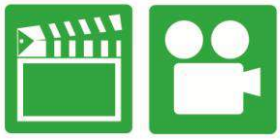
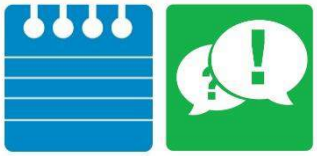
Automotive Electrical & Engine Performance 7/E

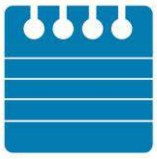
Chapter 26 Audio System Operation and Diagnosis

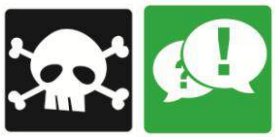
Opening Your Class

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. Describe how AM, FM, and satellite radio work. 2. Describe antennas and their diagnosis. 3. Discuss the purpose, function, and types of speakers. 4. Discuss crossovers and voice recognition systems. 5. Explain how Bluetooth systems work. 6. List causes and corrections of radio noise and interference. This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "H" (Accessories 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.

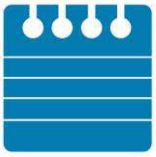
NOTE: This lesson plan is based on Automotive Electrical & Engine Performance 7/E Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 26: Chapter Images

ICONS	Ch26 Audio System Operation and Diagnosis
     	**1. SLIDE 1 CH26 AUDIO SYSTEM OPERATION AND DIAGNOSIS** **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 26-1** Audio systems use both electromagnetic radio waves and sound waves to reproduce sound inside the vehicle. 3. **SLIDE 3 EXPLAIN Figure 26-2** relationship among wavelength, frequency, and amplitude 4. **SLIDE 4 EXPLAIN Figure 26-3** The amplitude changes in AM broadcasting 5. **SLIDE 5 EXPLAIN FIGURE 26–4** The frequency changes in FM broadcasting and the amplitude remains constant 6. **SLIDE 6 EXPLAIN Figure 26-5** Using upper and lower sidebands allows stereo to be broadcast. Receiver separates the signals to provide left and right channels.
	**DISCUSSION: HAVE STUDENTS DISCUSS TERMS RFI & EMI. HOW DO RFI & EMI RELATE TO AUDIO SYSTEMS? ASK THE STUDENTS TO DESCRIBE THE DIFFERENCE BETWEEN AM (AMPLITUDE MODULATION) & FM (FREQUENCY MODULATION)**
	**DISCUSSION: HAVE STUDENTS DISCUSS CORRELATION BETWEEN FREQUENCY & WAVELENGTH. HOW IS FREQUENCY MEASURED?**

ICONS	Ch26 Audio System Operation and Diagnosis
	**DISCUSSION: HAVE STUDENTS' LIST MAIN COMPONENTS THAT MAKE UP AN AUDIO SYSTEM & BRIEFLY DISCUSS THEIR PURPOSE. WHO ADDRESSES AUDIO RELATED PROBLEMS?**
	**9. SLIDE 9 EXPLAIN FREQUENTLY ASKED QUESTION**
	**10. SLIDE 10 EXPLAIN RADIOS AND RECEIVERS** **11. SLIDE 11 EXPLAIN ANTENNAS** **12. SLIDE 12 EXPLAIN Figure 26-6** Five types of antennas used on GM vehicles include the slot antenna, fixed mast antenna, rear window defogger grid antenna, a powered mast antenna, and an integrated antenna.
	**13. SLIDES 13-14 EXPLAIN FREQUENTLY ASKED QUESTION**
	**15. SLIDE 15 EXPLAIN FIGURE 26–7** The ground plane is actually one-half of the antenna **16. SLIDE 16 EXPLAIN FIGURE 26–8** If all ohmmeter readings are satisfactory, the antenna is good.
	**DEMONSTRATION: SHOW STUDENTS HOW TO REMOVE & REPLACE ANTENNAS AND HOW TO AVOID BODY/PAINT DAMAGE.**
	**DEMONSTRATION: SHOW STUDENTS HOW TO USE AN DMM OHMMETER FUNCTION TO TEST ANTENNAS FOR SHORTS & OPENS**
	**17. SLIDE 17 EXPLAIN TECH TIP** **18. SLIDE 18 EXPLAIN FIGURE 26–9** Cutting a small hole in a fender cover helps to protect the vehicle when replacing or servicing an antenna..
	**19. SLIDE 19 EXPLAIN Figure 26-10** A typical power antenna assembly. Note the braided ground wire used to ensure that the antenna has a good ground plane
	20. SLIDE 20 EXPLAIN Speakers
	**INSTRUCTOR NOTE: FIGURE 28-8 IS OUT OF SEQUENCE & COMES AFTER FIGURE 28-10. DONE BY THE POWER POINT DEVELOPER**

