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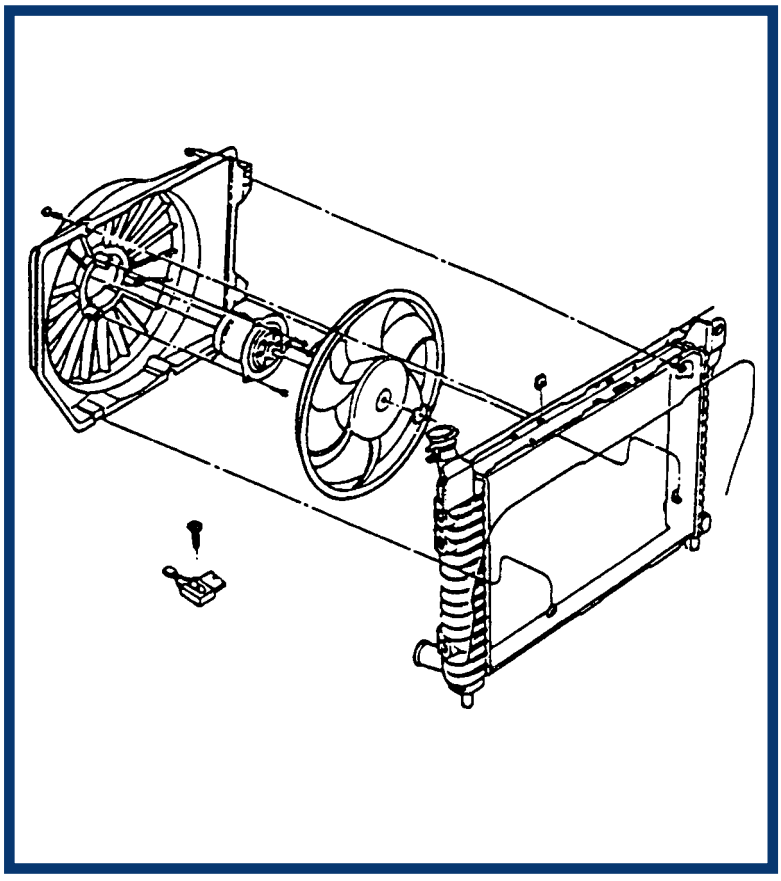

Module 3:
Engine Performance
Section C:
Emission Control Systems

Student Workbook

2001 Edition

Instructional Materials Laboratory
University of Missouri-Columbia

Automotive Technology

Module 3: Engine Performance

Section C: Emission Control Systems

Student Workbook

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Name:

MODULE 3: ENGINE PERFORMANCE SECTION C: EMISSION CONTROL SYSTEMS STUDENT WORKBOOK TRACKING SHEET					
Assignment Sheet	**Title of Assignment Sheet**	**Instructor Guide Page #**	**Student Workbook Page #**	**Instructor's Initials**	**Date**
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AS1-L1-UII	The Positive Crankcase Ventilation System	27-30	W 3-4		
AS1-L1-UIII	The Evaporative Emission Control System	61-64	W 9-10		
AS1-L1-UIV	The Exhaust Gas Recirculation System	95-98	W 17-18		
AS1-L1-UV	The Air Injection System	135-138	W 27-28		
AS1-L1-UVI	The Catalytic Converter	175-178	W 39-40		
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Job Sheet	**Title of Job Sheet**	**Instructor Guide Page #**	**Student Workbook Page #**	**Instructor's Initials**	**Date**
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JS1-L2-UIII	Test the Evaporative Emission Control System on a Carbureted Vehicle	69-70	W 11-12		
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JS2-L2-UV	Test and Service the Exhaust-Pulse Air Injection System	153-156	W 35-38		
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JS1-L2-UVII	Diagnosing an On-Board Diagnostics Generation Two System	223-224	W 53-54		
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JS1-L1-UIX	Adjust the Valves on Engines with Mechanical or Hydraulic Lifters	277-278	W 61-62		
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Name:

MODULE 3: ENGINE PERFORMANCE *SECTION C: EMISSION CONTROL SYSTEMS* *STUDENT WORKBOOK TRACKING SHEET - PAGE 2*					
Job Sheet	**Title of Job Sheet**	**Instructor Guide Page #**	**Student Workbook Page #**	**Instructor's Initials**	**Date**
JS3-L1-UIX	Verify Engine Operating Temperature	281-282	W 65-66		
JS4-L1-UIX	Inspect, Test, and Service the Cooling System	283-286	W 67-70		
JS5-L1-UIX	Drain, Flush, and Fill the Cooling System	287-288	W 71-72		
JS6-L1-UIX	Inspect, Test, and Service the Thermostat and Components	289-292	W 73-76		
JS7-L1-UIX	Inspect, Test, and Service the Fan and Fan Components	293-296	W 77-80		

AS1-L1-UI

NAME:

DATE:

THE BASICS OF EMISSIONS AND AIR POLLUTION

Directions — Answer the following questions by writing all responses on this sheet.

