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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** | Introduction to Hazardous Materials |
| **TEKS Student Expectations** | **130.334. (c) Knowledge and Skills**(3) The student executes safety procedures and protocols associated with fire management services. The student is expected to: (B) Apply protocols for handling hazardous materials at the awareness level(19) The student identifies safety procedures for ensuring a safe environment. The student is expected to: (A) Identify protective equipment and describe its uses; (B) Recognize traffic and scene control devices |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The students will be able to:1. Understand introductory knowledge hazmat operations2. Identify Department of Transportation (DOT) hazmat placards3. Analyze hazmat incident scenarios4. Describe effective approaches of first responders to hazmat incident scenarios5. Create a digital story illustrating their solution to a hazmat incident scenario |
| **Rationale** | A firefighter’s ability to recognize an incident involving hazardous materials (hazmat) or weapons of mass destruction (WMD) is critical. Firefighters must know how to identify the presence of hazmat and WMD, and know what their role is within the response plan. All firefighters must be certified as Hazardous Materials Operational Level to gain certification as a firefighter in the state of Texas. The coursework takes a minimum of 40 hours to complete.(Note: This lesson plan introduces basic hazmat information. Due to the nature of building construction and the overabundance of synthetic materials, all firefighters come into contact with hazmat during their daily duties. It is imperative that fire service members know how to protect themselves from these dangerous and toxic environments.) |
| **Duration of Lesson** | 4 hours |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | See Handout |
| **Materials/Specialized Equipment Needed** | * Introduction to Hazardous Materials Key Terms
* Introduction to Hazardous Materials Short Answers and Scenarios Activity handout
* Introduction to Hazardous Materials Department of Transportation (DOT) Placard Worksheet and Key
* Computers with presentation or digital storytelling software
* Computers with Internet access
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | Discuss as a class how a firefighter might be exposed to hazardous materials. Help the students create a list of unusual situations when firefighters might encounter hazardous materials. Ask the students to discuss the personal protective equipment (PPE) that reduces exposure risk (e.g. SCBA, latex gloves, face mask, etc.). Have the students hypothesize about additional precautions for severe hazardous materials incidents. Use the Discussion Rubric for assessment. |
| **Direct Instruction \*** | 1. Introduction to Hazmat
	1. Distinguish between hazmat incidents and other emergencies
		1. Hazmat incidents
			1. Involve a substance that poses an unreasonable risk to people, the environment, and/or property
			2. May involve a hazardous substance that has been or may be released from a container
			3. May involve a hazardous substance that is on fire
			4. Are more complex than a routine emergency incident
			5. May be the result of a deliberate or accidental attack
		2. Other emergencies – do not involve the release of a hazardous substance
	2. Training requirements for awareness-level (hazmat) first responders
		1. The Occupational Safety and Health Association (OSHA) and the US Environmental Protection Agency (EPA) require responders to meet specific training requirements
		2. The US Department of Justice (DOJ) requires first responders to have training to prepare them for terrorist incidents involving weapons of mass destruction (WMD)
		3. National Fire Protection Agency (NFPA) Standards
			1. NFPA 471: Recommended Practice for Responding to Hazardous Materials Incidents
			2. NFPA 472: Standard for Professional Competence of Responders to Hazardous Materials Incidents
			3. NFPA 473: Standard for Competencies for Emergency Medical Services (EMS) Personnel Responding to Hazardous Materials Incidents
	3. The primary responsibilities of an awareness-level responder at a hazmat incident
		1. Recognize the presence or potential presence of hazmat
		2. Recognize the container type and identify the material in it, if possible
		3. Transmit information to the appropriate authority and call for assistance
		4. Identify actions to protect oneself and others from the hazards
		5. Establish control of the scene by isolating the hazardous area and denying entry
	4. The primary agencies that regulate hazmat
		1. Department of Transportation (DOT)
			1. Issues transportation regulations for air space, highways, pipelines, railways, and waterways
			2. Enforces regulations at the federal, state, and local levels
			3. Defines when a material is considered hazardous
			4. Requires the use of placards during the transportation of hazmat
				1. Placards – diamond-shaped signs attached to hazmat transportation vehicles that identify the following:

