

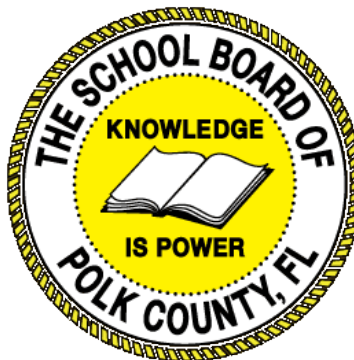
# Individual Test Item Specifications

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9200110- Automation and  
Production Technology 1

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2015



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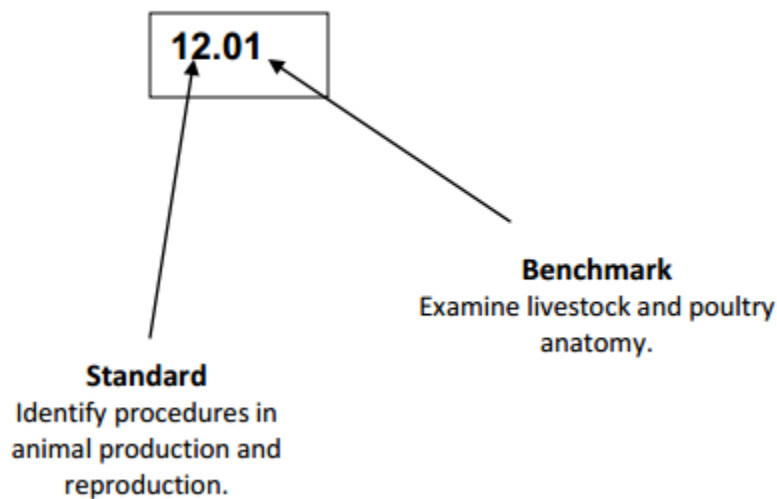
## I. Guide to the Individual Benchmark Specifications

Content specific guidelines are given in the *Individual Benchmark Specifications* for each course. The *Specifications* contains specific information about the alignment of items with the Florida Standards. It identifies the manner in which each benchmark is assessed, provides content limits and stimulus attributes for each benchmark, and gives specific information about content, item types, and response attributes.

### Benchmark Classification System

- Each Career and Technical Education course has its own set of course standards. The benchmarks are organized numerically, with two numbers separated by a decimal point. The first number is the standard number, and the second number is the benchmark number. You will see these numbers on the Item Specifications for each course.

An example, from Agritechnology 1:



*The image above describes the components of a Career and Technical Education Standard and Benchmark classification system.*

Each MAFS benchmark is labeled with a system of letters and numbers.

- The four letters in the *first position* of the label identify the **Subject**.
- The number(s) in the *second position* represents the **Grade Level**.
- The letter(s) in the *third position* represents the **Category**.
- The number in the fourth position shows the **Domain**.
- The number in the *fifth position* identifies the **Cluster**.
- The number in the last position identifies the specific **Benchmark**.



*The image above describes the components of a Florida Standard and Benchmark classification system.*

## Definitions of Benchmark Specifications

The *Individual Benchmark Specifications* provides standard-specific guidance for assessment item development for the Florida Department of Education Career and Technical Education item banks. For each benchmark assessed, the following information is provided.

<b>Reporting Category</b>	is a grouping of related benchmarks that can be used to summarize and report achievement.
<b>Standard</b>	refers to the standard statement presented in the Florida Standards.
<b>Benchmark</b>	refers to the benchmark statement presented in the Florida Standards. In some cases, two or more related benchmarks are grouped together because the assessment of one benchmark addresses another benchmark.
<b>Item Types</b>	are used to assess the benchmark or group of benchmark.
<b>Cognitive Complexity</b>	ideal level at which item should be assessed.
<b>Benchmark Clarifications</b>	explain how achievement of the benchmark will be demonstrated by students. In other words, the clarification statements explain what the student will do when responding to questions.
<b>Content Limits</b>	define the range of content knowledge and that should be assessed in the items for the benchmark.
<b>Stimulus Attributes</b>	define the types of stimulus materials that should be used in the items, including the appropriate use of graphic materials and item context or content.
<b>Response Attributes</b>	define the characteristics of the answers that a student must choose or provide.
<b>Content Focus</b>	addresses the broad key terms and concepts associated with the examples found in the standards, benchmarks, or benchmark clarifications.
<b>Sample Items</b>	are provided for each type of question assessed. The correct answer for all sample items is provided.