1. Name three types of natural air pollution.

2. How is smog created?

3. Name the four basic types of exhaust emissions.

4. What is a PMVI and what is its purpose?

5. What are the three basic types of emission control systems on modern vehicles?

The student must obtain a minimum score of ____ on AS1-L1-UI in order to receive an evaluation for Competencies L1-L9.

AS1-L1-UII

NAME:

DATE:

THE POSITIVE CRANKCASE VENTILATION SYSTEM

Directions — Answer the following questions by writing all responses on this sheet.

1. What is the purpose of the emission control system?

2. How are blowby gases created?

3. What is the function of the valve?

What is the function of the inlet filter?

4. Fill in the blanks.

   a. When at _____, high intake manifold vacuum causes the valve plunger to be pulled up toward the end of the valve closest to the intake manifold to restrict blowby gas flow at the intake end of the valve.

   b. During _____, intake manifold vacuum drops almost completely to cause the plunger to seat tightly against the crankcase end of the valve. This restricts blowby gas flow to the intake manifold.

   c. During _____, intake manifold vacuum decreases to cause the valve plunger to move toward the middle of the valve to allow for heavy blowby gas flow from the crankcase into the intake manifold.

5. Why are positive crankcase ventilation orifice systems used?

The student must obtain a minimum score of ____ on AS1-L1-UII in order to receive an evaluation for Competencies L1 and L2.

JS1-L2-UII

NAME(S):

DIAGNOSE AND SERVICE THE POSITIVE CRANKCASE VENTILATION SYSTEM

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Protective eyewear

EVALUATION

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Visually inspect the positive crankcase ventilation system. Complete the following chart. ____

	OK	Not OK
Vacuum hoses		
Filter		
Grommet		

3. Connect the exhaust ventilation equipment. ____

   CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

4. Start the engine. ____

5. Check the positive crankcase ventilation system operation. Is there vacuum present at the end of the valve? ____

If there is no vacuum present at the end of the valve, determine the problem and record in the following space.

6. Shut off the engine. ____

7. Remove the valve. Shake to see if it rattles. Record observations in the following space. ____

8. Using a service manual or other information source, locate a procedure for testing the positive crankcase ventilation system using an exhaust gas analyzer. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, test the positive crankcase ventilation system using an exhaust gas analyzer. Record observations in the following space.

9. Using a service manual or other information source, locate a procedure for replacing the defective positive crankcase ventilation system parts. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

   Be certain that the instructor approves the procedure and checks this box.

   ☐ Instructor Approved

   Using the procedure, replace the defective positive crankcase ventilation system parts.

10. Disconnect the exhaust ventilation equipment. ____

Average of the above evaluations ____

This average is a partial evaluation for Competency L1 and the final evaluation for Competency L2. The final evaluation for L1 is at the end of JS1-L1-UVIII. Use the partial evaluation score for the student's final evaluation for Competency L2.

AS1-L1-UIII

NAME:

DATE:

THE EVAPORATIVE EMISSION CONTROL SYSTEM

Directions — Answer the following questions by writing all responses on this sheet.

1. What are evaporative emissions?

2. What are the sources of evaporative emissions?

3. What are two causes of fuel expansion and evaporation?

4. What is the purpose of the charcoal canister?

5. List the three types of charcoal canister purge control systems.

The student must obtain a minimum score of ____ on AS1-L1-UIII in order to receive an evaluation for Competencies L1 and L9.

JS1-L2-UIII

NAME(S):

TEST THE EVAPORATIVE EMISSION CONTROL SYSTEM ON A CARBURETED VEHICLE

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Hand tools
Protective eyewear
Special tools

EVALUATION

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Describe in the following space the type of charcoal canister purge system on the vehicle. ____

3. Lift the vehicle on a hoist or place securely on safety stands. ____

4. Visually inspect the evaporative emission control system. Complete the following chart. ____

	OK	Not OK
Fuel filler cap		
Vent line(s)		
Charcoal canister		
Charcoal canister filter (Open-bottom type only)		

5. Using a service manual or other information source, locate a procedure for testing the charcoal canister purge valve. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, test the charcoal canister purge valve. Record the results in the following space.

6. Using a service manual or other information source, locate a procedure for checking the operation of the carburetor fuel bowl vent valve. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, test the carburetor fuel bowl vent valve. Record the results in the following space.

7. Lower the vehicle. ____

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L9. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for Competency L9 is at the end of JS2-L2-UIII.