Explosive (orange)Flammable or non-flammable gas (green or red)Flammable combustible liquids (red)Flammable solids (red candy-stripe or blue)Oxidizers (yellow)Poison (white)Radioactive (yellow and white)Corrosives (black and white)* + 1. EPA
			1. Researches and sets national standards for environmental programs
			2. Delegates the responsibility for issuing permits, monitoring, and enforcing the standards compliance of states and tribes
			3. Works with industries and government agencies for pollution prevention and energy conservation
		2. Department of Labor (DOL)
			1. Includes OSHA
			2. Is responsible for overseeing US labor laws
		3. Nuclear Regulatory Commission (NRC)
			1. Regulates US commercial nuclear power plants and the civilian use of nuclear materials
			2. Regulates the possession, use, storage, and transfer of radioactive materials
	1. Four products most often involved in hazmat incidents
		1. Flammable/combustible liquids
			1. Petroleum products
			2. Paint products
			3. Resins
			4. Adhesives
		2. Corrosives
			1. Sulfuric Acid
			2. Hydrochloric acid
			3. Sodium hydroxide
		3. Anhydrous ammonia
		4. Chlorine
	2. Hazard-control zones
		1. Provide scene control to
			1. Protect first responders from interference by unauthorized persons
			2. Help regulate the movement of first responders within the zones
			3. Minimize contamination
		2. Primary zone designations
			1. Hot zone
				1. The area of greatest hazard at a hazmat incident site
				2. No person should enter unless in approved PPE
			2. Warm zone
				1. The area between the hot zone and the cold zone where danger exists but risk is limited
				2. Responders may put on PPE and clean materials, if needed, but civilians and media are not allowed in this zone
			3. Cold zone
				1. The outermost area of a hazmat incident site, which is considered uncontaminated
				2. Special protective clothing measures are unnecessary in this zone
	3. General information about hazmat
		1. Hazmat
			1. May be elements, compounds, or mixtures found in gaseous, liquid, or solid states, or a combination of these states
			2. May present a direct threat to health or be considered dangerous because of their physical hazards
			3. Range in severity from negligible to extremely dangerous
				1. Non-flammable to extremely flammable
				2. Non-reactive to highly reactive (i.e. detonate easily or unexpectedly)
				3. Short-lived to multi-generational radioactive and biochemical effects
		2. Types of exposures
			1. Acute (single occurrence)
			2. Chronic (reoccurring)
		3. Types of health effects
			1. Acute – short-term effects that appear within hours or days (e.g. vomiting or diarrhea)
			2. Chronic – long-term effects that may take years to appear (e.g. cancer)
		4. Behaviors of hazmat
			1. Depend upon a material’s
				1. Physical state
				2. Flammability
				3. Boiling point
				4. Chemical reactivity
				5. Other properties
			2. Determine the type and amount of harm caused
			3. Influence the effects it has on containers, people, living organisms, other chemicals/materials, and the environment
	4. Potential ignition sources at a hazmat scene
		1. Open flames
		2. Static electricity
		3. Pilot lights
		4. Electrical sources
		5. Internal combustion engines
		6. Radiant heat
		7. Cigarettes
		8. Cameras
		9. Road flares
	5. Categories of health and physical hazards
		1. Thermal hazards
			1. Are related to temperature extremes
			2. Are caused by various factors such as
				1. Hazmat (e.g. elevated-temperature materials or cryogenic liquids)
				2. Conditions on the scene (e.g. extreme ambient air temperature)
		2. Radiological hazards
			1. Exist in many forms, but ionizing radiation is the greatest concern for firefighters
			2. Usually exist for firefighters during incidents at specific types of locations, but they might also be used in terrorist attacks
				1. Medical centers
				2. Industrial operations
				3. Nuclear power plants
				4. Research facilities
			3. Usually pose minimal risks for firefighters if proper precautions, such as wearing PPE, are taken
		3. Asphyxiation hazards
			1. Asphyxiants – substances that interfere with the oxygenation of the body and cause suffocation if untreated
			2. Two classes of asphyxiants
				1. Simple asphyxiant – gases that dilute or displace the oxygen needed for breathing
				2. Chemical asphyxiant – substances that prohibit the body from using oxygen
		4. Chemical hazards
			1. May produce a wide range of effects whose likelihood and severity are contingent on the following factors
				1. Chemical’s toxicity
				2. Route of exposure
				3. Nature and extent of exposure
				4. Susceptibility of the exposed person
			2. Are classified as follows
				1. Poisons/Toxic chemicals
				2. Corrosives
				3. Irritants
				4. Convulsants
				5. Carcinogens
				6. Sensitizers/Allergens
		5. Etiological/Biological hazards
			1. Are microorganisms that may cause severe disabling disease or illness, including
				1. Viral agents
				2. Bacterial agents
				3. Rickettsias
				4. Biological toxins
		6. Mechanical hazards
			1. Can cause trauma as a result of direct contact with an object, usually striking or friction
			2. Can be mild, moderate, or severe
			3. Can result from a single event
	6. Routes of entry for human exposure to hazmat
		1. Inhalation – breathing through the nose or mouth (e.g. smoke)
		2. Ingestion – consuming through the mouth by a process other than inhalation (e.g. pill)
		3. Injection – forcing through the skin by a puncture or break (e.g. syringe)
		4. Absorption – assimilating through mucous membranes or areas of the body where skin is the thinnest (e.g. eyes)
		5. Contact – occurs when a material touches skin or an exposed surface of the body (e.g. acid)

*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 \*** | Incident Response Digital Story – Have students write a response to the short-answer questions (part 1: 55 pts.) and the incident scenarios (part 2: 45 pts.) on the Introduction to Hazardous Materials Short Answers and Scenarios Activity handout. Then have the students select and transform one of their scenario responses into a digital story (part 3) using the computer-based software of their choice. For assessment, use the Individual Work Rubric and the Introduction to Hazardous Materials Short Answers and Scenarios Activity Sample Answers.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*NONE |
| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | * Introduction to Hazardous Materials Exam and Key
* Introduction to Hazardous Materials Key Terms Quiz and Key
* Introduction to Hazardous Materials Short Answers and Scenarios Activity
* Sample Answers
* Introduction to Hazardous Materials Department of Transportation (DOT) Placard Worksheet and Key
* Discussion Rubric
* Individual Work Rubric

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*NONE |
| **References/Resources/****Teacher Preparation** | * ISBN: 0879393890, *Hazardous Materials for First Responders*. Oklahoma State University Fire Protection Pub; 4th edition. 2010
* ISBN: 0879392568, *Awareness Level Training for Hazardous Materials.* Intl Fire Service Training Assn; 2nd edition. 2005
* ISBN: 0135151112, *Essentials of Firefighting and Fire Department Operations* (5th Edition), International Fire Service Training Association (IFSTA), 2008.
* <http://hazmatplacards.net/>
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| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** |  |
| **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, the students will select and research three toxic cleaning supplies. The students must find the material safety data sheets (MSDS) for each. (*Note:* The MSDS for most materials are available on the Internet.) Use the Individual Work 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)