<b>Standard</b>	04.0 Demonstrate an understanding of the core concepts of technology.
<b>Benchmark</b>	4.03 Identify new technologies that create new processes.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	The student will explain the safety requirements related to LOTO procedures.
<b>Content Focus</b>	Energy Source, Location, Lock, Tag, Hasp, Key Holder, Injury, Death, Authorized Employee, Affected Employee
<b>Content Limits</b>	Include knowledge of all processes, procedures, and safety requirements in regard to controlling energy sources on industrial machinery. Exclude specific procedures for specific pieces of machinery in specific settings.
<b>Stimulus Attributes</b>	Stimulus may include: Multiple choice may include the following, stem phrased as a question, scenarios, graphics, images, or charts as appropriate. Short Answer may include, scenarios graphics, images or charts as appropriate. Performance tasks may include, actual procedures, scenarios and demonstration
<b>Response Attributes</b>	Responses may include the following: -MC: one correct answer with three incorrect distractors. -Short response: Student written words, phrases or sentences. -Performance Task: Student actions in response to stimuli.
<b>Sample Item</b>	As plant manager, you are notified that maintenance failed to remove a Lock Out / Tag Out device from a piece of machinery. You are fairly certain that all employees from the previous shift have gone home and you need this machine to run parts for delivery tomorrow. In a few sentences, decide how to proceed. You must balance customer need with worker safety and OSHA Lock Out / Tag Out requirements.  Rubric: 2 Points – Student’s decision balances production needs with worker safety in a thoughtful and insightful manner. Response shows evidence that the student understands the importance of Lock Out / Tag Out in regard to employee safety and well-being. 1 point – Student address either production needs or employee safety. Response is thought out and still shows evidence that the student understands

	<p>the importance of Lock Out/Tag Out in regard to employee safety and well-being.</p> <p>0 Points - Given answer could lead to injury or death of an employee. The response may lack thoughtfulness or insight. Response may indicate that the student does not understand the importance of Lock Out / Tag Out in regard to employee safety and well-being.</p>
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<b>Standard</b>	4.0 Demonstrate an understanding of the core concepts of technology.
<b>Benchmark</b>	4.04 Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)= (ER)=X
<b>Cognitive Complexity Level</b>	Moderate-High
<b>Benchmark Clarification</b>	Given design criteria/constraints students will discuss/determine appropriate choices for a product's final design.
<b>Content Focus</b>	Design brief, constraint, criteria, trade off
<b>Content Limits</b>	All processes, procedures and actions relating to the benchmark. Exclude questions regarding specific classroom activities/equipment unless details of those activities/equipment will be given in the stimulus.
<b>Stimulus Attributes</b>	Stimulus may consist of stems phrased as questions in regard to the benchmark. Stimuli may include diagrams, tables, and graphics when appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	<p>A toy manufacturer wants to produce a new type of radio controlled robot. The robot should be sturdy enough to lift five pounds from the ground and light enough to be powered by an 18 volt battery. The robot will be approximately 1 foot wide x 1 foot tall x 2 foot wide. With all mechanisms and accessories, the robot cannot weigh more than 15 pounds. Given these constraints, which of the following materials would be the most suitable for the body and chassis of this robot?</p> <ul style="list-style-type: none"> <li>A. cast iron chassis with nylon skin</li> <li>B. stainless steel chassis with metal skin</li> <li>C. aluminum chassis with ABS plastic skin</li> <li>D. brass chassis with copper alloy skin</li> </ul> <p>Correct Answer: C</p>



<b>Standard</b>	4.0 Demonstrate an understanding of the core concepts of technology.
<b>Benchmark</b>	4.09 Outline complex systems that have many layers of controls and feedback loops to provide information.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)= (P)=X (ER)=X
<b>Cognitive Complexity Level</b>	Moderate-High
<b>Benchmark Clarification</b>	Students will analyze the operation of physical objects as a system. Further, they should be able to identify the parts of that system in a flow diagram or chart to illustrate the inter-relationship between the parts of that system.
<b>Content Focus</b>	Input, controller, process, output, open feedback loop, closed feedback loop
<b>Content Limits</b>	All processes, procedures and actions relating to analyzing the operation of a physical object as a system with discrete but inter-related parts. Exclude questions regarding specific classroom activities/equipment unless details of those activities/equipment will be given in the stimulus.
<b>Stimulus Attributes</b>	Stimulus may consist of stems phrased as questions in regard to the benchmark. Stimuli may include diagrams, tables, and graphics when appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	<p>How do you make the perfect pancake? Create a system map to demonstrate the procedure for making the perfect pancake. You must specifically state what the actual parts of the system are for full credit. Also, this must be a closed loop system for full credit.</p> <p>2 points Student used proper symbols to demonstrate the parts of the system and the flow of the system. Student specifically labeled each part of the system (ie, they did not simply put down “input, process, output etc). Student included some type of specific feedback loop to control the quality of the pancake.</p> <p>1 point. Student used proper symbols to demonstrate the parts of the system and the flow of the system. Student specifically labeled most parts of the system (ie, they did not simply put down “input, process, output etc).</p> <p>0 Points Student did not use proper symbols to map the system. Or they did not specifically label the parts of their system.</p>