JS2-L2-UIII

NAME(S):

TEST THE EVAPORATIVE EMISSION CONTROL SYSTEM ON A FUEL-INJECTED VEHICLE WITH AN ENGINE CONTROL MODULE

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Equipment:

Hand tools
Protective eyewear
Special tools

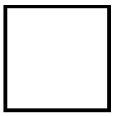
Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. _____

2. Describe in the following space the type of charcoal canister purge system on the vehicle. _____

3. Using a service manual or other information source, locate a procedure for accessing the diagnostic trouble codes. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

   Be certain that the instructor approves the procedure and checks this box.

   
   Instructor Approved

   Using the procedure, access the diagnostic trouble codes. Complete the following chart.

Diagnostic Trouble Code	Meaning

4. Lift the vehicle on a hoist or place securely on safety stands. ____

5. Visually inspect the evaporative emission control system. Complete the following chart. ____

	OK	Not OK
Fuel filler cap		
Vent line(s)		
Charcoal canister		
Charcoal canister filter (Open-bottom type only)		

6. Using a service manual or other information source, locate a procedure for testing the electronic components of the charcoal canister purge system. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

NOTE: Consider the diagnostic trouble codes that were accessed.

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, test the electronic components of the charcoal canister purge system. Record the results in the following space.

7. Make service recommendations based on the results of the visual inspection and electronic testing. Record the recommendations in the following space. ____

8. Lower the vehicle. ____

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L9. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for Competency L9 follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency L9 by averaging the evaluations of JS1-L2-UIII and JS2-L2-UIII.

JS1-L2-UIII ____

JS2-L2-UIII ____

The final evaluation for Competency L9 ____

AS1-L1-UIV

NAME:

DATE:

THE EXHAUST GAS RECIRCULATION SYSTEM

Directions — Fill in the blanks.

1. When combustion chamber temperatures reach 3500°F to 4000°F, _____ combines with _____ to form _____.

2. The EGR system _____ combustion chamber temperatures and uses a valve to _____ small amounts of exhaust gas back into the combustion chamber.

3. The _____ EGR system uses both vacuum and exhaust back pressure to control recirculation.

4. The _____ EGR system operates like a positive back pressure valve.

5. A _____ EGR system controlled by the ECM uses a vacuum signal to control valve position.

The student must obtain a minimum score of ____ on AS1-L1-UIV in order to receive an evaluation for Competencies L1 and L5.

JS1-L2-UIV

NAME(S):

DIAGNOSE THE EXHAUST GAS RECIRCULATION SYSTEM

DATE:

Equipment:

MODEL OF CAR:

Hand tools
Protective eyewear
Special tools

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Describe in the following space the type of exhaust gas recirculation system. ____

3. Describe in the following space the problems with vehicle operation that indicate that the exhaust gas recirculation system is malfunctioning. ____

NOTE: If the exhaust gas recirculation system is not controlled by an engine control module, go to 5.

4. Using a service manual or other information source, locate a procedure for accessing the diagnostic trouble codes. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, access the diagnostic trouble codes. Complete the following chart.

Diagnostic Trouble Code	Meaning

5. Using a service manual or other information source, locate a procedure for diagnosing the exhaust gas recirculation system. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

NOTE: Take the accessed diagnostic trouble codes into consideration when developing the diagnostic procedure.

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, diagnose the exhaust gas recirculation system. Record the results in the following space.

6. Make service recommendations based on the results of the diagnosis. Record the recommendations in the following space. ____

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L5. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for L5 is at the end of JS2-L2-UIV.

JS2-L2-UIV

REMOVE AND INSTALL EXHAUST GAS RECIRCULATION SYSTEM COMPONENTS

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Hand tools
Protective eyewear
Special tools

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. _____

2. Record in the following space the make and model of the vehicle and the type of exhaust gas recirculation system. _____

3. Using a service manual or other information source, locate a procedure for removing and replacing the valve and/or other components of the exhaust gas recirculation system. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

   Be certain that the instructor approves the procedure and checks this box.

   ☐ Instructor Approved

   Using the procedure, remove and replace the valve and/or other components of the exhaust gas recirculation system.

4. Using a service manual or other information source, locate a procedure for cleaning and inspecting the valve, removing obstructions from the passages, replacing the vacuum hoses, and performing other related maintenance. Include testing the exhaust gas recirculation system after replacement to ensure proper function. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, clean and inspect the valve, remove obstructions from the passages, replace the vacuum hoses, and perform other related maintenance. Record the results from the final testing in the following space.

Average of the above evaluations ____

This average is a partial evaluation for Competency L5. The final evaluation for L5 follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency L5 by averaging the evaluations of JS1-L2-UIV and JS2-L2-UIV.

