position when not being used.
- Be cautious where sparks are falling when grinding, cutting, or welding.
- If a car is off the ground (except when on an automotive lift), it must be supported by jack stands.
- Do not use chisels or punches with mushroomed heads. When striking the ends with a hammer, the heads might shatter on impact, causing fragments to become airborne.
- Wrenches must not be used when jaws are sprung, malformed, or bent. Slippage can occur.
- Secure work with a vise or clamp. Operate a tool with both hands as recommended by the manufacturer.
- Maintain good footing and keep yourself balanced when operating power tools.
- Do not put tools on top of a vehicle's battery. Accidentally touching both terminals will cause a spark, which could lead to an explosion.
- Inspect electrical cords for fraying before use. Do not use electric tools in damp or wet locations. Electric tools must have a three-wire cord with a ground and be plugged into a properly grounded receptacle or be double-insulated.
- Prior to grinding, stand off to the side and allow the grinder to get up to full operating speed. A grinding wheel can explode during start-up.

Name_____ Class_____ Date_____ Score_____

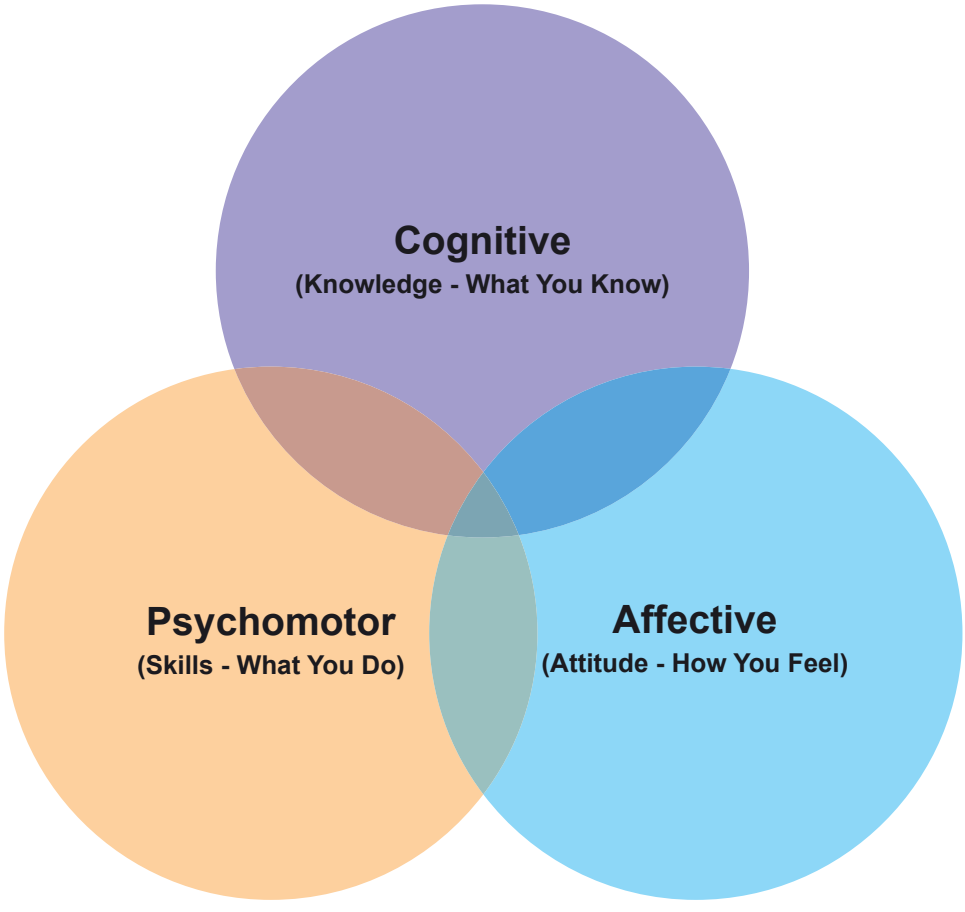
Appendix B - Activity Completion Record

	Activity	Date	Points	Grade
CHAPTER 1	Workplace Skills Activity			
	Car Identification and Preparing for Vehicle Service Activity			
	Owner's Manual Activity			
CHAPTER 2	Towing and Hauling Activity			
	Advanced Driver Assistance Systems (ADAS) Activity			
	Buying a New Automobile Activity			
	Buying a Used Automobile Activity			
CHAPTER 3	Automotive Expenses Activity			
CHAPTER 4	Repair Facilities Activity			
CHAPTER 5	Automotive Safety Activity			
	Safety Data Sheet (SDS) Activity			
	Personal Protection Equipment (PPE) and Fire Safety Activity			
CHAPTER 6	Tools and Equipment Activity			
	Fasteners Activity			
	Service Manual Activity			
CHAPTER 7	Interior Cleaning Activity			
	Exterior Cleaning Activity			
	Waxing Activity			
CHAPTER 8	Fluid Level Check Activity			
CHAPTER 9	Ohm's Law Activity			
	Circuit Construction Simulator Activity			
	Simple Circuits Activity			
	Voltage Drop Activity			
	Wiring Diagram Activity			
	Battery Activity			
	Charging Activity			
	Starting Activity			
CHAPTER 10	Oil and Filter Change Activity			
CHAPTER 11	Fuel System Part Identification Activity			
	Fuel System Maintenance Activity			
CHAPTER 12	Air Conditioning Activity			
	Cabin Air Filter Activity			
	Cooling System Activity			
CHAPTER 13	Ignition System Activity			
CHAPTER 14	Suspension and Steering Activity			
	Tire Inspection and Rotation Activity			
	Choosing the Right Tires Activity			
CHAPTER 15	Brake Inspection Activity			
CHAPTER 16	Drivetrain Activity			
CHAPTER 17	Exhaust and Emission Activity			
CHAPTER 18	Payback Period Activity			
	Future Vehicle Activity			
CHAPTER 19	Automotive Accessories Activity			
CHAPTER 20	Changing a Flat Tire Activity			
	Jump-Starting Activity			
	Lighting Activity			
	Replacing Wipers Activity			
	On-Board Diagnostics Activity			
CHAPTER 21	Electric Vehicles Activity			
CHAPTER 22	ADAS and Vehicle Automation Level Identification Activity			
			Total Points	Overall Grade

Appendix C - Domains of Learning

The *Auto Upkeep* curriculum focuses on three domains of learning: cognitive, psychomotor, and affective. Think of domains as categories of learning. The tasks/skills listed in the *Auto Upkeep Competency Profile* are categorized into the corresponding domain and the level of learning within that domain. These are the things that students should know and be able to do after completing the learning activities.

