Automotive Electrical & Engine Performance 8/E
Chapter 15 BATTERIES
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Electrical & Engine Performance 8th edition provides complete coverage of automotive areas pertaining vehicle electrical systems and engine performance. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, and Animations that are listed in this Lesson Plan. This Lesson Plan also references ASEEducation (NATEF) Task Sheets available from Jim's web site.
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 a battery works. 2. Describe the construction of a battery. 3. Discuss valve regulated batteries and the causes of battery failure. 4. Discuss how charge indicators work. 5. List battery ratings and battery sizes. **This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "B" (Battery Diagnosis and Service).**
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 8th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

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http://www.jameshalderman.com/books_a8.html#anchor2

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	**1. SLIDE 1 CH15 BATTERIES**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **NO VIDEOS IN THIS CHAPTER GOTO WWW.YOUTUBE.COM**
	**At the beginning of this class, you can download the crossword puzzle & Word Search from Jim's web site to familiarize your class with terms in this chapter & then discuss them, see below:** **HTTP://WWW.JAMESHALDERMAN.COM/BOOKS_A8.HTML#ANCHOR2** **DOWNLOAD** **CROSSWORD PUZZLE (MICROSOFT WORD) (PDF)** **WORD SEARCH PUZZLE (MICROSOFT WORD) (PDF**
	**SAFETY TIP: Have students access MSDS for an automotive battery to find safe handling instructions, first aid procedures, reactivity data, and so forth. Ask students to write a summary of properties and procedures detailed in MSDS and share their work with class.**
	**DISCUSS FREQUENTLY ASKED QUESTION: *What Is a SLI Battery?* Sometimes the term SLI is used to describe a type of battery. SLI means starting, lighting, and ignition, and describes the use of a typical automotive battery. Other types of batteries used in industry are usually batteries designed to be deep cycled, and are usually not as suitable for automotive needs.**
	3. **SLIDE 3** EXPLAIN **Figure 15-2** grid from a battery used in both positive and negative plates. 4. **SLIDE 4** EXPLAIN **Figure 15-3** two groups of plates are combined to form a battery element.

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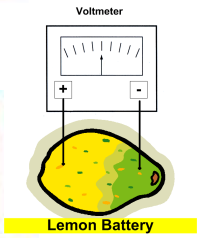
	**DISCUSSION:** Ask students to talk about release of hydrogen & oxygen (gassing) during charging. Why might gassing be dangerous when working around an automotive battery?
	**DEMONSTRATION:** Use AA batteries & voltmeter to demonstrate battery construction. Show students how voltage increases when batteries are connected in series versus parallel.
	5. **SLIDE 5 EXPLAIN Figure 15-4** cutaway battery showing connection of cells to each other through partition. 6. **SLIDE 6 EXPLAIN Figure 15-5** Chemical reaction for a lead-acid battery that is fully charged being discharged by the attached electrical load. 7. **SLIDE 7 EXPLAIN Figure 15-6** Chemical reaction for a lead-acid battery that is fully discharged being charged by the attached generator.
	**DISCUSS FREQUENTLY ASKED QUESTION:** ***Is There an Easy Way to Remember How a Battery Works? Yes.*** **Think of sulfuric acid solution in electrolyte being deposited, then removed from plates:** • **During discharge. Acid (SO4) is leaving electrolyte and getting onto both plates.** • **During charging. Acid (SO4) is being forced from both plates and enters electrolyte.**
	8. **SLIDE 8 EXPLAIN Figure 15-7** As battery becomes discharged, specific gravity of battery acid decreases.
 	**DEMONSTRATION: Lemon Battery:** Use a lemon and two dissimilar metals to show battery cell operation. See how many cells it takes to light a bulb. Did you have to wire the cells in series or parallel?
	**ACADEMIC TASK: CROSS-CURRICULAR ACTIVITY: SCIENCE:** Have students research chemical structure of a sulfuric

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	acid molecule. Have students discuss how the electrolyte used in a battery changes as the battery is discharged and charged.
	**9. SLIDE 9 EXPLAIN Figure 15-8** Typical battery charge indicator. If specific gravity is low (battery discharged), ball drops away from the reflective prism. When the battery is charged enough, the ball floats and reflects the color of the ball (usually green) back up through the sight glass and the sight glass is dark.
	**DISCUSS CHART 15-1 comparison showing the relationship among specific gravity, battery voltage, and state of charge.**
	**HANDS-ON TASK: Have the students locate and read the charge indicator on a battery to determine state-of charge. Have students explain the validity of charge indicators in determining battery state-of-charge.**
	**DISCUSSION: Discuss with students how specific gravity measurement is based on a gravity reading at a specific temperature. How could changes in temperature affect a battery's specific gravity measurement?**
	**10. SLIDE 10 EXPLAIN FIGURE 15–9** close up of a AGM cell showing the mat totally encasing the plates.
	**DEMONSTRATION: Show students different types of automotive batteries, focusing on characteristics that may be used to distinguish one from another.**
	**11. SLIDE 11 EXPLAIN FIGURE 15–10** AGM battery under the floor next to the spare tire on a Lexus NX300h hybrid-electric vehicle..
	12. SLIDE 12 EXPLAIN FIGURE 15–11 typical battery hold-down bracket. All batteries should use a bracket to prevent battery damage due to vibration and shock.
	**DISCUSSION: Discuss difference between CCA & CA ratings. What factors affect battery's CCA and CA ratings? Discuss why normal automotive batteries are not designed for repeated deep cycling. What vehicles are likely to use deep cycle batteries?**

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   	**HANDS-ON TASK:** Have students locate & record different battery ratings. Discuss how those ratings can be used to provide testing data, or to determine specifications for replacement batteries. **ASEEDUCATION Task Sheet: A1** Research applicable vehicle and service information, such as electrical/electronic system operation, service history, precautions, and technical service bulletins. **DISCUSS FREQUENTLY ASKED QUESTION:** ***What Determines Battery Capacity?*** Capacity of any battery is determined by the amount of active plate material in the battery. A battery with a large number of thin plates can produce high current for a short period. If a few thick plates are used, the battery can produce low current for a long period. A trolling motor battery used for fishing must supply a low current for a long period of time. An automotive battery is required to produce a high current for a short period for cranking. Therefore, every battery is designed for a specific application. 13. **SLIDE 13 EXPLAIN FIGURE 15–12** battery installed under the rear seat of a Cadillac showing vent tubes 14. **SLIDE 14 EXPLAIN FIGURE 15–13** This battery has a cranking amperes (CA) rating of 1,000. This means that this battery is capable of cranking an engine for 30 seconds at a temperature of 32°F (0°C) at a minimum of 1.2 volts per cell (7.2 volts for a 12-volt battery). **DISCUSS FREQUENTLY ASKED QUESTION:** **What Is Deep Cycling?** Deep cycling is almost fully discharging a battery and then completely recharging it. Golf cart batteries are an example of lead–acid batteries that must be designed to be deep cycled. A golf cart must be able to cover two 18-hole rounds of golf and then be fully recharged overnight. Charging is
  	

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	hard on batteries because the internal heat generated can cause plate warpage, so these specially designed batteries use thicker plate grids that resist warpage. Normal automotive batteries are not designed for repeated deep cycling.