JS1-L2-UIV ____

JS2-L2-UIV ____

Final evaluation for Competency L5 ____

AS1-L1-UV

NAME:

DATE:

THE AIR INJECTION SYSTEM

Directions — Answer the following questions by writing all responses on this sheet.

1. What is the purpose of the air injection system?

2. What is oxidation?

3. What is the function of the diverter valve?

4. What is the function of the air-switching valve?

5. When does the electronic secondary air injection system operate?

The student must obtain a minimum score of ____ on AS1-L1-UV in order to receive an evaluation for Competencies L1 and L6.

JS1-L2-UV

NAME(S):

TEST AND SERVICE THE AIR PUMP AIR INJECTION SYSTEM

DATE:

Equipment:

MODEL OF CAR:

Hand tools
Protective eyewear

MAKE OF CAR:

YEAR OF CAR:

VIN:

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. In the following space, describe the air pump air injection system on the vehicle. Include the components that are controlled by the engine control module. ____

3. Connect the exhaust ventilation equipment. ____

   CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

4. Test the air pump. ____

a. Visually inspect the air pump Complete the following chart.

	OK	Not OK
Air pump mounting		
Drive belt		
Hose connections		
Metal air injection tubes		
Air pump spins freely		

b. Start the engine.

c. Listen for unusual noise from the air pump. Record observations in the following space.

d. Check for air or exhaust leaks in the plumbing. Record observations in the following space.

e. Shut off the engine. Disconnect the hose from the air pump or diverter valve.

f. Start the engine.

g. Slowly increase the engine speed to 1500 rpm. Check for airflow discharge from the air pump. Record observations in the following space.

h. Shut the engine off and allow it to cool completely.

5. Test the air-switching valve during cold engine operation. ____

   a. Disconnect the hose that connects the air-switching valve to the exhaust manifold.

   b. Start the engine.

   c. Check for airflow at the hose connection to the exhaust manifold. Record observations in the following space.

   d. Disconnect the hose at the catalytic converter. Record observations in the following space.

   e. Reconnect the hose at the catalytic converter.

   f. Allow the engine to reach normal operating temperature.

   g. Check for airflow at the hose connectionto the exhaust manifold. Record observations in the following space.

   h. Check for airflow at the hose connection to the catalytic converter. Record observations in the following space.

   i. Reconnect the hoses.

j. Using a service manual or other information source, locate a procedure for testing the coolant vacuum switch, engine control module, and electrical solenoid. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor Approved

Using the procedure, test the coolant vacuum switch, engine control module, and electrical solenoid.

k. Shut off the engine.

6. Test the diverter valve. ____

a. Start the engine and allow it to reach normal operating temperature.

b. Accelerate and then sharply decelerate the engine.

c. Check if airflow is heard and felt as it is discharged to the atmosphere or air cleaner. Record observations in the following space.

d. Check if the diverter valve is receiving adequate vacuum. Record observations in the following space.

e. Shut off the engine.

7. Test the check valves. ____

   a. Visually inspect the check valves. Record observations in the following space.

   b. Remove the hoses at the check valves. Inspect the hoses for signs of exhaust burns. Record observations in the following space.

   c. Start the engine and allow it to reach normal operating temperature.

   d. Remove each hose and check for exhaust leaks at each check valve inlet. Record observations in the following space.

   e. Check for exhaust leaks at the metal air injection tubes. Record observations in the following space.

   f. Shut off the engine.

8. Disconnect the exhaust ventilation equipment. ____

9. Based on the tests, describe in the following space the condition of the air pump air injection system. ____

10. Using a service manual or other information source, locate a procedure for servicing the defective air pump air injection system components. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, service the defective air pump air injection system components.

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L6. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for L6 is at the end of JS3-L2-UVI.

JS2-L2-UV

NAME(S):

TEST AND SERVICE THE EXHAUST-PULSE AIR INJECTION SYSTEM

DATE:

Equipment:

MODEL OF CAR:

Hand tools
Protective eyewear

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Visually inspect the exhaust-pulse air injection system. Complete the following chart. ____

	OK	Not OK
Check valves		
Hoses		
Metal air injection tubes		

3. Connect the exhaust ventilation equipment. ____

   CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

4. Test the operation of the exhaust-pulse air injection system. ____

   a. Start the engine and allow it to reach normal operating temperature.

   b. Put the vehicle in neutral and allow the engine to idle.

      CAUTION: Secure the vehicle so that it does not move while in neutral.

c. Remove the hose at each check valve.

d. Check for negative exhaust pulses at each check valve. Record observations in the following space.

e. Check for hot exhaust gases escaping through the check valves. Record observations in the following space.

f. Put the vehicle in park.

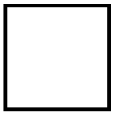
g. Shut off the engine.