Higher Levels ↑	Cognitive (Knowledge - Think)	Psychomotor (Skills - Do)	Affective (Attitudes - Feel)	↑ More Complex
	Evaluation	Naturalization	Characterization	
	Synthesis	Articulation	Organization	
	Analysis	Precision	Valuing	
	Application	Manipulation	Responding	
	Comprehension	Imitation	Receiving	
	Knowledge			



Name_____ Class_____ Date_____ Score_____

Appendix D - Competency Profile/Task List

Score/Mastery				
A	B	C	D	F
Master	Proficient	Apprentice	Novice	No Attempt
4	3	2	1	0

Grade Scale			
4.0 = A	3.0 = B	2.0 = C	1.0 = D
3.7 = A-	2.7 = B-	1.7 = C-	0.7 = D-
3.3 = B+	2.3 = C+	1.3 = D+	0 = F

Task/Skill	Domain	Level
Chapter 1. Introduction and How Cars Work		
Describe how cars work.	Cognitive	Knowledge
Locate and identify the Vehicle Identification Number (VIN).	Psychomotor	Imitation
Identify the engine size and configuration.	Cognitive	Knowledge
Explain the difference between manufacturer, make, and model.	Cognitive	Comprehension
Classify vehicle types.	Cognitive	Analysis
Distinguish differences between spark and compression ignition engines.	Cognitive	Analysis
Relate pollutants to gasoline and diesel engines.	Cognitive	Synthesis
Propose and discuss possible future vehicle designs.	Affective	Valuing
Practice identifying automobiles by model year, make, model, and type.	Psychomotor	Manipulation
Differentiate between force, work, power, and energy.	Cognitive	Analysis
Identify careers in the automotive industry.	Cognitive	Knowledge
Navigate an online owner's manual.	Psychomotor	Manipulation
Chapter 2. Buying an Automobile		
Differentiate between transportation needs and wants.	Cognitive	Analysis
Develop a budget.	Cognitive	Application
Identify the steps in purchasing an automobile.	Cognitive	Knowledge
Compare and contrast different places to purchase an automobile.	Cognitive	Evaluation
Calculate a reasonable offer for a vehicle.	Cognitive	Application
Advocate for safety features in an automobile.	Affective	Characterization
Carry out research on vehicles using available resources.	Psychomotor	Imitation
Evaluate window stickers.	Cognitive	Evaluation
Conduct a vehicle inspection.	Psychomotor	Manipulation
Propose the benefits of selling, trading in, or donating a used vehicle.	Affective	Valuing
Chapter 3. Automotive Expenses		
Explain how car payments are calculated.	Cognitive	Synthesis
Describe insurance coverage levels.	Cognitive	Evaluation
Propose when it may be beneficial to have additional insurance.	Affective	Valuing
Calculate monthly expenses on a given vehicle.	Cognitive	Application
Explain depreciation.	Cognitive	Comprehension
Differentiate between maintenance and repairs.	Cognitive	Analysis
Chapter 4. Repair Facilities		
Describe how technicians can become certified.	Cognitive	Knowledge
Communicate effectively with a technician or service writer.	Affective	Responding
Interpret a work order/repair invoice.	Cognitive	Evaluation
Demonstrate use of the three C's (concern, cause, and correction).	Psychomotor	Imitation
List and describe different types of facilities.	Cognitive	Knowledge
Conduct research to locate a quality repair facility.	Psychomotor	Manipulation
Characterize business ethics.	Affective	Characterization
Summarize differences between warranty types.	Cognitive	Evaluation

4	3	2	1	0	Task/Skill	Domain	Level
Chapter 5. Safety Around the Automobile							
					Demonstrate safe work practices.	Psychomotor	Precision
					Identify types of fires and explain what types of fire extinguishers to use.	Cognitive	Synthesis
					Explain the fire triangle.	Cognitive	Comprehension
					Evaluate when to wear specific personal protection equipment (PPE).	Cognitive	Evaluation
					Describe the purpose of OSHA and the EPA.	Cognitive	Knowledge
					Use different types of automotive lifts to safely support a vehicle.	Psychomotor	Precision
					Operate a jack and use jack stands to safely support a vehicle.	Psychomotor	Precision
					Judge when it is safe to work on a vehicle with airbag systems.	Affective	Organization
					Explain right-to-know laws.	Cognitive	Comprehension
					Interpret safety data sheets (SDSs).	Cognitive	Comprehension
					Practice safe lifting and carrying techniques.	Psychomotor	Imitation
					Identify factors that affect noise-induced hearing loss.	Cognitive	Knowledge
					Insert foam earplugs properly.	Psychomotor	Precision
Chapter 6. Tools, Fasteners, and Equipment							
					Recognize basic hand tools.	Cognitive	Comprehension
					Select the correct tool for the job.	Cognitive	Evaluation
					Use tools properly.	Psychomotor	Precision
					Utilize print and online service manuals.	Psychomotor	Precision
					Classify socket types.	Cognitive	Analysis
					Identify different types of wrenches.	Cognitive	Analysis
					Identify different types of pliers.	Cognitive	Analysis
					List the different types of screwdriver tips.	Cognitive	Knowledge
					Decide when it is justified to invest in a specialty tool.	Affective	Organization
					Categorize units into SI (metric) or U.S. Customary system.	Cognitive	Synthesis
					Differentiate between electric-, air-, and battery-powered tools.	Cognitive	Analysis
					Demonstrate the proper use of vehicle protection.	Psychomotor	Precision
Chapter 7. Auto Care and Cleaning							
					Identify different automotive finishes.	Cognitive	Knowledge
					Explain the importance of interior and exterior cleaning.	Cognitive	Evaluation
					Clean a vehicle inside and out.	Psychomotor	Articulation
					Wax a vehicle.	Psychomotor	Manipulation
					Differentiate between claying, polishing, and waxing.	Cognitive	Synthesis
					Describe how to clean an engine compartment.	Cognitive	Comprehension
					Locate and lubricate hinges, latches, and locks.	Psychomotor	Manipulation
					Repair a chip or scratch in a vehicle's finish.	Psychomotor	Manipulation
					Explain how paintless dent repair works.	Cognitive	Knowledge
Chapter 8. Fluid Level Check							
					Identify vehicle information for the correct fluid type.	Cognitive	Knowledge
					Identify different types of fluids used in an automobile.	Cognitive	Knowledge
					Describe differences between coolant types.	Cognitive	Knowledge
					Follow safety warnings listed on chemical containers.	Psychomotor	Precision
					Analyze fluid conditions.	Cognitive	Analysis
					Perform basic fluid level checks.	Psychomotor	Articulation
					Add fluids when required.	Psychomotor	Manipulation
					Justify using more environmentally friendly coolants.	Affective	Valuing
					Summarize why it is important to add the correct types of fluids.	Cognitive	Evaluation
					Store and dispose of chemicals properly.	Psychomotor	Manipulation

