Automotive Technology 5th Edition
Chapter 47 MAGNETISM & ELECTROMAGNETISM
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
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. Discuss the fundamentals of electromagnetism. 2. Explain how an electromagnet works and discuss its uses. 3. Discuss electromagnetic induction, ignition coils, and EMI suppression devices.
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.

NOTE: This lesson plan is based on the 5th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 47: ATE5 Chapter Images

ICONS	CH47 Magnetism
	**1. TITLE SLIDE 1 MAGNETISM AND ELECTROMAGNETISM** **6. SLIDE 6 EXPLAIN Figure 47-1** Freely suspended natural magnet (lodestone) will point toward magnetic north pole.
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**Videos**
	**DEMONSTRATION: Show students how to magnetize a small object such as a nail or paper clip. Have students magnetize a small object.**
	**3. SLIDE 3 EXPLAIN Figure 47-2** Magnet breaks or is cracked, it becomes 2 weaker magnets. **4. SLIDE 4 EXPLAIN Figure 47-3** Magnetic lines of force leave north pole & return to south pole of bar magnet. **5. SLIDE 5 EXPLAIN Figure 47-4** Iron filings and a compass can be used to observe magnetic lines of force. **6. SLIDE 6 EXPLAIN Figure 47-5** Magnetic poles behave like electrically charged particles—unlike poles attract and like poles repel.
	**Magnetic Induction (View) (Download)** **Magnets (View) (Download)** **Electron Travel, Magnet (View) (Download)**
	**7. SLIDE 7 EXPLAIN Figure 47-6** crankshaft position sensor and reluctor (notched wheel). **8. SLIDE 8 EXPLAIN Figure 47-7** magnetic field surrounds a straight, current-carrying conductor.
	**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.**

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	**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.**
	**9. SLIDE 9 EXPLAIN** Figure 47-8 left-hand rule for magnetic field direction is used with electron flow theory.
	10. SLIDE 10 EXPLAIN Figure 47-9 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?**
	**11. SLIDE 11 EXPLAIN Figure 47-10** Conductors with opposing magnetic fields will move apart into weaker fields.
	12. SLIDE 12 EXPLAIN Figure 47-11 Electric motors use interaction of magnetic fields to produce mechanical energy.
	13. SLIDE 13 EXPLAIN Figure 47-12 magnetic lines of flux surrounding a coil look similar to those surrounding a bar magnet.
	14. SLIDE 14 EXPLAIN Figure 47-13 left-hand rule for coils is shown.
	15. SLIDE 15 EXPLAIN Figure 47-14 iron core concentrates magnetic lines of force surrounding a coil.
	**16. SLIDE 16 EXPLAIN Figure 47-15** electromagnetic switch that has a movable arm is referred to as a relay.
	17. SLIDE 17 EXPLAIN Figure 47-16 (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.
	**18. SLIDE 18 EXPLAIN Figure 47-16 (b)** A relay is designed to carry lower current compared to a solenoid and uses a movable arm.
	19. SLIDE 19 EXPLAIN Figure 47-17 Voltage can

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	be induced by the relative motion between a conductor and magnetic lines of force. 20. **SLIDE 20 EXPLAIN Figure 47-18** Maximum voltage is induced when conductors cut across the magnetic lines of force (flux lines) at a 90-degree angle. 21. **SLIDE 21 EXPLAIN Figure 47-19** Mutual induction occurs when expansion or collapse of a magnetic field around one coil induces a voltage in a second coil. 22. **SLIDE 22 EXPLAIN Figure 47-21** 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. 23. **SLIDE 23 EXPLAIN Figure 47-22** coil-on-plug (COP) design typically uses a bobbin-type coil. 24. **SLIDE 24 EXPLAIN Figure 47-23** 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 and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action (P-1), Page 143 Task Sheet**
	**Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**