5. Disconnect the exhaust ventilation equipment. ____

6. Based on the tests, describe in the following space the condition of the exhaust-pulse air injection system. ____

7. Using a service manual or other information source, locate a procedure for servicing the defective exhaust-pulse air injection system components. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.



Instructor Approved

Using the procedure, service the defective exhaust-pulse air injection system components.

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L6. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for L6 is at the end of JS3-L2-UVI.

AS1-L1-UVI

NAME:

DATE:

THE CATALYTIC CONVERTER

Directions — Answer the following questions by writing all responses on this sheet.

1. What are the two catalysts in a two-way catalytic converter?

2. What are the three catalysts in a three-way catalytic converter?

3. What is cerium?

4. List three possible violations that could occur when repairing the exhaust system.

5. When can an aftermarket catalytic converter by used?

The student must obtain a minimum score of ____ on AS1-L1-UVI in order to receive an evaluation for Competencies L1 and L6.

JS1-L2-UVI

NAME(S):

TEST CATALYTIC CONVERTER EFFICIENCY USING AN EXHAUST GAS ANALYZER

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Equipment:

Exhaust gas analyzer
Hand tools
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Using a service manual or other information source, locate a procedure for testing catalytic converter efficiency using an exhaust gas analyzer. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

   Be certain that the instructor approves the procedure and checks this box.

   ☐ Instructor Approved

   Using the procedure, test catalytic converter efficiency using an exhaust gas analyzer. Record the observations in the following space.

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L6. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for L6 is at the end of JS3-L2-UVI.

JS2-L2-UVI

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

TEST THE EXHAUST SYSTEM BACK PRESSURE

Equipment:

Back pressure gauge
Hand tools
Protective eyewear
Tachometer
Vacuum gauge

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Determine if the vehicle has a loss of power, poor fuel economy, an overheating engine, or engine knock. Record observations in the following space. ____

3. Connect the exhaust ventilation equipment. ____

   CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

4. Using the following procedure, test the exhaust system back pressure using a vacuum gauge. ____

   a. Connect a vacuum gauge and tachometer.

   b. Start the engine and allow it to stabilize.

c. Check the vacuum reading. Record the reading in the following space.

d. Increase the engine speed to 2500 rpm and allow it to stabilize.

e. Check the vacuum reading. Record the reading in the following space.

f. Compare the vacuum readings to the proper specifications.

g. Shut off the engine. Disconnect the vacuum gauge and tachometer.

5. Using the following procedure, test the exhaust system back pressure using a back pressure gauge. ____

a. Remove the oxygen sensor.

NOTE: On systems with more than one oxygen sensor, remove the one that is closest to the engine.

b. Connect a back pressure gauge and tachometer.

c. Start the engine and allow it to stabilize.

d. Check the back pressure reading. Record the reading in the following space.

e. Increase the engine speed to 2500 rpm and allow it to stabilize.

f. Check the back pressure reading. Record the reading in the following space.

g. Compare the back pressure readings to the proper specifications.

h. Shut off the engine. Disconnect the back pressure gauge and tachometer.

6. Disconnect the exhaust ventilation equipment. ____

7. Based on the exhaust system back pressure tests, is the exhaust system restricted? If the exhaust system is restricted, identify the supporting reasons and/or signs. ____

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L6. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for L6 is at the end of JS3-L2-UVI.

JS3-L2-UVI

SERVICE THE CATALYTIC CONVERTER

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Hand tools
Protective eyewear
Safety stands or hoist

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Place the vehicle securely on safety stands or lift with a hoist. ____

3. Using a service manual or other information source, locate a procedure for removing the catalytic converter. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

   Be certain that the instructor approves the procedure and checks this box.

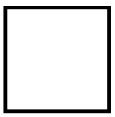
   ☐ Instructor Approved

   Using the procedure, remove the catalytic converter.

4. Inspect the catalytic converter for internal and external damage. Record the observations in the following space. ____

5. Using a service manual or other information source, locate a procedure for installing the catalytic converter. Include the proper torque specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

   Be certain that the instructor approves the procedure and checks this box.

   
   Instructor Approved

   Using the procedure, install the catalytic converter.

6. Connect the exhaust ventilation equipment. ____

   CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine. Check the catalytic converter for exhaust leaks. Repair any leaks. ____

8. Shut off the engine and disconnect the exhaust ventilation equipment. ____

9. Lower the vehicle. ____

Average of the above evaluations ____

This average is a partial evaluation for Competencies L1 and L6. The final evaluation for L1 is at the end of JS1-L1-UVIII. The final evaluation for L6 follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency L6 by averaging the evaluations of JS1-L2-UV, JS2-L2-UV, JS1-L2-UVI, JS2-L2-UVI, and JS3-L2-UVI.