4	3	2	1	0	Task/Skill	Domain	Level
					Chapter 9. Electrical System		
					Define electricity in terms of voltage, current, and resistance.	Cognitive	Knowledge
					Interpret a wiring diagram.	Cognitive	Analysis
					Explain different types of electrical circuits.	Cognitive	Comprehension
					Analyze different types of circuit problems.	Cognitive	Analysis
					Use a digital multimeter to test for voltage, resistance, and current.	Psychomotor	Manipulation
					Use Ohm's law to calculate for voltage, resistance, or current.	Cognitive	Application
					Locate, identify, and inspect starting system components.	Psychomotor	Manipulation
					Locate, identify, and inspect charging system components.	Psychomotor	Manipulation
					Test an AC generator (alternator).	Psychomotor	Manipulation
					Test a starter.	Psychomotor	Manipulation
					Clean and test an SLI battery.	Psychomotor	Manipulation
					Explain battery performance ratings.	Cognitive	Comprehension
					Inspect belt conditions.	Psychomotor	Manipulation
					Locate fuse junction blocks.	Psychomotor	Manipulation
					Describe different fuse types.	Cognitive	Knowledge
					Remove, inspect, and replace a blade style fuse.	Psychomotor	Imitation
					Differentiate between bulb types.	Cognitive	Analysis
					Chapter 10. Lubrication System		
					Define the purpose of engine oil.	Cognitive	Knowledge
					List and describe engine oil additives.	Cognitive	Comprehension
					Explain oil service and viscosity ratings.	Cognitive	Comprehension
					Differentiate between conventional, synthetic, and semi-synthetic oils.	Cognitive	Analysis
					Discuss the importance of oil filters.	Cognitive	Comprehension
					Change the oil and filter on a vehicle.	Psychomotor	Manipulation
					Advocate for the importance of oil recycling.	Affective	Characterization
					Chapter 11. Fuel System		
					Explain the purpose of the fuel system.	Cognitive	Comprehension
					Locate, identify, and inspect fuel system components.	Psychomotor	Manipulation
					Remove, inspect, and replace an air filter.	Psychomotor	Manipulation
					Remove and replace a fuel filter.	Psychomotor	Manipulation
					State gasoline and diesel properties.	Cognitive	Knowledge
					Identify ways to improve fuel economy.	Cognitive	Comprehension
					Explain how fuel is priced.	Cognitive	Evaluation
					Justify the use of clean burning fuels.	Affective	Valuing
					Explain how a turbocharger works.	Cognitive	Comprehension
					Chapter 12. Cooling System and Climate Control		
					Identify the purpose of the cooling system.	Cognitive	Comprehension
					Locate, identify, and inspect cooling system components.	Psychomotor	Manipulation
					Define coolant properties.	Cognitive	Knowledge
					Explain how coolant flows in an engine.	Cognitive	Comprehension
					Test coolant properties.	Psychomotor	Manipulation
					Change a cabin air filter.	Psychomotor	Manipulation
					List causes of engine overheating.	Cognitive	Knowledge
					Identify what to do if a vehicle overheats.	Cognitive	Knowledge
					Explain how charge-air coolers work.	Cognitive	Comprehension
					Analyze the benefits of active warm-up devices.	Cognitive	Analysis
					Explain how the air conditioning system works.	Cognitive	Comprehension

4	3	2	1	0	Task/Skill	Domain	Level
					Chapter 13. Ignition System		
					Define the purpose of the ignition system.	Cognitive	Knowledge
					Identify ignition system generations.	Cognitive	Analysis
					Categorize ignition system components into respective generations.	Cognitive	Analysis
					Remove, inspect, gap, and replace spark plugs.	Psychomotor	Manipulation
					Test spark plug wire resistance.	Psychomotor	Manipulation
					Remove, inspect, and replace COP boots.	Psychomotor	Manipulation
					Differentiate between interference and non-interference engines.	Cognitive	Analysis
					Chapter 14. Suspension, Steering, and Tires		
					Define the purpose of the suspension system.	Cognitive	Knowledge
					Locate, identify, and inspect suspension system components.	Psychomotor	Manipulation
					Define the purpose of the steering system.	Cognitive	Knowledge
					Locate, identify, and inspect steering system components.	Psychomotor	Manipulation
					Describe different tread designs.	Cognitive	Knowledge
					Identify repairable and non-repairable areas on a tire.	Cognitive	Knowledge
					Inspect and rotate tires.	Psychomotor	Manipulation
					Measure tire tread depth.	Psychomotor	Manipulation
					Locate the tire placard on a vehicle.	Psychomotor	Manipulation
					List causes of excessive tire wear.	Cognitive	Knowledge
					Analyze reasons for snow tire use vs. all-season tires.	Cognitive	Analysis
					Explain when run-flat technology may be beneficial.	Cognitive	Knowledge
					Explain how EV-specific tires are designed different from standard tires.	Cognitive	Comprehension
					Chapter 15. Braking System		
					Define the purpose and principles of the braking system.	Cognitive	Knowledge
					Locate, identify, and inspect braking system components.	Psychomotor	Manipulation
					Explain how regenerative braking works.	Cognitive	Comprehension
					Identify brake fluid properties.	Cognitive	Comprehension
					Discuss the advantage of antilock brakes.	Cognitive	Comprehension
					Explain how the parking brake works.	Cognitive	Comprehension
					Perform a disc brake inspection and measure brake pad thickness.	Psychomotor	Articulation
					Categorize different types of control and safety systems.	Cognitive	Synthesis
					Chapter 16. Drivetrain		
					Define the purpose of the drivetrain.	Cognitive	Knowledge
					Locate, identify, and inspect drivetrain components.	Psychomotor	Manipulation
					Describe different drivetrain configurations.	Cognitive	Comprehension
					Calculate gear ratios.	Cognitive	Application
					Explain the operational stages of a torque converter.	Cognitive	Comprehension
					Compare various types of differentials.	Cognitive	Comprehension
					Communicate CVT benefits.	Affective	Responding
					Chapter 17. Exhaust and Emission System		
					Define the purpose of the exhaust and emission system.	Cognitive	Knowledge
					Locate, identify, and inspect exhaust and emission system components.	Psychomotor	Manipulation
					Identify different types of automotive emissions.	Cognitive	Comprehension
					Explain how emission standards have evolved over time.	Cognitive	Comprehension
					Explain how the catalytic converter works.	Cognitive	Comprehension
					Locate the vehicle emission control information (VECI) sticker.	Psychomotor	Manipulation
					Explain how diesel aftertreatment technologies work.	Cognitive	Comprehension
					Describe the benefits of a properly working emission system.	Affective	Valuing

4	3	2	1	0	Task/Skill	Domain	Level
					Chapter 18. Alternative Fuels and Designs		
					Identify differences in automotive design, depending on the fuel source.	Cognitive	Analysis
					Differentiate tailpipe and upstream emissions.	Affective	Valuing
					Compare and contrast different alternative vehicle types.	Cognitive	Evaluation
					Compare petrobased and biobased fuels.	Cognitive	Evaluation
					Calculate the payback period on an alternative fueled vehicle.	Cognitive	Analysis
					Compare energy content in different fuel types.	Cognitive	Evaluation
					Differentiate between plug-in, full, and mild hybrids.	Cognitive	Analysis
					Describe different types of hybrid drivetrains.	Cognitive	Knowledge
					Illustrate how hydrogen can be used to power an electric motor.	Cognitive	Application
					Categorize different levels of automation.	Cognitive	Synthesis
					Discuss technological issues with alternative fueled vehicles.	Affective	Responding
					Chapter 19. Automotive Accessories		
					Identify available automotive accessories.	Cognitive	Analysis
					Explain different accessory functions.	Cognitive	Comprehension
					Estimate the cost of selected accessories for a specific vehicle.	Cognitive	Application
					Discuss the issues associated using electronic devices while driving.	Affective	Valuing
					Describe how a global positioning system works.	Cognitive	Comprehension
					Discuss negative impacts of remote starters.	Affective	Organizing
					Describe hitch classifications.	Cognitive	Knowledge
					Chapter 20. Common Problems and Roadside Emergencies		
					Identify common automotive problems.	Cognitive	Analysis
					Analyze basic automotive problems and formulate a solution.	Cognitive	Analysis
					Remove and replace a headlight.	Psychomotor	Manipulation
					Explain the different causes of black, blue, and white smoke.	Cognitive	Comprehension
					Identify unusual sounds and associate a possible problem to that sound.	Cognitive	Analysis
					Identify unusual smells and associate a possible problem to that smell.	Cognitive	Analysis
					Explain what might cause a “no-start” situation.	Cognitive	Comprehension
					Clean an SLI battery.	Psychomotor	Manipulation
					Inspect, remove, and replace wiper blades.	Psychomotor	Manipulation
					Locate a leak on a tire.	Psychomotor	Manipulation
					List items that should be in an emergency roadside and a winter safety kit.	Cognitive	Knowledge
					Perform a jump-start safely.	Psychomotor	Manipulation
					Inspect, remove, and replace a drive belt.	Psychomotor	Manipulation
					Remove and replace a flat tire with a spare tire.	Psychomotor	Manipulation
					Chapter 21. Electric Vehicles		
					Explain how an electric vehicle works.	Cognitive	Comprehension
					Describe what contributes to exterior design efficiency.	Cognitive	Comprehension
					Differentiate between electric vehicle charging levels.	Cognitive	Analysis
					Conduct research to identify and compare current electric vehicles.	Cognitive	Evaluation
					Explain the unique hazmat risks associated with lithium-ion battery fires.	Cognitive	Comprehension
					Chapter 22. Next-Generation Vehicles		
					Contrast a software-defined vehicle with a legacy architecture vehicle.	Cognitive	Evaluation
					Describe technologies made possible by the electromagnetic spectrum.	Cognitive	Comprehension
					Differentiate between the SAE J3016™ Levels of Driving Automation.	Cognitive	Analysis
					Discuss how artificial intelligence will impact autonomous vehicles.	Cognitive	Evaluation
					Explain operational design domains and why they are important.	Cognitive	Comprehension
					Discuss ethical issues with driverless and fully autonomous vehicles.	Affective	Responding

