

**Gas Tungsten Arc Welding (GTAW)**

**Tennessee State Standards: CTE Writing Prompt and Literacy Close Reading Task**

<b>Career Cluster</b>	Advanced Manufacturing
<b>Grade-Band</b>	9-10
<b>Text</b>	<b>Text Complexity Analysis</b>
<b>Title:</b> “Igniting Advances in Weld Quality and Consistency”	<b>Quantitative:</b> Lexile: 1380
<b>Author:</b> Bernard Mannion	<b>Qualitative:</b> This article provides students with a background on changes in welding techniques, including specific information about using new technology and benefits of specific approaches. Domain-specific vocabulary and concepts make this text more complex.
<b>Citation/Publication Information:</b> Mannion, B. (1999, Jan.) “Igniting Advances in Weld Quality and Consistency.” <i>Job Shop Technology</i> . Retrieved July 15, 2013.	<b>Reader and Task:</b> Students need to have a basic understanding of vocabulary, or the text could be used to develop this knowledge with close reading. Images and illustrations assist with learning.
<b>Link:</b> <a href="http://www.pro-fusiononline.com/feedback/jst-jan99.htm">http://www.pro-fusiononline.com/feedback/jst-jan99.htm</a>	

<b>ELA/Literacy Tennessee State Standards addressed by task*</b>	
<b>Strand</b>	<b>Grades 9-10</b>
TN State Standards Reading for Technical Subjects: Key Ideas and Details	<ol style="list-style-type: none"> <li>1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</li> <li>2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</li> <li>3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.*</li> </ol>
TN State Standards Reading for Technical Subjects: Craft and Structure	<ol style="list-style-type: none"> <li>4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to <i>grades 9-10 texts and topics</i>.</li> <li>5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., <i>force, friction, reaction force, energy</i>).</li> </ol>

<p>TN State Standards Writing for Technical Subjects: Text Types and Purposes</p>	<p><b>2.</b> Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a) Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</li> <li>b) Develop the topic with well-chosen, relevant, and sufficient facts, definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</li> <li>c) Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.</li> <li>d) Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.</li> <li>e) Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>f) Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</li> </ul>
<p>TN State Standards Writing for Technical Subjects: Production and Distribution of Writing</p>	<p><b>4.</b> Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>
<p>TN State Standards Writing for Technical Subjects: Research to Build and Present Knowledge</p>	<p><b>9.</b> Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>TN State Standards Reading for Technical Subjects: Key Ideas and Details</p>	<ul style="list-style-type: none"> <li><b>1.</b> Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</li> <li><b>2.</b> Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</li> <li><b>3.</b> Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.*</li> </ul>

<b>Tennessee CTE Standards addressed by task</b>	
Welding II	<p>10) Safely set up equipment for gas tungsten arc welding (GTAW). Identify and explain the equipment, equipment setup, power sources, and the electrical current used in the welding process. Drawing on multiple resources, compare and contrast water-cooled welding torches versus air-cooled welding torches used in GTAW. Write a brief paper distinguishing the characteristics and the appropriate applications of each torch type. For example, determine which torch is preferred in production welding contexts and explain why. (TN Reading 2, 4, 5, 7, 9; TN Writing 2, 4)</p> <p>11) Refer to previous research conducted on the filler metal classification system by the American Welding Society (AWS). Discuss the multiple factors that affect electrode selection for gas tungsten arc welding (GTAW). For example, pure tungsten (EWP) is not typically used with alternating current (AC) welding of materials because it has poor heat resistance and electron emission. (TN Reading 2, 3, 4, 5, 7, 9; TN Writing 2, 4)</p> <p>12) Using various electrodes and the gas tungsten arc welding (GTAW) process, demonstrate how to pad beads and make fillet welds on plain carbon steel, stainless steel, and aluminum in all feasible positions (e.g., horizontal, flat, vertical, overhead). Summarize the demonstration results of using various electrodes and explain the findings using supporting evidence from the AWS metal classification system and other resources. (TN Reading 3, 4, 5, 7; TN Writing 2, 4; TN Math N-Q, G-GMD)</p> <p>13) Identify and explain the following distinctive features about gas tungsten arc welding (GTAW): arc-control, oxidation-prevention, and gas-shielded GTAW. Describe and demonstrate specific examples of how metal transfer is affected by various shielded gas GTAW (e.g., argon, helium, hydrogen, nitrogen). Identify which gases are noble inert gases and explain why this is a distinguishing characteristic. (TN Reading 2, 4, 5, 7, 9; TN Math N-Q, G-GMD)</p>