JS1-L2-UV	_____
JS2-L2-UV	_____
JS1-L2-UVI	_____
JS2-L2-UVI	_____
JS3-L2-UVI	_____
Final evaluation for Competency L6	_____

AS1-L1-UVII

NAME:

DATE:

THE BASICS OF ON-BOARD DIAGNOSTICS GENERATION TWO

Directions — Answer the following questions by writing all responses on this sheet.

1. Define the following terms.

   Enable criteria —

   Trip —

   Warm-up cycle —

2. What did the California Air Research Board mandate in 1988?

3. Name the two types of emissions-related diagnostic trouble codes.

4. What does the second digit of the four-digit number in an OBD II DTC represent?

5. How many systems were required to be monitored for OBD I?

How many systems were required to be monitored for OBD II?

The student must obtain a minimum score of ____ on AS1-L1-UVII in order to receive an evaluation for Competency L1.

JS1-L2-UVII

NAME(S):

DIAGNOSING AN ON-BOARD DIAGNOSTICS GENERATION TWO SYSTEM

DATE:

Equipment:

MODEL OF CAR:

Data link connector (DLC)
Protective eyewear
Scan tool

MAKE OF CAR:

YEAR OF CAR:

VIN:

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Using a service manual or other information source, locate a procedure for performing a drive cycle. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

   Be certain that the instructor approves the procedure and checks this box.

   Instructor Approved

   Using the procedure, perform a drive cycle.

3. Connect a scan tool to the data link connecter (DLC). Turn the scan tool on. ____

4. Check the diagnostic trouble codes (DTCs). Record observations in the following space. ____

5. Determine the meaning of the DTCs. ____

6. Shut off the scan tool. Disconnect the scan tool. ____

7. Using a service manual or other information source, locate a procedure for repairing the cause of the DTCs. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

   Be certain that the instructor approves the procedure and checks this box.

   
   Instructor Approved

   Using the procedure, repair the cause of the DTCs.

8. Perform a drive cycle. ____

9. Connect a scan tool to the DLC. Turn the scan tool on. ____

10. Check for DTCs. Record observations in the following space. ____

    NOTE: There should not be DTCs. If one is set, repeat steps 5 through 8.

11. Shut off the scan tool. Disconnect the scan tool. ____

Average of the above evaluations ____

This is a partial evaluation for Competency L1. The final evaulation is at the end of JS1-L1-UVIII.

AS1-L1-UVIII

NAME:

DATE:

EXHAUST GAS ANALYSIS

Directions — Answer the following questions by writing all responses on this sheet.

1. What does the exhaust gas analyzer measure?

2. Name the five pollutants/gases that can be measured by an exhaust gas analyzer.

3. Name the three types of exhaust gas analyzers.

4. How are the following measured?

   a. Hydrocarbons —

   b. Carbon monoxide —

   c. Carbon dioxide —

   d. Oxygen —

   e. Oxides of nitrogen —

5. Name the three tests established by the Environmental Protection Agency that are components of the IM 240 procedure.

The student must obtain a minimum score of ____ on AS1-L1-UVIII in order to receive an evaluation for Competency L1.

JS1-L1-UVIII

NAME(S):

DIAGNOSE DRIVEABILITY CONCERNS USING AN EXHAUST GAS ANALYZER

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Exhaust gas analyzer
Protective eyewear

EVALUATION

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Connect the exhaust ventilation equipment. ____

   CAUTION: Be sure to use the approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

3. Connect the exhaust gas analyzer according to the manufacturer's procedures. ____

   NOTE: It may be necessary to block the source of air to the catalytic converter. A catalytic converter that works properly cleans the exhaust gases and makes it difficult to get an accurate reading.

4. Turn on the exhaust gas analyzer and allow it to warm up. ____

5. Zero and calibrate the exhaust gas analyzer. ____

6. Start the engine and allow it to reach normal operating temperature. ____

7. Check the exhaust gas analyzer readings. Record the readings in the following space. ____

8. Shut off the engine. ____

9. Disconnect the exhaust gas analyzer and the exhaust ventilation equipment. ____

10. Based on the readings, determine what may be the cause of the driveability concerns. Record the causes in the following space. ____

Average of the above evaluations ____

This average is a partial evaluation for Competency L1. The final evaluation for L1 follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency L1 by averaging the evaluations of JS1-L2-UII, JS1-L2-UIII, JS2-L2-UIII, JS1-L2-UIV, JS1-L2-UV, JS2-L2-UV, JS1-L2-UVI, JS2-L2-UVI, JS3-L2-UVI, JS1-L2-UVII, and JS1-L1-UVIII.