Appendix E - Daily Reflection Log

Directions

At the end of each day, write a short paragraph reflecting on what you learned.

Monday

Tuesday

Wednesday

Thursday

Friday

Name_____ Class_____ Date_____ Score_____

Appendix F - Article, Website, or Video Review Form

Directions

Research an article, visit a website, or watch a video and then complete this form by writing sentences in your own words. Do not copy verbatim from the source.

Bibliography

Summary

Opinions/Conclusions/Reactions

Appendix G - Career Exploration Form

Directions

Use the Occupational Outlook Website (**www.bls.gov/ooh**) to research a career. As you identify the following, write complete sentences in your own words. Do not copy verbatim from the website.

Career

_____

Salary Potential

_____

Education/Training Required

_____

_____

_____

Job Outlook

_____

_____

_____

Nature of the Work

_____

_____

_____

_____

Working Conditions

_____

_____

_____

_____

_____

Reason You Chose this Career

_____

_____

_____

_____

_____

Name_____ Class_____ Date_____ Score_____

Appendix H - Work Order/Repair Invoice

Repair and Service Facility
123 Main Ave.
Anytown, USA
555-0100

Work Order Number: _____
Date & Time Received: ___/___/___ ___:___AM PM
Promised: ___/___/___ ___:___AM PM
Order Written By: _____

Customer Contact Information		
Name:		
Address:		
City:	State:	Zip:
Phone Home: ( )		
Work: ( )	Cell: ( )	

Vehicle Information		
Year/Color		
Make/Model/Trim		
License Plate		
Odometer Reading	IN	OUT
Engine Size		
VIN		

Description of Customer Concern

Possible Cause

Customer Rights	
Do you want your parts returned?	Yes ❑ No ❑
Do you want a written estimate?	Yes ❑ No ❑
If the job exceeds the estimate by 10% or more, do you authorize us in proceeding?	Yes ❑ No ❑
If additional repairs are found necessary, do you authorize us in proceeding?	Yes ❑ No ❑
Do you request a written estimate for repairs with cost in excess of $50.00?	Yes ❑ No ❑

Estimate of Repair	
Parts	$
Labor Rate $ ____ per Hr. x ___ Hrs.	$
Other/Supplies	$
Preliminary Estimate Total	$

I hereby authorize the above repair work to be done with the necessary materials, and hereby grant you and/or your employees permission to operate the vehicle herein described on streets, highways, or elsewhere for the purpose of testing and/or inspection. An express mechanic's lien is hereby acknowledged on above vehicle to secure the amount of repairs thereof.
Authorized By_____

❑ **Lubricate Chassis** ❑ **Change Oil** ❑ **Check All Fluids** ❑ **Rotate Tires** ❑ **Wash**

Parts Required			
Qty.	Item No.	Description	Price
		Total Parts	

Labor Required			
Service Description	Hours	Labor Rate	Charge
		Total Labor	

Other/Supplies Required			
Qty.	Item No.	Description	Price
		Towing	
		Environmental Fees	
		Supplies	
		Total Other/Supplies	

Repair Total	
Total Parts	$
Total Labor	$
Total Other/Supplies	$
Subtotal	$
Tax	$
Total Amount Due ►	$

Repair Summary - Correction to Problem

Signed_____

Date_____

Name_____ Class_____ Date_____ Score_____

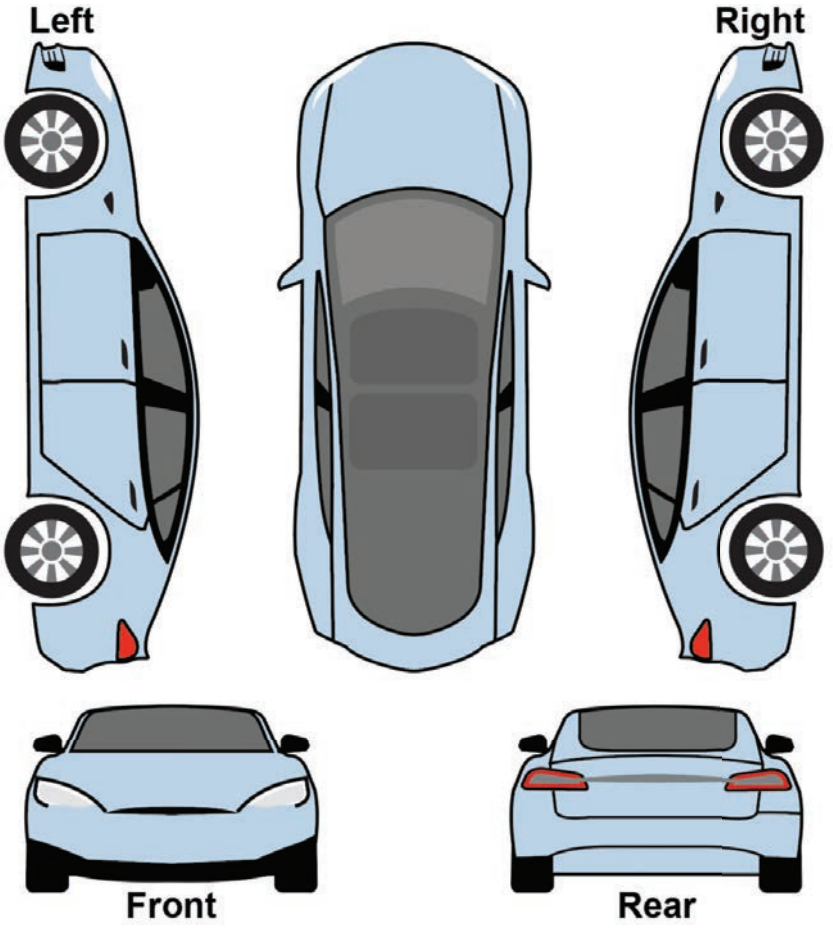
Appendix I - Vehicle Walk-Around Inspection Form

Model Year	Make	Model	Trim Level	Vehicle Identification Number (VIN)	License Plate

Engine/e-Motor	Drivetrain	Odometer
❑ICE (Size____) ❑EV ❑Hybrid ❑Other_____	❑FWD ❑RWD ❑4WD ❑AWD	

Instructions - Preparing for Vehicle Service and Return to Customer

1. Use vehicle protection, such as: fender covers, mats, seat covers, and steering wheel covers as required.
2. Begin visual inspection at the driver's door, working back toward the rear and around to the passenger side.
3. Look for signs of collision damage or repair. Use the "damage type codes" and mark on the diagram any damage to the paint, body, lights, wheels, trim, and glass.
4. Complete the inspection, adding comments and details as needed.
5. Identify ADAS component locations and mark them on the diagram. Note if components are damaged or dirty.
6. Check the bottom corner of windows for a label that identifies glass type: laminated (multilayer - difficult to break) or tempered (made breakable for an emergency). Mark tempered windows for customer safety reference.
7. After inspection and/or service, prepare the vehicle to return to the customer following your shop procedure.



