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| **TEXAS CTE LESSON PLAN**[www.txcte.org](http://www.txcte.org) |
| **Lesson Identification and TEKS Addressed** |
| **Career Cluster** | Law, Public Safety, Corrections, and Security |
| **Course Name** | Firefighter I |
| **Lesson/Unit Title** | Ventilation Tools and Their Safe Operation |
| **TEKS Student Expectations** | **130.334. (c) Knowledge and Skills** (19) The student comprehends the fire extinguishment theory.(D) The student is expected to describe solutions to mitigate potential hazards (E) The student is expected to describe procedures for safe operation at emergency scenes |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The student will be able to:1. Safely demonstrate the tools used for ventilation
2. Describe the procedures for safe operation of those tools at emergency scenes
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| **Rationale** | Ventilation, by definition is a systematic removal of heated air, smoke, and fire gases from a burning building and replacing them with cooler air (IFSTA). When ventilation is done correctly it slows fire spreading; facilitates rescue; reduces property damage, danger to firefighters, and building occupants; and reduces the chance of flashover and backdraft. Ventilation is one of the most crucial tactics utilized in successful firefighting operations. To effectively ventilate, firefighters need to be familiar with the firefighter tools used to ventilate and how to use them safely. |
| **Duration of Lesson** | 5 hours |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  |
| **Materials/Specialized Equipment Needed** | * Tool Identification Activity Key
* Computer-based presentation software (optional)
* Ventilation Tools Quiz and Key
* Discussion Rubric
* Presentation Rubric
* Writing Rubric
* Computer/projector
* Power tools: rotary saw and chain saw
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | Use the following questions and topics for a class discussion about firefighter safety in tool operation and effective use. The Discussion Rubric may be used for assessment.* What tools are used for ventilation?
* What are some specific examples of a tool’s use?
* Can tools be used for all types of ventilation or only for specific uses?
* What are the safe uses for each?
* What are the bad habits that firefighters might use if they become complacent or too familiar with a tool’s use?
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| **Direct Instruction \*** | 1. Firefighting Tools Commonly Used for Ventilation Purposes
	1. Turnout gear (protective clothing) – clothing firefighters must wear to protect themselves while fighting fires (including ventilation), during rescue operations, and on emergency medical calls
	2. Cutting tools
		1. Axes
			1. Pick-head axe – 6- or 8-pound head, is a very versatile tool, and is often used to open up roofs to create ventilation openings. It can also be used to break windows for ventilation
			2. Flat-head axe – 6- or 8-pound head, can also be used to open up roofs and create ventilation openings, but is not as versatile as a pick-head axe
		2. Power saws
			1. Chain saws – commonly used during ventilation operations. When equipped with a carbide tip they can rapidly cut through many different types of roofing materials

b. Rotary saws – have many uses, but if the blade is changed to cut wood they are effective in ventilation operations* 1. Pushing/pulling tools

1. Pike poles – used for pushing or pulling down ceilings in ventilation operations to provide a path for smoke, heat, and fire gases to exit the building through established ventilation openings2. Roofman’s Hooks – used to sound roofs and can be used to pry roof shingles if necessary* 1. Portable Fans

1. Blowers – used in positive pressure ventilation (PPV) where firefighters create positive pressure within the structure. This pressure is slightly higher than the outside atmospheric pressure, and smoke, heat, and fire gases are forced through the ventilation opening by mechanically blowing air into and through the structure2. Smoke ejectors – used in negative pressure ventilation (NPV) by drawing smoke, heat, and gases to established ventilation openings in the exterior of the structure* 1. Nozzles

1. Combination nozzles – used in the wide fog pattern for hydraulic ventilation. The nozzle is operated at 100 psi. The air movement created from the fog stream helps push the smoke, heat, and fire gases from the building. The fog stream is inside the structure and placed so that 85 to 95 percent of the window or door opening to the outside is covered by a wide fog pattern2.Fog nozzles – used in a wide fog pattern in hydraulic ventilation as well. The nozzle pressure is also set at 100 psi. The air movement created from the fog stream helps push the smoke, heat, and fire gases from the building. The fog stream is inside the structure and placed so that 85 to 95 percent of the window or door opening to the outside is covered by a wide fog patternF. Attack lines – to be in position before ventilation operations are begun II. Tool Safety* 1. Cutting tools
		1. Make sure you have the correct tool for the job
		2. Wear your personal protective equipment (PPE) while doing the job. Gloves, eye protection, and hearing protection should all be used
		3. Maintain situation awareness
		4. Keep unauthorized people out of the work area
	2. Pushing and pulling tools
		1. When pushing or pulling ceilings with a pike pole, be aware of falling ceiling and roofing material
		2. Do not use prying tools as pulling tools or pulling tools as prying tools. Use tools for what they are intended
		3. Maintain tool handles to avoid splinters and other damage
	3. Power saws
		1. Make sure you have the correct tool for the job. Match the saw and/or saw blade to the material you need to cut
		2. Wear your PPE while doing the job. Gloves, eye protection, and hearing protection should all be used
		3. Inspect the saw before and after each use
		4. Do not use a power saw if you are working in a flammable atmosphere or near flammable liquids or gases
		5. Keep unauthorized people out of the work area
		6. Follow the manufacturer’s guidelines for saw operation
		7. Keep the blades and/or chains well sharpened. Dull saws are more likely to cause accidents and injuries
		8. Start all cuts with the power saw at full throttle
	4. Portable fans
		1. Take advantage of prevailing wind conditions

