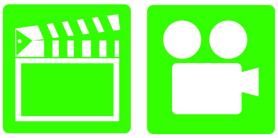
A6 Electricity & Electronics 4th Edition

Chapter 24 Driver Information & Navigation Systems

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Electricity and Electronics Systems.** 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 "A" (General Electrical/Electronic System Diagnosis).**
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.

ICONS	Ch24 Driver Info & Navigation Systems
	**1. SLIDE 1 CH24 DRIVER INFORMATION & NAVIGATION SYSTEMS**
	2. SLIDES 2-3 EXPLAIN OBJECTIVES
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/**
	WEB SITE IS CONSTANTLY UPDATED
	**4. SLIDES 4-5 EXPLAIN** Dash Warning Symbols
	6. SLIDE 6 EXPLAIN Figure 24-1 Engine coolant temperature is too high & **EXPLAIN** Dash Warning Symbols & **EXPLAIN Figure 24-2** Engine oil pressure too low. &
	7. SLIDE 7 EXPLAIN Figure 24-3 Water detected in fuel. Notice to drain the water from the fuel filter assembly on a vehicle equipped with a diesel engine & **EXPLAIN Figure 24-4** Maintenance required. This usually means that the engine oil is scheduled to be changed or other routine service items replaced or checked
	8. SLIDE 8 EXPLAIN Figure 24-5 Malfunction indicator lamp (MIL), also called a check engine light. The light means the engine control computer has detected a fault.
	9. SLIDE 9 EXPLAIN Figure 24-6 Charging system fault detected.
	10. SLIDE 10 EXPLAIN Dash Warning Symbols
	11. SLIDE 11 EXPLAIN Figure 24-7 Fasten safety belt warning light & **EXPLAIN Figure 24-8** Fault detected in the supplemental restraint (airbag) system.
	12. SLIDE 12 EXPLAIN Figure 24-9 Fault detected in base brake system & **EXPLAIN FIGURE 24–10** Brake light bulb failure detected
	13. SLIDE 13 EXPLAIN Figure 24-11 Exterior light bulb failure detected & **EXPLAIN Figure 24-12** Worn brake pads or linings detected.
	14. SLIDE 14 EXPLAIN Dash Warning Symbols
	15. SLIDE 15 EXPLAIN Figure 24-13 Fault detected in antilock brake system & **EXPLAIN Figure 24-14** Low tire pressure detected
	**16. SLIDE 16 EXPLAIN Figure 24-15** Door open or ajar & **EXPLAIN Figure 24-16** Windshield washer fluid low.
	17. SLIDE 17 EXPLAIN Dash Warning Symbols

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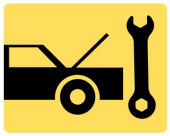
	18. **SLIDE 18 EXPLAIN Figure 24-17 Low fuel level & EXPLAIN Figure 24-18 Headlights on**. 19. **SLIDE 19 EXPLAIN Figure 24-19** Low traction detected. Traction control system is functioning to restore traction (usually flashes when actively working to restore traction) & **EXPLAIN Figure 24-20** Vehicle stability control system either off or working if flashing. 20. **SLIDE 20 EXPLAIN Figure 24-21** Traction control system has been turned off & **EXPLAIN Figure 24-22** 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: HAVE STUDENTS 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 DASHBOARD CLUSTER ASSEMBLIES. HAVE THEM IDENTIFY MEANING OF EACH SYMBOL AND LABEL IT ON LAB VEHICLE. GRADE STUDENTS ON THEIR ABILITY TO IDENTIFY SYMBOLS & SYSTEMS ASSOCIATED WITH THEM.**
	21. **SLIDE 21 EXPLAIN OIL PRESSURE WARNING DEVICES**
	22. **SLIDE 22 EXPLAIN Figure 24-23** 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
	**DISCUSSION: DISCUSS OPERATION OF AN OIL PRESSURE GAUGE AND SENDING UNIT. WHAT IS THE VOLTAGE OF OUTPUT FROM THE SENSOR?**
	23. **SLIDE 23 EXPLAIN Figure 24-24** temperature gauge showing normal operating temperature between 180°F and 215°F, depending on specific vehicle and engine

