

AUTOMOTIVE TECHNOLOGY
MODULE 3: ENGINE PERFORMANCE
SECTION A: IGNITION SYSTEMS
STUDENT WORKBOOK

WRITTEN BY
LARRY RAINS
DANA TANNEHILL

REVISED BY
KEITH KENDRICK

TECHNICAL REVIEW
ROGER DONOVAN
ROBIN FERGUSON
ED MCCOY

SCIENCE REVIEW
JENNIFER GLOVER

PROJECT COORDINATOR
RICHARD BRANTON



PRODUCED BY THE INSTRUCTIONAL MATERIALS LABORATORY
10 LONDON HALL
UNIVERSITY OF MISSOURI-COLUMBIA
COLUMBIA, MO 65211
(800) 669-2465

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EDITORS
ERICA KASSEL
SUSAN RHYNE

GRAPHICS
LISA BENNETT
CHRIS CASEY
THERESA WIEHAGEN

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IGNITION SYSTEMS

MODULE 3: ENGINE PERFORMANCE
SECTION A: IGNITION SYSTEMS
STUDENT WORKBOOK TRACKING SHEET

Assignment Sheet	Title of Assignment Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
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AS1-L1-UII	Overview of Distributor Ignition Systems	IGS 33-36	W 3-4		
AS1-L2-UII	Components and Operation of Breaker Point Ignition Systems	IGS 53-56	W 5-6		
AS1-L3-UII	Components of Solid-State Ignition Systems	IGS 65-68	W 7-8		
AS1-L4-UII	Components of Computerized Ignition Systems	IGS 71-74	W 9-10		
AS1-L1-UIII	Overview and Theory of Electronic Ignition Systems	IGS 151-154	W 33-34		
AS1-L2-UV	Identifying Waveform Patterns	IGS 259-262	W 71-72		
AS1-L1-UVI	Understanding Standardized Terminology	IGS 293-296	W 81-82		
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Job Sheet	Title of Job Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
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JS2-L5-UII	Timing an Engine Using a Timing Light	IGS 107-108	W 15-16		
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JS4-L5-UII	Inspecting and Replacing the Breaker Points and Condenser	IGS 113-116	W 21-24		
JS5-L5-UII	Removing and Replacing the Ignition Distributor	IGS 117-118	W 25-26		
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Job Sheet	Title of Job Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
JS2-L2-UIII	Checking the Spark Plugs and Testing the Secondary Circuit on Computerized and Electronic Ignition Systems	IGS 169-172	W 41-44		
JS1-L1-UIV	Performing Engine Vacuum Gauge Tests	IGS 201-202	W 45-46		
JS2-L1-UIV	Performing a Cranking Engine Compression Test with the Throttle Closed	IGS 203-206	W 47-50		
JS3-L1-UIV	Performing a Cranking Engine Compression Test with the Throttle Open	IGS 207-210	W 51-54		
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JS5-L1-UIV	Performing a Cylinder Leakage Test	IGS 215-218	W 59-62		
JS6-L1-UIV	Performing a Cylinder Balance Test	IGS 219-222	W 63-66		
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JS1-L2-UV	Diagnosing a Distributor Ignition System with an Oscilloscope	IGS 263-266	W 73-76		
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JS1-L1-UVII	Diagnosing and Servicing Computerized Engine Control Systems	IGS 385-386	W 85-86		
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JS4-L1-UVII	Diagnosing Ignition-Related Sensors Using a Lab Scope	IGS 391-394	W 91-94		

IGNITION SYSTEMS

AS1-L1-UI

NAME:

BASIC IGNITION SYSTEMS

DATE:

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

1. Describe how primary current is interrupted in the following ignition systems.

Breaker point ignition system —

Solid-state ignition system —

Computerized ignition system —

2. What is the difference between DI and EI?
3. List the strokes in a gasoline engine four-stroke cycle.

IGNITION SYSTEMS

AS1-L1-UII

NAME:

OVERVIEW OF DISTRIBUTOR IGNITION SYSTEMS

DATE:

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

1. Define the following terms.

Base Timing —

Carbon track —

Electromagnetic induction —

Firing order —

Ignition Timing —

Pre-ignition —

Self-inductance —

Timing advance —

TDC —

2. What are the three tasks that the distributor ignition system must be able to perform?

IGNITION SYSTEMS

AS1-L2-UII

NAME:

COMPONENTS AND OPERATION OF BREAKER POINT IGNITION SYSTEMS

DATE:

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

1. List the primary system components of breaker point ignition systems.
2. List the secondary system components of breaker point ignition systems.
3. What are the two principles of electromagnetic induction?
4. How does current flow when the vehicle operator turns the ignition switch and cranks the engine?
5. How do breaker point ignition systems advance timing?

ENGINE PERFORMANCE

IGNITION SYSTEMS

AS1-L3-UII

NAME:

COMPONENTS OF SOLID-STATE IGNITION SYSTEMS

DATE:

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

1. What component consists of a permanent magnet and has a coil of fine wire surrounding it?
2. What component is used in some solid-state ignition systems instead of a permanent magnet signal generator?
3. What component does the job of the breaker points in solid-state ignition systems?
4. What is the transistor and what are the three regions?
5. What is the function of the ignition resistor?

ENGINE PERFORMANCE

IGNITION SYSTEMS

AS1-L4-UII

NAME:

COMPONENTS OF COMPUTERIZED IGNITION SYSTEMS

DATE:

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

1. What component uses an electronic signal to fire the coil?

2. What is the function of the permanent magnet signal generator or the Hall Effect switch?

3. What component establishes and controls base timing?

4. Describe the function and list the appropriate abbreviation for each of the following sensors.

Crankshaft position sensor —

Camshaft position sensor —

Manifold absolute pressure sensor —

Intake air temperature sensor —

ENGINE PERFORMANCE

Engine coolant temperature sensor —

Knock sensor —

Throttle position sensor —

IGNITION SYSTEMS

JS1-L5-UII

TESTING THE PRIMARY CIRCUIT AND IGNITION COIL

Equipment:

Hand tools
Ohmmeter
Protective eyewear
Voltmeter

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for performing voltage tests of the primary ignition system in either a breaker point or solid-state ignition 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 before continuing.



Following the procedure, perform a voltage test of the primary ignition system in either a breaker point or solid-state ignition system. Record the results of each voltage test in the following chart. If applicable, respond to the results.

CAUTION: Make sure the instructor is aware of any changes that might have to be made in the procedure.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Voltage Test	Result
Measure the voltage drop across the resistor bypass circuit while cranking the engine.	
Measure the available voltage at the side of the ignition coil.	
Check the voltage drop across the coil primary.	
Check the voltage drop across the primary coil circuit.	
Check the voltage drop across the circuit between the ignition switch and ignition resistor.	