Damage Type Codes
- B = Burn
- C = Crease
- D = Dent
- E = Bent
- F = Finish
- G = Gouge
- H = Hail
- J = Rip or Crack
- K = Buckle
- L = Lip
- P = Parking Lot Dings
- R = Rust (Surface)
- S = Scratch (Surface)
- T = Paint Problem
- * = Not Specified

Damage Type Glass
- GB = Glass Broken
- GCh = Glass Chipped
- GCr = Glass Cracked
- GS = Glass Scratched

Window Glass Type
- TG = Tempered Glass

ADAS Components
- ■ = Cameras
- ● = Lidar Sensors
- ▶ = Radar Sensors
- ≈ = Ultrasonic Sensors

Comments/Details

Name_____ Class_____ Date_____ Score_____

Appendix J - Multi-Point Vehicle Inspection Form

Model Year	Make	Model	Trim Level	Vehicle Identification Number (VIN)	License Plate

Engine/e-Motor	Preparing for Vehicle Service and Return to Customer	
❑ICE (Size____) ❑EV ❑Hybrid ❑Other _____	❑Vehicle Protection	❑Walk-Around Inspection

☑ Satisfactory ☑ May Need Future Attention ☑ Requires Immediate Attention ▭▭▭ Not Applicable

Brakes and Tires

Left Front	_____ mm	Brake Lining	_____ mm	Right Front
	_____ psi	Tire Pressure	_____ psi	
	___ /32nds	Tread Depth	___ /32nds	
Front Tire Size (Placard) ____/____R____		Actual Size	____/____R____	
Left Rear	_____ mm	Brake Lining	_____ mm	Right Rear
	_____ psi	Tire Pressure	_____ psi	
	___ /32nds	Tread Depth	___ /32nds	
Rear Tire Size (Placard) ____/____R____		Actual Size	____/____R____	

Tread Wear ❑ Normal ❑ Edge ❑ Center ❑ Cupped ❑ Cut ❑ Feathered

Tire Age in Years ❑ 0-3 ❑ 4-6 ❑ 7+ | Spare Tire ___ /32nds ___ psi

Under Vehicle (Visual)

❑❑❑	Brake Lines/Hoses
❑❑❑	CV Axles/Boots
❑❑❑	Leaks
❑❑❑	Muffler/Exhaust
❑❑❑	Parking Brake Cable
❑❑❑	Shock Absorbers
❑❑❑	Steering Linkage
❑❑❑	Struts/Suspension
❑❑❑	Tie Rod Ends/Boots
❑❑❑	Other _____

Fluids/e-Fluids

Type	Engine Oil	Coolant/ e-Thermal	Power Steering	Brake	Clutch	Trans./ e-Trans.	Differential	Washer
Condition	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑
Leak	❑	❑	❑	❑	❑	❑	❑	❑
Level	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑	❑❑❑

Battery (12-Volt)

❑ Good ❑ Replace

CCA ___	CA _____	BCI____

❑❑❑	Battery Condition
❑❑❑	Hold-Down/Box
❑❑❑	Terminals/Cables

Battery Age _____ Years

Under Hood

❑❑❑	A/C Hoses
❑❑❑	Belt Tensioner
❑❑❑	Drive Belts
❑❑❑	Engine Air Filter
❑❑❑	HEPA/Other Air Filter
❑❑❑	Radiator/Radiator Cap
❑❑❑	Radiator/Heater Hoses
❑❑❑	Other _____

Wipers

Front	Rear	
❑❑❑	❑❑❑	Spray Function
❑❑❑	❑❑❑	Wiper and Blade

ADAS Components(Sensors/Etc.)

❑❑❑	Cameras
❑❑❑	Lidar Sensors
❑❑❑	Radar Sensors
❑❑❑	Ultrasonic Sensors

Vehicle Interior

❑❑❑	Cabin Filter
❑❑❑	Dome Lights
❑❑❑	Heat/Cool Seats
❑❑❑	Horn
❑❑❑	HVAC/Blower
❑❑❑	Parking Brake
❑❑❑	Power Functions
❑❑❑	Other _____

Exterior Lights

Left	Right	
❑❑❑	❑❑❑	Brake Lights
❑❑❑	❑❑❑	Daytime Running
❑❑❑	❑❑❑	Hazard Warning
❑❑❑	❑❑❑	Headlights High Beam
❑❑❑	❑❑❑	Headlights Low Beam
❑❑❑	❑❑❑	Parking Lights
❑❑❑	❑❑❑	Taillights
❑❑❑	❑❑❑	Turn Signals
❑❑❑		License Plate Light
❑❑❑		Third/High Mount Brake

Dash Warning Lights

❑	No Active Warnings
❑	ABS/Brakes
❑	Airbag/SRS
❑	Battery
❑	Check Engine
❑	Engine Temp
❑	Oil Pressure
❑	Power Steering
❑	TPMS
❑	Transmission Temp
❑	Other _____

ADAS Warning Lights

❑	No Active Warnings
❑	Adaptive Cruise Control
❑	Adaptive Headlights
❑	Blind Spot Detection
❑	EV External Sound
❑	Front Collision Alert
❑	Lane Departure Alert
❑	Master Alert
❑	Parking Assist
❑	Rear Collision Alert
❑	Other _____

This is a partial list of inspection items, please consult the owner's manual for specific requirements.

(This Page May Be Photocopied)

ASE Maintenance and Light Repair (MLR) Tasks

ASE Task Priority

Priority Level 1 (P-1)	Priority Level 2 (P-2)	Priority Level 3 (P-3)

For every task, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

FOUNDATIONAL TASKS - REQUIRED 2024

Shop and Personal Safety

1. Identify general lab/shop safety rules and procedures. CH 5
2. Utilize safe procedures for handling of tools and equipment. CH 6
3. Identify and use proper placement of floor jacks and jack stands. CH 5, CH 20
4. Identify and use proper procedures for safe lift operation, ensuring the configuration and weight rating of the lift is appropriate for the vehicle being lifted, including xEVs. CH 5
5. Utilize proper ventilation procedures for working within the lab/shop area. CH 5
6. Identify marked safety areas. CH 5
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. CH 5
8. Identify the location and use of eye wash stations. CH 5
9. Identify the location of the posted evacuation routes. CH 5
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. CH 5
11. Identify and wear appropriate clothing for lab/shop activities. CH 5
12. Secure hair and jewelry for lab/shop activities. CH 5
13. Identify vehicle systems which pose a safety hazard during service such as: supplemental restraint systems (SRS), electronic brake control systems, stop/start systems, and remote start systems. CH 1, CH 5
14. Identify vehicle systems which pose a safety hazard during service due to high voltage such as: xEV drivetrains, lighting systems, ignition systems, A/C systems, injection systems, etc. CH 1, CH 9
15. Locate and demonstrate knowledge of safety data sheets (SDS). CH 5
16. Demonstrate knowledge of personal protective equipment (PPE) required for use in high voltage/electric vehicle circuits. CH 21

xEV Vehicle Safety

1. Demonstrate knowledge of hazards related to high voltage systems/electric vehicles, including electrocution, fire, explosion, arc flash, gases and fumes, hazardous chemicals, and EMF, and how to properly respond to emergency situations. CH 21
2. Demonstrate knowledge of high voltage system and component coloring, warning labels, lights, signage, and lock-out/tag-out procedures. CH 21
3. Demonstrate ability to identify which components and circuits contain high voltage. CH 21

xEV Vehicle Safety . . .