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	**SHOW VIDEO: TESTING DASH GAUGES WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=TESTING%20AND%20DIAGNOSING%20DASH%20GAUGES&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T9.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T9.XML
	**24. SLIDE 24 EXPLAIN Figure 24-25** Typical brake warning light switch located on or near the master brake cylinder.
	25. SLIDE 25 EXPLAIN Figure 24-26 red brake warning lamp can be turned on if the brake fluid level is low.
	**26. SLIDE 26 EXPLAIN** Other Vehicle Operations
	27. SLIDE 27 EXPLAIN Figure 24-27 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**
	**28. SLIDE 28 EXPLAIN Figure 24-28** A typical instrument display uses data from the sensors over serial data lines to the individual gauges.
	**29. SLIDE 29 EXPLAIN Figure 24-29** Most stepper motors use four wires which are pulsed by the computer to rotate the armature in steps.
	30. SLIDE 30 EXPLAIN Figure 24-30 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
	**31. SLIDE 31 EXPLAIN Figure 24-31** typical head-up display showing zero miles per hour, which is actually projected on the windshield from the head-up display in the dash.
	32. SLIDE 32 EXPLAIN Figure 24-32 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.
	33. SLIDE 33 EXPLAIN Figure 24-33 typical head-up display (HUD) unit.

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	**DISCUSSION: HAVE STUDENTS DISCUSS ADVANTAGES OF HEAD-UP DISPLAY. WHERE IS HUD UNIT INSTALLED?**
	**34. SLIDE 34** EXPLAIN Night Vision **35. SLIDE 35** EXPLAIN **Figure 24-34** A night vision camera behind the grille of a Cadillac
	**36. SLIDE 36** EXPLAIN Digital Electronic Display Operation **37. SLIDE 37** EXPLAIN **Figure 24-35** (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.
	38. SLIDE 38 EXPLAIN **Figure 24-36** 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.
	**39. SLIDE 39** EXPLAIN Digital Electronic Display Operation **40. SLIDE 40** EXPLAIN **Figure 24-37 (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. **(b)** The front view of the electronic analog dash display. **(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.
	41. SLIDE 41 EXPLAIN **FIGURE 24–38** 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 24–39** Many newer vehicles place the ignition switch on the dash and incorporate antitheft controls. Note the location of the accessory position

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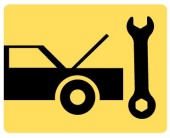
	**DISCUSSION: DISCUSS DIFFERENCE BETWEEN ANALOG AND DIGITAL GAUGES. HOW IS STEPPER MOTOR USED IN ANALOG DASH DISPLAYS?**
	**DISCUSSION: DISCUSS DIAGNOSIS OF DASH ELECTRONIC CIRCUITS. WHY AREN'T DASH ELECTRONIC CIRCUITS SHOWN ON A WIRING DIAGRAM? HOW WOULD A SHORT-TO-GROUND IN SENDING UNIT WIRE AFFECT OPERATION?**
	**DEMONSTRATION: SHOW STUDENTS HOW TO USE AN OHMMETER TO CHECK SENDING UNIT WIRES FOR OPENS AND SHORTS.**
	**43. SLIDE 43 EXPLAIN ELECTRONIC SPEEDOMETERS**
	**ANIMATION: INPUT DISCREET SIGNALS WWW.MYAUTOMOTIVELAB.COM** HTTP://PEGASUS2.PEARSONED.COM/PEGASUS/MODULES/TEACHINGPLAN/FRMCOURSEPREVIEW.ASPX?FROM=CC
	**44. SLIDE 44 EXPLAIN Figure 24-40** A vehicle speed sensor located in the extension housing of the transmission. Some vehicles use the wheel speed sensors for vehicle speed information.
	**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.**
	**45. SLIDE 45 EXPLAIN Figure 24-41 (a)** Some odometers are mechanical and are operated by a stepper motor. **(b)** Many vehicles are equipped with an electronic odometer
	**DISCUSSION: DISCUSS ELECTRONIC SPEEDOMETERS. WHAT ADVANTAGES DOES USING A SPEED SENSOR HAVE OVER A SPEEDOMETER GEAR-AND-CABLE ARRANGEMENT?**
	**VEHICLES EQUIPPED WITH ELECTRONIC ODOMETERS OR TRIPOMETERS MUST BE IN CORRECT MODE TO RESET MAINTENANCE LIGHT**