Record in the following space any of the tests that did not meet specifications. Try to determine and record the reason the test did not meet specifications.

- 3. Using a service manual or other information source, locate a procedure for measuring the resistance of the primary and secondary ignition coil windings. The procedure should include resistance specifications for both the primary and secondary coil windings. 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 before continuing.



**Instructor
Approved**

IGNITION SYSTEMS

Following the procedure, measure the resistance of the primary and secondary coil windings. Record the measured resistance in the following space.

CAUTION: Make sure the instructor is aware of any changes that might have to be made in the procedure.

- a. Primary resistance _____
- b. Secondary resistance _____
- c. Compare the measured resistances to the specifications from the appropriate service manual. Based on this comparison, record in the following space if the ignition coil is good or bad.

Average of the above evaluations _____

This average is a partial evaluation for Competency J2. The final evaluation for J2 will be made at the end of JS1-L1-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS2-L5-UII

TIMING AN ENGINE USING A TIMING LIGHT

Equipment:

Distributor wrench
Protective eyewear
Tachometer
Timing light

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for checking and adjusting the ignition timing and checking the operation of the advance mechanism using a timing light. Be sure to include any procedure for preparing the engine for an ignition timing check (for example, place transmission in neutral, disconnect and plug the vacuum advance hose). Determine and record the timing specification and engine speed at which the timing is to be checked and set. 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 before continuing.



**Instructor
Approved**

Following the procedure, check and adjust the ignition timing and check the operation of the advance mechanism using a timing light. Record the results of the test in the following chart.

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

CAUTION: Keep your fingers clear of the fan and other moving parts when checking or adjusting the timing.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

NOTE: If it is necessary to readjust the idle speed before checking timing, see the instructor for the procedure.

	Yes	No
Is the base timing correct?	<input type="checkbox"/>	<input type="checkbox"/>
Is the base timing incorrect? Did you adjust to specification?	<input type="checkbox"/>	<input type="checkbox"/>
Is the base timing incorrect, but it cannot be adjusted?	<input type="checkbox"/>	<input type="checkbox"/>
If the timing could not be adjusted, explain the reason in the following space.		
	OK	Not OK
Vacuum advance	<input type="checkbox"/>	<input type="checkbox"/>
Centrifugal advance	<input type="checkbox"/>	<input type="checkbox"/>

3. If required, reset the idle speed and shut off the engine. Reconnect any components that were disconnected for timing checks and disconnect the test equipment.

Average of the above evaluations

This average is a partial evaluation for Competency J4. The final evaluation for J4 will be made at the end of JS3-L5-UII.

IGNITION SYSTEMS

JS3-L5-UII

TIMING AN ENGINE USING A TIMING METER

Equipment:

Distributor wrench
Protective eyewear
Tachometer
Timing meter

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for checking and adjusting the ignition timing and checking the operation of the advance mechanism using a timing meter. Be sure to include any procedure for preparing the engine for an ignition timing check (for example, place transmission in neutral, disconnect and plug the vacuum hose). Determine and record the timing specification and the engine speed at which the timing is to be checked and set. Determine and record the timing meter offset degree setting for the vehicle being serviced. 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 before continuing.



**Instructor
Approved**

Following the procedure, check and adjust the ignition timing and check the operation of the advance mechanism using a timing meter. Record the results of the test in the following chart.

CAUTION: Make sure the instructor is aware of any changes that might need to be made in the procedure.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

NOTE: Connect the timing meter to the vehicle engine as directed by the meter manufacturer. If required, use the appropriate magnetic probe adapter. Block the wheels, start the engine and run the vehicle until it reaches normal operating temperature. If it is necessary to reset the idle speed before checking the timing, see the instructor for this procedure.

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

	Yes	No
Is the base timing correct?	<input type="checkbox"/>	<input type="checkbox"/>
Is the base timing incorrect? Did you adjust to specification?	<input type="checkbox"/>	<input type="checkbox"/>
Is the base timing incorrect, but it cannot be adjusted?	<input type="checkbox"/>	<input type="checkbox"/>
If the timing could not be adjusted, explain the reason in the following space.		
	OK	Not OK
Vacuum advance	<input type="checkbox"/>	<input type="checkbox"/>
Centrifugal advance	<input type="checkbox"/>	<input type="checkbox"/>

IGNITION SYSTEMS

3. If required, reset the idle speed and shut off the engine. Reconnect any components that were disconnected for timing checks and disconnect the test equipment.

Average of the above evaluations

This average is a partial evaluation for Competency J4. The final evaluation for J4 follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency J4 by averaging the evaluations of JS2-L5-UII and JS3-L5-UII.

JS2-L5-UII _____

JS3-L5-UII _____

Final evaluation for Competency J4 _____

IGNITION SYSTEMS

JS4-L5-UII

INSPECTING AND REPLACING THE BREAKER POINTS AND CONDENSER

Equipment:

Dwell meter
Feeler gauge
Hand tools
Protective eyewear
Tachometer
Timing light

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Remove the distributor cap and rotor. Inspect the condition of the distributor cap and rotor. Record the inspection results in the following space.
3. Remove the breaker points and condenser from the distributor housing.
NOTE: Take care not to allow the small screws to fall into the distributor.
4. Visually inspect the condition of the breaker points.
 - a. Is there excessive pitting? Yes _____ No _____
 - b. Is the contact alignment adequate? Yes _____ No _____

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

5. Test the condenser by using a condenser tester.

NOTE: Refer to the appropriate service manual for condenser capacity specification.

	OK	Not OK
Series resistance		
Leakage		
Capacity		

6. Inspect the condition of the distributor.

	OK	Not OK
Centrifugal advance		
Vacuum advance		
Distributor shaft		
Breaker plate		
Primary wire		

If any of the above are marked "Not OK," explain the problem in the following space.

IGNITION SYSTEMS

7. Install the breaker points and condenser. _____

NOTE: As directed by the instructor, replace any defective or worn parts discovered during the tests and inspections.

- a. Wipe the breaker plate clean.
- b. Lubricate the distributor cam with a distributor cam lubricant. Lubricate other pivot points as outlined in the appropriate service manual.
- c. Set the breaker point gap to specification. Refer to the appropriate service manual for the specification.

NOTE: If reusing old ignition points, the gap must be set by using a dwell meter.

- d. Check and, if necessary, correct the contact alignment.

NOTE: Some breaker point contacts are preset and should not be adjusted. Consult the appropriate service manual before performing this step.