ICONS	Ch26 Audio System Operation and Diagnosis
	21. **SLIDE 21 EXPLAIN Figure 26-11** Between 6 and 7 volts is applied to each speaker terminal, and the audio amplifier then increases the voltage on one terminal and at the same time decreases the voltage on the other terminal causing the speaker cone to move. The moving cone then moves the air, causing sound. 22. **SLIDE 22 EXPLAIN Figure 26-12** A typical automotive speaker with two terminals. The polarity of the speakers can be identified by looking at the wiring diagram in the service manual or by using a 1.5 volt battery to check. When the battery positive is applied to the positive terminal of the speaker, the cone will move outward. When the battery leads are reversed, the speaker cone will move inward.
	23. **SLIDE 23 EXPLAIN Figure 26-13** (a) Two 4 ohm speakers connected in series result in total impedance of 8 ohms. (b) Two 4 ohm speakers connected in parallel result in total impedance of 2 ohms.
	24. **SLIDE 24 EXPLAIN TECH TIP**
 	**DISCUSSION: HAVE STUDENTS DISCUSS BASIC SPEAKER OPERATION. HOW DO SPEAKERS CONVERT ELECTRICAL ENERGY INTO ACOUSTICAL ENERGY?**
	**DEMONSTRATION: SHOW STUDENTS EXAMPLES OF DIFFERENT TYPES OF SPEAKERS & EXPLAIN HOW TO DETERMINE THEIR USE**
	**HANDS-ON TASK: HAVE STUDENTS USE 1.5-VOLT BATTERY TO TEST SPEAKER POLARITY. POLARITY OF SPEAKERS IDENTIFIED BY LOOKING AT WIRING DIAGRAM OR USING A 1.5 VOLT BATTERY TO CHECK. WHEN BATTERY + APPLIED TO POSITIVE TERMINAL OF SPEAKER, CONE WILL MOVE OUTWARD. WHEN BATTERY LEADS ARE REVERSED, SPEAKER CONE WILL MOVE INWARD.**
	25. **SLIDES 25-26 EXPLAIN** Speakers
	**DISCUSS WARNING**

ICONS	Ch26 Audio System Operation and Diagnosis
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**15. SLIDE 15 EXPLAIN Figure 26-14** Crossovers are used in audio systems to send high-frequency sounds to the small (tweeter) speakers and low frequency sounds to larger (woofer) speakers.
	**DISCUSSION: REVIEW OHM'S LAW & WAY WIRING LOADS IN SERIES OR PARALLEL AFFECT CIRCUIT RESISTANCE & CURRENT. ASK STUDENTS HOW SPEAKER RESISTANCE AFFECTS SPEAKER'S PERFORMANCE**
	**DEMONSTRATION: ON ELECTRICAL TRAINER: BUILD SERIES & PARALLEL CIRCUITS SIMILAR TO SPEAKER ARRAYS & USE BULBS TO SIMULATE SPEAKER LOADS.**
	**HANDS-ON TASK: PROVIDE STUDENTS WITH SAMPLE SERIES & PARALLEL CIRCUITS ON ELECTRICAL TRAINER. ASSIGN VALUES TO LOADS AND SOURCE VOLTAGE. HAVE STUDENTS USE OHM'S LAW TO CALCULATE TOTAL RESISTANCE AND CURRENT IN EACH CIRCUIT.**
	**16. SLIDE 16 EXPLAIN** Aftermarket Sound System Upgrade & **EXPLAIN Figure 26-15** Two capacitors connected in parallel provide the necessary current flow to power large subwoofer speakers
	**DISCUSSION: DISCUSS IMPORTANCE OF FUSE SIZE AND PLACEMENT IN AFTERMARKET AUDIO SYSTEMS. WHAT IS REASON FOR USING A FUSE?**
	**EXPLAIN CHART 26-1** **17. SLIDE 17 EXPLAIN Figure 26-16** powerline capacitor should be connected through the power wire to the amplifier as shown. When amplifier requires more electrical power (watts) than the battery can supply, capacitor will discharge into the amplifier and supply necessary current for fraction of a second it is needed by amplifier. At other times when capacitor is not needed, it draws current from the battery to keep it charged