4. Demonstrate knowledge of steps needed to assess possible hazards prior to servicing a high voltage/electric vehicle, including awareness of automatic systems that may operate while the key switch/ignition is off. CH 21
5. Understand limitations on which systems, components, and circuits of a high voltage/electric vehicle a technician is capable of safely servicing based on their level of training and qualification. CH 21
6. Demonstrate knowledge of high voltage/electric vehicle intake process, inspection, handling, and in-process monitoring for all vehicles including damaged/compromised vehicles. CH 21

Tools and Equipment

1. Identify tools and their usage in automotive applications. CH 6
2. Identify standard and metric designation. CH 6
3. Demonstrate safe handling and use of appropriate tools. CH 6
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. CH 6
5. Demonstrate proper use of precision measuring tools (e.g., micrometer, dial-indicator, dial-caliper). CH 6
6. Perform common fastener and thread repair, including removing broken bolts, restoring internal and external threads, and repairing internal threads with a thread insert. CH 6

Preparing for Vehicle Service

1. Identify information needed and the service requested on a repair order. CH 1, CH 4
2. Identify purpose and demonstrate proper use of vehicle protection such as: fender covers, mats, seat, and steering wheel covers. CH 1, CH 4, CH 7
3. Perform a vehicle walk-around inspection; identify and document existing vehicle conditions such as body damage, paint damage, windshield damage, etc. CH 4
4. Perform a vehicle multi-point inspection and complete a vehicle inspection report (written and/or electronic). CH 4
5. Demonstrate use of the three C's (concern, cause, and correction). CH 4
6. Create a plan of action for each specific service or diagnostic situation, including placing vehicle in service mode as required. CH 4
7. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. CH 4

Preparing Vehicle for Customer

1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). CH 1, CH 7

WORKPLACE SKILLS - REQUIRED 2024

Personal Standards

1.	Reports to work daily on time; able to take directions and motivated to accomplish the task at hand.	CH 1
2.	Dresses appropriately and uses language and manners suitable for the workplace.	CH 1
3.	Maintains personal hygiene appropriate for the workplace.	CH 1
4.	Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.	CH 1
5.	Demonstrates honesty, integrity, and reliability.	CH 1

Work Habits/Ethics

1.	Complies with workplace policies/laws.	CH 1
2.	Contributes to the success of the team, assists others and requests help when needed.	CH 1
3.	Works well with all customers and coworkers.	CH 1
4.	Negotiates solutions to interpersonal and workplace conflicts.	CH 1
5.	Contributes ideas and initiative.	CH 1, CH 18

Work Habits/Ethics . . .

6.	Follows directions.	CH 1
7.	Communicates effectively, both in writing and verbally, with customers and coworkers.	CH 1, CH 18
8.	Reads and interprets workplace documents; writes clearly and concisely.	CH 1
9.	Analyzes and resolves problems that arise in completing assigned tasks.	CH 1
10.	Organizes and implements a productive plan of work.	CH 1
11.	Uses scientific, technical, engineering and mathematics (STEM) principles and reasoning to accomplish assigned tasks.	CH 1, CH 2, CH 3, CH 18, CH 19
12.	Identifies and addresses the needs of all customers, providing helpful, courteous, and knowledgeable service and advice as needed.	CH 1
13.	Respectful of tools and property used in school and workplace environment.	CH 1
14.	Contributes to an inclusive environment where every coworker and customer feels welcomed, heard, and valued.	CH 1, CH 18

I. ENGINE REPAIR - MLR 2024

A. General

1.	Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 2, CH 6, CH 8, CH 10
2.	Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
3.	Verify operation of the instrument panel engine warning indicators.	P-1	CH 20
4.	Inspect engine assembly for fuel, oil, coolant, and other leaks.	P-1	CH 8
5.	Install engine covers using gaskets, seals, and sealers as required.	P-2	
6.	Demonstrate knowledge of the procedure for verifying engine mechanical timing.	P-2	
7.	Inspect engine mounts.	P-2	
8.	Identify service precautions related to service of the internal combustion engine of an xEV.	P-2	CH 18

B. Cylinder Head and Valve Train

1.	Identify cylinder head and valve train components and configurations.	P-1	CH 1

C. Engine Block Assembly

1.	Identify engine block assembly components and configurations.	P-1	CH 1

D. Lubrication and Cooling Systems

1.	Identify lubrication and cooling system components and configurations.	P-1	CH 8, CH 10, CH 12
2.	Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required.	P-1	CH 10
3.	Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant reservoir/recovery tank, heater core, and galley plugs.	P-1	CH 8, CH 12
4.	Identify causes of engine overheating.	P-2	CH 12, CH 20
5.	Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.	P-1	CH 8, CH 9
6.	Inspect and test coolant; drain and recover coolant; flush and/or refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.	P-1	CH 12
7.	Identify different types of water/coolant pumps (belt driven, chain driven, and electric).	P-2	CH 12
8.	Remove, inspect, and replace thermostat and gasket/seal.	P-1	CH 12

II. AUTOMATIC TRANSMISSION AND TRANSAXLE - MLR 2024

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 2, CH 6, CH 8, CH 16
2. Identify automatic transmission and transaxle components and configurations, including torque converter automatic, dual-clutch automatic (DCT), CVT, and xEV drive.	P-1	CH 8, CH 16
3. Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
4. Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle equipped with a dipstick.	P-1	CH 8, CH 16
5. Demonstrate knowledge of procedures to check transmission fluid condition and level; inspect for leaks on transmission or transaxle not equipped with a dipstick.	P-1	
6. Demonstrate knowledge of transmission/transaxle gear reduction/multiplication operation using driving, driven, and held member (power flow) principles.	P-3	
7. Demonstrate knowledge of hydraulic principles (Pascal's Law) in a transmission/transaxle.	P-3	

B. In-Vehicle Transmission/Transaxle

1. Inspect external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.	P-2	
2. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.	P-1	CH 8
3. Demonstrate knowledge of relearn procedures.	P-2	
4. Inspect, replace and/or align power train mounts.	P-3	

C. Off-Vehicle Transmission and Transaxle

1. Describe the operational characteristics of a continuously variable transmission (CVT).	P-3	CH 16
2. Describe the operational characteristics of a hybrid vehicle drive train.	P-3	CH 18
3. Describe the operational characteristics of dual-clutch transmission (DCT).	P-3	

III. MANUAL DRIVE TRAIN AND AXLES - MLR 2024

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 20, CH 6, CH 8, CH 16
2. Identify manual drive train and axle components and configurations.	P-1	CH 8, CH 16
3. Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-2	CH 20
4. Check fluid condition; check for leaks.	P-3	CH 8, CH 16
5. Drain and refill manual transmission/transaxle; use proper fluid type per manufacturer specification.	P-2	CH 8, CH 16

B. Clutch

1. Demonstrate knowledge of procedures to check and adjust clutch primary cylinder fluid level.	P-3	CH 8, CH 16

C. Drive Shaft, Half Shafts, Universal Joints and Constant-Velocity (CV) Joints (Front, Rear, All, and Four-wheel Drive)

1. Inspect and/or remove/replace bearings, hubs, and seals.	P-2	
2. Inspect and/or service/replace shafts, yokes, boots, and universal/CV joints.	P-2	CH 16