8. Install the distributor rotor and cap. _____

9. Connect the dwell meter, tachometer, and timing light. Block the wheels, start the engine, and run the vehicle until it reaches normal operating temperature. _____

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

10. Read the dwell on the dwell meter with the engine at idle speed. Compare your reading to the specification recorded in the appropriate service manual. If your reading is out of specification, readjust the dwell. _____

NOTE: If the distributor is the external adjustment type, the dwell may be adjusted with the engine running. If the distributor is the internal adjustment type, shut the engine off and repeat step 7c.

11. After adjusting the dwell, set the ignition timing to the specification given in the appropriate service manual. _____

ENGINE PERFORMANCE

12. Shut off the engine and disconnect the test equipment.

Average of the above evaluations

This average is a partial evaluation for Competency J2. The final evaluation for J2 will be made at the end of JS1-L1-UV.

IGNITION SYSTEMS

JS5-L5-UII

REMOVING AND REPLACING THE IGNITION DISTRIBUTOR

Equipment:

Distributor wrench
Hand tools
Protective eyewear
Tachometer
Timing light or timing meter

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using the following procedure, remove the distributor.
 - a. Clean the debris from around the base of the distributor housing.
 - b. If so equipped, disconnect the vacuum advance hose.
 - c. Disconnect the primary wiring to the distributor.
 - d. Remove the distributor cap from the distributor.

NOTE: If the spark plug wires are removed, mark their position to ensure a proper reassembly.

- e. Crank the engine until the distributor rotor is in position to fire the Number 1 cylinder and the timing mark is aligned with the top dead center mark.

NOTE: If the timing marks are not visible, scribe a mark on the distributor housing at the point at which the distributor rotor is pointing. Next, scribe a second mark on the distributor housing and a corresponding mark on the engine block. These marks will aid in reassembly.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

f. Remove the distributor hold-down clamp and then remove the distributor. Place a clean towel over the hole in the engine where the distributor was removed.

3. Using the following procedure, install the distributor. _____

a. Insert the distributor in the engine, aligning the marks that were made before removal.

NOTE: Do not force the distributor into the engine. It may be necessary to use a long screwdriver or other suitable tool to turn the oil pump to align the drive coupling before inserting the distributor.

b. Install the distributor hold-down clamp and bolt. Snug, but do not tighten, the hold-down bolt.

c. Install the distributor cap, vacuum advance line, and primary wiring.

d. Start the engine and set the ignition timing to specification.

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

Average of the above evaluations _____

This average is a partial evaluation for Competencies J2 and J3. The final evaluations for J2 and J3 will be made at the end of JS1-L1-UV.

IGNITION SYSTEMS

JS6-L5-UII

DISTRIBUTOR DISASSEMBLY, INSPECTION, AND REASSEMBLY

Equipment:

Hand tools
Protective eyewear
Serviceable distributor
Special tools

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. If required, remove the distributor from the vehicle.
3. Using a service manual or other information source, locate a procedure for disassembling the distributor to be serviced. 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 before continuing.

Instructor
Approved

Following the procedure, disassemble the distributor to be serviced.

CAUTION: Make sure the instructor is aware of any changes that might have to be made in the procedure.

4. Using a service manual or other information source, locate a procedure for cleaning and inspecting the distributor components. 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 before continuing.

Instructor
Approved

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Following the procedure, clean and inspect the distributor components.

CAUTION: Make sure the instructor is aware of any changes that might have to be made in the procedure.

NOTE: Do not use a cleaning solvent on the advance mechanism, breaker points, condenser, ignition module, permanent magnet signal generator, or Hall Effect switch.

Record the results of the tests and inspections in the following space.

5. Using a service manual or other information source, locate a procedure for assembling and adjusting the distributor to be serviced. Be sure to include any applicable adjustment specifications. 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 before continuing.



Following the procedure, assemble and adjust the distributor.

CAUTION: Make sure the instructor is aware of any changes that might need to be made in the procedure.

NOTE: If a tester is available, test the operation of the distributor on a distributor test stand. If required, reinstall the distributor in the vehicle and reset the timing.

Average of the above evaluations

This average is a partial evaluation for Competencies J2 and J3. The final evaluations for J2 and J3 will be made at the end of JS1-L1-UV.

IGNITION SYSTEMS

JS7-L5-U11

REMOVING, INSPECTING, AND REPLACING THE SPARK PLUGS AND TESTING THE SECONDARY CIRCUIT

Equipment:

Digital multimeter
Hand tools
Protective eyewear
Spark plug gap gauge
Spark plug socket

Procedure:

CAUTION: If the engine is hot, allow it to cool before performing the procedures on this job sheet.

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a twisting motion, remove the spark plug wires from the spark plugs.

NOTE: Grasp the spark plug wires by the plug boot. Do not pull on the wire.

NOTE: Mark the wires with numbered tape to aid in proper reassembly.

3. Using compressed air, blow the contaminants from around each of the spark plugs.
4. Remove the spark plugs. Be sure to keep the plugs in order, according to the cylinders from which they were removed.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

5. Inspect the condition of each spark plug. Using a spark plug diagnosis chart to assist in the inspection, record the diagnosis of each spark plug in the following chart.

Spark Plugs	Diagnosis
Plug #1	
Plug #2	
Plug #3	
Plug #4	
Plug #5	
Plug #6	
Plug #7	
Plug #8	

6. Measure and adjust the spark plug gap to specification. Refer to the appropriate service manual for this specification.

7. Install the spark plugs and torque to specification. If used, be sure to install the gaskets properly. Refer to the appropriate service manual for torque specification.

8. Remove the distributor cap and, if possible, leave the wires attached to the cap.

9. Set the ohmmeter to x1000 scale and measure the resistance of each spark plug wire from the plug end to the proper distributor cap terminal.

IGNITION SYSTEMS

10. Compare the resistance reading of each wire to the specification. Refer to the appropriate service manual for specification. _____
- a. Any wire that exceeds maximum resistance should be removed from the distributor cap and measured again.
 - b. If the resistance is acceptable after removal from the cap, check the distributor cap and wire connector for corrosion or looseness.
 - c. If the resistance is still excessive after removing the wire from the distributor cap, replace the wire.
 - d. Measure the resistance of the coil secondary wire in the same manner.
 - e. Record the results of the resistance tests in the following space. Note any wires with excessive resistance and the ohmmeter reading.

11. Reinstall all the wires to spark plugs and reinstall the distributor cap. Replace any defective wires as directed by the instructor. _____

NOTE: Be certain all wires are fully seated and properly routed.

12. Block the wheels, start the engine, and check for the proper operation of the engine. Shut off the engine. _____

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

Average of the above evaluations _____

This average is a partial evaluation for Competency J3. The final evaluation for J3 will be made at the end of JS1-L1-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

AS1-L1-UIII

NAME:

OVERVIEW AND THEORY OF ELECTRONIC IGNITION SYSTEMS

DATE:

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

1. What are the two types of electronic ignition systems?
2. What is the difference between a wasted-spark and unit ignition system?
3. List three advantages to an electronic ignition system.
4. List two differences between electronic and computerized ignition systems.
5. In the past, why were computerized ignition systems considered a distributor ignition system?

