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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** | SCBA Air Management and Safety |
| **TEKS Student Expectations** | **130.334. (c) Knowledge and Skills**(11) The student analyzes the internal systems that sustain life in the human body and identifies the physical requirements of a self-contained breathing apparatus wearer.(C) The student is expected to identify the firefighter’s physical requirements for wearing a self-contained breathing apparatus (12) The student demonstrates confidence in performing firefighting skills while wearing a self-contained breathing apparatus.(B) The student is expected to describe how to calculate the air supply duration in the cylinder(D) The student is expected to describe the uses and limitations of the self-contained breathing apparatus(F) The student is expected to demonstrate the replacement of an expended cylinder on a self-contained breathing apparatus assembly with a full cylinder(13) The student demonstrates inspection, care, and testing procedures for the self-contained breathing apparatus.(A) The student is expected to document routine maintenance for the self-contained breathing apparatus |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** |

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| The students will be able to: |
| 1. Identify the firefighters’ physical requirements for wearing a self- |
| contained breathing apparatus |
| 2. Describe and demonstrate how to calculate the air supply duration in |
| the cylinder |
| 3. Describe the uses and limitations of the SCBA |
| 4. Demonstrate the replacement of an extended cylinder on a self- |
| contained breathing apparatus assembly with a full cylinder |
| 5. Document routine maintenance for the SCBA |

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| **Rationale** |

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| Firefighters work in smoky, toxic atmospheres that can be detrimental to |
| their health. The Self-Contained Breathing Apparatus (SCBA) allows |
| firefighters to perform their duties in these environments, but they must |
| understand SCBA’s limitations, know its operational rules and requirements, |
| and calculate its air supply continually during use. |

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| **Duration of Lesson** | 3 to 5 hours |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  |
| **Materials/Specialized Equipment Needed** | * SCBA Air Management and Safety Quiz and Key
* SCBA Inspection Procedure Checklist
* SCBA Cylinder Replacement–One-Person Method Checklist
* SCBA Cylinder Replacement–Two-Person Method Checklist
* Discussion Rubric
* Individual Work Rubric
* Presentation Rubric
* Computer with interactive white board
* Computer(s) with Internet access or computer-based presentation software Note-taking materials
* Personal Protective Equipment (PPE)
* SCBA
* Paper and pencils
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) |

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| Bring a SCBA to class. Allow the students to handle and examine the SCBA. |
| Discuss as a class the importance of fully understanding a SCBA prior to |
| use. Use the Discussion Rubric for assessment. |

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| **Direct Instruction \*** | Use the Outline to teach the use and importance of a Self-Contained Breathing Apparatus to firefighters. Have students take notes. Encourage student discussion.

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| I. SCBA Review |
| A. Four reasons people need to wear SCBA devices |
| 1. Oxygen falls below 18% (21% is normal) |
| 2. Atmosphere is full of smoke |

* 1. Toxic fumes, gasses, or materials are in the area
	2. The environment is over 120 degrees Fahrenheit
1. Two types of SCBA systems
	1. Closed system
		1. The SCBA recirculates the air the wearer exhales and adds oxygen to it
		2. Nothing leaves the SCBA and goes into the environment
		3. This type of SCBA is rare in the fire service
	2. Open system (two kinds)
		1. Demand – air is provided to the user on demand, every time he or she takes a breath
		2. Open – pressure in the mask is slightly above that of the normal atmosphere, keeping contaminants out
2. An SCBA cylinder typically holds around 2000-2200 psi of air. A good rule of thumb is that this will last an average of 30 minutes
3. NFPA requires that all SCBA devices have a personal alert safety system (PASS) device go off if the individual wearing it stays inactive for 30 seconds
	1. When the pressure reaches or drops below 500 psi the person wearing it (and his or her partner) MUST evacuate the scene. This includes when a rescue is underway
	2. Safety checks on an SCBA:
		1. Safety checks should be done daily

 * + 1. Check the cylinder pressure gauge. When full, the gauge should read approximately 2000 psi
		2. Ensure that the face piece is clean and without cracks or damage. The straps must be in good working order
		3. Check all the pressure lines for damage or wear and abuse
		4. Check all the straps to ensure they are in good condition
		5. Check the exhalation valve for proper functioning
		6. Check all the gauges for proper readings