D. Differential and Drive Axles
D.1 Ring and Pinion Gears and Differential Housing Assembly

1. Inspect differential housing; check for leaks; inspect housing vent.	P-1	CH 8, CH 16
2. Check and adjust differential housing fluid level; use proper fluid type per manufacturer specification.	P-1	CH 8, CH 16
3. Drain and refill differential housing; using proper fluid type per manufacturer specification.	P-1	

D. Differential and Drive Axles
D.2 Drive Axles

1. Inspect and replace drive axle wheel studs.	P-2	CH 14

E. Four-wheel Drive/All-wheel Drive

1. Identify concerns related to variations in tire circumference and/or final drive ratios.	P-3	
2. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.	P-2	CH 16

IV. SUSPENSION AND STEERING - MLR 2024

A. General

1.	Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 2, CH 6, CH 8, CH 14, CH 20
2.	Identify suspension and steering system components and configurations.	P-1	CH 14
3.	Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
4.	Disable, enable, and properly handle SRS/airbag system components during vehicle service following manufacturers' procedures.	P-2	

B. Steering System

1.	Inspect rack and pinion steering gear tie rod ends (sockets) and bellows boots.	P-1	CH 14
2.	Inspect power steering fluid level and condition.	P-2	CH 8, CH 14
3.	Drain and replace power steering system fluid; use proper fluid type per manufacturer specification.	P-2	CH 14
4.	Inspect for power steering fluid leakage.	P-2	CH 8, CH 14
5.	Remove, inspect, replace, and/or adjust power steering pump drive belt.	P-2	CH 14
6.	Inspect, remove, and/or replace power steering hoses and fittings.	P-2	CH 14
7.	Inspect pitman arm, relay (centerlink/ intermediate) rod, idler arm, mountings, and steering linkage damper.	P-3	CH 14
8.	Inspect tie rod ends (sockets), tie rod sleeves, and clamps (non-rack and pinion).	P-3	CH 14
9.	Demonstrate knowledge of electric power steering system operation.	P-2	CH 14

C. Suspension System

1.	Inspect upper and/or lower control arms, bushings, and shafts.	P-2	CH 14
2.	Inspect and replace rebound/jounce bumpers.	P-3	CH 14
3.	Inspect track bar, strut rods/radius arms, and related mounts and bushings.	P-2	CH 14
4.	Inspect upper and/or lower ball joints (with or without wear indicators).	P-2	CH 14
5.	Inspect suspension system coil springs and spring insulators.	P-2	CH 14
6.	Inspect torsion bars and mounts.	P-3	CH 14
7.	Inspect, remove, and/or replace front/ rear stabilizer bar (sway bar) bushings, brackets, and links.	P-2	CH 14
8.	Inspect, remove, and/or replace strut assembly, strut coil spring, insulators, and upper strut bearing mount.	P-2	CH 14
9.	Inspect components of rear suspension systems (coil, leaf, and torsion beams).	P-1	CH 14
10.	Inspect components of electronically controlled suspension systems.	P-2	CH 14

D. Related Suspension and Steering Service

1	Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.	P-1	CH 14
2.	Inspect front and rear wheel bearings.	P-1	
3.	Describe the function of electronically controlled suspension and steering systems and components, (i.e., active suspension and stability control).	P-2	CH 14

E. Wheel Alignment

1	Determine the need to recalibrate a vehicle's advanced driver assistance system (ADAS) that may require calibration after repairs or adjustments.	P-1	
2	Perform pre-alignment inspection; measure vehicle ride height.	P-1	
3.	Describe four-wheel alignment angles (camber, caster, toe, setback, and thrust angle) and effects on vehicle handling\tire wear.	P-1	CH 14

F. Wheels and Tires

1.	Inspect tire condition/age; identify tire wear patterns; check for correct tire size, application (service-class, load, and speed ratings), and air pressure as listed on the tire information placard/ label.	P-1	CH 14, CH 20
2.	Rotate tires according to manufacturer's recommendations including vehicles equipped with tire pressure monitoring systems (TPMS).	P-1	CH 14
3.	Dismount, inspect, and remount tire on wheel (with/without TPMS); balance wheel and tire assembly.	P-1	CH 14
4.	Inspect tire and wheel assembly for air loss; determine needed action.	P-1	CH 14
5.	Repair tire following tire manufacturer approved procedure.	P-1	CH 14
6.	Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate/ relearn system; verify operation of instrument panel lamps.	P-1	CH 14
7.	Demonstrate knowledge of steps required to remove and replace sensors (per OEM/sensor manufacturer) in a tire pressure monitoring system (TPMS).	P-1	CH 14
8.	Perform Road Force balance/match mounting.	P-3	

V. BRAKES - MLR 2024

A. General

1.	Research vehicle service information such as fluid type, system design (hydraulic, electronic, etc.), vehicle service history, service precautions, technical service bulletins, and recalls including xEV and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 6, CH 8, CH 15
2.	Identify brake system components and configurations.	P-1	CH 15
3.	Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
4.	Research the need to place a vehicle in service mode before servicing the brake system.	P-1	CH 15
5.	Research the need to perform calibration/ recalibration, initialization, or relearn procedures as required.	P-1	CH 15
6.	Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).	P-1	CH 15
7.	Install wheel and torque lug nuts/wheel fasteners.	P-1	CH 14, CH 15

B. Hydraulic System

1.	Demonstrate knowledge of hydraulic principles (Pascal's law).	P-1	CH 15
2.	Describe proper brake pedal height, travel, and feel.	P-1	CH 15
3.	Check primary cylinder for proper operation.	P-1	CH 15
4.	Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports.	P-1	CH 15
5.	Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.	P-1	CH 8
6.	Bleed and/or replace fluid in the brake system.	P-1	CH 15
7.	Test brake fluid for contamination.	P-2	CH 15
8.	Identify components of brake warning light system.	P-2	CH 15

C. Drum Brakes

1.	Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.	P-2	
2.	Refinish brake drum and measure final drum diameter; compare with specification.	P-3	
3.	Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/ self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.	P-3	
4.	Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.	P-3	
5.	Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.	P-3	

D. Disc Brakes

1.	Remove and clean caliper assembly; inspect for leaks, damage, and wear.	P-1	CH 15
2.	Inspect caliper mounting and slides/pins for proper operation, wear, and damage.	P-1	CH 15
3.	Remove, inspect, and/or replace brake pads and retaining hardware.	P-1	CH 15
4.	Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads against rotor; inspect for leaks.	P-1	CH 15
5.	Clean and inspect rotor and mounting surface, measure rotor thickness, thickness variation, and lateral runout.	P-1	CH 15
6.	Remove and reinstall/replace rotor.	P-1	CH 15
7.	Refinish rotor on vehicle; measure final rotor thickness and compare with specification.	P-3	
8.	Refinish rotor off vehicle; measure final rotor thickness and compare with specification.	P-3	
9.	Retract and re-adjust caliper piston on an integrated parking brake system.	P-2	
10.	Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendation.	P-1	CH 15

E. Power-Assist Units

1	Check brake pedal travel with and without engine running to verify proper power booster operation.	P-2	
2.	Identify components of the brake power assist system (vacuum/ hydraulic/electric).	P-2	

F. Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical)

1.	Remove, clean, inspect, repack/replace, and install wheel bearings; remove and install bearing races; replace seals; install hub and adjust bearings.	P-3	
2.	Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.	P-2	CH 15
3.	Check parking brake operation (including electric parking brakes); check parking brake indicator light system operation.	P-2	CH 15
4.	Check operation of brake stop light system.	P-1	CH 15
5.	Inspect and replace wheel studs/fasteners.	P-2	CH 14