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS1-L2-UIII

INSPECTING AND TESTING COMPUTERIZED AND ELECTRONIC IGNITION SYSTEMS

Equipment:

Digital multimeter
Protective eyewear
Scan tool

Procedure:

CAUTION: For the following procedures, make sure the instructor is aware of any changes that might need to be made in the procedure.

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using the appropriate service manual, describe the design and configuration of the ignition system on a separate sheet of paper. The description should indicate:
 - a. Whether the vehicle uses a crankshaft position sensor, distributor shaft position sensor, or both a camshaft position sensor and crankshaft position sensor to provide basic timing input to the ECM. Also, whether the sensor is a permanent magnet signal generator or a Hall Effect switch.
 - b. Whether or not the vehicle uses a distributor.
3. Using a service manual or other information source, locate a procedure for accessing trouble codes for the vehicle. Make sure the procedure can be performed with available equipment. 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 before continuing.



Instructor
Approved

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Using the procedure, access the trouble codes. Record the results on the following chart.

NOTE: If no trouble codes are present, give examples of two trouble codes and what they mean.

Trouble Code	Meaning

- 4. Using a service manual or other information source, locate a procedure for testing the crankshaft position sensor, the distributor shaft position sensor, or camshaft position sensor. 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 before continuing.

**Instructor
Approved**

Using the procedure, test the crankshaft position sensor, the distributor shaft position sensor, or camshaft position sensor. Record the results on a separate sheet of paper.

- 5. Using a service manual or other information source, locate a procedure for replacing the crankshaft position sensor, the distributor shaft position sensor, or camshaft position sensor. 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 before continuing.

**Instructor
Approved**

Following the procedure, replace the crankshaft position sensor, the distributor shaft position sensor, or camshaft position sensor.

IGNITION SYSTEMS

6. Using a service manual or other information source, locate a procedure for visually inspecting and testing the continuity of all the wiring in the primary side of the ignition. 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 before continuing.

**Instructor
Approved**

Using the procedures, visually inspect and test the continuity of all wiring in the primary side of the ignition. Record the results on a separate sheet of paper.

7. If the ignition system uses a distributor, use a service manual or other information source to locate a procedure for inspecting the distributor. The procedure should include:
- Inspecting the distributor cap for cracks, carbon tracking, burning, corrosion in the towers, and any loose wires.
 - Inspecting the distributor rotor for cracks, carbon tracking, or burn-through.
 - Examining the rotor tip for signs of excessive burning.
 - Checking the rotor spring contact for adequate tension and for wear at the distributor cap carbon button contact area.

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 before continuing.

**Instructor
Approved**

NOTE: Computerized ignition systems are most often a type of electronic ignition system. In the past, these were referred to as distributor ignition systems because a few computerized systems incorporated a distributor into the secondary circuit for spark distribution.

Using the procedure, inspect the distributor. Record the results on a separate sheet of paper.

8. Using a service manual or other information source, locate a procedure for removing and replacing the distributor. 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 before continuing.



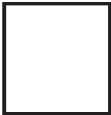
**Instructor
Approved**

Using the procedure, remove and replace the distributor.

9. Using a service manual or other information source, locate a procedure for inspecting the coil(s). The procedure should include:
- a. Inspecting the coil cover(s) for cracking or carbon tracking.
 - b. Inspecting the condition of the primary wiring. If the wiring or insulation is frayed or worn, repair or replace as necessary.
 - c. Inspecting the condition of the secondary coil wire(s). If the insulation is cracked or if an insulating boot is bad, replace the wire(s).
 - d. Checking for tightness of all the wiring connections.
 - e. Inspecting the condition of the wire(s) and tower(s).
 - f. Inspecting for the correct coil polarity.

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 before continuing.



**Instructor
Approved**

Using the procedure, inspect the coil(s). Record the results on a separate sheet of paper.

IGNITION SYSTEMS

10. Using a service manual or other information source, locate a procedure for testing the coil(s). Write the procedure on a separate sheet of paper. 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 before continuing.

**Instructor
Approved**

Using the procedure, test the coil(s). Record the results on a separate sheet of paper.

11. Using a service manual or other information source, locate a procedure for replacing the coil(s). 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 before continuing.

**Instructor
Approved**

Using the procedure, replace the coil(s). Record the results on a separate sheet of paper.

Average of the above evaluations _____

This average is a partial evaluation for Competencies J2 and J3. The final evaluations for J2 and J3 will be made at the end of JS1-L1-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS2-L2-UIII

CHECKING THE SPARK PLUGS AND TESTING THE SECONDARY CIRCUIT ON COMPUTERIZED AND ELECTRONIC IGNITION SYSTEMS

Equipment:

Hand tools
Protective eyewear
Spark plug gap gauge
Spark plug socket

Procedure:

CAUTION: For the following procedures, make sure the instructor is aware of any changes that might need to be made in the procedure.

CAUTION: If the engine is hot, allow it to cool before performing the procedures on this job sheet.

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for inspecting the secondary wiring. The procedure should include:
 - a. Inspecting the insulation for cracking, chafing, oil soaking, or other damage.
 - b. Inspecting the condition of the wire boots.
 - c. Checking that all wires are securely attached at the spark plugs, the distributor cap (if system is so equipped), and the coil.
 - d. Inspecting for the proper routing of the spark plug wires.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

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 before continuing.



**Instructor
Approved**

Using the procedure, inspect the secondary wiring. Record the results on a separate sheet of paper. Correct any problems you find.

- 3. Using a twisting motion, remove the spark plug wires from the spark plugs. _____

NOTE: Grasp the spark plug wires by the plug boot. Do not pull on the wire.

NOTE: Mark the wires with numbered tape to aid in proper reassembly.

- 4. Using compressed air, blow the contaminants from around each of the spark plugs. _____

- 5. Remove the spark plugs. Keep the plugs in order according to the cylinders from where they were removed. _____

IGNITION SYSTEMS

6. Inspect the condition of each spark plug. Use a spark plug diagnosis chart to assist in the inspection. Record the diagnosis of each spark plug on the following chart.

Spark Plugs	Diagnosis
Plug #1	
Plug #2	
Plug #3	
Plug #4	
Plug #5	
Plug #6	
Plug #7	
Plug #8	

7. Measure and adjust the spark plug gap to specification. Refer to the appropriate service manual for this specification.

8. Using a service manual or other information source, locate a procedure for testing the resistance of the spark plug wires. Indicate whether or not the system uses a distributor. Make sure to include the removal of the wires from the coil(s) and all specifications. Write the procedure on a separate sheet of paper. 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 before continuing.