<b>Standard</b>	5 .o Demonstrate an understanding of the influence of technology on history as well as its cultural, social, economic, and political effects.
<b>Benchmark</b>	5.02 Define the folLowing "Ages" to show the progression and their impact on society: Iron Age, Middle Ages, Renaissance, Industrial Revolution, and the Information Age.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)=X (P)= (ER)=
<b>Cognitive Complexity Level</b>	Low-Moderate
<b>Benchmark Clarification</b>	Students will describe the interaction between technology and history throughout the various stages of human history. This is to be a big picture view of history, focusing only on major developments in technology that made positive and negative impacts on human culture and society.
<b>Content Focus</b>	Iron Age, Middle Ages, Renaissance, Industrial Revolution, Information Age
<b>Content Limits</b>	Students will recognize the major characteristics and developments in each of the given ages. Exclude obscure or insignificant facts/developments that had limited impact on human society. Also, exclude developments that fall outside of the generally accepted chronological boundaries of the given ages.
<b>Stimulus Attributes</b>	Stimulus may consist of stems phrased as questions in regard to the benchmark. . Stimuli may include diagrams, tables, and graphics when appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	Which of the folLowing technological developments would most correctly be placed in the Industrial Revolution? A. Heavy PLow B. Patent Laws C. Printing Press D. Smelting Iron Correct Answer: B

<b>Standard</b>	6.0 Demonstrate an understanding of the attributes of engineering design.
<b>Benchmark</b>	6.01 Describe the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)=X (P)= (ER)=
<b>Cognitive Complexity Level</b>	Low-Moderate
<b>Benchmark Clarification</b>	Describe the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
<b>Content Focus</b>	Design Process
<b>Content Limits</b>	Students should be able to describe the design process. Limit the actual stages in the design process to the stages outlined by the course frameworks.
<b>Stimulus Attributes</b>	Stems may be phrased as questions and may include graphics, diagrams, pictures and other media as appropriate. May also include examples of projects in various stages of the design for students to analyze.
<b>Response Attributes</b>	Responses may consist of three distractors with one right answer. Responses may also consist of student sentences / phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	You are working on a cross functional team that is performing material and product failure analysis on a new prototype for an existing product. In which phase of the design process are you most likely? A. Creating or Making the product B. Identifying criteria and specifying constraints C. Researching and generating ideas D. Testing and evaluating the design Correct Answer: D

<b>Standard</b>	6.0 Demonstrate an understanding of the attributes of engineering design.
<b>Benchmark</b>	6.03 Restate design problems that are seldom presented in a clearly defined form.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)= (P)=X (ER)=X
<b>Cognitive Complexity Level</b>	Moderate-High
<b>Benchmark Clarification</b>	Students will clearly state a design problem given a scenario in which the design issues are unclear.
<b>Content Focus</b>	Design brief
<b>Content Limits</b>	All processes, procedures and actions relating to the benchmark. Exclude questions regarding specific classroom activities/equipment unless details of those activities/equipment will be given in the stimulus.
<b>Stimulus Attributes</b>	Stimulus may consist of stems phrased as questions in regard to the benchmark. Stimuli may include diagrams, tables, and graphics when appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	<p>While inspecting parts from a drill press you notice that a particular hole is off by <math>\frac{1}{4}</math>" every tenth part. After investigation, you discover that the robotic arm that feeds the drill press taps the part guides on the drill press table every time it moves over them. By the tenth part, an operator has to manually tighten the guides. Which of the following most accurately restates the design problem presented in this scenario?</p> <ul style="list-style-type: none"> <li>A. An operator got mad because he had to retighten the machine after every 10 parts.</li> <li>B. The part guides on this process need to be adjusted so that they are completely out of the robot's path.</li> <li>C. Every tenth part from this drill press is scrap due to operator error.</li> <li>D. This drill press needs to be recalibrated so that it drills in the same place every time.</li> </ul> <p>Correct Answer: B</p>

