# Automotive Electrical & Engine Performance 7/E

## Chapter 15 BATTERIES

## 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.<br>1. Describe how a battery works.<br>2. Describe deep cycling.<br>3. Discuss how charge indicators work.<br>4. List battery ratings.<br>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 7/E Chapter Images found on Jim's web site @ www.jameshalderman.com**
**LINK CHP 15: Chapter Images**

| ICONS | Ch15 BATTERIES |
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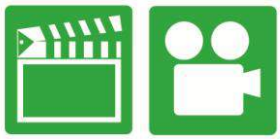
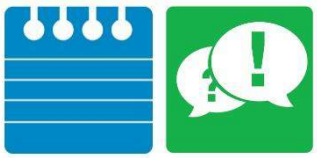
|  | **1. SLIDE 1 CH15 BATTERIES** |
|  | **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/**<br>**WEB SITE IS CONSTANTLY UPDATED**<br>**NO VIDEOS IN THIS CHAPTER GOTO WWW.YOUTUBE.COM** |
|  | **At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them**<br>**Crossword Puzzle (Microsoft Word) (PDF)**<br>**Word Search Puzzle (Microsoft Word) (PDF)** |
|  | **DISCUSS FREQUENTLY ASKED QUESTION** |
|  | **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 & PROCEDURES DETAILED IN MSDS AND SHARE THEIR WORK WITH CLASS.** |
|  | **2. SLIDE 2 EXPLAIN Figure 15-1** Batteries are constructed of plates grouped into cells & installed in a plastic case |
| | **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. |
|   | **DISCUSSION: ASK STUDENTS TO TALK ABOUT RELEASE OF HYDROGEN & OXYGEN (GASSING) DURING CHARGING. WHY MIGHT GASSING BE DANGEROUS WHEN WORKING AROUND AN AUTOMOTIVE BATTERY?** |

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|   | **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**: HOW BATTERY WORKS & **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. |
|   | **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 ACID MOLECULE. HAVE STUDENTS DISCUSS HOW THE ELECTROLYTE USED IN A BATTERY CHANGES AS THE BATTERY IS DISCHARGED AND CHARGED.** |
|  | **DISCUSS FREQUENTLY ASKED QUESTION** |
|  | 8. **SLIDE 8 EXPLAIN SPECIFIC GRAVITY & FIGURE 15–7** As the battery becomes discharged, specific gravity of the battery acid decreases**.** |
| | 9. **SLIDE 9 EXPLAIN FIGURE 15–8** Typical battery charge indicator. If the specific gravity is low (battery discharged), the 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 sight glass is dark. |
|  | 10. **SLIDE 10 EXPLAIN** Valve-Regulated Lead-Acid Batteries & **EXPLAIN FIGURE 15-9** absorbed glass mat battery is totally sealed and is more vibration |

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| | resistant than conventional lead-acid batteries<br>11. **SLIDE 11 EXPLAIN BATTERY RATINGS & EXPLAIN FIGURE 15-10** This battery has a rating of 1,000 amperes using the cold cranking rating and 900 amperes using the CCA (cold-cranking method) |
|  | **DEMONSTRATION: SHOW STUDENTS DIFFERENT TYPES OF AUTOMOTIVE BATTERIES, FOCUSING ON CHARACTERISTICS THAT MAY BE USED TO DISTINGUISH ONE FROM ANOTHER.** |
|  | 12. **SLIDE 12 EXPLAIN FIGURE 15–11** 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). |
|  | **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?** |
|  | **DISCUSS FREQUENTLY ASKED QUESTION** |
|  | **EXPLAIN BATTERY SIZES** |
|  | **HANDS-ON TASK: 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?** |
|  | **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.** |

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|   | **NATEF TASK SHEET: RESEARCH APPLICABLE VEHICLE AND SERVICE INFORMATION, SUCH AS ELECTRICAL/ELECTRONIC SYSTEM OPERATION, SERVICE HISTORY, PRECAUTIONS, AND TECHNICAL SERVICE BULLETINS** |