ICONS	Ch26 Audio System Operation and Diagnosis
  	**DEMONSTRATION: SHOW STUDENTS EXAMPLES OF DIFFERENT TYPES OF CAPACITORS, & DEMONSTRATE HOW TO PROPERLY MATCH A CAPACITOR WITH AMPLIFIER OUTPUT** **DISCUSSION: ASK STUDENTS TO DESCRIBE HOW LOUD NOISES AFFECT HEARING, & DISCUSS WHEN HEARING PROTECTION SHOULD BE WORN.** 18. **SLIDE 18 EXPLAIN** Voice Recognition & **EXPLAIN Figure 26-17** Voice commands can be used to control many functions, including navigation systems, climate control, telephone, and radio. 19. **SLIDE 19 EXPLAIN Figure 26-18** The voice command icon on the steering wheel of a Cadillac. 20. **SLIDE 20 EXPLAIN Figure 26-19** Bluetooth earpiece that contains a microphone and speaker unit that is paired to a cellular phone. The telephone has to be within 33 ft (10 m) of the earpiece.
  	**TERM BLUETOOTH COMES FROM THE KING OF DENMARK: HAROLD BLUETOOTH, WHO UNITED THE NETHERLANDS** **DISCUSS FREQUENTLY ASKED QUESTION** 21. **SLIDE 21 EXPLAIN** Satellite Radio & **EXPLAIN Figure 26-20** SDARS uses satellites and repeater stations to broadcast radio. 22. **SLIDE 22 EXPLAIN Figure 26-21** An aftermarket XM radio antenna mounted on the rear deck lid. The deck lid acts as the ground plane for the antenna 23. **SLIDE 23 EXPLAIN Figure 28-22** A shark-fin-type factory antenna used for both XM and OnStar
 	**DISCUSS FREQUENTLY ASKED QUESTION** 24. **SLIDE 24 EXPLAIN** Radio Interference **& EXPLAIN Figure 26-23** radio choke and/or a capacitor can be installed in the power feed lead to any radio, amplifier, or equalizer. 25. **SLIDE 25 EXPLAIN Figure 26-24** Many automobile

ICONS	Ch26 Audio System Operation and Diagnosis
     	manufacturers install a coaxial capacitor, like this one, in the power feed wire to the blower motor to eliminate interference caused by the blower motor. **EXPLAIN TECH TIP** **26. SLIDE 26 EXPLAIN Figure 26-25** "sniffer" can be made from an old antenna lead-in cable by removing about 3 in. of the outer shielding from the end. Plug the lead-in cable into the antenna input of the radio and tune the radio to a weak station. Move the end of the antenna wire around the vehicle dash area. The sniffer is used to locate components that may not be properly shielded or grounded and can cause radio interference through the case (housing) of the radio itself. **DISCUSS REAL WORLD FIX** **ON-VEHICLE NATEF TASK: DIAGNOSE STATIC AND WEAK OR NO RECEPTION; DETERMINE NECESSARY ACTION.** **27. SLIDE 27 EXPLAIN FIGURE 26–26** The tip of this antenna was struck by lightning