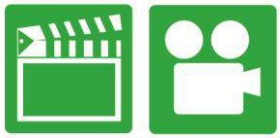
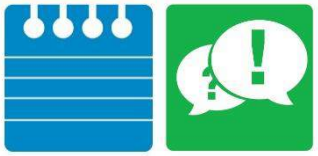
Automotive Electrical & Engine Performance 7/E

Chapter 22 Driver Information & Navigation Systems

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	**This course or class covers Automotive Electrical & Engine Performance. It correlates material to task lists specified by ASE and NATEF.**
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain the chapter learning objectives to the students. 1. Identify the meaning of dash warning symbols. 2. Explain the operation of electronic speedometers and electronic odometers. 3. Describe how a navigation system works. 4. Explain the operation and diagnosis of OnStar, backup camera, and backup sensor. 5. Describe how to troubleshoot malfunctioning dash instruments. This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "F" (Gauges, Warning Devices, and Driver Information System Diagnosis and Repair).
Establish the Mood or Climate	Provide a *WELCOME,* Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: This lesson plan is based on Automotive Electrical & Engine Performance 7/E Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 22: Chapter Images

ICONS	Ch22 Driver Info & Navigation Systems
     	**1. SLIDE 1 CH22 DRIVER INFORMATION & NAVIGATION SYSTEMS** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Videos** **At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)** 2. **SLIDE 2 EXPLAIN Figure 22-1** Engine coolant temperature is too high & **EXPLAIN** Dash Warning Symbols 3. **SLIDE 3 EXPLAIN Figure 22-2** Engine oil pressure too low 4. **SLIDE 4 EXPLAIN Figure 22-3** Water detected in fuel. Notice to drain the water from the fuel filter assembly on a vehicle equipped with a diesel engine 5. **SLIDE 5 EXPLAIN Figure 22-4** Maintenance required. This usually means that the engine oil is scheduled to be changed or other routine service items replaced or checked 6. **SLIDE 6 EXPLAIN Figure 22-5** Malfunction indicator lamp (MIL), also called a check engine light. The light means the engine control computer has detected a fault. 7. **SLIDE 7 EXPLAIN Figure 22-6** Charging system fault detected. 8. **SLIDE 8 EXPLAIN Figure 22-7** Fasten safety belt warning light 9. **SLIDE 9 EXPLAIN Figure 22-8** Fault detected in the supplemental restraint (airbag) system.

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	10. **SLIDE 10 EXPLAIN Figure 22-9** Fault detected in base brake system 11. **SLIDE 11 EXPLAIN FIGURE 22–10** Brake light bulb failure detected 12. **SLIDE 12 EXPLAIN Figure 22-11** Exterior light bulb failure detected 13. **SLIDE 13 EXPLAIN Figure 22-12** Worn brake pads or linings detected. 14. **SLIDE 14 EXPLAIN Figure 22-13** Fault detected in antilock brake system 15. **SLIDE 15 EXPLAIN Figure 22-14** Low tire pressure detected
	**EXPLAIN TECH TIP**
	16. **SLIDE 16 EXPLAIN Figure 22-15** Door open or ajar 17. **SLIDE 17 EXPLAIN Figure 22-16** Windshield washer fluid low. 18. **SLIDE 18 EXPLAIN Figure 22-17 Low fuel level** 19. **SLIDE 19 EXPLAIN Figure 22-18 Headlights on**. 20. **SLIDE 20 EXPLAIN Figure 22-19** Low traction detected. Traction control system is functioning to restore traction (usually flashes when actively working to restore traction) 21. **SLIDE 21 EXPLAIN Figure 22-20** Vehicle stability control system either off or working if flashing. 22. **SLIDE 22 EXPLAIN Figure 22-21** Traction control system has been turned off 23. **SLIDE 23 EXPLAIN Figure 22-22** indicates cruise control is on and able to maintain vehicle speed if set. Some vehicles use a symbol that looks like a small speedometer to indicate that cruise control is on.
	**DISCUSSION: DISCUSS IMPORTANCE OF INDICATOR, OR WARNING, LIGHTS. WHAT IS PURPOSE OF DASH WARNING LIGHT?**
	**HANDS-ON TASK: PROVIDE STUDENTS WITH COMMON WARNING SYMBOLS USED ON VEHICLE CLUSTER ASSEMBLIES. HAVE THEM IDENTIFY MEANING OF SYMBOL & LABEL IT ON LAB VEHICLE. GRADE STUDENTS ON THEIR ABILITY TO IDENTIFY SYMBOLS & SYSTEMS ASSOCIATED WITH THEM.**