**What key insights should students take from these texts?**

1. How recent developments in the welding industry impact welding technique, quality, and the manufacturing engineer.
2. There are a variety of welding materials and techniques that impact final product characteristics.
3. Specific tools and advancements (such as tungsten electrode) allow for increased quality and consistency of welding output.
4. Two most popular methods used for precision joining are the gas tungsten arc welding (GTAW) process – also referred to as the tungsten inert gas (TIG) process – and the plasma weld process.

**Text-Dependent Questions**

1. What differences between gas and plasma weld processes are highlighted in the text?
2. What does Mannion conjecture is the most important element of the modern welding system? What evidence does he give for why this element is so important?
3. What impacts weld quality, according to the article?
4. Using evidence from the text, summarize how the process of gas tungsten arc welding (GTAW) – also referred to as the tungsten inert gas (TIG) process – works.
5. Using evidence from the text, summarize how the process of plasma welding works.

Writing Mode	Writing Prompt
Argumentative	Write an essay in which you compare and contrast the welding techniques of the gas tungsten arc welding (GTAW) process – also referred to as the tungsten inert gas (TIG) process – and the plasma weld process. Based on the information provided in the text, determine if one type is preferred and if so, why. Support your claim with an analysis of the material presented, using valid reasoning and sufficient evidence for support.

**Discussion:** This text could be explored orally and used to form the basic foundation of a lesson or series of lessons. Lexile scores are slightly higher than grade-band recommendations because of advanced vocabulary; however, the conventionality and organization of this text should allow comfortable access for students. Close-reading questions should be developed in advance in order to drive student understanding of the material while also practicing reading skills. For information on how to develop questions for this type of discussion, visit [http://www.tncore.org/english\\_language\\_arts/curricular\\_resources/text\\_dependent\\_questions.aspx](http://www.tncore.org/english_language_arts/curricular_resources/text_dependent_questions.aspx).

**Writing and/or Assessment:** The writing prompt included can be either a constructed-response assessment or a longer-term writing assignment for students to develop and refine over time to gauge student understanding of technical content as well as reading and writing skills as outlined by the Tennessee State Standards for English Language Arts in Technical Subjects. An appropriate writing rubric – such as those found at [http://tncore.org/literacy\\_in\\_science\\_and\\_technology/assessment/scoring\\_resources.aspx](http://tncore.org/literacy_in_science_and_technology/assessment/scoring_resources.aspx) – should be used to assess student work.

- **Assessment:** If using this material as an assessment, present text to students and provide them with the prompt and materials to use to construct their response. This should be a timed exercise (for example, 60 minutes). Use this exercise as an assessment to measure student progress toward reading and writing expectations as well as content knowledge. This is a good primer activity for state assessments.
- **Task:** If using this material as a writing task, you may scaffold the text with close readings and text-based questions to guide student exploration of the text. A culminating task of this lesson or sequence of lessons could be the writing prompt – either assigned in class, as homework, or as a report that is drafted and refined over time to build writing skills.

**Scaffolding and support for special education students, English language learners, and struggling readers:** Consider pre-teaching synonyms of difficult vocabulary words. Lower-level readers and ELL students can still be challenged without being overloaded with difficulty. This strategy can also be used to differentiate for stronger readers by introducing new, and more challenging, vocabulary. Struggling readers would also benefit from visual aids to illustrate many of the ideas presented. Pictures, diagrams, and charts alongside the text will go far to aide students as they dissect the article.

**Note:** Social, ethnic, racial, religious, and gender bias is best determined at the local level where educators have in-depth knowledge of the culture and values of the community in which students live. TDOE asks local districts to review these materials for social, ethnic, racial, religious, and gender bias before use in local schools.