

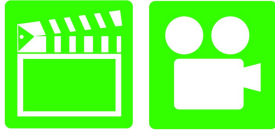
Automotive Maintenance and Light Repair, 1ST Edition

Chapter 23 Electrical Fundamentals

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automotive Maintenance and Light Repair . 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. <ul style="list-style-type: none">— Prepare for ASE Electrical/Electronic Systems (A6) certification test content area “A” (General Electrical/Electronic System Diagnosis).— Define electricity.— Explain the units of electrical measurement.— Discuss the relationship among volts, amperes, and ohms.— Discuss the principles of magnetism.— Discuss how electricity can be obtained from different sources.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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



Ch23 Electrical Fundamentals

1. SLIDE 1 C23 Electrical Fundamentals
2. SLIDES 2-3 EXPLAIN OBJECTIVES

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

4. SLIDE 4 EXPLAIN ELECTRICITY

5. SLIDE 5 EXPLAIN Figure 23-1 In an atom (left), electrons orbit protons in the nucleus just as planets orbit the sun in our solar system (right)

6. SLIDE 6 EXPLAIN Figure 23-2 nucleus of an atom has a positive (+) charge and the surrounding electrons have a negative (-) charge.

7. SLIDE 7 EXPLAIN Figure 23-3 figure shows a balanced atom. The number of electrons is the same as the number of protons in the nucleus.

SHOW ANIMATION ON AN ATOM (FIGURE 23-3)
[WWW.MYAUTOMOTIVELAB.COM](http://www.myautomotivelab.com)

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31_FIG_31_2/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_2/index.htm)

8. SLIDE 8 EXPLAIN Figure 23-4 Unlike charges attract and like charges repel.

9. SLIDE 9 EXPLAIN ELECTRICITY

ANIMATION ON AN LIKE & UNLIKE ATTRACTION (FIGURE 23-4)
[WWW.MYAUTOMOTIVELAB.COM](http://www.myautomotivelab.com)

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31_FIG_31_4/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_4/index.htm)

DISCUSSION: DISCUSS FLOW OF ELECTRICAL CURRENT AND HOW THE CONSTANT FLOW, OR JUMPING OF ELECTRONS, CREATES CURRENT

ELECTRON FLOW

DEMONSTRATION: USE MAGNETS TO DEMO HOW OPPOSITES FORCES ATTRACT AND LIKE FORCES REPEL. SHOW HOW MAGNETS ATTRACT & REPEL EACH OTHER DEPENDING ON POLE ORIENTATION

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10. **SLIDE 10 EXPLAIN** Figure 23-5 unbalanced, positively charged atom (ion) will attract electrons from neighboring atoms.

11. **SLIDE 11 EXPLAIN** Figure 23-6 hydrogen atom is simplest atom, with only one proton, one neutron, and one electron. More complex elements contain higher numbers of protons, neutrons, and electrons.

ANIMATION: ELECTRON FLOW (FIGURE 23-5) **WWW.MYAUTOMOTIVELAB.COM**

http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter31_Fig_31_5/index.htm

12. **SLIDE 12 EXPLAIN ELECTRICITY**

13. **SLIDE 13 EXPLAIN** Figure 23-7 As number of electrons increases, they occupy increasing energy levels that are farther from the center of the atom.

14. **SLIDE 14 EXPLAIN** Figure 23-8 Electrons in the outer orbit, or shell, can often be drawn away from the atom and become free electrons.

DISCUSSION: DISCUSS ELECTRON ORBIT AROUND NUCLEUS & SHELLS ELECTRONS ORBIT WITHIN. HOW MANY SHELLS FORM AROUND A NUCLEUS? DISCUSS VALENCE RING & HOW MOVEMENT OF ELECTRONS FROM THIS RING CREATES CURRENT. DESCRIBE DIFFERENCE BETWEEN FREE & BOUND ELECTRONS.

15. **SLIDES 15-16 EXPLAIN** How Electrons Move Through Conductor

17. **SLIDE 17 EXPLAIN** FIGURE 23-9 **CURRENT** electricity is movement of electrons through conductor

18. **SLIDE 18 EXPLAIN** FIGURE 23-10 Conventional theory states that current flows through circuit from positive (+) to negative (-). Automotive electricity uses conventional theory in all electrical diagrams and schematics.

