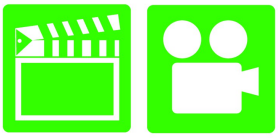
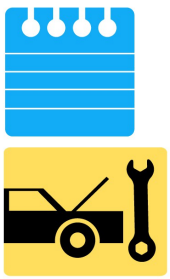
A6 Electricity & Electronics 4th Edition

Chapter 26 ACCESSORY CIRCUITS

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. Explain how cruise control operates and how to troubleshoot the circuit. 2. Describe how power windows and power seats operate. 3. Diagnose incorrect electric lock and keyless entry operation, and determine necessary action. 4. Explain how an antitheft system works, and diagnose faulty operation. **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	Ch26 ACCESSORY CIRCUITS
	**1. SLIDE 1 CH26 ACCESSORY CIRCUITS** **2. SLIDES 2-3 EXPLAIN OBJECTIVES**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**4. SLIDE 4 EXPLAIN Cruise Control** **5. SLIDE 5 EXPLAIN Figure 26-1** This cruise control servo unit has an electrical connection with wires that go to the cruise control module or the vehicle computer, depending on the vehicle. The vacuum hoses supply engine manifold vacuum to the rubber diaphragm that moves the throttle linkage to maintain the preset speed
	**DEMONSTRATION: SHOW STUDENTS COMPONENTS OF CRUISE CONTROL SYSTEM. IF POSSIBLE, SHOW MULTIPLE OEM SYSTEMS TO DEMONSTRATE DIFFERENT DESIGNS.** **WHEN SERVICING CRUISE CONTROL SYSTEM, YOU WILL BE CLOSE TO AIR BAG & ABS. SERVICE INFORMATION WILL INSTRUCT YOU WHEN TO DISARM AND/OR DEPRESSURIZE THESE SYSTEMS. FAILURE TO FOLLOW THESE PROCEDURES CAN RESULT IN PERSONAL INJURY & COSTLY REPAIRS.**
	**6. SLIDE 6 EXPLAIN Figure 26-2** cruise control used on a Toyota/Lexus.
	**7. SLIDE 7 EXPLAIN Figure 26-3** Circuit diagram of a typical electronic cruise control system. **8. SLIDE 8 EXPLAIN** Cruise Control **NOT ALL VEHICLES HAVE TRAILER TOW MODE. MORE COMMON ON HEAVY-DUTY PICKUPS**
	HANDS-ON TASK: HAVE THE STUDENTS DESCRIBE CRUISE CONTROL SYSTEMS AND HOW THEY OPERATE. HAVE THEM CREATE A TABLE TO LIST SOME COMMON CAUSES OF INOPERATIVE CRUISE CONTROL SYSTEMS.

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	**DISCUSSION: DISCUSS USE OF MULTIPLE SAFETY SWITCHES. WHY IS A CLUTCH OR BRAKE SWITCH NECESSARY?**
	**DISCUSSION: HAVE STUDENTS TALK ABOUT INTEGRATION OF CRUISE CONTROL SYSTEM WITH ECM. DOES THIS HELP WITH TROUBLESHOOTING PROCEDURES?**
	9. **SLIDE 9** EXPLAIN **Figure 26-4** A typical electronic throttle with the protective covers removed. 10. **SLIDE 10** EXPLAIN **FIGURE 26–5** A trailer icon lights on the dash of this Cadillac when the transmission trailer towing mode is selected.
	**DISCUSSION: DISCUSS ELECTRONIC THROTTLE CRUISE CONTROL. WHAT COMPONENTS ARE NOT NEEDED WITH THIS SYSTEM?**
	**Radar Cruise Control**
	11. **SLIDE 11** EXPLAIN Radar Cruise Control 12. **SLIDE 12** EXPLAIN **Figure 26-6** Radar cruise control uses sensors to keep the distance the same even when traffic slows ahead.
	13. **SLIDE 13** EXPLAIN **Figure 26-7** Most radar cruise control systems use radar, both long and short range. Some systems use optical or infrared cameras to detect objects.
	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE RADAR CRUISE CONTROL SYSTEMS. HOW DO THESE SYSTEMS OPERATE?**
	**DISCUSSION: DISCUSS WHY RADAR CRUISE CONTROL DOES NOT INTERFERE WITH A RADAR DETECTOR. WHAT ARE THE FREQUENCIES OF LONG-RANGE AND SHORT RANGE RADAR?**
	14. **SLIDES 14-15** EXPLAIN Precollision System 16. **SLIDE 16** EXPLAIN **Figure 26-8** precollision system is designed to prevent a collision first, and then interacts to prepare for a collision if needed.