JS1-L2-UII	_____
JS1-L2-UIII	_____
JS2-L2-UIII	_____
JS1-L2-UIV	_____
JS1-L2-UV	_____
JS2-L2-UV	_____
JS1-L2-UVI	_____
JS2-L2-UVI	_____
JS3-L2-UVI	_____
JS1-L2-UVII	_____
JS1-L1-UVIII	_____
Final evaluation for Competency L1	_____

JS1-L1-UIX

NAME(S):

ADJUST THE VALVES ON ENGINES WITH MECHANICAL OR HYDRAULIC LIFTERS

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Equipment:

Dial indicator
Feeler gauge
Hand tools
Micrometer set
Protective eyewear

Procedure:

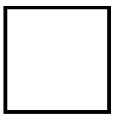
1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Determine and record in the following space if the engine has mechanical or hydraulic lifters. ____

NOTE: For an engine with mechanical lifters, go to 3. For an engine with hydraulic lifters, go to 4.

3. Using a service manual or other information source, locate a procedure for adjusting the valves on an engine with mechanical lifters. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.



Instructor Approved

Using the procedure, adjust the valves on an engine with mechanical lifters. Record the results in the following space.

4. Using a service manual or other information source, locate a procedure for adjusting the valves on an engine with hydraulic lifters. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

Instructor Approved

Using the procedure, adjust the valves on an engine with hydraulic lifters. Record the results in the following space.

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Program Certification Standards Task List. The final evaluation is at the end of JS7-L1-UIX.

JS2-L1-UIX

VERIFY CAMSHAFT TIMING

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Equipment:

Hand tools
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. _____

2. Determine and record in the following space the type of engine in the vehicle. _____

NOTE: For valve-in-head and L-head engines, go to 3. For overhead camshaft engines, go to 4.

3. Using a service manual or other information source, locate a procedure for verifying camshaft timing in valve-in-head or L-head engines. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

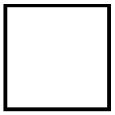
Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, verify camshaft timing in valve-in-head or L-head engines. Record observations in the following space.

4. Using a service manual or other information source, locate a procedure for verifying camshaft timing in an overhead camshaft engine. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.



Instructor Approved

Using the procedure, verify camshaft timing in an overhead camshaft engine. Record observations in the following space.

5. In the following space, determine the type of service that needs to be performed based on the observations. ____

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Program Certification Standards Task List. The final evaluation is at the end of JS7-L1-UIX.

JS3-L1-UIX

NAME(S):

VERIFY ENGINE OPERATING TEMPERATURE

DATE:

Equipment:

MODEL OF CAR:

Protective eyewear
Temperature-measuring device

MAKE OF CAR:

YEAR OF CAR:

VIN:

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Aim a digital remote infrared thermometer at one of the cylinder heads. ____

3. Pull the trigger. Record the engine operating temperature in the following space. ____

4. In the following space, determine the type of service that needs to be performed based on the results. ____

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Program Certification Standards Task List. The final evaluation is at the end of JS7-L1-UIX.

JS4-L1-UIX

NAME(S):

INSPECT, TEST, AND SERVICE THE COOLING SYSTEM

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Hand tools
Pressure tester
Protective eyewear

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Inspect the cooling system. Complete the following chart. ____

	OK	Not OK
Radiator cap		
Hoses		
Outer shell of the radiator		
Coolant passages inside the radiator		
Coolant recovery tank		

3. Perform a cooling system pressure test. ____

   a. Connect a pressure tester to the radiator filler neck.

   b. Pump the pressure tester until the pressure reaches the release pressure mark on the cap.

c. Complete the following chart.

	OK	Not OK
Are there heater core leaks:		
On the ground?		
On the floor under the engine?		
On the right front carpet in the passenger compartment?		
Is the water pump leaking?		
Are there leaks where hoses connect to metal components?		
Are there hoses that have expanded in a balloonlike fashion?		

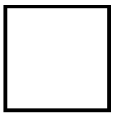
d. Relieve the pressure and disconnect the pressure tester.

4. Inspect the condition of the coolant. Include the color and feel. Record observations in the following space. ____

5. In the following space, determine the type of service that needs to be performed based on the inspection and test results. ____

6. Using a service manual or other information source, locate a procedure for servicing the defective cooling system components. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.



Instructor Approved

Using the procedure, service the defective cooling system components.

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Program Certification Standards Task List. The final evaluation is at the end of JS7-L1-UIX.

JS5-L1-UIX

NAME(S):

DRAIN, FLUSH, AND FILL THE COOLING SYSTEM

DATE:

Equipment:

MODEL OF CAR:

Coolant
Fresh water
Hand tools
Protective eyewear

MAKE OF CAR:

YEAR OF CAR:

VIN:

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Connect the exhaust ventilation equipment. ____

   CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

3. Drain the cooling system. ____

   a. Remove the radiator cap. The petcock on the bottom radiator cap should open freely.

   b. Remove the thermostat.

   c. Start the engine and allow it to reach normal operating temperature.

   d. Shut off the engine.

   e. Open the drain. Let the coolant drain completely from the radiator.

