

# Automotive Heating and Air Conditioning, 8e

## Chapter 1 Heating and Air-Conditioning Principles

### Opening Your Class



KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of <b>Automotive Heating and Air Conditioning, 8e</b> . It correlates material to task lists specified by ASE and NATEF/ASEE Education.
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. <ol style="list-style-type: none"><li>1. Prepare for the ASE Heating and Air Conditioning (A7) certification test content area "A" (A/C System Service, Diagnosis and Repair).</li><li>2. Discuss the changes of states of matter.</li><li>3. Discuss the effect of heat and temperature on matter.</li><li>4. Discuss the two types of humidity.</li><li>5. Explain heating and cooling load.</li><li>6. Explain the three ways in which heat flows.</li><li>7. Describe the air-conditioning process.</li><li>8. Explain the purpose of an HVAC system.</li></ol>
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.

**NOTE: This lesson plan is based on the 8<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 01:**

**[http://www.jameshalderman.com/links/book\\_hvac/ci/hvac\\_ci\\_ch\\_1.pptx](http://www.jameshalderman.com/links/book_hvac/ci/hvac_ci_ch_1.pptx)**

**These Power Point files contain more than just the images.**

ICONS	Ch01 Heating & Air-Conditioning Principles
 	<p><b>1. SLIDE 1 HEATING &amp; AIR-CONDITIONING PRINCIPLES</b></p> <p><b>2. SLIDES 2-3 EXPLAIN OBJECTIVES</b>  <b>Check for ADDITIONAL VIDEOS &amp; ANIMATIONS @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a></b>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p><b>Chapter 1 Videos</b>  <a href="http://www.jameshalderman.com/links/book_hvac/vid/ch1/video_frame.html">http://www.jameshalderman.com/links/book_hvac/vid/ch1/video_frame.html</a></p> <p><b>Crossword Puzzle (Microsoft Word) (PDF)</b>  <b>Word Search Puzzle (Microsoft Word) (PDF)</b></p> <p><b>4. SLIDES 4-7 EXPLAIN Introduction</b></p> <p><b><u>DISCUSSION:</u> DISCUSS 3 STATES OF WATER &amp; HOW THEY RELATE TO AUTOMOTIVE HVAC SYSTEMS. EXPLAIN HOW MOLECULES OF WATER ARE MOVING AT DIFFERENT STATES. ASK WHY THERE HAS TO BE AN UNBALANCED FORCE FOR THE MOLECULES TO TRANSFER HEAT?</b></p> <p><b>8. SLIDE 8 EXPLAIN FIGURE 1–1</b> Water is a substance that can be found naturally in solid, liquid, and vapor states..</p> <p><b>9. SLIDE 9 EXPLAIN FIGURE 1–2</b> extra heat required to change a standard amount of water at its boiling point to vapor is called latent heat of vaporization.</p> <p><b><u>LATENT HEAT OF EVAPORATION</u></b></p> <p><b>10. SLIDE 10 EXPLAIN FIGURE 1–3</b> latent heat of vaporization that water vapor stores is released when vapor condenses to a liquid. Temperature stays same.</p> <p><b>SOME DMMS COME WITH A TEMPERATURE PROBE FOR CHECKING TEMPERATURES. USE THIS ON THE RADIATOR HOSES TO</b></p>

**CHECK FOR A THERMOSTAT OPENING. ALSO, INFRARED TEMPERATURE GUNS ARE AVAILABLE TO CHECK TEMPERATURES.**

- 11. SLIDE 11 FIGURE 1–4 Heat intensity is measured using a thermometer. 2 common measuring scales, Celsius and Fahrenheit, are shown here. This thermometer is also marked with water freezing and boiling and refrigerant boiling temperatures.
- 12. SLIDES 12 **EXPLAIN** FIGURE 1–5 Heat travels from higher temperature (higher energy level), to lower temperature (lower energy level).
- 13. SLIDE 13 **EXPLAIN** FIGURE 1–6 combination meter that measures and displays both temperature and the humidity is useful to use when working on air-conditioning systems.

