

# Automotive Technology 6<sup>th</sup> Edition

## Chapter 50 BATTERIES

### Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. 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, Animations, and ASEEducation (NATEF) Task Sheets.
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 learning objectives to students as listed below: 1. Describe the construction of a battery. 2. Explain how a battery and a charge indicator work. 3. Discuss valve regulated batteries and causes of battery failure. 4. List battery ratings and battery sizes.
Establish the Mood or Climate	Provide a <b>WELCOME</b> , 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: Lesson plan is based on 6<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**DOWNLOAD Chapter 50 Chapter Images: From [http://www.jameshalderman.com/automotive\\_principles.html](http://www.jameshalderman.com/automotive_principles.html)**

**NOTE: You can use Chapter Images or possibly Power Point files:**

## ICONS



## CH50 Battery Operation

### 1. TITLE SLIDE 1 BATTERIES

2. SLIDE 2 **EXPLAIN** Figure 50-1 Batteries are constructed of plates grouped into cells & installed in a plastic case

Check for **ADDITIONAL VIDEOS & ANIMATIONS**  
@ <http://www.jameshalderman.com/>  
**WEB SITE IS CONSTANTLY UPDATED**

[http://www.jameshalderman.com/automotive\\_principles.html](http://www.jameshalderman.com/automotive_principles.html)

### **DOWNLOAD**

**Crossword Puzzle (Microsoft Word) (PDF)**

**Word Search Puzzle (Microsoft Word) (PDF)**

### **Videos**

**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.**

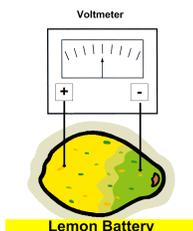
### **DISCUSS FREQUENTLY ASKED QUESTION:**

***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 50-2 grid from a battery used in both positive and negative plates.
4. SLIDE 4 **EXPLAIN** Figure 50-3 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?**

## ICONS



## CH50 Battery Operation

**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 50-4 cutaway battery showing connection of cells to each other through partition.
6. **SLIDE 6 EXPLAIN** Figure 50-5 Chemical reaction for a lead-acid battery that is fully charged being discharged by the attached electrical load.
7. **SLIDE 7 EXPLAIN** Figure 50-6 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 ( $\text{SO}_4$ ) is leaving electrolyte and getting onto both plates.**
  - **During charging. Acid ( $\text{SO}_4$ ) is being forced from both plates and enters electrolyte.**
8. **SLIDE 8 EXPLAIN** Figure 50-7 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.**

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## CH50 Battery Operation

9. **SLIDE 9 EXPLAIN Figure 50-8** 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 50-1 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 50-9** 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 50-10** AGM battery under the floor next to the spare tire on a Lexus NX300h hybrid-electric vehicle..

12. **SLIDE 12 EXPLAIN FIGURE 50-11** 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?**

**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.**

## ICONS



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## CH50 Battery Operation

**ASE EDUCATION Task Sheet: Research applicable vehicle and service information, such as electrical/electronic system operation, service history, precautions, and technical service bulletins (P-1)**

### **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 50–12 battery installed under the rear seat of a Cadillac showing vent tubes
14. SLIDE 14 **EXPLAIN** FIGURE 50–13 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 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

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**batteries are not designed for repeated deep cycling.**