**Instructor
Approved**

Using the procedure, test the resistance of the spark plug wires. Record the results on a separate sheet of paper.

Average of the above evaluations

This average is a partial evaluation for Competency J3. The final evaluation for J3 will be made at the end of JS1-L1-UV.

IGNITION SYSTEMS

JS1-L1-UIV

PERFORMING ENGINE VACUUM GAUGE TESTS

Equipment:

Protective eyewear
Tachometer
Vacuum gauge

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Perform a vacuum gauge test.
 - a. Connect the vacuum gauge to an intake manifold vacuum source. Attach a vacuum hose to an accessible intake manifold vacuum connector and extend it up to the gauge.

CAUTION: Be sure to use the approved exhaust ventilation equipment when operating the vehicle in an enclosed area.
 - b. Start the engine and allow it to reach operating temperature.
 - c. Read the vacuum at idle speed and record the readings in the following space.
3. Perform an exhaust restriction test.
 - a. Connect the vacuum gauge in the same way as in the vacuum gauge test.
 - b. Connect a tachometer to the engine.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

- c. Gradually accelerate the engine speed from idle to 2000 rpm. Observe the reading.
- d. Maintain the engine speed at 2000 rpm for about 10 seconds or longer. Observe the reading.
- e. Record the observations and readings in the following space.

4. Perform a cranking vacuum test. _____

- a. Start the engine and allow it to reach operating temperature. Shut the engine off.
- b. Disable the ignition system.
- c. Back out the throttle stop screw until the throttle is completely closed and make sure the automatic choke is released.

NOTE: Fuel-injected engines do not use chokes. It may be impossible to obtain accurate results.

- d. Crank the engine.
- e. Observe and record the cranking speed in the following space.

5. Based on the tests, describe the condition of the engine in the following space. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

IGNITION SYSTEMS

JS2-L1-UIV

PERFORMING A CRANKING ENGINE COMPRESSION TEST WITH THE THROTTLE CLOSED

Equipment:

Compression gauge
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Start the engine and allow it to reach operating temperature. Shut the engine off.

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

3. Disable the ignition and fuel systems.
4. Remove the air filter.
5. Using compressed air, blow debris away from the spark plugs.
6. Remove all the spark plugs.

NOTE: If the spark plugs are not removed, the manifold vacuum will draw fuel from the carburetor into the cylinders.

7. Install the compression gauge in one cylinder.
8. Crank the engine at least four compression strokes.

NOTE: If the engine cranks slowly, the readings will not be accurate. Charge the battery and test the battery/starter/charging system. It may be necessary to keep a battery charger on the battery when performing this test.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

9. Observe the compression gauge. Note the readings on the first “puff” and at the highest point. Record the readings in the following chart. _____
10. Repeat the procedure for each cylinder. Record the readings in the chart. _____

Cylinder	Throttle Closed First "Puff" Reading	Throttle Closed Highest Reading	Manufacturer Specific	OK Yes or No
Cylinder #1				
Cylinder #2				
Cylinder #3				
Cylinder #4				
Cylinder #5				
Cylinder #6				
Cylinder #7				
Cylinder #8				

NOTE: If the first “puff” is low but gradually builds up to a normal reading, there is most likely a worn ring or cylinder wall problem. If the readings are higher than specifications or higher on one cylinder, there is most likely a carbon buildup or camshaft problem. If the reading remains the same on some strokes or is slow on others or if different readings are obtained on subsequent tests of the same cylinder, there is most likely a sticking valve.

IGNITION SYSTEMS

11. Reinstall the air filter and spark plugs. Reconnect the ignition and fuel systems.

12. Based on the test results, describe the condition of the engine in the following space.

Average of the above evaluations

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS3-L1-UIV

PERFORMING A CRANKING ENGINE COMPRESSION TEST WITH THE THROTTLE OPEN

Equipment:

Compression gauge
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Start the engine and allow it to reach operating temperature. Shut the engine off.

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

3. Disable the ignition and fuel systems.
4. Remove the air filter.
5. Block the throttle valve to the wide open position.
6. Using compressed air, blow debris away from the spark plugs.
7. Remove all the spark plugs.

NOTE: If the spark plugs are not removed, manifold vacuum will draw fuel from the carburetor into the cylinders.

8. Install the compression gauge in one cylinder.
9. Crank the engine at least four compression strokes.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

NOTE: If the engine cranks slowly, the readings will not be accurate. Charge the battery and test the battery/starter/charging system. It may be necessary to keep a battery charger on the battery when performing the test.

10. Observe the compression gauge. Note the readings on the first “puff” and at the highest point. Record the readings in the following chart. _____

11. Repeat the procedure for each cylinder. Record the readings in the chart. _____

Cylinder	Throttle Open First "Puff" Reading	Throttle Open Highest Reading	Change from Closed Throttle Yes or No
Cylinder #1			
Cylinder #2			
Cylinder #3			
Cylinder #4			
Cylinder #5			
Cylinder #6			
Cylinder #7			
Cylinder #8			

NOTE: If the first “puff” is low but gradually builds up to a normal reading, there is most likely a worn ring or cylinder wall problem. If the readings are higher than specifications or higher on one cylinder, there is most likely a carbon buildup or camshaft problem. If the reading remains the same on some strokes or is slow on others or if different readings are obtained on subsequent tests of the same cylinder, there is most likely a sticking valve.

IGNITION SYSTEMS

- 12. Unblock the throttle valve. _____
- 13. Reinstall the air filter and spark plugs. Reconnect the ignition and fuel systems. _____
- 14. Based on the test results, describe the condition of the engine in the following space. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS4-L1-UIV

PERFORMING A RUNNING ENGINE COMPRESSION TEST

Equipment:

Compression gauge
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Start the engine and allow it to reach operating temperature. Shut the engine off.

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

3. Remove the spark plug from the cylinder to be tested.
4. Install the compression gauge in the cylinder to be tested.
5. Start the engine and allow it to idle.
6. Release the compression gauge pressure.
7. Observe the compression reading at idle. Record the reading in the chart on the following page.
8. Slowly raise the engine speed to 1500 rpm. Observe the compression reading. Record the reading in the chart.
9. Return the engine speed to idle.
10. Release the compression gauge pressure.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

11. Snap the throttle open and then closed. Observe the compression reading. Record the reading in the chart. _____

NOTE: Attempt to open the throttle as wide as possible without increasing the engine speed because this allows more air in without increasing the engine rpm.

