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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, & Security |
| **Course Name** | Firefighter II |
| **Lesson/Unit Title** | Introduction to Hazardous Materials |
| **TEKS Student Expectations** | **130.335. (c) Knowledge and Skills**(4) The student describes the characteristics and applications for the classes of extinguishers. The student is expected to:(A) identify the classification of types of fires as they relate to the use of portable fire extinguishers and the materials involved in each class of fire(B) identify the appropriate fire extinguisher for each class of fire(C) identify and describe fire extinguisher characteristics and operations |
| **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:* Understand introductory knowledge hazmat operations
* Identify Department of Transportation (DOT) hazmat placards
* Analyze hazmat incident scenarios
* Describe effective approaches of first responders to hazmat incident scenarios
* Create a digital story illustrating their solution to a hazmat incident scenario
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| **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** | This lesson should take 4 hours. |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  |
| **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 \*** | I. Introduction to HazmatA. Distinguish between hazmat incidents and other emergencies1. Hazmat incidentsa. Involve a substance that poses an unreasonable risk to people, the environment, and/or propertyb. May involve a hazardous substance that has been or may be released from a containerc. May involve a hazardous substance that is on fired. Are more complex than a routine emergency incidente. May be the result of a deliberate or accidental attack2. Other emergencies – do not involve the release of a hazardous substanceB. Training requirements for awareness-level (hazmat) first responders1. The Occupational Safety and Health Association (OSHA) and the US Environmental Protection Agency (EPA) require responders to meet specific training requirements2. 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) Standardsa. NFPA 471: Recommended Practice for Responding to Hazardous Materials Incidentsb. NFPA 472: Standard for Professional Competence of Responders to Hazardous Materials Incidentsc. NFPA 473: Standard for Competencies for Emergency Medical Services (EMS) Personnel Responding to Hazardous Materials IncidentsC. The primary responsibilities of an awareness-level responder at a hazmat incident1. Recognize the presence or potential presence of hazmat2. Recognize the container type and identify the material in it, if possible3. Transmit information to the appropriate authority and call for assistance4. Identify actions to protect oneself and others from the hazards5. Establish control of the scene by isolating the hazardous area and denying entryD. The primary agencies that regulate hazmat1. Department of Transportation (DOT)a. Issues transportation regulations for air space, highways, pipelines, railways, and waterwaysb. Enforces regulations at the federal, state, and local levelsc. Defines when a material is considered hazardousd. Requires the use of placards during the transportation of hazmat1. Placards – diamond-shaped signs attached to hazmat transportation vehicles that identify the following:a. Explosive (orange)b. Flammable or non-flammable gas (green or red)c. Flammable combustible liquids (red)d. Flammable solids (red candy-stripe or blue)e. Oxidizers (yellow)f. Poison (white)g. Radioactive (yellow and white)h. Corrosives (black and white)2. EPAa. Researches and sets national standards for environmental programsb. Delegates the responsibility for issuing permits, monitoring, and enforcing the standards compliance of states and tribesc. Works with industries and government agencies for pollution prevention and energy conservation3. Department of Labor (DOL)a. Includes OSHAb. Is responsible for overseeing US labor laws4. Nuclear Regulatory Commission (NRC)a. Regulates US commercial nuclear power plants and the civilian use of nuclear materialsb. Regulates the possession, use, storage, and transfer of radioactive materialsE. Four products most often involved in hazmat incidents1. Flammable/combustible liquidsa. Petroleum productsb. Paint productsc. Resinsd. Adhesives2. Corrosivesa. Sulfuric Acidb. Hydrochloric acidc. Sodium hydroxide3. Anhydrous ammonia4. ChlorineF. Hazard-control zones1. Provide scene control toa. Protect first responders from interference by unauthorized personsb. Help regulate the movement of first responders within the zonesc. Minimize contamination2. Primary zone designationsa. Hot zone1. The area of greatest hazard at a hazmat incident site2. No person should enter unless in approved PPEb. Warm zone1. The area between the hot zone and the cold zone where danger exists but risk is limited2. Responders may put on PPE and clean materials, if needed, but civilians and media are not allowed in this zonec. Cold zone1. The outermost area of a hazmat incident site, which is considered uncontaminated2. Special protective clothing measures are unnecessary in this zoneG. General information about hazmat1. Hazmata. May be elements, compounds, or mixtures found in gaseous, liquid, or solid states, or a combination of these statesb. May present a direct threat to health or be considered dangerous because of their physical hazardsc. Range in severity from negligible to extremely dangerous1. Non-flammable to extremely flammable2. Non-reactive to highly reactive (i.e. detonate easily or unexpectedly)3. Short-lived to multi-generational radioactive and biochemical effects2. Types of exposuresa. Acute (single occurrence)b. Chronic (reoccurring)3. Types of health effectsa. Acute – short-term effects that appear within hours or days (e.g. vomiting or diarrhea)b. Chronic – long-term effects that may take years to appear (e.g. cancer)4. Behaviors of hazmata. Depend upon a material’s1. Physical state2. Flammability3. Boiling point4. Chemical reactivity5. Other propertiesb. Determine the type and amount of harm causedc. Influence the effects it has on containers, people, living organisms, other chemicals/materials, and the environmentH. Potential ignition sources at a hazmat scene1. Open flames2. Static electricity3. Pilot lights4. Electrical sources5. Internal combustion engines6. Radiant heat7. Cigarettes8. Cameras9. Road flaresI. Categories of health and physical hazards1. Thermal hazardsa. Are related to temperature extremesb. Are caused by various factors such as1. Hazmat (e.g. elevated-temperature materials or cryogenic liquids)2. Conditions on the scene (e.g. extreme ambient air temperature)2. Radiological hazardsa. Exist in many forms, but ionizing radiation is the greatest concern for firefightersb. Usually exist for firefighters during incidents at specific types of locations, but they might also be used in terrorist attacks1. Medical centers2. Industrial operations3. Nuclear power plants4. Research facilitiesc. Usually pose minimal risks for firefighters if proper precautions, such as wearing PPE, are taken3. Asphyxiation hazardsa. Asphyxiants – substances that interfere with the oxygenation of the body and cause suffocation if untreatedb. Two classes of asphyxiants1. Simple asphyxiant – gases that dilute or displace the oxygen needed for breathing2. Chemical asphyxiant – substances that prohibit the body from using oxygen4. Chemical hazardsa. May produce a wide range of effects whose likelihood and severity are contingent on the following factors1. Chemical’s toxicity2. Route of exposure3. Nature and extent of exposure4. Susceptibility of the exposed personb. Are classified as follows1. Poisons/Toxic chemicals2. Corrosives3. Irritants4. Convulsants5. Carcinogens6. Sensitizers/Allergens5. Etiological/Biological hazardsa. Are microorganisms that may cause severe disabling disease or illness, including1. Viral agents2. Bacterial agents3. Rickettsia4. Biological toxins6. Mechanical hazardsa. Can cause trauma as a result of direct contact with an object, usually striking or frictionb. Can be mild, moderate, or severec. Can result from a single eventJ. Routes of entry for human exposure to hazmat1. 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) |
| **Guided Practice \*** |  |
| **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. |
| **Lesson Closure** | None |
| **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
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| **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)** | English/Language Arts StandardsV. ResearchC. Produce and design a document.1. Design and present an effective product.2. Use source material ethically. |
| **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) | 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)