      CAUTION: Used coolant is a hazardous material and should be disposed of according to law.

4. Flush the cooling system. ____

   a. Remove one of the heater hoses and connect a supply of fresh water to the hose end that leads into the heater.

   b. Allow the cooling system to fill with water.

   c. Start the engine and allow it to idle.

   d. Adjust the water flow so that the radiator stays full while the drain is running wide open. Keep the engine and the fresh water running until the discharge fluid runs clear.

   e. Shut off the engine. Let the drain run until it stops. Close the petcock.

   f. Install the thermostat.

   g. Connect the heater hose.

5. Fill the cooling system. ____

   a. Using a service manual or other information source, determine the coolant capacity.

   b. Fill the radiator with 50% coolant and 50% fresh water.

   c. Start the engine and allow it to reach normal operating temperature.

   d. Check if the coolant is circulating and the upper radiator tank is warm.

   e. If the cooling system is working properly and there are no leaks, top off the radiator tank with fresh water. Repair any leaks.

   f. Replace the radiator cap. Shut off the engine.

6. Disconnect the exhaust ventilation equipment.

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Program Certification Standards Task List. The final evaluation is at the end of JS7-L1-UIX.

JS6-L1-UIX

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

INSPECT, TEST, AND SERVICE THE THERMOSTAT AND COMPONENTS

Equipment:

Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Inspect the thermostat and components for damage. Record observations in the following space. ____

3. Test the thermostat operation. ____

   a. Connect the exhaust ventilation equipment.

      CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

   b. Set the dashboard heater control on the minimum setting.

   c. Start the engine.

   d. Touch the upper and lower radiator hoses to compare the temperatures. Complete the following chart.

	Cold	Warm	Hot
Upper radiator hose			
Lower radiator hose			

e. Allow the engine to continue to warm.

f. Touch the upper and lower radiator hoses. Complete the following chart.

	Cold	Warm	Hot
Upper radiator hose			
Lower radiator hose			

g. Observe the thermostat to see if it opens when the engine reaches 180°F to 212°F. Record observations in the following space.

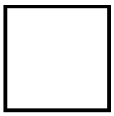
h. Touch the lower hose. It should increase in temperature until it reaches a temperature 30°F to 40°F less than the upper hose. Record observations in the following space.

i. Shut off the engine and disconnect the exhaust ventilation equipment.

4. In the following space, determine the type of service that needs to be performed based on the inspection and test results. ____

5. Using a service manual or other information source, locate a procedure for servicing the defective thermostat and components. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.



Instructor Approved

Using the procedure, service the defective thermostat and components.

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Program Certification Standards Task List. The final evaluation is at the end of JS7-L1-UIX.

JS7-L1-UIX

INSPECT, TEST, AND SERVICE THE FAN AND FAN COMPONENTS

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

Equipment:

Protective eyewear

Procedure:

EVALUATION

1. Wear protective eyewear while performing the procedures on this job sheet. ____

2. Determine and record in the following space the type of fan on the vehicle. ____

3. Inspect the fan. Record observations in the following space. ____

4. Using a service manual or other information source, locate a procedure for testing the fan. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.

☐ Instructor Approved

Using the procedure, test the fan. Record the results in the following space.

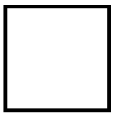
5. Inspect and test the fan components. Complete the following chart. ____

	OK	Not OK
Fan clutch		
Fan shroud and ducting		
Air dams		
Fan control devices		

6. In the following space, determine the type of service that needs to be performed based on the inspection and test results. ____

7. Using a service manual or other information source, locate a procedure for servicing the defective fan and fan components. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. ____

Be certain that the instructor approves the procedure and checks this box.



Using the procedure, service the defective fan and fan components.

Average of the above evaluations ____

This job sheet is a partial evaluation for Section VIII: Engine Performance, F. Engine Related Service on the National Automotive Technicians Education Foundation Progam Certification Standards Task List. The final evaluation follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation by averaging the evaluations of JS1-L1-UIX, JS2-L1-UIX, JS3-L1-UIX, JS4-L1-UIX, JS5-L1-UIX, JS6-L1-UIX, and JS7-L1-UIX.

JS1-L1-UIX	_____
JS2-L1-UIX	_____
JS3-L1-UIX	_____
JS4-L1-UIX	_____
JS5-L1-UIX	_____
JS6-L1-UIX	_____
JS7-L2-UIX	_____
Final evaluation	_____