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	**24. SLIDE 24 EXPLAIN OIL PRESSURE WARNING DEVICES** **25. SLIDE 25 EXPLAIN Figure 22-23** A typical oil pressure sending unit provides a varying amount of resistance as engine oil pressure changes. The output from the sensor is a variable voltage **DISCUSS REAL WORLD FIX**
	
	**25. SLIDE 25 EXPLAIN Figure 22-24** temperature gauge showing normal operating temperature between 180° F and 215° F, depending on specific vehicle and engine
	**DISCUSSION: DISCUSS OPERATION OF AN OIL PRESSURE GAUGE AND SENDING UNIT. WHAT IS VOLTAGE OF OUTPUT FROM THE SENSOR?**
	**26. SLIDE 26 EXPLAIN Figure 22-25** Typical brake warning light switch located on or near the master brake cylinder. **27. SLIDE 27 EXPLAIN Figure 22-26** red brake warning lamp can be turned on if the brake fluid level is low.
	**28. SLIDE 28 EXPLAIN Figure 22-27** Electromagnetic fuel gauge wiring. If the sensor wire is unplugged and grounded, the needle should point to "E" (empty). If the sensor wire is unplugged and held away from ground, the needle should point to "F" (full)
	**DEMONSTRATION: SHOW STUDENTS HOW TO USE A VARIABLE RESISTANCE POTENTIOMETER LIKE A 90 OHM GAS GAUGE TANK SENDER TO TEST GAUGES FOR PROPER OPERATION**
	**29. SLIDE 29 EXPLAIN Figure 22-28** A typical instrument display uses data from the sensors over serial data lines to the individual gauges. **30. SLIDE 30 EXPLAIN Figure 22-29** Most stepper motors use four wires which are pulsed by the computer to rotate the armature in steps. **31. SLIDE 31 EXPLAIN Figure 22-30** The ground for the "check oil" indicator lamp is controlled by the electronic low-oil buffer. Even though this buffer is connected to an oil level sensor, the buffer also takes into consideration the amount of time the engine

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	**32. SLIDE 32 EXPLAIN HUD & EXPLAIN Figure 22-31** typical head-up display showing zero miles per hour, which is actually projected on the windshield from the head-up display in the dash. **33. SLIDE 33 EXPLAIN Figure 22-32** dash-mounted control for the head-up display on this Cadillac allows the driver to move the image up and down on the windshield for best viewing. **34. SLIDE 34 EXPLAIN Figure 22-33** typical head-up display (HUD) unit.
	**DISCUSSION: HAVE STUDENTS DISCUSS ADVANTAGES OF HEAD-UP DISPLAY. WHERE IS HUD UNIT INSTALLED?**
	**35. SLIDE 35 EXPLAIN Figure 22-34** A night vision camera behind the grille of a Cadillac **36. SLIDE 36 EXPLAIN Figure 22-35** (a) Symbol and line drawing of a typical light emitting diode (LED). (b) Grouped in 7 segments, this array is called a 7-segment LED display with a common anode (positive connection). Dash computer toggles cathode (negative) side of each individual segment to display numbers and letters. (c) When all segments turned on, #8 displayed. **37. SLIDE 37 EXPLAIN Figure 22-36** typical navigation system. This Honda/Acura system uses some of climate control functions as well as trip information on display. This particular unit uses a DVD unit in the trunk along with a global positioning satellite (GPS) to display a map and your exact location for the entire country. **38. SLIDE 38 EXPLAIN Figure 22-37 (a)** View of vehicle dash with the instrument cluster removed. Sometimes the dash instruments can be serviced by removing the padded dash cover (crash pad) to gain access to the rear of the dash. **39. SLIDE 39 EXPLAIN Figure 22-37 (b)** The front view of the electronic analog dash display. **40. SLIDE 40 EXPLAIN Figure 22-37 (c)** The rear view of the dash display showing that there are a few bulbs that can be serviced, but otherwise unit is serviced as an assembly.

