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| **TEXAS CTE LESSON PLAN**  [www.txcte.org](http://www.txcte.org) | |
| **Lesson Identification and TEKS Addressed** | |
| **Career Cluster** | Manufacturing |
| **Course Name** | Manufacturing Engineering Technology II |
| **Lesson/Unit Title** | Hydraulic and Pneumatic Systems |
| **TEKS Student Expectations** | **130.356. (c) Knowledge and Skills**  (6) The student demonstrates an understanding of mechanical and fluid systems.  (B) The student is expected to use pneumatics devices  (C) The student is expected to use hydraulics devices |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | |
| **Instructional Objectives** | • Discuss the purpose of hydraulic and pneumatic systems.  • Research and discuss terms used in typical hydraulic and pneumatic systems.  • Discuss operational principles of typical hydraulic and pneumatic systems schematics.  • Describe the basic principle of Pascal’s law.  • Recall why it is important to keep hydraulic and pneumatic systems free of leaks.  • List three similarities between hydraulic and pneumatic systems.  • Identify two advantages pneumatic systems have over hydraulic systems.  • List an advantage of hydraulic systems over pneumatic systems.  • Name what step must be taken before disconnecting lines on either system for maintenance. |
| **Rationale** | Students will be able to recall the principles of hydraulic and pneumatic systems in a manufacturing process |
| **Duration of Lesson** | Teacher’s Discretion |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | 1. Actuators 2. Pump 3. Compressor 4. Gauges 5. Pressure relief valves 6. Control valve 7. Filter 8. Reservoir 9. Hydraulic fluid 10. Tubes / hoses 11. Fittings / connections |
| **Materials/Specialized Equipment Needed** | Instructional Aids:  1. Matching Terms and Definitions handout and answer key  2. Hydraulic and Pneumatic Systems worksheet and answer key  3. Warm-up activity  Materials Needed:  1. Pen or pencil  2. Paper  Equipment Needed:  1. Computer  2. Internet access (optional)  3. Overhead projector |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | SAY: Having an understanding of hydraulic and pneumatic systems will greatly contribute to your career success.  ASK: Have you ever thought about how important hydraulic and pneumatic energy is to your everyday life?  SHOW: Images of common hydraulic and pneumatic equipment: elevators, automobile brakes, earth moving equipment, roller coasters.  SAY: Hydraulic and pneumatic devices removed much of the manual labor from our daily lives.  ASK: Have you ever talked to a senior citizen about the amount of manual labor they were required to do when they were young?  SHOW: Photos examples of manual labor from early in the 20th century; and modern hydraulic and pneumatic equipment. |
| **Direct Instruction \*** | 1. Introduction and Start of Lesson    1. Begin Hydraulic and Pneumatic Systems. Using the Matching Terms and Definitions handout, students will pair-share and teach each other the terms and definitions. They may do computer-based research to look up the meaning. 2. Hydraulic and Pneumatic Systems    1. Discuss the importance of hydraulic and pneumatic systems and how the development of these systems have impacted the safety and efficiency of labor in our lives.    2. Historical overview    3. 21st century advancements 3. Hydraulic Systems    1. Discuss the principles of hydraulic systems including Pascal’s law, the schematic diagram and system components.    2. Pascal’s Law    3. Typical system schematic 4. Pneumatic Systems    1. Discuss the principles of pneumatic systems including the schematic diagram and system components. Ensure students understand how the system operates. Have some background knowledge, and challenge the students to make some contributions to the discussion.    2. Pneumatic system principles    3. Typical system schematic 5. Hydraulic and Pneumatic Systems Worksheet    1. Distribute and assign the Hydraulic and Pneumatic Systems Worksheet to the students. Teacher will go over the answers in class for better understanding    2. Assign worksheet    3. Teacher will go over worksheet in class   *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 \*** | Using Matching Terms and Definitions handout, students will pair-share and teach each other the terms and definitions. They may do computer-based research to look up the meaning.  *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 \*** | Students will do the computer-based research to look up and match the meaning of words on the handout, writing out definitions on a sheet of paper. Students will complete the Hydraulic and Pneumatic Systems Worksheet.  *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** | Question: Why are hydraulic and pneumatic systems necessary?  Answer: Hydraulic and pneumatic systems are necessary to accomplish heavy, complex labor processes. These processes are vital to our society. They save time and allow products to be produced faster and reduces manual labor.  Question: Identify equipment that depends on hydraulic and pneumatic systems.  Answer: Earth moving and agriculture equipment, hospital and dental equipment, automotive and aircraft brakes and steering systems.  Question: What is necessary to become good at maintaining hydraulic and pneumatic systems?  Answer: A high level of understanding of system operations. |
| **Summative/End of Lesson Assessment \*** | Informal Assessment:  Oral question/answer. Students will complete definitions teacher has on the board from terms in the definitions handout. Students will complete the Hydraulic and Pneumatic Systems Worksheet and will go over it in class with the teacher.  *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** | **Teacher Preparation:**  Teacher should review the Hydraulic and Pneumatic Systems Matching Terms and Definitions handout, and Hydraulic and Pneumatic Systems Worksheet. Teachers are also encouraged to conduct their own research on lesson material and prepare a presentation based on the lesson outline. Locate images of common hydraulic and pneumatic equipment such as bulldozers, forklifts, jackhammers, dental drills, photo examples of manual labor from early in the 20th century; and modern hydraulic and pneumatic equipment to show students during the presentation.  **References:**  1. O\*Net – www.onetonline.org  2. OSHA Safety Hazard Information Bulletin on Hydraulic Systems Preventive Maintenance, <https://www.osha.gov/dts/hib/hib_data/hib19920714.html>, (1992).  3. Safeguarding Equipment and Protecting Workers from Amputations, <http://www.osha.gov/Publications/OSHA3170/osha3170.html>, (2001).  4. Construction Safety and Health: Hand and Power Tools, <http://www.osha.gov/doc/outreachtraining/htmlfiles/tools.html>, (1996).  5. Hydraulic Presses, <http://www.sme.org/Wiki.aspx?id=61792&terms=hydraulic> , (2012).  6. Hydraulic Presses, <http://www.sme.org/Wiki.aspx?id=61792&terms=pneumatic> , (2012). |
| **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) | 1. Students can work in groups to find equipment schematics of other hydraulic and pneumatic systems; study them and discuss the operations within the group 2. Students can conduct research and identify a nearby manufacturing facility, then contact the maintenance supervisor and request a tour of the facility to find out more about how other hydraulic and pneumatic systems are maintained. If allowed they can take photos and conduct interviews and create a presentation for class |
| **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)