8. Check the low-pressure alarm to be sure it is functioning II. SCBA Air Management* 1. The low-air alarm signifies that there is
		1. 25 percent of the cylinder’s air remaining
		2. Up to 5 minutes of air supply
		3. Insufficient time to exit from deep inside a large or complex structure
	2. For your own safety
		1. Comply with the accountability system in use
		2. Maintain your situational awareness
		3. Manage your air supply
	3. Three basic elements to effective air management
		1. Know your point of no return (beyond 50 percent of the air supply of the team member with the lowest gauge reading)
		2. Know how much air you have (at all times)
		3. Make a conscious decision to stay or to leave when your air is down to 50 percent
	4. The decision to stay or to leave is
		1. A team decision that is always made by your supervisor
		2. If your team has only two members, both members must leave at the same time
	5. To maximize your air supply, check it
		1. At the beginning of your shift (make sure that the cylinder is at least 90 percent full)
		2. When donning the SCBA and opening the cylinder valve
		3. While working, at 5-10 minute intervals and at key points, such as when changing locations and finishing assignments
		4. During egress from the hazard zone, at 2-3 minute intervals when refilling or replacing a cylinder
1. SCBA Limitations
	1. Limitations of the wearer
		1. Physical factors
			1. Physical condition
			2. Agility
			3. Facial features
		2. Medical factors
			1. Neurological functioning
			2. Muscular/skeletal condition
			3. Cardiovascular training
			4. Respiratory functioning
		3. Mental factors
			1. Adequate training in equipment use
			2. Self-confidence
			3. Emotional stability
	2. Limitations of the equipment
		1. Limited visibility
		2. Decreased ability to communicate
		3. Increased weight
		4. Decreased mobility
	3. Limitations of the air supply
		1. Physical condition of the wearer
		2. Degree of physical exertion
		3. Emotional stability of the wearer
		4. Condition of the apparatus
		5. Cylinder pressure prior to use
		6. Training and experience of the wearer

IV. SCBA Safety Precautions and Special Uses1. Firefighters
	1. Must be physically fit
		1. Breathing equipment can weigh from 25 to 35 pounds (11 kg to 16 kg)
	2. Must be trained to recognize the signs and symptoms of heat-related illnesses
	3. Should closely monitor how they are feeling while wearing SCBA and rest when they become fatigued
	4. Must be fit-tested annually if they are certified to wear SCBA
	5. Must remember that air-supply duration varies with the following
		1. Size of the cylinder and the beginning pressure
		2. Firefighters’ conditioning
		3. Type of task being performed
		4. Level of training
		5. Operational environment
		6. Degree of firefighters’ stress
	6. Should not remove their SCBA until they leave the contaminated area
		1. Must work in teams of two or more while they are in any Immediately Dangerous to Life and Health (IDLH) atmosphere
			1. Team members must remain in physical, voice, or visual contact
			2. Firefighters should check their air supply status frequently
	7. Special Uses
		1. Operating in areas of limited visibility
			1. Crawling
				1. Helps firefighters avoid the higher temperatures found at the ceiling
				2. Helps firefighters remain below the thermal layer and increase visibility
			2. Crawling and probing with a tool
				1. Prevents firefighters from falling through holes or down stairs or elevator shafts
				2. Allows firefighters to feel for victims under beds and behind furniture
			3. Crouch or “duck walk”
				1. Is faster than crawling
				2. Is more dangerous than crawling unless firefighters can see the floor in front of them
			4. Using a tag-line such as a
				1. Hose line
				2. Rope
				3. Electrical cord
			5. Using a wall to find an exit (door or window)