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	**ON-VEHICLE NATEF TASK: DIAGNOSE BODY ELECTRONIC SYSTEM CIRCUITS USING A SCAN TOOL.**
	17. **SLIDE 17** EXPLAIN Heated Rear Window Defoggers
	18. **SLIDE 18** EXPLAIN **Figure 26-9** switch and relay control current through heating grid of a rear window defogger.
	19. **SLIDE 19** EXPLAIN **Figure 26-10** A rear window defogger electrical grid can be tested using a voltmeter to check for a decreasing voltage as the meter lead is moved from the power side toward the ground side. As the voltmeter positive lead is moved along grid (on inside of the vehicle), the voltmeter reading should steadily decrease as the meter approaches ground side of grid.
	**DISCUSSION: HAVE STUDENTS TALK ABOUT STEPS & TOOLS REQUIRED TO TEST REAR WINDOW DEFROSTER GRID. WILL ALL GRIDLINES HAVE SAME VOLTAGE DROP?**
	20. **SLIDE 20** EXPLAIN **Figure 26-11** The typical repair material contains conductive silver-filled polymer, which dries in 10 minutes and is usable in 30 minutes.
	**DEMONSTRATION: SHOW HOW TO TEST A REAR WINDOW DEFROSTER GRID WITH DMM. NOTE VOLTAGE DROP FROM POWER SIDE TO GROUND SIDE OF WINDOW.**
	**DEMONSTRATION: SHOW STUDENTS REAR WINDOW DEFROSTER GRID. SHOW HOW TO REPAIR A BROKEN OR DAMAGED GRID USING REPAIR MATERIAL.**
	**DEMONSTRATION: SHOW GLASS FROM HEATED MIRROR. WHY DOESN'T HEATED MIRROR USE GRIDS SIMILAR TO THOSE IN REAR WINDOW GLASS?**
	**DISCUSSION: DISCUSS HEATED MIRRORS. WHAT ARE PURPOSE & FUNCTION OF THESE MIRRORS?**
	21. **SLIDE 21** EXPLAIN Homelink Garage Door Opener
	22. **SLIDE 22** EXPLAIN **Figure 26-12** Typical HomeLink garage door opener buttons. Notice that three

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	different units can be controlled from the vehicle using the HomeLink system
	**23. SLIDE 23** EXPLAIN Power Windows
	24. SLIDE 24 EXPLAIN **Figure 26-13** typical power window circuit using PM motors. Control of the direction of window operation is achieved by directing the polarity of the current through the non-grounded motors. The only ground for the entire system is located at the master control (driver's side) switch assembly.
	**DEMONSTRATION: SHOW STUDENTS HOW POWER WINDOWS OPERATE**
	**25. SLIDE 25** EXPLAIN **Figure 26-14** An electric motor & regulator assembly raise and lower the glass on a power window
	**DEMONSTRATION: POWER WINDOWS: TRACE CIRCUIT SO STUDENTS UNDERSTAND HOW BOTH MOTOR TERMINALS ARE AT GROUND POTENTIAL BEFORE SWITCHES ARE MOVED. TRACE CURRENT FLOW SO STUDENTS UNDERSTAND HOW POWER IS REVERSED.**
	**26. SLIDE 26** EXPLAIN **Figure 26-15** A master power window control panel with the buttons and the cover removed.
	**Power Door Locks** **Power Seat Control** **Power Window Regulator** **Power Windows**
	**DEMONSTRATION: DEMONSTRATE PROCEDURE FOR CHECKING MASTER POWER WINDOW SWITCH. USE TEST LIGHT & DMM TO TEST FOR CURRENT ON PROPER WIRES WHEN SWITCH IS ACTIVATED.**
	**27. SLIDE 27** EXPLAIN **Power Seats and Electrically Heated Seats**