 * + 1. When doing PPV, make sure that the cone of air covers the entire entry opening
		2. If using electrical cords and generators, make sure that they don’t create a tripping hazard
		3. When doing PPV, it will not be necessary to enter the building to set it up
		4. Make sure you are schooled in methods of creating ventilation openings in all roof types. Flat and pitched roofs may have a variety of different coverings
		5. Be aware of backdraft situations
		6. Avoid “churning” air when creating ventilation. Churning is the recirculation of gases being drawn back into a room or structure because the exit opening around the smoke ejector has not been sealed
	1. Fog nozzles
		1. Maintain all nozzles according to the manufacturer’s specifications
		2. Check gaskets for damage and replace them if necessary
		3. Check for external damage to the nozzle.
		4. Check for internal damage to the nozzle and any debris inside the nozzle. Clean according to the manufacturer’s specifications
	2. Attack lines
		1. Hoses should be washed, dried, and replaced according to the department standard operating procedures (SOPs) and the manufacturer’s specifications
		2. Inspect hoses for damage and wear in accordance with the department SOPs and the manufacturer’s specifications
		3. Test hoses in accordance with the department SOPs and the manufacturer’s specifications
1. Scene Safety/Life Safety Hazards Associated with Ventilation
2. The first consideration is always life safety – both the lives of the firefighters and the building occupants. Ask these questions:
	1. Are the occupants awake or asleep?
	2. Have the occupants become overcome by smoke and carbon monoxide poisoning?
	3. Are the building occupants alive or dead?
	4. Are the building occupants lost, or have they found a safe area of refuge within the building?
3. Timely ventilation can help mitigate most of the circumstances above. Ask these questions:
	1. Do you start ventilation before search and rescue operations?
	2. Does the fire need to be attacked before beginning ventilation?
4. There are hazards that exist for firefighters. Ask these questions:
	1. What type of structure is involved?
	2. How old is the structure?
	3. How and where will ventilation be facilitated?
	4. Are there natural openings that could be used, or are you going to have to create openings in the structure?
	5. Hazards associated with the accumulation of heat, smoke, and other fire gases include
		1. Visual impairment
		2. Toxic/flammable gases
		3. Oxygen deficient atmospheres
		4. Potential for backdraft
		5. Potential for flashover

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** Instruction can be differentiated by use of oral exam, skill demonstration, or written testing. When a student has met the minimum standard to be considered competent in the didactic phase of instruction as well as the tactile learning phase, it should be recorded.
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| **Guided Practice \*** | *Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*NONE |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | 1. Have students complete some assigned reading from the text about ventilation tools and tool safety. After reading the assignment, have students describe the safe operations of at least 10 tools used at emergency scenes. Use the Writing Rubric for assessment.
2. Have each student present a lesson demonstrating two tools used for ventilation. Using computer-based presentation software is optional. The lesson should include involving the other students in the safe use of each tool. Use the Presentation Rubric for assessment.
3. Print the pages of the Tool Identification Activity and pass them out to students. There are 15 tools to identify and a space next to each to write factual information. Students should be allowed to use their textbook, the Internet, and personal resources to find the information they need.

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*Students will participate in peer teaching (mentoring) and team learning, guided research and note taking (web-based), and keeping journals (keywords and definitions). |
| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | Ventilation Tools Quiz and KeyDiscussion RubricPresentation RubricWriting Rubric*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:***Accommodations for Learning Differences:** For reinforcement, students will participate in peer teaching (mentoring) and team learning, guided research and note taking (web-based), and keeping journals (keywords and definitions). |
| **References/Resources/****Teacher Preparation** | 0135151112, *Essentials of Firefighting* (5th Edition), International Fire Service Training Association (IFSTA). |
| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** | English/Language Arts Standards II. ReadingB. Understand new vocabulary and concepts and use them accurately in reading, speaking, and writing.1. Identify new words and concepts acquired through study of their relationships to other words and concepts.

3. Use reference guides to confirm the meanings of new words or concepts. |
| **Recommended Strategies** |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy****Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies****Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication****90 Second Speech Topics** |  |
| **Other Essential Lesson Components** |
| **Enrichment Activity**(e.g., homework assignment) | For enrichment, students will participate in situational awareness exercises, classroom discussions, and training exercises. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)