<b>Standard</b>	7.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.
<b>Benchmark</b>	7.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)= (P)=X (ER)=X
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	Students will demonstrate knowledge of good work place behavior and will be able to address improper behavior in a professional manner.
<b>Content Focus</b>	Professional behavior, dress code, code of conduct, ethical behavior
<b>Content Limits</b>	General proper workplace behavior. Exclude classroom/company specific policies if the policy wont be clearly stated in the stem.
<b>Stimulus Attributes</b>	Stems may be phrased as questions and may include graphics, diagrams, pictures and other media as appropriate. May also include examples of work place policy for students to analyze.
<b>Response Attributes</b>	Responses may consist of three distractors with one right answer. Responses may also consist of student sentences / phrases that demonstrate knowledge in this area. Responses may also consist of actions that demonstrate knowledge of good workplace behavior.
<b>Sample Item</b>	<p>As a plant manager, you are interviewing candidates for new front line production technicians. As one interviewee enters your office, you realize it is someone that you dated in High school. This individual and yourself parted ways as friends, and have not had any contact since graduation; however, you are still fond of this individual. Their resume reveals a poor work history with multiple changes in employer over a short period of time. Additionally, their pre-interview screening profile reveals that they are only marginally qualified for the job. Why would you hire this individual? In a few short sentences, address whether or not you would hire this individual for the job. You must include at least two logical reasons to support your decision in your answer. Your answer must display evidence that you understand the ethics of this dilemma.</p> <p>Rubric 2 Points Answer is direct and certain. Two logical reasons are given. Answer also gives a well thought out response in regard to this ethical dilemma. 1 Point</p>

	<p>Answer is direct and certain. One logical reason is given. Answer seems to take into account the workplace ethics involved in making this decision.</p> <p>0 Points</p> <p>Answer is not direct or certain. Or, no logical reasons given. Or, answer seems to be swayed more by emotion than logic. No thought or care is given to the ethics involved in making this decision.</p>
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<b>Standard</b>	7.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.
<b>Benchmark</b>	7.02 Discuss motivation and human behavior.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)= (ER)=X
<b>Cognitive Complexity Level</b>	Low-moderate
<b>Benchmark Clarification</b>	Students will discuss differing theories of human motivation and behavior
<b>Content Focus</b>	Internal / external motivators
<b>Content Limits</b>	General and accepted theories of human motivation. Obscure, contested, politically motivated, religiously motivated, or personal views/opinions should be excluded.
<b>Stimulus Attributes</b>	Stems may be phrased as questions and may include graphics, diagrams, pictures and other media as appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one right answer. Responses may also consist of student sentences / phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	<p>As a plant manager, you are concerned about creating a compensation package that encourages employee loyalty and innovation. Using Herzberg's Hygiene-Motivation theory, which of the following benefits would most likely attract and retain talented and creative employees?</p> <ul style="list-style-type: none"> <li>A. maternal / paternal paid leave</li> <li>B. comprehensive medical and dental benefits</li> <li>C. pay scale that doubles what closest competitors offer</li> <li>D. weekly free periods to explore self-directed projects</li> </ul> <p>Correct Answer: D</p>

<b>Standard</b>	7.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.
<b>Benchmark</b>	7.05 Demonstrate knowledge of techniques for making effective presentations to internal and external customers.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)= (P)=X (ER)=X
<b>Cognitive Complexity Level</b>	Low-Moderate
<b>Benchmark Clarification</b>	Students will demonstrate good technique or good choice of technique for delivering presentations to a group of their peers.
<b>Content Focus</b>	Internal/external customer
<b>Content Limits</b>	All processes, procedures and actions relating to the benchmark. Exclude questions regarding specific classroom activities/equipment unless details of those activities/equipment will be given in the stimulus.
<b>Stimulus Attributes</b>	Stimulus may consist of stems phrased as questions in regard to the benchmark. Stimuli may include diagrams, tables, and graphics when appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	Which of the following should you do as a presenter to engage your audience? A. Speak in a calm, monotone voice B. Speak as loudly as possible C. Speak with different inflections and tones D. Speak directly from notecards. Correct Answer: C

