

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / HVAC — System Basics

Course Code: CONSTRUCTION

### **COURSE INTRODUCTION:** HVAC

This course is designed to provide the HVAC (Heating, Ventilation, and Air Conditioning) student with a solid background in the principles of HVAC systems and the practices of installing and maintaining them.

Units in this course include:

1. System Basics
2. System Components
3. System Installation and Upkeep

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / HVAC — System Basics

Course Code: CONSTRUCTION

<p><b>UNIT DESCRIPTION:</b> System Basics                  These lessons are designed to provide the HVAC student with the necessary background and principle information regarding HVAC systems. Topics covered include heating, cooling, and system design.</p>		<p><b>SUGGESTED UNIT TIMELINE:</b> 3 lessons                  Lesson 1: Heating                  Lesson 2: Cooling                  Lesson 3: System Design  <b>CLASS PERIOD (min.):</b> 90 minutes</p>				
<p><b>ESSENTIAL QUESTIONS:</b></p> <ol style="list-style-type: none"> <li>1. How do different types of furnaces work?</li> <li>2. How can furnaces be installed and maintained to perform at their best?</li> <li>3. How are the principles of the refrigeration cycle applied to cooling systems?</li> <li>4. What are the different components of cooling systems, and how do they work together?</li> <li>5. How are heating and cooling systems designed to fit heating and cooling loads?</li> <li>6. How are manufacturers' product data used to select heating and cooling equipment?</li> </ol>						
<b>ESSENTIAL MEASURABLE LEARNING OBJECTIVES</b>						
<b>ESSENTIAL MEASURABLE LEARNING OBJECTIVES</b>	<b>CCSS LEARNING GOALS (Anchor Standards/Clusters)</b>	<b>CROSSWALK TO STANDARDS</b>				
		<b>GLEs/CLEs</b>	<b>PS</b>	<b>CCSS</b>	<b>NCCER</b>	<b>DOK</b>
1. Students will describe different types of furnaces, including how they operate and are installed and maintained.				L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2	03108-07	Level 1
2. Students will demonstrate their knowledge of the refrigeration cycle and cooling systems.				L 9-10.1 L 9-10.2 L 9-10.4 L 9-10.6 L 11-12.1 L 11-12.2 L 11-12.4 L 11-12.6 RST 11-12.9	03107-07	Level 1
3. Students will complete heating and cooling load calculations for a simple residence.				N-RN 3 N-Q 1 N-CN 6	03407-09	Level 1

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / HVAC — System Basics

Course Code: CONSTRUCTION

			A-CED 3 S-IC 6 L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2		
4. Students will use product data from manufacturers to select heating and cooling equipment.			RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1 L 9-10.1 L 9-10.2 L 9-10.4 L 9-10.6 L 11-12.1 L 11-12.2 L 11-12.4 L 11-12.6 WHST 9-10.1 WHST 9-10.4 WHST 9-10.10 WHST 11-12.1 WHST 11-12.4 WHST 11-12.10	03407-09	Level 3
<p><b>ASSESSMENT DESCRIPTIONS*:</b> (Write a brief overview here. Identify Formative/Summative. Actual assessments will be accessed by a link to PDF file or Word doc.)</p> <p>Students will demonstrate their understanding of content and ability to apply learned skills by:</p> <ul style="list-style-type: none"> <li>• Verbally responding to Instructor’s questions about furnaces (Formative)</li> <li>• Creating infographics about different types of furnaces (Summative)</li> <li>• Drawing diagrams of the refrigeration cycle and cooling systems (Summative)</li> <li>• Using an online tool to calculate heating and cooling loads (Formative)</li> <li>• Selecting heating and cooling equipment based on loads and product data, and justifying their selections (Summative)</li> </ul>					