V. Changing SCBA Cylinders* 1. SCBA cylinders need to be changed frequently during extended emergency operations
	2. A salvage cover should be placed on the ground to protect spare cylinders
	3. Empty cylinders should be segregated from the supply of cylinders ready for use
	4. Out-of-service cylinders should be clearly marked
	5. Methods for changing a cylinder
		1. One-person method
			1. Place the SCBA unit on a firm surface
			2. Close the cylinder valve
			3. Bleed air pressure from high- and low-pressure hoses
			4. Disconnect the high-pressure coupling from the cylinder
			5. Remove the empty cylinder from the harness assembly
			6. Verify that the replacement cylinder is 90-100% of rated capacity
			7. Check the cylinder valve opening and the high-pressure hose fitting for debris
	6. Place the new cylinder into the backpack
	7. Connect the high-pressure hose to the cylinder and then tighten the connection
	8. Slowly and fully open the cylinder valve and listen for an audible alarm and leaks as the system pressurizes
		1. If air leaks are detected, determine if connections need to be tightened or if valves, donning switch, etc. need to be adjusted
		2. SCBA with audible leaks due to malfunctions shall be removed from service, tagged, and reported to the officer
		3. On some SCBA, the audible alarm does not sound when the cylinder valve is opened. You must know the operation of your particular unit
1. Two-person method
	1. The firefighter wearing the SCBA
		1. Disconnects the regulator from the face piece or disconnects the low-pressure hose from the regulator (depending on the type of SCBA)
		2. Positions the cylinder for easy access by kneeling down or bending over
	2. The firefighter removing the cylinder
		1. Fully closes the cylinder valve
		2. Releases the air pressure from the high- and low-pressure hoses
		3. Disconnects the high-pressure coupling from the cylinder
		4. Removes the empty cylinder from the harness assembly
		5. Inspects replacement cylinder and ensures that cylinder is 90-100% of rated capacity
		6. Places new cylinder into the harness assembly
		7. Checks the cylinder valve opening and the high-pressure hose fitting for debris and clears any debris by quickly opening and closing the cylinder valve
		8. Connects the high-pressure hose to the cylinder and hand-tightens
		9. Slowly and completely opens the cylinder valve and listens for an audible alarm and leaks as the system pressurizes
		10. On some SCBA, the audible alarm does not sound when the cylinder valve is opened
	3. The firefighter wearing the SCBA
		1. Dons regulator and takes normal breaths
		2. Checks pressure reading on remote gauge and/or indicators and reports reading

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** NONE
 |
| **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 \*** | SCBA Inspection Procedure – Have the students conduct an SCBA inspection. During the inspection, have the students touch each component and state its name and condition. Use the SCBA Inspection Procedure Rubric as a student guide and as an assessment. (*Note:* This activity may be completed with the students grouped as partners while evaluating each other. Regardless of the method of assessment the components do not have to be completed in the order listed on the SCBA Inspection Procedure Rubric. The inspection should be performed with the cylinder removed from the back plate.)1. Cylinder Replacement – Have the students demonstrate replacing a SCBA cylinder using the one- and two-person methods. Use the SCBA Cylinder Replacement–One-Person Method Checklist and the SCBA Cylinder Replacement–Two-Person Method Checklist to guide the activity and for assessment.

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** Students will create a technical illustration of the SCBA using paper and pencils. The illustration should include and label all of the SCBA components. Use the Individual Work Rubric for assessment.
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| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | * SCBA Air Management and Safety Quiz and Key
* SCBA Inspection Procedure Checklist
* SCBA Cylinder Replacement–One-Person Method Checklist
* SCBA Cylinder Replacement–Two-Person Method Checklist
* Discussion Rubric
* Individual Work Rubric
* Presentation 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 create a technical illustration of the SCBA using paper and pencils. The illustration should include and label all of the SCBA components. Use the Individual Work Rubric for assessment. |
| **References/Resources/****Teacher Preparation** | 0135151112, *Essentials of Firefighting and Fire Department Operations* (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)** | Cross-Disciplinary Standards I. Key Cognitive Skills C. Problem solving1. Analyze a situation to identify a problem to be solved.
2. Develop and apply multiple strategies to solve a problem.

3.Collect evidence and data systematically and directly relate to solving a problem. |
| **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 create a technical demonstration about either an SCBA inspection or an SCBA operational check using computer-based presentation software. Use the Presentation Rubric for assessment. |
| **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)