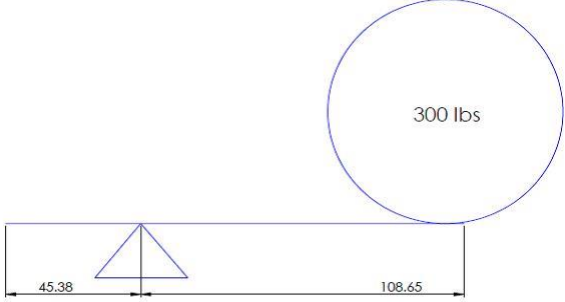


<b>Standard</b>	8.0 Demonstrate an understanding of workplace safety and workplace organization.
<b>Benchmark</b>	8.01 Locate and use Material Safety Data Sheets (MSDS).
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)=X (P)= (ER)=
<b>Cognitive Complexity Level</b>	Low
<b>Benchmark Clarification</b>	The student will locate and use MSDS sheets as is appropriate to a production environment.
<b>Content Focus</b>	Right to know, MSDS, OSHA, ANSI, Flammable, Combustible, NFPA 704
<b>Content Limits</b>	Include all processes, procedures and actions related to using an MSDS sheet. Exclude any technical chemical information that might be specific to a compound or industry. Also, exclude classroom specific processes and procedures as well as issues related to PPE, HAZ MAT, and clean up (these items are handled in other standards).
<b>Stimulus Attributes</b>	Stimulus may include an MSDS sheet or visual clue/representation for students to reference. Stimulus may also include scenarios in which student uses or interprets MSDS information.
<b>Response Attributes</b>	Selected response items may include three incorrect distractors and one correct answer. Performance response will include student actions regarding the processes or procedure of using an MSDS sheet.
<b>Sample Item</b>	In general, under which section of an MSDS would an employee look if they were concerned about the affects of exposure to a chemical compound? A. Accidental Release Measures B. Exposure Controls C. First Aid Measures D. Hazards Identification. Correct Answer: D

<b>Standard</b>	8.0 Demonstrate an understanding of workplace safety and workplace organization.
<b>Benchmark</b>	8.14 Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)= (P)=X (ER)=X
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	The student will demonstrate knowledge of general machine safeguards and may include machine guards, safety interlocks, emergency stops, light curtains, circuit breakers, ventilation systems, etc.
<b>Content Focus</b>	Engineering Control, Machine Guard, E-Stop, Light Curtain, Pinch Point, Interlock, Ventilation System, Redundant Control
<b>Content Limits</b>	May include all processes, procedures and actions relating to inspecting a machine for safety before operation. Excludes PPE.
<b>Stimulus Attributes</b>	Question or scenario related to the safe operation of machinery. May include inspections of actual machinery or inspection of graphics/visual cues.
<b>Response Attributes</b>	Selected response items may include three incorrect distractors and one correct answer. Performance response will include student demonstrations of knowledge regarding machine safety inspection
<b>Sample Item</b>	<p>Sam is the supervisor at a fabrication plant. An employee complained that the guarding near a specific point of the machine makes it uncomfortable to operate. The machine is set up to run a job that utilizes platforms and conveyors that are adjustable in height. Considering safety, ergonomic, and legal concerns, what would be the best action for Sam to take?</p> <ul style="list-style-type: none"> <li>A. Remove the guarding for the employee and post a sign above the hazardous area.</li> <li>B. Explain why the guarding is necessary and tell the employee to get back to work.</li> <li>C. Retrain the employee for the standard operating procedure on that machine.</li> <li>D. Leave the guarding in place and adjust the machine set up for employee comfort.</li> </ul> <p>Correct Answer: D</p>

<b>Standard</b>	8.0 Demonstrate an understanding of workplace safety and workplace organization.
<b>Benchmark</b>	8.15 Identify procedures for handling hazardous material.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Low-Moderate
<b>Benchmark Clarification</b>	The student will demonstrate knowledge of proper handling of hazardous materials including storage, clean up, and required PPE during clean up operations. Students will also demonstrate knowledge of proper first aid response to material exposure.
<b>Content Focus</b>	May include: MSDS, HMIRS, B-NICE, B-LEVE, Carcinogen, Permissible Exposure Limit, Immediately Dangerous to Life and Health
<b>Content Limits</b>	May include all processes, procedures and actions related to the proper handling, storage, and emergency response for hazardous materials. It should exclude any information that is proprietary to a specific hazardous compound, hazardous compound manufacturer, or brand of PPE.
<b>Stimulus Attributes</b>	Stimulus may include actual MSDS sheets and NFPA 704 Diamonds. Stimuli may ask students to interpret MSDS sheets or create labels for compounds using MSDS sheets. Stimuli may also ask students to identify appropriate PPE and procedures for the storage, use, and clean up of a given chemical compound if the question also includes the MSDS for that compound. Or stimulus may ask general questions regarding the pertinent areas of a standard MSDS sheet in regard to chemical storage, use and clean up.
<b>Response Attributes</b>	Selected Response items may include incorrect distractors and one correct answer. Short Answer questions will include student phrases and sentences that indicate knowledge of hazardous material storage, use, and clean up. Performance Response will include student demonstrations of knowledge regarding hazardous material storage, use and clean up.
<b>Sample Item</b>	As a building maintenance person, you are called to clean up a chemical spill. What general steps would you take prior to cleaning up the spill? Rubric 2 Points - Student response focuses on checking the MSDS sheet in all of the following areas: Exposure Controls, Handling and Storage, Accidental Release, and Hazard Identification. 1 Point - Student response addresses two of the above mentioned MSDS sheet 0 - Points Student response addresses one or fewer of the above mentioned MSDS areas.