**DISCUSSION: DISCUSS WHY AEROSOL CANS BECOME COLD WHEN SPRAYED CONTINUOUSLY AND WHY A CAN OF NONFLAMMABLE REFRIGERANT CAN EXPLODE WHEN HEATED BY FIRE. HINT: HAVE THEM FOCUS ON RELATIONSHIP BETWEEN PRESSURE AND TEMPERATURE FOR A VAPOR.**

- 14. SLIDES 14-15 **EXPLAIN** Heating and Cooling Load
  
- 16. SLIDE 16 **EXPLAIN** FIGURE 1–8 Winter presents a heat load where heat must be added for comfort (right). Summer presents a cooling load.
- 17. SLIDE 17 **EXPLAIN** FIGURE 1–9 Ice has a cooling effect because of latent heat of fusion which means that it absorbs heat as it melts.
- 18. SLIDE 18 **EXPLAIN** FIGURE 1–10 At one time, evaporative coolers were used to cool car interiors. Air forced through a water-wetted mesh produces evaporation and a cooling effect.
- 19. SLIDE 19 **EXPLAIN** FIGURE 1–11 Heat, from in-vehicle cabin air, causes the refrigerant to boil in the evaporator (left). The compressor increases the pressure and moves refrigerant vapor to the condenser, where the heat is transferred to ambient air. This also causes the vapor to return to liquid

ICONS	Ch01 Heating & Air-Conditioning Principles
	<p>form.</p> <p><b><u>A/C SYSTEM OPERATION</u></b></p> <p><b><u>DEMONSTRATION: USE LAB VEHICLE SHOW PARTS OF AN AUTOMOTIVE HEATING SYSTEM &amp; A/C SYSTEM. SHOW BLOWER MOTOR THAT SENDS HEATED AIR INTO PASSENGER COMPARTMENT. USE AN INFRARED THERMOMETER TO SHOW TEMPERATURE DIFFERENCES ON HIGH AND LOW SIDES OF AC SYSTEM &amp; HEATING SYSTEM.</u></b></p> <p>20. SLIDES 20-21 <b>EXPLAIN</b> Heat Movement</p> <p>22. SLIDE 22 <b>EXPLAIN</b> FIGURE 1–12 Heat can be moved from source by convection, conduction, or radiation.</p> <p><b><u>CONDUCTION</u></b></p> <p><b><u>CONVECTION</u></b></p> <p><b><u>RADIANT HEAT</u></b></p> <p>23. SLIDES 23-24 <b>EXPLAIN</b> Air-conditioning Process (1 of 2)</p> <p>25. SLIDE 25 <b>EXPLAIN</b> FIGURE 1–13 Matter can change state by adding or removing heat</p> <p><b><u>HEAT TRANSFER &amp; BOILING</u></b></p> <p><b><u>HEAT TRANSFER</u></b></p> <p><b><u>HEAT TRANSFER THROUGH LATENT HEAT</u></b></p> <p><b><u>DISCUSSION: ASK STUDENTS TO TALK ABOUT HOW HEAT IS ABSORBED BY AN AUTOMOTIVE A/C SYSTEM.</u></b></p> <p>26. SLIDE 26 <b>EXPLAIN</b> water molecule contains two oxygen atoms and one hydrogen atom. R-12 is a combination of one carbon, two chlorine, and two fluorine atoms. R-134a is a combination of two carbon, four fluorine, and two hydrogen atoms</p>

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	<p>27. SLIDE 27 <b>EXPLAIN</b> FIGURE 1–15 Ice is a solid form of water with a low temperature and slow molecular action.</p> <p>28. SLIDE 28 <b>EXPLAIN</b> FIGURE 1–16 Water is warmer than ice and can flow to take the shape of any container</p> <p>29. SLIDE 29 <b>EXPLAIN</b> FIGURE 1–17 Adding heat to water produces steam, the gas state, with a much freer molecular action.</p> <p>30. SLIDE 30 <b>EXPLAIN</b> Purpose of an HVAC System <b><u>HVAC SYSTEM</u></b></p> <p>31. SLIDE 31 <b>EXPLAIN</b> FIGURE 1–18 When air comes into contact with the cold evaporator, excess moisture forms dew. This condensed moisture leaves the car through the evaporator drain <b><u>HVAC SYSTEM</u></b></p> <p>32. SLIDES 32-33 <b>EXPLAIN</b> Summary</p>