12. Repeat the procedure for each cylinder. Record the readings in the chart. _____

Cylinder	Idle Compression	1500 rpm Compression	Snap Compression
Cylinder #1			
Cylinder #2			
Cylinder #3			
Cylinder #4			
Cylinder #5			
Cylinder #6			
Cylinder #7			
Cylinder #8			

NOTE: The expected results of a running engine compression test are idle compression at 100 psi - plus or minus 20, 1500 rpm compression at 60 psi - plus or minus 20, and snap compression at 80% of wide open throttle cranking compression.

IGNITION SYSTEMS

13. Reinstall all the spark plugs.

14. Based on the test results, describe the condition of the engine in the following space.

Average of the above evaluations

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS5-L1-UIV

PERFORMING A CYLINDER LEAKAGE TEST

Equipment:

Cylinder leakage tester
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Start the engine and allow it to reach operating temperature. Shut the engine off.

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

3. Remove the air filter.
4. Block the throttle valve to the wide open position.
5. Using compressed air, blow debris away from the spark plugs.
6. Remove all the spark plugs.
7. Remove the crankcase filler cap.
8. Remove the radiator filler cap and check the coolant. If the coolant is low, fill the radiator to the proper level.
9. Rotate the engine until the cylinder to be tested is at top dead center.

NOTE: A whistle attached to a hose that is threaded into the spark plug hole is commonly used to locate top dead center.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

10. Calibrate and connect the cylinder leakage tester according to the manufacturer's instructions. Observe and record the reading in the following chart.
11. Repeat the procedure for each cylinder. Record the readings in the chart.

Cylinder	Percent of Leakage
Cylinder #1	
Cylinder #2	
Cylinder #3	
Cylinder #4	
Cylinder #5	
Cylinder #6	
Cylinder #7	
Cylinder #8	

12. If excessive cylinder leakage is recorded, listen at the different points to determine the source of the leak. If any cylinder is showing more than a 20% leakage rate, record the source of leakage in the following space.

IGNITION SYSTEMS

- 13. Unblock the throttle valve. _____
- 14. Reinstall the air filter and spark plugs. _____
- 15. Based on the test results, describe the condition of the engine in the following space. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS6-L1-UIV

PERFORMING A CYLINDER BALANCE TEST

Equipment:

Cylinder balance tester
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for connecting a cylinder balance tester to the 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 before continuing.

--

Instructor
Approved

Using the procedure, connect the cylinder balance tester to the engine.

3. Connect a tachometer to the engine if it is not a part of the cylinder balance tester.
4. Start the engine and allow it to reach operating temperature. Shut the engine off.

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

5. Disconnect the oxygen sensor and unplug the EGR hose or connector.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

6. Restart the engine. Bring the engine speed to 1000 rpm and maintain that speed.

7. Select the cylinder shorting mode on the cylinder balance tester.

NOTE: Make sure to disable the idle air control on a fuel-injected engine because it will compensate for the shorted cylinder and raise the engine rpm.

8. Short each cylinder for the same amount of time — about 2 to 3 seconds. Give the engine about 5 seconds between each short.

NOTE: All shorted cylinders should cause the rpm to drop a certain percentage.

9. Observe the tachometer for the rpm drop on each cylinder. Record the reading in the following chart.

10. Repeat the procedure for each cylinder. Record the readings in the chart.

Cylinder	Percent of rpm Drop
Cylinder #1	
Cylinder #2	
Cylinder #3	
Cylinder #4	
Cylinder #5	
Cylinder #6	
Cylinder #7	
Cylinder #8	

IGNITION SYSTEMS

NOTE: All cylinders in the engine should drop about the same amount.

- 11. Reconnect the oxygen sensor and the EGR hose or connector. _____
- 12. Clear the codes. _____
- 13. Based on the test results, describe the condition of the engine in the following space. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS1-L1-UV

PERFORMING A PRELIMINARY VISUAL ENGINE INSPECTION

Equipment:

Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using the following chart, perform a preliminary visual engine inspection.

	OK	Not OK
Spark plug wires		
Primary wiring		
Battery terminals		
Air filter		
Drive belts		
Coolant level		
Oil leaks		
Coolant leaks		
Fuel leaks		

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

3. If any of the items in the chart were marked "Not OK," describe the problem and the steps that are necessary to correct the problem.

IGNITION SYSTEMS

4. Using the following chart, visually inspect the exhaust system.

CAUTION: Because the following test must be done without any exhaust ventilation connected to the tail pipe, perform this test outdoors.

	OK	Not OK
Engine started cold		
Exhaust color		
Exhaust sound		
Exhaust odor		
Engine at idle		
Exhaust color		
Exhaust sound		
Exhaust odor		
Engine at 2000 rpm		
Exhaust color		
Exhaust sound		
Exhaust odor		

5. If any of the items in the chart were marked "Not OK," describe the problem and the steps that are necessary to correct the problem.

Average of the above evaluations

This average is a partial evaluation for Competencies J2 and J3. The final evaluations for J2 and J3 follow.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency J2 by averaging the evaluations of JS1-L5-UII, JS4-L5-UII, JS5-L5-UII, JS6-L5-UII, JS1-L2-UIII, and JS1-L1-UV.

- JS1-L5-UII _____
- JS4-L5-UII _____
- JS5-L5-UII _____
- JS6-L5-UII _____
- JS1-L2-UIII _____
- JS1-L1-UV _____

Final evaluation for Competency J2 _____

II. Determine the student's final evaluation for Competency J3 by averaging the evaluations of JS5-L5-UII, JS6-L5-UII, JS7-L5-UII, JS1-L2-UIII, JS2-L2-UIII, and JS1-L1-UV.

- JS5-L5-UII _____
- JS6-L5-UII _____
- JS7-L5-UII _____
- JS1-L2-UIII _____
- JS2-L2-UIII _____
- JS1-L1-UV _____

Final evaluation for Competency J3 _____

IGNITION SYSTEMS

AS1-L2-UV

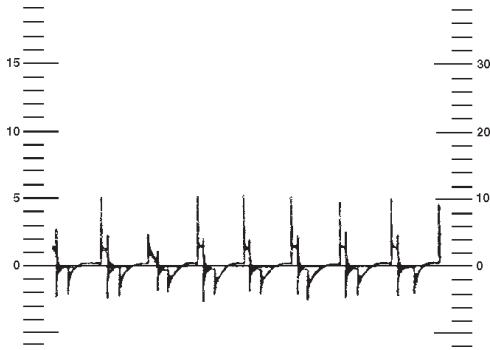
NAME:

IDENTIFYING WAVEFORM PATTERNS

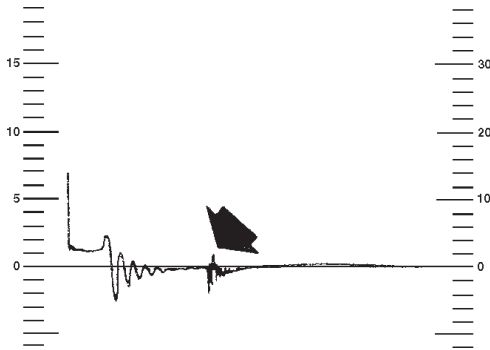
DATE:

Directions — Identify the following patterns. List what each represents and any possible causes. Write all responses on this sheet.