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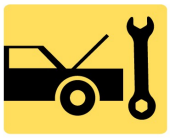
DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO TEST VSS (PM GENERATOR TYPE) USING SOLDERING GUN**
QUESTION	**DISCUSSION: DISCUSS HOW INFORMATION FROM VSS IS USED BY OTHER ELECTRONIC CIRCUITS. WHY COULD A MALFUNCTION IN VSS AFFECT TRANSMISSION SHIFTING?**
DEMO	**DEMONSTRATION: SHOW HOW TO REMOVE INSTRUMENT CLUSTER & HOW TO REMOVE TRIM PIECES WITHOUT BREAKING RETENTION CLIPS.**
	**HANDS-ON TASK: HAVE STUDENTS USE DMM TO TEST A VEHICLE SPEED SENSOR CIRCUIT.**
	**46. SLIDE 46 EXPLAIN** NAVIGATION AND GPS **47. SLIDE 47 EXPLAIN Figure 24-42** fuel tank module assembly that contains the fuel pump and fuel level sensor in one assembly.
QUESTION	**DISCUSSION: HAVE STUDENTS DISCUSS OPERATION OF VOICE ACTIVATED SYSTEMS. CAN YOU NAME ANY OF THE SPECIFIC OEM SYSTEMS? WHAT THE TERM BLUETOOTH MEAN?**
	**48. SLIDE 48 EXPLAIN NAVIGATION AND GPS** **49. SLIDE 49 EXPLAIN Figure 24-43** 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
	**50. SLIDE 50 EXPLAIN Figure 24-44** typical GPS display screen showing the location of vehicle & **EXPLAIN Figure 24-45** typical navigation display showing various options. Some systems do not allow access to these functions if vehicle is in gear and/or moving. **51. SLIDE 51 EXPLAIN Figure 24-46** screen display of a navigation system that is unable to acquire usable signals from GPS satellites.
QUESTION	**DISCUSSION: DISCUSS DIFFERENT COMPONENTS THAT COMPOSE A NAVIGATION SYSTEM. WHAT IS THE INPUT DEVICE FOR USERS ON MOST NAVIGATION SYSTEMS?**

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	**52. SLIDE 52 EXPLAIN ONSTAR** **53. SLIDE 53 EXPLAIN Figure 24-47** The 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. **54. SLIDE 54 EXPLAIN** ONSTAR
	**ON-VEHICLE NATEF TASK: INSPECT AND TEST GAUGES AND GAUGE SENDING UNITS; DETERMINE NECESSARY ACTION**
	**55. SLIDE 55 EXPLAIN** Backup Camera & Sensors **56. SLIDE 56 EXPLAIN Figure 24-48** typical view displayed on the navigation screen from the backup camera. **57. SLIDE 57 EXPLAIN Figure 24-49** typical fisheye-type backup camera usually located near the center on the rear of the vehicle near the license plate **58. SLIDE 58 EXPLAIN Figure 24-50** A typical backup sensor display located above the rear window inside the vehicle. The warning lights are visible in the inside rearview mirror. **59. SLIDE 59 EXPLAIN Figure 24-51** The small round buttons in the rear bumper are ultrasonic sensors used to sense distance to an object.
	**DEMONSTRATION: SHOW STUDENTS HOW TO LOCATE AND IDENTIFY BACKUP SENSORS.**
	**60. SLIDE 60 EXPLAIN** Lane Departure Warning System **61. SLIDE 61 EXPLAIN Figure 24-52** 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
	**DISCUSSION: DISCUSS HOW LANE DEPARTURE WARNING SYSTEMS OPERATE. HOW DOES SYSTEM DETECT WHETHER A VEHICLE IS CHANGING LANES ON PURPOSE OR ACCIDENTALLY?**

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 	**ON-VEHICLE NATEF TASK:** INSPECT AND TEST CONNECTORS, WIRES, AND PRINTED CIRCUIT BOARDS OF GAUGE CIRCUITS; DETERMINE NECESSARY ACTION. **62. SLIDES 62-63** EXPLAIN SUMMARY