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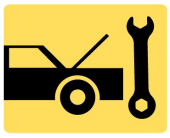
	**DISCUSSION: DISCUSS PROGRAMMING PROCEDURE FOR AUTO UP/DOWN POWER WINDOWS. WHY WOULD IT BE HELPFUL TO BE ABLE TO PROGRAM WINDOWS WITHOUT USING SCAN TOOL? POINT OUT THAT MANY OF THE SYSTEMS IN NEWER VEHICLES ARE ACCESSIBLE ONLY WITH A DEDICATED OEM SCAN TOOL OR LAPTOP COMPUTER.**
	**WHEN SERVICING POWER WINDOWS, KEEP YOUR FINGERS & HANDS AWAY FROM LINKAGE WHILE IT IS IN OPERATION OR WHEN REMOVING COMPONENTS. LINKAGE HAS SHARP EDGES & CAN CAUSE SERIOUS INJURY**
	**28. SLIDE 28 EXPLAIN Figure 26-16** A power seat uses electric motors under the seat, which drive cables that extend to operate screw jacks (up and down) or gears to move the seat forward and back. **29. SLIDE 29 EXPLAIN Figure 26-17** A typical power seat circuit diagram. Notice that each motor has a built-in electronic (solid-state) PTC circuit protector. The seat control switch can change the direction in which the motor(s) runs by reversing the direction in which the current flows through the motor.
	**DEMONSTRATION: POWER SEATS:TRACE CIRCUIT SO STUDENTS UNDERSTAND HOW POWER SEATS OPERATE**
	**DEMONSTRATION: REMOVE POWER DRIVER SEAT FROM A LAB VEHICLE. FLIP SEAT OVER & POINT OUT PARTS OF POWER SEAT ASSEMBLY**
	**HANDS-ON TASK: HAVE STUDENTS REMOVE A POWER SEAT FROM LAB VEHICLE. REMIND THEM THAT THEY ALWAYS NEED TO USE ON-LINE SERVICE INFORMATION TO FIND PROPER PROCEDURE.**
	**DISCUSSION: DISCUSS POWER SEAT MOTORS. WHAT IS THE ADVANTAGE TO HAVING A SEPARATE MOTOR FOR EACH FUNCTION INSTEAD OF HAVING ONE-HOUSING WITH MULTIPLE ARMATURES?**

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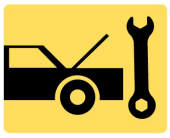
	**DISCUSSION: DISCUSS POWER SEAT CIRCUITS. WHY IS A CIRCUIT BREAKER USED INSTEAD OF FUSE FOR POWER SEAT CIRCUIT PROTECTION?**
	**30. SLIDE 30 EXPLAIN Figure 26-18** A typical memory seat module showing the three-wire potentiometer used to determine seat position
	**OPTIONAL HANDS-ON TASK: HAVE STUDENTS PROGRAM A MEMORY SEAT POSITION TO SUIT THEIR SIZE. HAVE THEM TALK ABOUT MEMORY SEATS. HOW MIGHT THIS FUNCTION BE HELPFUL WHERE SEVERAL PEOPLE SHARE A CAR?**
	**31. SLIDE 31 EXPLAIN Figure 26-19** heating element of a heated seat is a replaceable part, but service requires that the upholstery be removed. The yellow part is the seat foam material and the entire white cover is the replaceable heating element. This is then covered by the seat material.
	**DISCUSSION: DISCUSS ELECTRICALLY HEATED SEATS. HOW ARE SEATS HEATED? HOW IS TEMPERATURE REGULATED?**
	**32. SLIDE 32 EXPLAIN** Heated and Cooled Seats and Heated Steering Wheel **33. SLIDE 33 EXPLAIN Figure 26-20** Peltier effect device is capable of heating or cooling, depending on the polarity of the applied current.
	**DISCUSSION: DISCUSS HEATED & COOLED SEATS. WHAT IS THERMOELECTRIC DEVICE (TED)? HOW ARE MOST SEATS EQUIPPED?**
	**34. SLIDE 34 EXPLAIN Figure 26-21** The heated steering wheel is controlled by a switch on the steering wheel in this vehicle
	**DISCUSSION: DISCUSS COMPONENTS OF A HEATED & COOLED STEERING WHEEL. HOW DOES HEATER AND COOLING OPERATE?**
	**35. SLIDE 35 EXPLAIN Adjustable Pedals**

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	**36. SLIDE 36 EXPLAIN Figure 26-22** A typical adjustable pedal assembly. Both the accelerator and the brake pedal can be moved forward and rearward by using the adjustable pedal position switch
	**37. SLIDE 37 EXPLAIN Keyless Entry and Antitheft Systems**
	38. SLIDE 38 EXPLAIN FIGURE 26–23 Electrically folded mirror in the folded position **& FIGURE 26–24** The electric mirror control is located on the driver's side door panel on this Cadillac Escalade.
	**39. SLIDE 39 EXPLAIN Figure 26-25** A typical electric power door lock circuit diagram. Note that the control circuit is protected by a fuse, whereas the power circuit is protected by a circuit breaker. As with the operation of power windows, power door locks typically use reversible permanent magnet (PM) non-grounded electric motors. These motors are geared mechanically to the lock-unlock mechanism.
	**Power Door Locks**
	**40. SLIDE 40 EXPLAIN Figure 26-26** A key fob remote with the cover removed showing the replaceable battery.
	41. SLIDE 41 EXPLAIN Figure 26-27 A typical vehicle showing the location of the various components of the remote keyless entry system.
	**DEMONSTRATION: DEMO RKE OPERATION**
	**DEMONSTRATION: OBTAIN SEVERAL REMOTE KEYLESS ENTRY FOBS OR TRANSMITTERS TO SHOW TO YOUR STUDENTS. SEPARATE THE CASES OF THE FOBS TO LET STUDENTS SEE THE INTERNAL COMPONENTS, ESPECIALLY KEYPAD TOUCH AREAS ON CIRCUIT BOARD. DISCUSS RANGE OF REMOTE KEYLESS ENTRY KEY FOBS. WHAT IS MEANT BY "LINE OF SIGHT"?**
	**DISCUSSION: DISCUSS ROLLING CODE TRANSMITTERS. WHAT OTHER COMPONENT USES ROLLING CODE TECHNOLOGY?**

