# A6 Electricity & Electronics 4th Edition

## Chapter 17 BATTERIES

## 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.<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 "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 | Ch17 BATTERIES |
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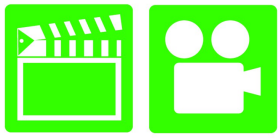
|  | **1. SLIDE 1 CH17 BATTERIES** |
| | **2. SLIDES 2-3 EXPLAIN OBJECTIVES** |
|  | **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** |
| | **WEB SITE IS CONSTANTLY UPDATED** |
|  | **4. SLIDE 4 EXPLAIN INTRODUCTION** |
| | **5. SLIDE 5 EXPLAIN: BATTERY CONSTRUCTION** |
| | **6. SLIDE 6 EXPLAIN Figure 17-1** Batteries are constructed of plates grouped into cells & installed in a plastic case |
|   | **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.** |
| | **7. SLIDE 7 EXPLAIN Figure 17-2** grid from a battery used in both positive and negative plates. |
| | **8. SLIDES 8-9 EXPLAIN BATTERY CONSTRUCTION** |
| | **10. SLIDE 10 EXPLAIN Figure 17-3** 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?** |
|   | **DEMONSTRATION: USE AA BATTERIES & VOLTMETER TO DEMONSTRATE BATTERY CONSTRUCTION. SHOW STUDENTS HOW VOLTAGE INCREASES WHEN BATTERIES ARE CONNECTED IN SERIES VERSUS PARALLEL.** |
|  | **11. SLIDE 11 EXPLAIN Figure 17-4** cutaway battery showing connection of cells to each other through partition |

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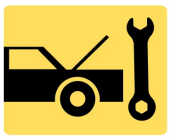
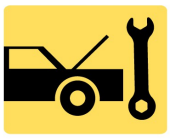
|  | **12. SLIDE 12 EXPLAIN**: HOW BATTERY WORKS<br>**13. SLIDE 13 EXPLAIN Figure 17-5** Chemical reaction for a lead-acid battery that is fully charged being discharged by the attached electrical load.<br>**14. SLIDE 14 EXPLAIN Figure 17-6** Chemical reaction for a lead-acid battery that is fully discharged being charged by the attached generator. |
|  | **15. SLIDE 15 EXPLAIN**: SPECIFIC GRAVITY<br>**16. SLIDE 16 EXPLAIN Figure 17-7** 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 ACID MOLECULE. HAVE STUDENTS DISCUSS HOW THE ELECTROLYTE USED IN A BATTERY CHANGES AS THE BATTERY IS DISCHARGED AND CHARGED.** |
|  | **17. SLIDE 17 EXPLAIN Figure 17-8** 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. |
|  | **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?** |
|  | **18. SLIDE 18 EXPLAIN: VALVE REGULATED LEAD-ACID BATTERIES**<br>**19. SLIDE 19 EXPLAIN Figure 17-9** Absorbed glass mat battery is totally sealed and is more vibration resistant than conventional lead-acid batteries. |

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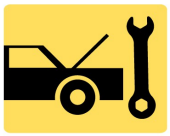
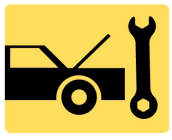
|  | **DEMONSTRATION: SHOW STUDENTS DIFFERENT TYPES OF AUTOMOTIVE BATTERIES, FOCUSING ON CHARACTERISTICS THAT MAY BE USED TO DISTINGUISH ONE FROM ANOTHER.** |
|  | **20. SLIDE 20** EXPLAIN CAUSES & TYPES of BATTERY FAILURE<br>**21. SLIDE 21** EXPLAIN **Figure 17-10** A typical battery hold-down bracket. All batteries should use a bracket to prevent battery damage due to vibration and shock.<br>**22. SLIDE 22** EXPLAIN: BATTERY RATINGS<br>**23. SLIDE 23** EXPLAIN **Figure 17-11** 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?** |
|  | **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.** |
|  | **24. SLIDE 24** EXPLAIN**: BATTERY RATINGS**<br>**25. SLIDE 25** EXPLAIN **SUMMARY** |
|   | **NATEF TASK SHEET: RESEARCH APPLICABLE VEHICLE AND SERVICE INFORMATION, SUCH AS ELECTRICAL/ELECTRONIC SYSTEM OPERATION, SERVICE HISTORY, PRECAUTIONS, AND TECHNICAL SERVICE BULLETINS** |