
















# Automotive Heating and Air Conditioning, 7e







## Chapter 3 Heating and Air-Conditioning Principles

### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	This course or class covers operation and service of <b>Automotive Heating and Air Conditioning, 7e</b> . It correlates material to task lists specified by ASE and NATEF.
<b>Motivate Learners</b>	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.
<b>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.</b>	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>
<b>Establish the Mood or Climate</b>	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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	Ch03 Heating & Air-Conditioning Principles
       	<p>1. SLIDE 1 HEATING &amp; AIR-CONDITIONING PRINCIPLES</p> <p>2. SLIDES 2-3 EXPLAIN OBJECTIVES</p> <p>Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b> @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p>4. SLIDES 4-5 EXPLAIN Changes of States of Matter</p> <p>6. SLIDE 6 EXPLAIN Heat and Temperature</p> <p>7. SLIDE 7 EXPLAIN Two Types of Humidity</p> <p>8. SLIDES 8-9 EXPLAIN Heating and Cooling Load</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>10. SLIDE 10 EXPLAIN Figure 3–8 Winter presents a heat load where heat must be added for comfort (right). Summer presents a cooling load.</p> <p>11. SLIDE 11 EXPLAIN Figure 3–9 Ice has a cooling effect because of latent heat of fusion which means that it absorbs heat as it melts.</p> <p><b><u>LATENT HEAT OF EVAPORATION</u></b>  <b><u>WWW.MYAUTOMOTIVELAB.COM</u></b>  <a href="http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a77_animation/chapter48_fig_48_2/index.htm">HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A77_ANIMATION/CHAPTER48 FIG_48_2/INDEX.HTM</a></p> <p>12. SLIDE 12 EXPLAIN Figure 3–10 At one time, evaporative coolers were used to cool car interiors. Air forced through a water-wetted mesh produces evaporation and a cooling effect.</p> <p><b>SOME DMMS COME WITH A TEMPERATURE PROBE FOR CHECKING TEMPERATURES. USE THIS ON THE RADIATOR HOSES TO CHECK FOR A THERMOSTAT OPENING. ALSO, INFRARED TEMPERATURE GUNS ARE AVAILABLE TO CHECK TEMPERATURES.</b></p>

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	<p>13. SLIDE 13 EXPLAIN Figure 3–11 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 vapor to return to liquid form.</p> <p>14. SLIDES 14-15 EXPLAIN Three Ways Heat Flows</p> <p>16. SLIDE 16 EXPLAIN Figure 3–12 Heat can be moved from source by convection, conduction, or radiation.</p>
 	<p><u>CONDUCTION</u></p> <p><u>CONVECTION</u></p> <p><u>RADIANT HEAT</u></p> <p><b><u>DISCUSSION:</u> DISCUSS WHY AEROSOL CANS BECOME COLD WHEN SPRAYED CONTINUOUSLY AND WHY A CAN OF NONFLAMMABLE REFRIGERANT CAN EXPLODE WHEN HEATED BY FIRE. <u>HINT:</u> HAVE THEM FOCUS ON RELATIONSHIP BETWEEN PRESSURE AND TEMPERATURE FOR A VAPOR.</b></p>
	<p>17. SLIDES 17-18 EXPLAIN Air-conditioning Process</p>
	<p><u>A/C SYSTEM OPERATION</u></p>
	<p><b><u>DEMONSTRATION:</u> 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.</b></p>
	<p>19. SLIDE 19 EXPLAIN Figure 3–15 Ice is solid form of water with low temperature &amp; slow molecular action.</p> <p>20. SLIDE 20 EXPLAIN Figure 3–16 Water is warmer than ice and can flow to take shape of any container.</p> <p>21. SLIDE 21 EXPLAIN Figure 3–17 Adding heat to water produces steam, the gas state, with a much freer molecular action.</p>

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   <p data-bbox="350 510 456 537">QUESTION</p>   	<p data-bbox="586 264 1089 296"><u>HEAT TRANSFER &amp; BOILING</u></p> <p data-bbox="586 312 891 344"><u>HEAT TRANSFER</u></p> <p data-bbox="586 361 1338 392"><u>HEAT TRANSFER THROUGH LATENT HEAT</u></p> <p data-bbox="586 409 1328 531"><b><u>DISCUSSION: ASK STUDENTS TO TALK ABOUT HOW HEAT IS ABSORBED BY AN AUTOMOTIVE A/C SYSTEM.</u></b></p> <p data-bbox="623 548 1370 579">22. SLIDE 22 EXPLAIN Purpose of an HVAC System</p> <p data-bbox="623 596 1414 737">23. SLIDE 23 EXPLAIN Figure 3–18 When air comes into contact with the cold evaporator, excess moisture forms dew. This condensed moisture leaves the car through the evaporator drain.</p> <p data-bbox="586 747 886 779"><u>HVAC SYSTEM</u></p> <p data-bbox="623 890 1170 921">24. SLIDES 24-25 EXPLAIN Summary</p>