Chapter 20 ELECTRICAL FUNDAMENTALS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class serves as an introduction to the world of automotive service. 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. 1. Prepare for ASE Electrical/Electronic Systems (A6) certification test content area "A" (General Electrical/Electronic System Diagnosis). 2. Define electricity. 3. Explain the units of electrical measurement. 4. Discuss the relationship among volts, amperes, and ohms. 5. Discuss how electricity can be obtained from different sources.
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	CH39 ELECTRICAL FUNDAMENTALS
	**1. TITLE SLIDE 1 ELECTRICAL FUNDAMENTALS** **2. SLIDE 2 READ & EXPLAIN ELECTRICITY**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**3. SLIDE 3 EXPLAIN Figure 20-1** In an atom (left), electrons orbit protons in the nucleus just as planets orbit the sun in our solar system (right). **4. SLIDE 4 EXPLAIN Figure 20-2** nucleus of an atom has a positive (+) charge and the surrounding electrons have a negative (-) charge. **5. SLIDE 5 EXPLAIN Figure 20-3** 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 39-3) www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter31_Fig_31_2/index.htm
	**6. SLIDE 6 EXPLAIN Figure 20-4** Unlike charges attract and like charges repel.
	**Magnets: Show magnets like & unlike poles animation like Figure 20-4 http://www.jameshalderman.com/**
	**Show ANIMATION on an LIKE & UNLIKE ATTRACTION (Figure 39-4) www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter31_Fig_31_4/index.htm
	**DISCUSSION: Have students talk about flow of electrical current and how the constant flow, or jumping of electrons, creates current.**

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	**DEMONSTRATION: Use magnets to demonstrate how opposites forces attract and like forces repel. Show how magnets attract and repel each other depending on the orientation of their poles.**
	7. **SLIDE 7 READ & EXPLAIN Electricity TEXT** 8. **SLIDE 8 EXPLAIN Figure 20-5** conductor is any element that has one to three electrons in its outer orbit.
	**DISCUSSION: Have students 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.**
	9. **SLIDE 9 EXPLAIN Figure 20-6** Copper is an excellent conductor of electricity because it has just one electron in its outer orbit, making it easy to be knocked out of its orbit and flow to other nearby atoms. This causes electron flow, which is definition of electricity.
	**Copper Atom** **http://www.jameshalderman.com/**
	**DISCUSSION: Have students discuss different conductors. Why is copper most commonly used conductor in electrical systems?**
	10. **SLIDE 10 READ & EXPLAIN Electricity TEXT** 11. **SLIDE 11 EXPLAIN Figure 20-7** Insulators are elements with five to eight electrons in the outer orbit. 12. **SLIDE 12 EXPLAIN Figure 20-8** Semiconductor elements contain exactly four electrons in the outer orbit
	**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?**
	**Show ANIMATION: ELECTRON FLOW** **www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter31_Fig_31_5/index.htm

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	**Electron Flow** **http://www.jameshalderman.com/**
	**Complete Task Sheet on Electrical Fundamentals**
	**SEARCH INTERNET: Research amperage required for various household appliances, small electronic & electrical devices. Do these same devices use same number of amperes around world? Ask students to rank current drawn by different automobile accessories, such as headlights & IP panel lights. Ask students to create presentation of their findings for class.**
	13. **SLIDES 13-14 READ & EXPLAIN** How Electrons Move Through a Conductor 15. **SLIDE 15 EXPLAIN FIGURE 20-9 Current** is movement of electrons through a conductor 16. **SLIDE 16 EXPLAIN FIGURE 20.10 Conventional Theory** states that current flows through a circuit from positive **(+)** to negative **(–).** Automotive electricity uses conventional theory in all electrical diagrams and schematics 17. **SLIDE 17 READ & EXPLAIN** Units of Electricity 18. **SLIDE 18 EXPLAIN Figure 20-11** One ampere is the movement of 1 coulomb (6.28 billion billion electrons) past a point in 1 second. 19. **SLIDE 19 EXPLAIN Figure 20-12** 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. **Ammeter displays current flow in amperes** 20. **SLIDE 20 READ & EXPLAIN VOLTS** 21. **SLIDE 21 EXPLAIN Figure 20-13 Voltage** is electrical pressure that causes electrons to flow through a conductor
	**Show ANIMATION: VOLTAGE (Figure 20-13)** **www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter31_Fig_31_17/index.htm

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	**ANIMATION: Voltage & Resistance (Figure 20-13) http://www.jameshalderman.com/**
	**22. SLIDE 22 EXPLAIN Figure 20-14** 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 Project Board to show students measuring voltage**
	**23. SLIDE 23 READ & EXPLAIN OHMS** **24. SLIDE 24 EXPLAIN Figure 20-19 Resistance to flow of electrons through conductor measured in ohms.** **25. SLIDE 25 READ & EXPLAIN** Conductors & Resistance
	**Show ANIMATION: RESISTANCE (Figure 20-19) www.myautomotivelab.com http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter31_Fig_31_19/index.htm**
	**ANIMATION: Voltage & Resistance (Figure 20-19) http://www.jameshalderman.com/**
	**DEMONSTRATION: Show how DMM measures voltage. Use Project Board to show students measuring RESISTANCE**
 	**DISCUSSION: Have students talk about resistance to electron flow, or ohms. How does material used as a conductor affect resistance?**
	**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.**

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	**DISCUSSION:** Have students discuss various sizes of conductors & reasons different sizes are used for different circuits. What happens when the conductor length is doubled? What happens when conductor diameter is increased?
	**HOMEWORK: as Class Task:** Have students work in small groups and use Internet to research a small electromagnet. Ask them to construct an electromagnet, based on their research. As a class, have students theorize how their magnet's strength could be increased.
	**HOMEWORK:** Have students use Internet to research electrical current. Ask them to work in groups of 3 or 4 to prepare slide presentations for class. Have class discuss information presented in each presentation.
	**Homework:** complete Ch20 crossword puzzle: http://www.jameshalderman.com/links/book_intro/cw/crossword_ch_20.pdf