19. **SLIDE 19 EXPLAIN** UNITS OF ELECTRICITY

20. **SLIDE 20 EXPLAIN** FIGURE 23-11 One ampere is the movement of 1 coulomb (6.28 billion billion electrons) past a point in 1 second.

21. **SLIDE 21 EXPLAIN** FIGURE 23-12 ammeter is installed in the path of the electrons similar to a water meter used to measure the flow of water in gallons per minute. The ammeter displays current flow in amperes.

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COMPLETE TASK SHEET ON ELECTRICAL FUNDAMENTALS

SEARCH INTERNET: RESEARCH AMPERAGE REQUIRED FOR APPLIANCES, SMALL ELECTRONIC & ELECTRICAL DEVICES. DO THESE DEVICES USE SAME NUMBER OF AMPERES AROUND WORLD? ASK STUDENTS TO RANK CURRENT DRAWN BY DIFFERENT AUTOMOBILE ACCESSORIES, I.E. HEADLIGHTS & IP PANEL LIGHTS.

22. SLIDE 22 EXPLAIN Units of Electricity
23. SLIDE 23 EXPLAIN FIGURE 23-13 **VOLTAGE** is electrical pressure that causes electrons to flow through conductor

ANIMATION: VOLTAGE (FIGURE 23-13) **WWW.MYAUTOMOTIVELAB.COM**

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31 FIG 31_17/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_17/index.htm)

24. SLIDE 24 EXPLAIN FIGURE 23-14 This digital multimeter set to read DC volts is being used to test the voltage of a vehicle battery. Most multimeters can also measure resistance (ohms) and current flow (amperes).

DEMONSTRATION: SHOW HOW DMM MEASURES VOLTAGE. USE TRAINER TO SHOW STUDENTS MEASURING VOLTAGE








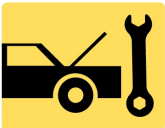
Voltage & Resistance

25. SLIDE 25 EXPLAIN UNITS OF ELECTRICITY
26. SLIDE 26 EXPLAIN FIGURE 23-15 **RESISTANCE** to flow of electrons through conductor measured in ohms

ANIMATION: RESISTANCE (FIGURE 23-15) **WWW.MYAUTOMOTIVELAB.COM**

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31 FIG 31_19/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_19/index.htm)

Voltage & Resistance

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<p data-bbox="212 254 342 380">DEMO</p> <p data-bbox="212 394 496 548">   QUESTION </p> <p data-bbox="212 562 407 709">  </p> <p data-bbox="212 724 456 863">   QUESTION </p> <p data-bbox="212 867 456 1005">   QUESTION </p> <p data-bbox="212 1056 375 1182">  </p>	<p data-bbox="586 254 1414 380"><u>DEMONSTRATION: SHOW HOW DMM MEASURES VOLTAGE. USE PROJECT BOARD TO SHOW MEASURING RESISTANCE</u></p> <p data-bbox="586 394 1414 541"><u>DISCUSSION: HAVE STUDENTS TALK ABOUT RESISTANCE TO ELECTRON FLOW, OR OHMS. HOW DOES MATERIAL USED AS A CONDUCTOR AFFECT RESISTANCE?</u></p> <p data-bbox="626 558 1349 590">27. SLIDE 27 EXPLAIN Conductors and Resistance</p> <p data-bbox="586 724 1398 835"><u>DISCUSSION: DISCUSS DIFFERENT CONDUCTORS. WHY IS COPPER MOST COMMONLY USED CONDUCTOR IN ELECTRICAL SYSTEMS?</u></p> <p data-bbox="586 863 1406 1052"><u>DISCUSSION: DISCUSS INSULATORS & REASON THEY MAKE POOR CONDUCTORS. WHAT IS RELATIONSHIP BETWEEN NUMBER OF ELECTRONS AN INSULATOR MATERIAL HAS & ITS ABILITY TO ACQUIRE & RELEASE ELECTRONS?</u></p> <p data-bbox="586 1056 1406 1276"><u>HANDS-ON TASK: HAVE BATTERY CABLES AND COMMON ELECTRICAL WIRING AVAILABLE TO PROVIDE STUDENTS A HANDS-ON EXPERIENCE WITH DIFFERENCES IN RESISTANCE THAT RESULT FROM CONDUCTORS OF DIFFERENT LENGTHS, DIAMETERS, AND MATERIALS.</u></p>