<b>Standard</b>	8.0 Demonstrate an understanding of workplace safety and workplace organization.
<b>Benchmark</b>	8.26 Selection and use of personal protective equipment (PPE).
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	The student will demonstrate knowledge of when PPE is necessary. Student will select appropriate PPE for a task, given information from multiple sources (MSDS sheets, Job Hazard Analysis, Work Instructions, etc). The student will demonstrate knowledge of common PPE for general industrial settings. The students will demonstrate knowledge of the use, storage, and maintenance of common pieces of PPE.
<b>Content Focus</b>	Engineering Control, SCBA, Positive Pressure Check, Negative Pressure Check, Respirator, z87, z89
<b>Content Limits</b>	Students will understand how and why PPE is selected for a specific job, students will understand how to don and doff basic PPE, and how to properly care for general PPE. Questions should not cover processes, knowledge, or action in regard to a specific brand of PPE unless the data sheet for that PPE is made available in the test question.
<b>Stimulus Attributes</b>	Stimulus May include- Multiple Choice: May include the following, stem phrased as a question, scenarios, graphics, images, or charts as appropriate. - Short Answer: May include scenarios, graphics, images or charts as appropriate. - Performance tasks may include actual procedures, scenarios and demonstration
<b>Response Attributes</b>	Selected response items may include incorrect distractors and one correct answer. Short Answer questions will include student phrases and sentences that indicate knowledge of PPE choice, use, and care. Performance Response will include student demonstrations of knowledge regarding PPE choice, use, and care
<b>Sample Item</b>	As a production technician, you are assigned to a work station in which it is possible for particulate to enter your eyes. What is the appropriate OSHA approved PPE for this specific hazard? A. safety glasses rated z87 B. safety glasses rated z89 C. safety glasses rated z80 D. safety glasses rated z82 Correct Answer: A

<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.06 Calculate and measure the mechanical advantage of a first-class, second-class, and third-class lever.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)=X (P)=` (ER)=`
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	Given a type of lever students will express mechanical advantage gained by the use of the lever through one of the two formulas:(ideal mechanical advantage) $IMA = D_e / D_r$ or (actual mechanical advantage) $AMA = F_r / F_e$ where $D_e$ = distance from the effort end to the folcrum, $D_r$ = distance from the resistance end to the folcrum, $F_r$ = Force at the resistance end and $F_e$ = Force at the effort end. Students will choose which formula is appropriate for a given scenario.
<b>Content Focus</b>	IMA, AMA, Class 1 Lever, Class 2 lever, Class 3 Lever
<b>Content Limits</b>	Students will apply IMA and AMA to levers regardless of class. Discussions should exclude mechanical advantage of any other simple machine. These are covered in seperate standards.
<b>Stimulus Attributes</b>	Stimulus may consist of a stem/question that asks students to perform calculations. Tables and graphics may be provided when appropriate in addition to a written stem to communicate data that is pertinent to the question.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	 <div style="border: 1px solid black; padding: 5px;"> <p>The image on the left describes the components of a lever. The circle on the right-side represents the weight, the triangle on the left-side represents the fulcrum, and the rectangle represents the lever.</p> </div>

Given the lever pictured above, what is the least amount of effort (rounded to the nearest whole number) required to move the resistance end upward in direction?

- A. 7 Lbs
- B. 125 Lbs
- C. 126 lbs
- D. 717 Lbs

Correct Answer: C ( $108.65 / 45.38 = \text{MA of } 2.39$ .  $300/2.39 = 125.52$ , rounded to 126).