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 	**EXPLAIN TECH TIP** 41. **SLIDE 41 EXPLAIN FIGURE 22–38** Typical ignition switch positions. Notice the bulb check position between "on" (run) and "start." These inputs are often just voltage signal to the body control module and can be checked using a scan tool. 42. **SLIDE 42 EXPLAIN FIGURE 22–39** Many newer vehicles place the ignition switch on the dash and incorporate antitheft controls. Note the location of the accessory position
	**DISCUSSION: DISCUSS DIFFERENCE BETWEEN ANALOG & DIGITAL GAUGES. HOW IS STEPPER MOTOR USED IN ANALOG DISPLAYS?**
	**DISCUSSION: DISCUSS DIAGNOSIS OF DASH ELECTRONIC CIRCUITS. WHY AREN'T DASH ELECTRONIC CIRCUITS SHOWN ON A WIRING DIAGRAM? HOW WOULD A SHORT-TO-GROUND IN SENDING UNIT WIRE AFFECT OPERATION?**
	**DEMONSTRATION: SHOW STUDENTS HOW TO USE AN OHMMETER TO CHECK SENDING UNIT WIRES FOR OPENS AND SHORTS.**
	**DISCUSS REAL WORLD FIX**
 	**EXPLAIN TECH TIP** 43. **SLIDE 43 EXPLAIN ELECTRONIC SPEEDOMETERS &EXPLAIN Figure 22-40** A vehicle speed sensor located in the extension housing of the transmission. Some vehicles use the wheel speed sensors for vehicle speed information. 44. **SLIDE 44 EXPLAIN Electronic Odometers & EXPLAIN Figure 22-41 (a)** Some odometers are mechanical and are operated by a stepper motor. 45. **SLIDE 45 EXPLAIN Figure 22-41 (b)** Many vehicles are equipped with an electronic odometer
	

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	DISCUSS REAL WORLD FIX
	**DISCUSSION:** DISCUSS ELECTRONIC SPEEDOMETERS. WHAT ADVANTAGES DOES USING A SPEED SENSOR HAVE OVER A SPEEDOMETER GEAR-AND-CABLE ARRANGEMENT?
	**HANDS-ON TASK:** HAVE STUDENTS USE DMM TO TEST SENSORS/SWITCHES. HAVE STUDENTS INSPECT & TEST GAUGE FUSES TO CHECK POWER SUPPLY TO GAUGE CIRCUITRY. USE SCAN TOOL TO RETRIEVE DATA THAT COULD HELP DIAGNOSE SPEEDOMETER PROBLEMS.
	VEHICLES EQUIPPED WITH ELECTRONIC ODOMETERS OR TRIPOMETERS MUST BE IN CORRECT MODE TO RESET MAINTENANCE LIGHT
	**DEMONSTRATION:** SHOW STUDENTS HOW TO TEST VSS (PM GENERATOR TYPE) USING SOLDERING GUN
	**DISCUSSION:** DISCUSS HOW INFORMATION FROM VSS IS USED BY OTHER ELECTRONIC CIRCUITS. WHY COULD A MALFUNCTION IN VSS AFFECT TRANSMISSION SHIFTING?
	**DEMONSTRATION:** SHOW HOW TO REMOVE INSTRUMENT CLUSTER & HOW TO REMOVE TRIM PIECES WITHOUT BREAKING RETENTION CLIPS.
	**HANDS-ON TASK:** HAVE STUDENTS USE DMM TO TEST A VEHICLE SPEED SENSOR CIRCUIT.
	DISCUSS REAL WORLD FIX
	46. **SLIDE 46 EXPLAIN Figure 22-42** fuel tank module assembly that contains the fuel pump and fuel level sensor in one assembly.

