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| CTE Pathway/Program | Transportation Cluster |
| Class Name | Introduction To Industrial Technology (38001) |
| Grade level | Freshman/Sophomore |

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| Unit Title | Handtools & Measurement |
| Lesson Title | Introduction to handtools - Wrenches |
| Suggested Lesson Time | Two 50 minute class periods |
| Lesson Objectives | Upon completion of the lesson and activities, the students will be able to select, and use correctly, the proper wrench for service procedures as measured by responses on the Handtool Lesson 1 worksheet and Handtool & Measurement unit exam. |

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| Preparation | |
| *Instructor* | *Student* |
| References | Assignments |
| Modern Automotive Technology, 7th edition, James E. Duffy. ISBN 978-1-59070-957-3  Most automotive textbooks will have a chapter devoted to handtools. | Read Chapter 3 – Basic Handtools  p.34-36  Handtool Lesson 1 student worksheet to be completed during the lesson. |
| Instructional Media |
| PowerPoint Slideshow  Videos |
| Equipment and Tools |
| Computer with Projector, Internet access  Assorted wrenches |
| Materials |
| Lesson 1 Worksheet |

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| Introduction |
| Lesson 1 PowerPoint slide #2. Question: What is the function of handtools? What are the correct names of the tools pictured?  While some tools have different trade names, the correct name is what most manufactures will use in their catalogues. Knowing both will be useful to students, especially if they work with a technician as an intern. |

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| Information Presentation | |
| *Information* | *Key Points* |
| Day 1  Handtool Lesson 1 PowerPoint presentation (Slide #2)  Slide #3 – Introduction to Handtools  Slide #4 – Function of Tools  Slide #5 – Function of Wrenches  Slide #6 – Wrench Types | **Introduction: 35 Minutes**  Let several students share what they believe the function of a handtool is, and the names of the tools pictured.  Video: “The ABC’s of Handtools” (31:46 min)  **Instruction: 15 Minutes**  Emphasize that tools are used to make work easier. If job being done is very difficult you may not be using the correct tool for the task. Examples of tools that reduce apply forces include micro-surgery equipment.  Have the students share their opinions and list the types of wrenches they can come up with.    Explain that each type of wrench was specifically designed for a specific task to make it easier. Failing to use the correct wrench for the job may make the task difficult or damage the fastener. |
| Slide #7 – Wrench Sizes  Slide #8 – Standard Wrench Sizes  Slide #9 – Metric Wrench Sizes  Slide #10 – Standard Ignition Wrench Sizes  Slide #11 – Metric Ignition Wrench Sizes  Day 2  Slide #12 – Open End Wrenches  Slide #13 – Open End Wrenches  Slide #14 – Special Open End Wrenches  Slide #15 – Special Open End Wrenches  Slide #16 – Box End Wrenches  Slide #17 – Box End Wrenches  Slide #18 – Box End Wrench Types  Slide #19 – Box End Wrench Types  Slide #20 – Special Use Box End Wrenches  Slide #21 – Special Use Box End Wrenches  Slide #22 – Special Use Box End Wrenches  Slide #23 – Combination End Wrench  Slide #24 – Combination End Wrench  Slide #25 – Ratcheting Combination End Wrenches  Slide #26 – Adjustable Wrench  Slide #27 – Pipe Wrench  Slide #28 – Pipe Wrench  Slide #29 – Monkey Wrench  Slide #30– Flare Nut Wrench  Slide #31 – Flex Combination Wrench  Slide #32 – Oil Filter Wrench  Slide #33 – Strap Wrench  Slide #34 – Wheel Lug Wrench  Slide #35 – Safe Wrench Usage  Slide #36 – Safe Wrench Usage  Slide #37 - Activity | Note the wrench sizes correspond to bolt head or nut flat sizes with the exception of Whitworth bolts and wrenches  Use the slide to help students understand that standard wrench sizes are in 1/16th inch increments. Have students complete question #10 of the Handtool Lesson 1 worksheet  Note that many sets do not include every possible size.  Note that standard ignition wrenches are sized in 32nds of an inch. Have students complete question #11 of the Handtool Lesson 1 worksheet  Note that metric ignition wrenches are sized in .5 and 1mm increments. Have students complete question #12 of the Handtool Lesson 1 worksheet  **Introduction - Review wrench sizing**  PowerPoint slide pictures will animate first. See if students can identify the pictures first without the titles. Note the alternate term of “spanner” for wrench. Have samples of each wrench type to pass around.  Emphasize that open end wrenches should not be used to loosen tight bolts and nuts as they will damage the bolt or nut flats, rounding them.  Tappet Wrench  Demonstrate a ratcheting open-end wrench if available  Box end wrench identification  Emphasize the length and enclosed end for advantage over tight bolts and nuts.  Twelve point is the most common, but six point is available for bolts and nuts that are subject to rounding, such as exhaust manifold bolts and nuts.  Offsets provide swing room for fingers.  Obstruction box end identification  Distributor Wrench – note video link that shows a distributor wrench being used.  Demonstrate a ratcheting box end wrench  Combination wrench identification  Normally the first set of wrenches purchased by technicians. Note convenience of both open and closed end but lacks the length of a box end and the two different sizes that give the technician a better chance of picking the correct size wrench the first time.  Demonstrate ratcheting combination wrenches. Note some models have a reversing lever and flex-head design. Cheaper versions must be turned over to change direction.  Emphasize use only when the correct size wrench is not available. Common choice of farmers to carry in a small tractor tool box.  Pipe wrench identification  Very strong wrench good for rounded bolt removal, but large and hard to get into tight spaces  Early adjustable wrench, but large and bulking compared to the current adjustable wrench design (cresant)  Tubing wrench identification - helps to reduce the chance of rounding fuel and brake line fittings.  Flex Combination wrench identification – normally used by alignment shops. Great leverage for breaking rusted bolts loose without rounding.  Oil Filter wrench identification - pass different types around – discuss advantages and disadvantages of each.  Strap wrench identification – may be used on very tight oil filters, but clamping action may crush the filter can.  Lug wrench identification  Discuss the correct way to use wrenches safely and possible injuries if used incorrectly.  Demonstrate correct hand position for pushing on a wrench.  **Summary (5 Minutes)** |

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| Summary |
| Being able to select the correct size and type of wrench for the service task to be performed is an important skill for technicians to work productively and safely. Students should recognize that technicians desire a wide variety of tools because they understand that the right tool will make the service task easier and faster to complete allowing them to complete more service procedures earning them more income. |

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| Student Activities |
| Students will be writing answers to the questions in the Handtool Lesson 1 worksheet as the lesson progresses.  Shop activities could include:  Selecting the proper wrenches to complete an oil change on a given vehicle.  Using a lug wrench to remove wheel lug nuts.  Practice selecting the right size wrench by sight.  Identifying bolts as metric or standard (covered in later lesson) |

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| Student Evaluation |
| Students will hand in the Handtool Lesson 1 worksheet to be graded. Questions from this lesson will be included in the basic handtool quiz and handtool & measurement unit test. |