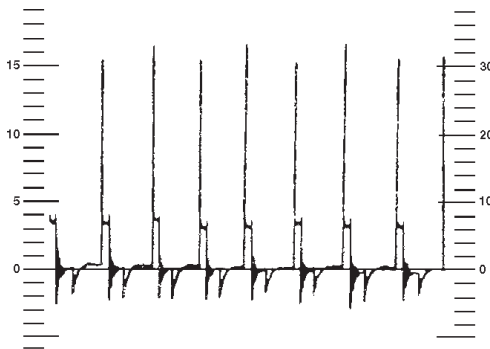
1.



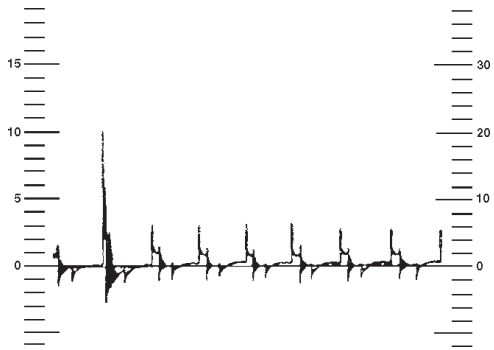
2.



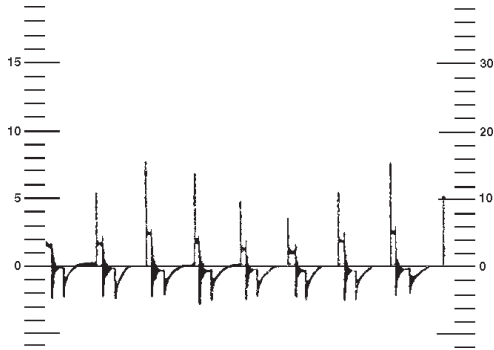
3.



4.



5.



IGNITION SYSTEMS

JS1-L2-UV

DIAGNOSING A DISTRIBUTOR IGNITION SYSTEM WITH AN OSCILLOSCOPE

Equipment:

Oscilloscope
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Hook the oscilloscope to the engine according to the manufacturer's instructions. Hook the ventilation equipment to the exhaust.
3. Start the engine and allow it to reach normal operating temperature. Record the engine size, dwell time, and firing order in the following chart.

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

Engine size	
Dwell time	
Firing order	

4. Check the primary raster pattern by marking the following applicable blanks. Refer to a service manual or other appropriate information source for the pattern specifications.

a. Dwell period	OK _____	Not OK _____
b. Primary on	OK _____	Not OK _____
c. Primary off	OK _____	Not OK _____

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

- d. Coil oscillations OK _____ Not OK _____
- e. Uneven primary off trace OK _____ Not OK _____

5. Check the secondary parade pattern and mark the following appropriate blanks. Refer to a service manual or other appropriate information source for the pattern specifications. _____

- a. Firing spikes even (within 3 kV) OK _____ Not OK _____
and between 5 and 15 kV height

	Firing kV	Burn kV	Burn Time
Cylinder 1			
Cylinder 2			
Cylinder 3			
Cylinder 4			
Cylinder 5			
Cylinder 6			
Cylinder 7			
Cylinder 8			

- b. Firing line normal OK _____ Not OK _____
- c. All cylinders similar OK _____ Not OK _____

6. Check the secondary raster pattern and mark the following appropriate blanks. Refer to a service manual or other appropriate information source for the pattern specifications. _____

- a. Firing lines even OK _____ Not OK _____
- b. Primary turns on OK _____ Not OK _____
- c. Dwell period OK _____ Not OK _____
- d. Coil oscillations OK _____ Not OK _____

IGNITION SYSTEMS

7. Shut the vehicle off and disconnect the test equipment. Based on the oscilloscope tests, determine the condition of the vehicle. Record the findings in the following space.

Average of the above evaluations

This average is a partial evaluation for Competency J1. The final evaluation for J1 will be made at the end of JS2-L2-UV.

ENGINE PERFORMANCE

IGNITION SYSTEMS

JS2-L2-UV

DIAGNOSING AN ELECTRONIC IGNITION SYSTEM WITH AN OSCILLOSCOPE

Equipment:

- Oscilloscope
- Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Hook the oscilloscope to the engine according to the manufacturer's instructions. Hook the ventilation equipment to the exhaust.
3. Start the engine and allow it to reach normal operating temperature. Record the engine size and firing order in the following chart.

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

Engine size	
Firing order	

4. Check the primary raster pattern by marking the following applicable blanks. Refer to a service manual or other appropriate information source for the pattern specifications.
 - a. Dwell period OK ____ Not OK ____
 - b. Primary on OK ____ Not OK ____
 - c. Primary off OK ____ Not OK ____
 - d. Coil oscillations OK ____ Not OK ____
 - e. Uneven primary off trace OK ____ Not OK ____

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

5. Check the secondary pattern and mark the following appropriate blanks. Refer to a service manual or other appropriate information source for the pattern specifications. _____

a. Firing spikes even (within 3 kV) OK _____ Not OK _____
 and between 5 and 15 kV height

	Firing kV	Burn kV	Burn Time
Cylinder 1			
Cylinder 2			
Cylinder 3			
Cylinder 4			
Cylinder 5			
Cylinder 6			
Cylinder 7			
Cylinder 8			

b. Firing line normal OK _____ Not OK _____

c. All cylinders similar OK _____ Not OK _____

6. Check the secondary raster pattern and mark the following appropriate blanks. Refer to a service manual or other appropriate information source for the pattern specifications. _____

a. Firing lines even OK _____ Not OK _____

b. Primary turns on OK _____ Not OK _____

c. Dwell period OK _____ Not OK _____

d. Coil oscillations OK _____ Not OK _____

IGNITION SYSTEMS

7. Shut the vehicle off and disconnect the test equipment. Based on the oscilloscope tests, determine the condition of the vehicle. Record the findings in the following space.

Average of the above evaluations

This average is a partial evaluation for Competency J1. The final evaluation for J1 follows.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency J1 by averaging the evaluations of JS1-L1-UIV, JS2-L1-UIV, JS3-L1-UIV, JS4-L1-UIV, JS5-L1-UIV, JS6-L1-UIV, JS1-L2-UV, and JS2-L2-UV.