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        	**DISCUSS REAL WORLD FIX** **DISCUSSION: HAVE STUDENTS DISCUSS OPERATION OF VOICE ACTIVATED SYSTEMS. CAN YOU NAME ANY OF THE SPECIFIC OEM SYSTEMS? WHAT THE TERM BLUETOOTH MEAN?** **47. SLIDE 47 EXPLAIN Figure 22-43** Global positioning systems use 24 satellites in high earth orbit whose signals are picked up by navigation systems. The navigation system computer then calculates the location based on the position of the satellite overhead **48. SLIDE 48 EXPLAIN Figure 22-44** typical GPS display screen showing the location of vehicle **49. SLIDE 49 EXPLAIN Figure 22-45** typical navigation display showing various options. Some systems do not allow access to these functions if vehicle is in gear and/or moving. **50. SLIDE 50 EXPLAIN Figure 22-46** screen display of a navigation system that is unable to acquire usable signals from GPS satellites **DISCUSS FREQUENTLY ASKED QUESTION & NOTE** **DISCUSSION: DISCUSS DIFFERENT COMPONENTS THAT COMPOSE A NAVIGATION SYSTEM. WHAT IS THE INPUT DEVICE FOR USERS ON MOST NAVIGATION SYSTEMS?** **EXPLAIN TECH TIPS** **DISCUSS FREQUENTLY ASKED QUESTION & NOTE** **51. SLIDE 51 EXPLAIN Figure 22-47** three-button OnStar control is located on the inside rearview mirror. The left button (telephone handset icon) is pushed if a hands-free cellular call is to be made. The center button is depressed to contact an OnStar advisor and the right emergency button is used to request that help be sent to the vehicle's location.

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	**ON-VEHICLE NATEF TASK: INSPECT AND TEST GAUGES AND GAUGE SENDING UNITS; DETERMINE NECESSARY ACTION**
	52. **SLIDE 52 EXPLAIN BACKUP CAMERA & Figure 22-48** typical view displayed on the navigation screen from the backup camera. 53. **SLIDE 53 EXPLAIN Figure 22-49** typical fisheye-type backup camera usually located near the center on the rear of the vehicle near the license plate 54. **SLIDE 54 EXPLAIN Figure 22-50** A typical backup sensor display located above the rear window inside the vehicle. The warning lights are visible in the inside rearview mirror.
	55. **SLIDE 55 EXPLAIN Figure 22-51** The small round buttons in the rear bumper are ultrasonic sensors used to sense distance to an object.
	**EXPLAIN TECH TIP**
	**DEMONSTRATION: SHOW STUDENTS HOW TO LOCATE AND IDENTIFY BACKUP SENSORS.**
	56. **SLIDE 56 EXPLAIN Figure 22-52** A lane departure warning system often uses cameras to sense the road lines and warns the driver if the vehicle is not staying within the lane, unless the turn signal is on
	**EXPLAIN TECH TIP**
	**DISCUSSION: DISCUSS HOW LANE DEPARTURE WARNING SYSTEMS OPERATE. HOW DOES SYSTEM DETECT WHETHER A VEHICLE IS CHANGING LANES ON PURPOSE OR ACCIDENTALLY?**
	**ON-VEHICLE NATEF TASK: INSPECT AND TEST CONNECTORS, WIRES, AND PRINTED CIRCUIT BOARDS OF GAUGE CIRCUITS; DETERMINE NECESSARY ACTION.**
	57. **SLIDES 57-68 GAS GAUGE DIAGNOSIS SLIDE SHOW**