<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.07 Calculate the coefficient of friction given application data.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)=X (P)= (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	The student will describe the coefficient of friction between two objects as the force required to move one object over the other divided by the force holding them together. $\mu = F / N$ . Where $\mu$ = Coefficient, $F$ = applied force, $N$ = Normal Force.
<b>Content Focus</b>	Friction, Static Energy, Kinnet Energy, Static Friction, Rolling Friction, Kinetic Friction, Kinetic Force, Normal Force,
<b>Content Limits</b>	Students will calculate the coefficient of friction given data. The students will also use tables with coefficients of friction for common materials in calculations. Exlude classroom or application specific items.
<b>Stimulus Attributes</b>	Stimulus may consist of a stem/question that asks students to perform calculations. Tables and graphics may be provided when appropriate in addition to a written stem to communicate data that is pertinent to the question.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area.
<b>Sample Item</b>	A small robot needs to slide a 2.72 N block along a flat path. The robot needs to exert 2.09 N of force to slide this block. What is the coefficient of friction for this applicaiton? A. .7684 B. 1.301 C. 1.000 D. .3426 Correct Answer: A

<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.26 Install and adjust a pilLow block antifriction bearing and shaft.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	The student will install and adjust pilLow block bearings and shafts for simple applications. The student will understand how to allign shafts and inspect bearings for signs of wear as well. The student will recognize misalignment conditions.
<b>Content Focus</b>	PilLow Block Bearing, Seal, Lubrication, Shaft, Coupling, Alignment, Misalignment.
<b>Content Limits</b>	Students will demonstrate knowledge of all processes, procedures and actions related to the installations of bearings in a simple power transmission system. Exclude specific questions about belt, chain, pulley, or gear alignment under this standard.
<b>Stimulus Attributes</b>	Stimulus may consist of stems phrased as questions in regard to bearing installation and care. Stimuli may also include specific performance tasks relating to the installation of pilLowblock bearings. Stimuli may include diagrams, tables, and graphics when appropriate in regard to pilLow block bearing installation.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area. Performance tasks may include student actions, procedures and processes that demonstrate the ability to properly install pilLow block bearings.
<b>Sample Item</b>	<p>During job change over you notice that there is excessive grease showing around the outside of a pilLow block bearing. What is the next best course of action?</p> <ul style="list-style-type: none"> <li>A. check predictive maintenance schedule for bearing age and do vibration analysis</li> <li>B. clean the excess grease from the bearing and re-lubricate according to specifications</li> <li>C. replace the bearing and document the defective equipment according to company policy</li> <li>D. watch the bearing while it runs for ten minutes and re-lubricate if excessive heat is detected</li> </ul> <p>Correct Answer: B</p>



<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.31 Calculate and measure the mechanical advantage of a pulley combination.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)=X (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	Students will calculate and measure the mechanical advantage of a movable pulley system.
<b>Content Focus</b>	IMI, AMA, Load, Effort, Attachment Point, Pulley Block, Sheve,
<b>Content Limits</b>	All processes, procedures, and actions relating to calculating and measuring mechanical advantage of pulleys. Exclude questions regarding compound pully systems.
<b>Stimulus Attributes</b>	Stems may be prhased as questions and may include graphics, diagrams, pictures and other media as appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area. Performance tasks may include student actions, procedures and processes that demonstrate the ability to calculate/measure mechanical advantage for pulley applications.
<b>Sample Item</b>	An employee needs to lift 400lbs two feet into the air before placing the load onto a table. The employee has medical restrictions that prevent him from exerting more than 30 lbs of force at any time during the day. How many pulleys and what length of rope should you provide to this employee? A. 7 pulleys, 2 feet of rope B. 7 pulleys, 14 feet of rope C. 14 pulleys, 2 feet of rope D. 14 pulleys, 28 feet of rope Correct Answer: D

<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.33 Calculate and measure the mechanical advantage of a gear drive.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)=X (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	Students will calculate and measure the mechanical advantage gained by using gears in differing combinations for different applications.
<b>Content Focus</b>	IMI, AMA, mesh, drive gear, driven gear
<b>Content Limits</b>	All processes, procedures and actions relating to calculating and measuring mechanical advantage of gear drives. Exclude questions relating to gear direction.
<b>Stimulus Attributes</b>	Stems may be phrased as questions and may include graphics, diagrams, pictures and other media as appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area. Performance tasks may include student actions, procedures and processes that demonstrate the ability to calculate and measure mechanical advantage in gear drives.
<b>Sample Item</b>	What is the rotational speed of a 30 tooth gear that is driven by a 10 tooth gear on a 2000 RPM DC motor? A. 67 RPMs B. 200 RPMs C. 600 RPM s D. 667 RPMs Correct Answer: D