JS1-L1-UIV _____

JS2-L1-UIV _____

JS3-L1-UIV _____

JS4-L1-UIV _____

JS5-L1-UIV _____

JS6-L1-UIV _____

JS1-L2-UV _____

JS2-L2-UV _____

Final evaluation for Competency J1 _____

IGNITION SYSTEMS

AS1-L1-UVI

NAME:

UNDERSTANDING STANDARDIZED TERMINOLOGY

DATE:

Directions — Complete the following chart by using the clue in each row.

STANDARDIZED TERMINOLOGY RECOMMENDED BY THE SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)				
System Functions	J1930	Former Ford Term	Former GM Term	Former Chrysler Term
			HEI	
	EI			
Input Sensors (Signals)				
		CPS, VRS, PIP		
				CTS
Mass Airflow				
			TPS	
Control				
		EEC, ECA, MCU		
Output Signals				
Exhaust Gas Recirculation				
				AIS
Diagnostics				
			Diag. Ckt. Chk	

ENGINE PERFORMANCE

IGNITION SYSTEMS

AS1-L2-UVI

NAME:

SENSORS

DATE:

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

1. What is the function of each of the following sensors?

Intake air temperature sensor —

Throttle position sensor —

Oxygen sensor —

Vehicle speed sensor —

Manifold absolute pressure sensor —

2. What is a thermistor? Give one example of a sensor that is a thermistor.

3. What is a potentiometer? Give one example of a sensor that is a potentiometer.
4. What is atmospheric pressure?
5. What are the two basic types of manifold absolute pressure sensors and what is the difference between the two?

IGNITION SYSTEMS

JS1-L1-UVII

DIAGNOSING AND SERVICING COMPUTERIZED ENGINE CONTROL SYSTEMS

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for accessing the diagnostic trouble codes for the vehicle to be serviced. 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 before continuing.



**Instructor
Approved**

Using the procedure, access the diagnostic trouble codes and record the results in the following chart.

If no codes are present, give some examples of codes and their meanings.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Diagnostic Trouble Code	Meaning

3. Using a service manual or other information source, locate the procedures for testing the components indicated by the codes. Include the procedures and specifications for testing the wiring continuity related to the 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 procedures.

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

**Instructor
Approved**

Using the procedures, perform the tests and record the results on a separate sheet of paper.

4. After testing is complete, use a separate sheet of paper to describe any repairs and/or replacement procedures. Have the instructor check the following box to indicate approval of the repairs and/or procedures.

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

**Instructor
Approved**

Perform the repairs and/or procedures.

Average of the above evaluations

This average is a partial evaluation for Competencies J5 and J6. The final evaluation for Competencies J5 and J6 will be made at the end of JS4-L1-UVII.

IGNITION SYSTEMS

JS2-L1-UVII

DIAGNOSING IGNITION-RELATED SENSORS USING A DIGITAL MULTIMETER

Equipment:

Digital multimeter
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the sensors on the following chart with a digital multimeter. Include the specifications for hertz, volts, ohms, etc. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

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



**Instructor
Approved**

Perform the procedures and record the results in the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

	Specification	Reading	Working Correctly? (Yes/No)	Initials
Crankshaft Position Sensor				
Hall Effect Sensor				
Engine Coolant Temperature Sensor				
Intake Air Temperature Sensor				
Throttle Position Sensor				
Frequency-Signal Type Manifold Absolute Pressure Sensor				
Simple-Voltage Type Manifold Absolute Pressure Sensor				
Frequency-Signal Type Mass Airflow Sensor				
Simple-Voltage Type Mass Airflow Sensor				
Knock Sensor				

Average of the above evaluations _____

This average is a partial evaluation for Competencies J5 and J6. The final evaluation for Competencies J5 and J6 will be made at the end of JS4-L1-UVII.

IGNITION SYSTEMS

JS3-L1-UVII

DIAGNOSING IGNITION-RELATED SENSORS USING A SCAN TOOL

Equipment:

Protective eyewear
Scan tool

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the sensors on the following chart using a scan tool. Include the specifications for hertz, volts, ohms, etc. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

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



**Instructor
Approved**

Perform the procedures and record the results in the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

	Specification	Reading	Working Correctly? (Yes/No)	Initials
Crankshaft Position Sensor				
Hall Effect Sensor				
Engine Coolant Temperature Sensor				
Intake Air Temperature Sensor				
Throttle Position Sensor				
Frequency-Signal Type Manifold Absolute Pressure Sensor				
Simple-Voltage Type Manifold Absolute Pressure Sensor				
Frequency-Signal Type Mass Airflow Sensor				
Simple-Voltage Type Mass Airflow Sensor				
Knock Sensor				

Average of the above evaluations _____

This average is a partial evaluation for Competencies J5 and J6. The final evaluation for Competencies J5 and J6 will be made at the end of JS4-L1-UVII.

IGNITION SYSTEMS

JS4-L1-UVII

DIAGNOSING IGNITION-RELATED SENSORS USING A LAB SCOPE

Equipment:

Lab scope
Protective eyewear

Procedure:

1. Wear protective eyewear while performing all the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the sensors on the following chart using a lab scope. Include the specifications for hertz, volts, ohms, etc. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

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

**Instructor
Approved**

Perform the procedures and record the results on the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

	Specification	Reading	Working Correctly? (Yes/No)	Initials
Crankshaft Position Sensor				
Hall Effect Sensor				
Engine Coolant Temperature Sensor				
Intake Air Temperature Sensor				
Throttle Position Sensor				
Frequency-Signal Type Manifold Absolute Pressure Sensor				
Simple-Voltage Type Manifold Absolute Pressure Sensor				
Frequency-Signal Type Mass Airflow Sensor				
Simple-Voltage Type Mass Airflow Sensor				
Knock Sensor				

Average of the above evaluations _____

This average is a partial evaluation for Competencies J5 and J6. The final evaluation for Competencies J5 and J6 follows.

IGNITION SYSTEMS

FINAL EVALUATION INSTRUCTIONS

- I. Determine the student's final evaluation for Competency J5 by averaging the evaluations of JS1-L1-UVII, JS2-L1-UVII, JS3-L1-UVII, and JS4-L1-UVII.

JS1-L1-UVII _____

JS2-L1-UVII _____

JS3-L1-UVII _____

JS4-L1-UVII _____

Final evaluation for Competency J5 _____

- II. Determine the student's final evaluation for Competency J6 by averaging the evaluations of JS1-L1-UVII, JS2-L1-UVII, JS3-L1-UVII, and JS4-L1-UVII.

JS1-L1-UVII _____

JS2-L1-UVII _____

JS3-L1-UVII _____

JS4-L1-UVII _____

Final evaluation for Competency J6 _____

ENGINE PERFORMANCE