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QUESTION	**DISCUSSION: DISCUSS REMOTE KEYLESS ENTRY (RKE) SYSTEMS & THEIR COMPONENTS INVOLVED IN THESE SYSTEMS. HOW DO ELECTRONIC KEY FOBS OR TRANSMITTERS WORK?**
	HANDS-ON TASK: DIVIDE STUDENTS INTO GROUPS. HAVE THEM WORK TOGETHER TO CREATE A SPREADSHEET THAT SHOWS PROCEDURES FOR PROGRAMMING REMOTE KEYLESS ENTRY TRANSMITTERS.
	42. **SLIDE 42 EXPLAIN Figure 26-28** A shock sensor used in alarm and antitheft systems. If the vehicle is moved, the magnet will move relative to the coil, inducing a small voltage that will trigger the alarm.
DEMO	**DEMONSTRATION: USE LAB VEHICLE TO SHOW COMPONENTS OF ANTITHEFT SYSTEM. ACTIVATE SYSTEM TO SHOW HOW LAMPS FLASH & HORN OR SIREN SOUNDS.**
QUESTION	**DISCUSSION: HAVE STUDENTS TALK ABOUT ANTITHEFT SYSTEMS. WHAT ARE COMPONENTS OF ANTITHEFT SYSTEM?**
	MOST ANTITHEFT KEYS NOW HAVE A TRANSPONDER CHIP EMBEDDED IN PLASTIC HEAD OF KEY
	43. **SLIDE 43 EXPLAIN Figure 26-29** Door switches, which complete the ground circuit with the door open, are a common source of high resistance. 44. **SLIDE 44 EXPLAIN Figure 26-30** special tool is needed to diagnose a GM VATS security system and special keys that contain a resistor pellet. 45. **SLIDE 45 EXPLAIN Figure 26-31** Passlock series of General Motors security systems uses a conventional key. The magnet is located in the ignition lock cylinder and triggers the Hall-effect sensors.
DEMO	**DEMONSTRATION: IF AVAILABLE, SHOW YOUR STUDENTS AN EXAMPLE OF GM PASSKEY WITH EXPOSED RESISTOR. DEMONSTRATE HOW TO MEASURE RESISTANCE OF RESISTOR**
QUESTION	**DISCUSSION: DISCUSS GM PASSLOCK ANTITHEFT SYSTEM SHOWN BELOW. HOW DOES THIS LOCK CYLINDER SEND A SIGNAL TO**

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	INSTRUMENT CLUSTER OR BCM? **DISCUSSION:** HAVE STUDENTS TALK ABOUT THE USE OF **SPECIAL KEYS FOR ANTITHEFT SYSTEMS**. WHAT HAPPENS IF AN UNPROGRAMMED KEY IS USED?
	**DISCUSSION:** DISCUSS DIAGNOSTIC STEPS USED FOR **TROUBLESHOOTING ANTITHEFT SYSTEM**. WHY IS IT IMPORTANT TO HAVE ACCURATE SERVICE DATA BEFORE TROUBLESHOOTING ANY ELECTRONIC SYSTEM?
	**ON-VEHICLE NATEF TASK:** DIAGNOSE PROBLEMS WITH THE ANTI-THEFT SYSTEM
	46. **SLIDES 46-47** EXPLAIN Electrical Accessory Symptom Guide 48. **SLIDE 48** EXPLAIN **Figure 26-32** Corrosion or faults at the junction between the wiring and the rear window electrical grid are the source of many rear window defogger problems.
	**ON-VEHICLE NATEF TASK:** DIAGNOSE MOTOR-DRIVEN ACCESSORY CIRCUITS; DETERMINE NECESSARY ACTION.
	**DEMONSTRATION:** SHOW STUDENTS HOW TO REMOVE A DOOR PANEL. EXPLAIN HIDDEN FASTENERS.
	49. **SLIDE 49** EXPLAIN **SUMMARY**
	**ON-VEHICLE NATEF TASK:** REMOVE & REINSTALL DOOR PANEL