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / HVAC — System Basics

Course Code: CONSTRUCTION

<b>*Attach Unit Summative Assessment, including Scoring Guides/Scoring Keys/Alignment Codes and DOK Levels for all items. Label each assessment according to the unit descriptions above (i.e., Grade Level/Course Title/Course Code, Unit #).</b>	
<b>Obj. #</b>	<b>INSTRUCTIONAL STRATEGIES (research-based): (Teacher Methods)</b>
1, 2, 3	Direct: Instructor-led demonstrations
1, 4	Indirect: Instructor provides materials to guide student learning.
1	Interactive: Instructor guides students to work in teams.
3	Experiential: Instructor guides students through an online tool.
<b>Obj. #</b>	<b>INSTRUCTIONAL ACTIVITIES: (What Students Do)</b>
1	Peer-Partner Learning
1, 2, 4	Writing to Inform
3	Simulation
<b>UNIT RESOURCES: (include Internet addresses for linking)</b>	
Support documents:	
<ul style="list-style-type: none"> <li>• [FURNACE INFOGRAPHIC RUBRIC]</li> <li>• [COOLING SYSTEM DIAGRAM RUBRIC]</li> <li>• [EQUIPMENT RATIONALE RUBRIC]</li> </ul>	
Internet resources:	
<ul style="list-style-type: none"> <li>• Air Conditioning Contractors of America (<a href="http://www.acca.org">www.acca.org</a>)</li> <li>• American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) (<a href="http://www.ashrae.org/">http://www.ashrae.org/</a>)</li> <li>• Refrigeration Service Engineers Society (RSES) (<a href="http://www.rses.org/">http://www.rses.org/</a>)</li> <li>• <a href="http://www.makeuseof.com/tag/awesome-free-tools-infographics/">http://www.makeuseof.com/tag/awesome-free-tools-infographics/</a></li> <li>• <a href="http://www.air-conditioning-and-refrigeration-guide.com/refrigeration-cycle.html">http://www.air-conditioning-and-refrigeration-guide.com/refrigeration-cycle.html</a></li> <li>• <a href="http://www.hvacfun.com/a-understanding-the-basics-of-refrig-piping.htm">http://www.hvacfun.com/a-understanding-the-basics-of-refrig-piping.htm</a></li> <li>• <a href="http://www.loadcalc.net/">http://www.loadcalc.net/</a></li> <li>• <a href="http://www.reedconstructiondata.com/smartbuildingindex/central-heating-equipment/manufacturers/">http://www.reedconstructiondata.com/smartbuildingindex/central-heating-equipment/manufacturers/</a></li> <li>• <a href="http://www.ajaxboiler.com/wp-content/uploads/downloads/2011/09/Ajax-Catalog-2011-FINAL.pdf">http://www.ajaxboiler.com/wp-content/uploads/downloads/2011/09/Ajax-Catalog-2011-FINAL.pdf</a></li> <li>• <a href="http://www.ahridirectory.org/ahridirectory/pages/home.aspx">http://www.ahridirectory.org/ahridirectory/pages/home.aspx</a></li> </ul>	

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / HVAC — System Basics

Course Code: CONSTRUCTION

- <http://www.ahridirectory.org/ahridirectory/pages/ac/defaultSearch.aspx>

Resources available from MCCE free loan library ([www.mcce.org](http://www.mcce.org)):

- T&I DVD ROM 11.2  
HVAC Basics: Residential Heating and Ventilation  
Shopware  
LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.  
DVD ROM — This program illustrates several different types of heating systems, including forced-air gas furnaces, high-efficiency furnaces, and hot air systems. Different types of ignition and fuels are covered, along with the major elements of gas furnaces, including solenoids, burners, manifolds, heat exchangers, and more. Air flow components such as supply and return plenums, air filters, and split capacitor motors are also explained, in addition to thermostats, pilot safety switches, and gas valves. Viewers will get a look at the automated service centers at the heart of many modern large office buildings, which maintain climate control using high-tech sensors and adjustment systems. 24 minutes.
- T&I DVD ROM 11.3  
HVAC Basics: Residential Air Conditioning  
Shopware  
LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.  
DVD ROM — This program, summarizes air conditioning operation and service. Typical systems for cooling or dehumidifying residential environments are covered. Details on condensing units and their components—including the condenser coil, compressor, motor, fan, and accumulator—are illustrated along with typical outside housings and insulation materials. The three methods of heat transfer—conduction, convection, and radiation—are outlined, along with the difference between high side and low side pressure systems. The refrigeration cycle is demonstrated, as are different types of compressors, such as scroll, reciprocating, and piston. Heat pumps, electrical controls, evaporators, and sight glasses are explained. 21 minutes.