G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS) and Electronic Stability Control (ESC) Systems

1.	Identify electronic brake control system components and describe function (ABS, TCS, ESC).	P-2	CH 15
2.	Describe the operation of a regenerative braking system.	P-3	CH 15

VI. ELECTRICAL/ELECTRONIC SYSTEMS - MLR 2024

A. General

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 2, CH 6, CH 8, CH 9, CH 11, CH 20
2. Identify electrical/electronic system components and configurations.	P-1	CH 9, CH 20, CH 21
3. Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
4. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	CH 9, CH 20
5. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance.	P-1	CH 9
6. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.	P-1	CH 9
7. Describe precautions related to the use of test lights.	P-3	CH 20
8. Use fused jumper wires to check operation of electrical circuits per service information.	P-2	CH 20
9. Use wiring diagrams to trace electrical/electronic circuits.	P-1	CH 9
10. Measure key-off battery drain (parasitic draw).	P-2	CH 9
11. Inspect and test fusible links, circuit breakers, and fuses.	P-1	CH 20
12. Repair and/or replace connectors, terminal ends, and wiring of electrical/electronic systems (including solder repair).	P-2	CH 20
13. Research the need to perform calibration/recalibration, initialization, or relearn procedures as required.	P-1	CH 9

B. Batteries (Low Voltage)

1. Perform battery state-of-charge test; determine needed action.	P-1	CH 9
2. Confirm proper battery capacity, size, type, and application for vehicle; perform battery capacity and load test, as recommended by manufacturer.	P-1	CH 9
3. Maintain or restore electronic memory functions as recommended by manufacturer.	P-2	CH 9
4. Inspect and clean battery; check battery cables, connectors, clamps, and hold-downs.	P-1	CH 8, CH 9
5. Perform battery charging according to manufacturer's recommendations.	P-1	CH 9

B. Batteries (Low Voltage)...

6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply according to manufacturer's recommendations.	P-1	CH 20
7. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.	P-2	CH 9

C. Starting System (Low Voltage)

1. Perform starter current draw test.	P-1	CH 9
2. Perform starter circuit voltage drop tests.	P-1	CH 9
3. Inspect and test starter relays and solenoids.	P-2	CH 9
4. Remove and install starter in a vehicle.	P-3	CH 9
5. Inspect and test switches, connectors, and wires of starter control circuits.	P-2	CH 9
6. Demonstrate knowledge of an automatic idle-stop/start-stop system that uses a low-voltage starter to restart the engine.	P-2	CH 18

D. Charging System (Low Voltage)

1. Perform charging system output test.	P-1	CH 9
2. Inspect, adjust, and replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.	P-1	CH 9
3. Remove, inspect, and replace generator (alternator).	P-3	CH 9
4. Perform charging circuit voltage drop tests.	P-2	CH 9

E. Lighting Systems

1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.	P-1	CH 20
2. Aim headlights.	P-2	

F. Instrument Cluster and Driver Information Systems

1. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required.	P-1	CH 20

G. Body Electrical Systems

1. Demonstrate knowledge of vehicle comfort, convenience, access, safety, and related systems operation.	P-3	CH 22
2. Remove and reinstall door panel.	P-2	
3. Describe the operation of keyless entry/remote-start systems.	P-3	CH 22
4. Describe disabling and enabling procedures for supplemental restraint system (SRS); verify indicator lamp operation.	P-2	
5. Verify windshield wiper and washer operation; replace wiper blades.	P-1	CH 20

H. xEV Systems

1. Locate procedures to safely de-energize/de-stable and energize/enable high-voltage systems.	P-3	CH 21

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) - MLR 2024

A. General

1.	Research vehicle service information, including refrigerant/oil/fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 1, CH 12
2.	Identify heating, ventilation, and air conditioning (HVAC) components and configurations.	P-1	CH 12
3.	Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
4.	Demonstrate knowledge of the steps of an A/C performance test, as recommended by manufacturer.	P-2	CH 12
5.	Identify abnormal operating noises in the A/C system.	P-3	CH 12
6.	Visually inspect A/C system for signs of leaks.	P-1	CH 12
7.	Verify heating and air conditioning concerns.	P-1	CH 12
8.	Research the need to place a vehicle in service mode before servicing the HVAC system.	P-1	CH 12

B. Refrigeration System Components

1.	Inspect and/or replace A/C compressor drive belts, pulleys, and tensioners.	P-1	CH 12
2.	Inspect for proper A/C condenser airflow.	P-2	CH 12
3.	Inspect evaporator housing condensation drain.	P-1	CH 12

C. Heating, Ventilation, and Engine Cooling Systems

1.	Inspect engine cooling and heater systems hoses and pipes.	P-1	CH 12

D. Operating Systems and Related Controls

1.	Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets.	P-1	CH 12
2.	Identify the source of HVAC system odors.	P-2	CH 12

E. Refrigerant Recovery, Recycling, and Handling

1.	Demonstrate knowledge of the requirement to recover, recycle, and handle refrigerants using proper equipment and procedures.	P-1	CH 12

VIII. ENGINE PERFORMANCE - MLR 2024

A. General

1.	Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS).	P-1	CH 1, CH 2, CH 6, CH 8, CH 11, CH 13, CH 17, CH 20
2.	Retrieve and record on-board diagnostic DTCs, monitor status, and freeze frame data; clear codes and data when directed.	P-1	CH 20
3.	Demonstrate knowledge of proper engine cooling system operation.	P-1	CH 12
4.	Demonstrate knowledge of camshaft timing including engines equipped with variable valve timing (VVT) systems.	P-1	

B. Computerized Controls

1.	Identify computerized control system components and configurations.	P-1	CH 9

C. Ignition System

1.	Identify ignition system components and configurations.	P-1	CH 13
2.	Remove and replace spark plugs; inspect secondary ignition components for wear and damage.	P-2	CH 13

D. Fuel, Air Induction, and Exhaust System

1.	Identify fuel, air induction, and exhaust system components and configurations.	P-1	CH 11, CH 17
2.	Replace fuel filter(s) where applicable.	P-3	CH 11
3.	Inspect, service, or replace air filters, filter housings, and intake duct work.	P-1	CH 11
4.	Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields.	P-1	CH 17
5.	Inspect condition of exhaust system hangers, brackets, clamps, and heat shields.	P-1	CH 17
6.	Check and refill diesel exhaust fluid (DEF).	P-3	CH 17

E. Emissions Control Systems

1.	Identify emission control system components and configurations.	P-1	CH 11, CH 17
2.	Inspect, test, and service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses.	P-2	CH 11, CH 17

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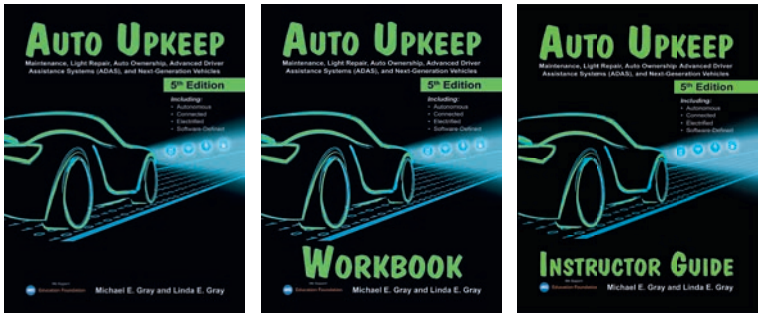

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