<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.36 Install and align a fractional HP V-belt drive with a finished bore.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)= (SA)= (P)=X (ER)=X
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	Students will properly install and align a v-belt drive. In addition, students will recognize misalignment, wear, and other maintenance issues in regard to V-belt drives.
<b>Content Focus</b>	Verticle angle misalignment, Horizontal angle misalignment, Parallell misalignment, Preventative maintenance, Belt tension
<b>Content Limits</b>	All processes, procedures and actions relating to installing and aligning a V belt drive system. Exclude items specific to other types of belt drive systems.
<b>Stimulus Attributes</b>	Stems may be prhased as questions and may include graphics, diagrams, pictures and other media as appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area. Performance tasks may include student actions, procedures and processes that demonstrate the ability to properly install v-belts.
<b>Sample Item</b>	<p>When setting up a V-Belt pulley drive you notice that the bottom of the V-belt is riding in the bottom of the groove of the drive pulley. What does this indicate about the state of pulley and the belt?</p> <p>A. The pulley is fine, the belt needs to be replaced.  B. The belt is fine, the pulley needs to be replaced.  C. Both the belt and pulley are fine, no adjustments are needed.  D. Both the belt and pulley are worn, both should be replaced.</p> <p>Correct Answer: B</p>

<b>Standard</b>	9.0 Demonstrate an understanding of mechanisms.
<b>Benchmark</b>	9.42 Install and align a roller chain drive system with adjustable centers.
<b>Item Types</b> (MC)-Multiple Choice (SA)-Short Answer (P)-Performance (ER)-Extended Response	(MC)=X (SA)= (P)=X (ER)=
<b>Cognitive Complexity Level</b>	Moderate - High
<b>Benchmark Clarification</b>	Students will properly install and align a roller chain drive system. In addition they will recognize installation and maintenance issues in regard to chain drives.
<b>Content Focus</b>	Masterlink, Chain Sag, lubrication
<b>Content Limits</b>	All processes, procedures and actions relating to installing and aligning roller chain drives. May include questions regarding maintenance that relate to the installation of chain drives as well. Exclude information that is specific to other types of chain drives.
<b>Stimulus Attributes</b>	Stems may be phrased as questions and may include graphics, diagrams, pictures and other media as appropriate.
<b>Response Attributes</b>	Responses may consist of three distractors with one correct answer. Responses may also consist of student sentences/phrases that demonstrate knowledge in this area. Performance tasks may include student actions, procedures and processes that demonstrate the ability to properly install chain drives
<b>Sample Item</b>	<p>Install and align a roller chain drive system. Sprockets must be aligned, leveled and spaced at 6" from centers. The chain sag should be adjusted to 1/8." Additionally, all mounting bolts must be secured at 10 ft/lbs of torque.</p> <p>Items needed:</p> <ol style="list-style-type: none"> <li>1) 1/3 HP electric motor</li> <li>2) 2 PilLow Block bearing standoffs</li> <li>3) 2 Sprockets</li> <li>4) Chain</li> <li>5) Adjustable motor mount.</li> <li>6) 2) keys</li> <li>7) 12" Shaft</li> <li>8) Nuts / Bolts</li> <li>9) Socket / Wrench Set</li> <li>10) Torque Wrench</li> <li>11) Tape Measure</li> </ol>

	<p><b>Rubric</b></p> <p><b>4 Points</b> All of the following is present / true in regard to the belt drive.</p> <ol style="list-style-type: none"> <li>1) Drive works (it transfers power / motion from the drive pulley to the driven pulley).</li> <li>2) Sprockets are properly aligned, and leveled.</li> <li>3) All components properly tightened.</li> <li>4) Area around the drive is clean and free from excess lubrication, unused / unneeded tools, and other debris.</li> <li>5) Chain sag is correct.</li> </ol> <p><b>3 Points</b> All of the following is present / true in regard to the belt drive.</p> <ol style="list-style-type: none"> <li>1) Drive works (it transfers power / motion from the drive pulley to the driven pulley).</li> <li>2) Three of the items 2-5 listed above are true.</li> </ol> <p><b>2 Points</b> All of the following is present / true in regard to the belt drive.</p> <ol style="list-style-type: none"> <li>1) Drive works (it transfers power / motion from the drive pulley to the driven pulley).</li> <li>2) Two of the items 2-5 listed above are true.</li> </ol> <p><b>1 Points</b> All of the following is present / true in regard to the belt drive.</p> <ol style="list-style-type: none"> <li>1) Drive works (it transfers power / motion from the drive pulley to the driven pulley).</li> <li>2) One of the items 2-5 listed above are true.</li> </ol> <p><b>0 Points</b> All of the following is present / true in regard to the belt drive.</p> <ol style="list-style-type: none"> <li>1) Drive doesn't work or..</li> <li>2) Drive works, but none of the items 2-5 are true.</li> </ol>
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