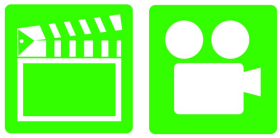
A6 Electricity & Electronics 4th Edition

Chapter 13 Magnetism & Electromagnetism

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. 1. Explain how magnetism and voltage are related. 2. Explain how an electromagnet works. 3. Describe how an ignition coil works. **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	Ch013 Magnetism & Electromagnetism
	**1. SLIDE 1 CH13 MAGNETISM & ELECTROMAGNETISM** **2. SLIDES 2-3 EXPLAIN OBJECTIVES**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**Magnetic Induction** **Magnets**
	**4. SLIDE 4 EXPLAIN**: FUNDAMENTALS OF MAGNETISM **5. SLIDE 5 EXPLAIN Figure 13-1** Freely suspended natural magnet (lodestone) will point toward magnetic north pole.
	**DEMONSTRATION: SHOW STUDENTS HOW TO MAGNETIZE A SMALL OBJECT SUCH AS A NAIL OR PAPER CLIP. HAVE STUDENTS MAGNETIZE A SMALL OBJECT**
	**6. SLIDE 6 EXPLAIN Figure 13-2** Magnet breaks or is cracked, it becomes 2 weaker magnets. **7. SLIDE 7 EXPLAIN Figure 13-3** Magnetic lines of force leave north pole & return to south pole of bar magnet. **8. SLIDE 8 EXPLAIN Figure 13-4** Iron filings and a compass can be used to observe magnetic lines of force. **9. SLIDE 9 EXPLAIN TEXT** **10. SLIDE 10 EXPLAIN Figure 13-5** Magnetic poles behave like electrically charged particles—unlike poles attract and like poles repel.
	**ANIMATION: ATTRACTION & REJECTION BETWEEN LIKE/UNLIKE POLES OF A MAGNET** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A6_Animation/Chapter13_Fig_13_5/index.htm
	**11. SLIDE 11 EXPLAIN Figure 13-6** crankshaft position sensor and reluctor (notched wheel). **12. SLIDE 12 EXPLAIN TEXT**
	**13. SLIDE 13 EXPLAIN Figure 13-7** magnetic field surrounds a straight, current-carrying conductor.

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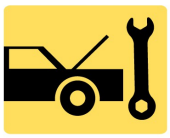
	**DEMONSTRATION: WRAP A NUMBER 16 NAIL WITH 20 TURNS OF INSULATED WIRE. CONNECT ENDS OF THE WIRE TO A D CELL BATTERY. SHOW STUDENTS HOW THE NAIL IS NOW A MAGNET AND CAN PICK UP SMALL METAL OBJECTS**
	**HANDS-ON TASK: HAVE STUDENTS BUILD THEIR OWN ELECTROMAGNETS. LET THEM TRY MORE THAN ONE BATTERY, MORE TURNS OF WIRE, OR A LARGER CORE. HAVE THEM DOCUMENT THE STRENGTH OF EACH VERSION OF THE ELECTROMAGNET TO DECIDE WHAT PRODUCES A STRONGER MAGNET AND WHAT DOES NOT.**
	**14. SLIDE 14 EXPLAIN Figure 13-8 left-hand rule for magnetic field direction is used with electron flow theory.** **15. SLIDE 15 EXPLAIN Figure 13-9** right-hand rule for magnetic field direction is used with the conventional theory of electron flow
	**DISCUSSION: HAVE STUDENTS TALK ABOUT RIGHT-HAND & AND LEFT-HAND RULES OF MAGNETISM. WHICH RULE IS USED TO DETERMINE THE DIRECTION OF THE MAGNETIC FLUX LINES IN MOST AUTOMOTIVE CIRCUITS?**
	**16. SLIDE 16 EXPLAIN Figure 13-10** Conductors with opposing magnetic fields will move apart into weaker fields.
	17. SLIDE 17 EXPLAIN TEXT **18. SLIDE 18 EXPLAIN Figure 13-11** Electric motors use interaction of magnetic fields to produce mechanical energy. **19. SLIDE 19 EXPLAIN Figure 13-12** magnetic lines of flux surrounding a coil look similar to those surrounding a bar magnet. **20. SLIDE 20 EXPLAIN Figure 13-13** left-hand rule for coils is shown. **21. SLIDE 21 EXPLAIN Figure 13-14** iron core concentrates magnetic lines of force surrounding a coil.
	**22. SLIDE 22 EXPLAIN USES OF ELECTROMAGNETISM** **23. SLIDE 23 EXPLAIN Figure 13-15** electromagnetic switch that has a movable arm is referred to as a relay.

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	**24. SLIDE 24 EXPLAIN Figure 13-16 (a)** A starter with attached solenoid. All of the current needed by the starter flows through the two large terminals of the solenoid and through the solenoid contacts inside **(b)** A relay is designed to carry lower current compared to a solenoid and uses a movable arm.
	**ANIMATION: ELECTROMAGNETISM IN RELAY:** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A6_Animation/Chapter13_Fig_13_15/index.htm
	**25. SLIDE 25 EXPLAIN ELECTROMAGNETIC INDUCTION** **26. SLIDE 26 EXPLAIN Figure 13-17** Voltage can be induced by the relative motion between a conductor and magnetic lines of force. **27. SLIDE 27 EXPLAIN Figure 13-18** Maximum voltage is induced when conductors cut across the magnetic lines of force (flux lines) at a 90-degree angle.
	**28. SLIDE 28 EXPLAIN** IGNITION COILS **29. SLIDE 29 EXPLAIN Figure 13-19** Mutual induction occurs when expansion or collapse of a magnetic field around one coil induces a voltage in a second coil. **30. SLIDE 30 EXPLAIN FIGURE 13–20** Some ignition coils are electrically connected, called married (top figure) whereas others use separated primary and secondary windings, called divorced (lower figure). **31. SLIDE 31 EXPLAIN Figure 13-21** A GM waste-spark ignition coil showing the section of laminations that is shaped like the letter E . These mild steel laminations improve the efficiency of the coil. **32. SLIDE 32 EXPLAIN Figure 13-22** coil-on-plug (COP) design typically uses a bobbin-type coil. **33. SLIDE 33 EXPLAIN ELECTROMAGNETIC INTERFERENCE**
	**34. SLIDE 34 EXPLAIN Figure 13-23** To help prevent underhood electromagnetic devices from interfering with the antenna input, it is important that all ground wires, be properly grounded.
	**NATEF TASK SHEET INSPECT & TEST SWITCHES, CONNECTORS, RELAYS, SOLENOID SOLID STATE DEVICES, AND WIRES OF LECTRICAL/ELECTRONIC CIRCUITS; PERFORM NECESSARY ACTION**

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	**35. SLIDES 35-36 EXPLAIN SUMMARY**