



**California
Subject
Examinations for
Teachers®**

TEST GUIDE

**INDUSTRIAL AND TECHNOLOGY
EDUCATION
SUBTEST II**

**Sample Questions and Responses
and Scoring Information**

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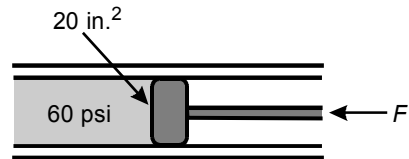
Sample Test Questions for CSET: Industrial and Technology Education Subtest II

Below is a set of multiple-choice questions and constructed-response questions that are similar to the questions you will see on Subtest II of CSET: Industrial and Technology Education. You are encouraged to respond to the questions without looking at the responses provided in the next section. Record your responses on a sheet of paper and compare them with the provided responses.

1. The release of electrons due to the interaction of a photon and a semiconductor is the basis of operation for which of the following devices?

- A. photovoltaic cells
- B. bipolar transistors
- C. light-emitting diodes
- D. thermocouples

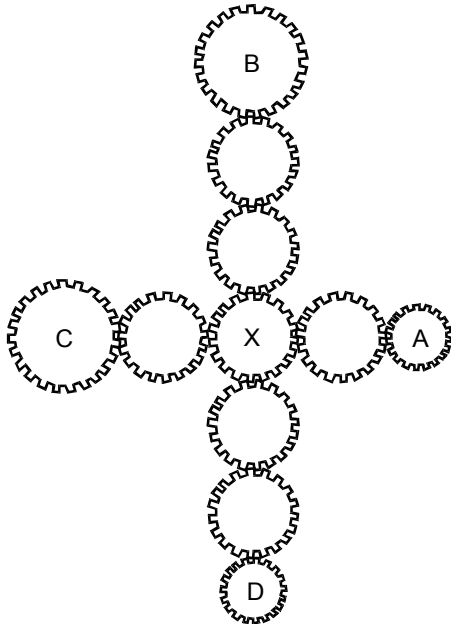
2. Use the diagram below to answer the question that follows.



A piston has a surface area of 20 in.². What force must be applied to the piston to produce a pressure of 60 psi in the cylinder?

- A. 3 lbs.
- B. 80 lbs.
- C. 1,200 lbs.
- D. 3,600 lbs.

3. Use the diagram below to answer the question that follows.

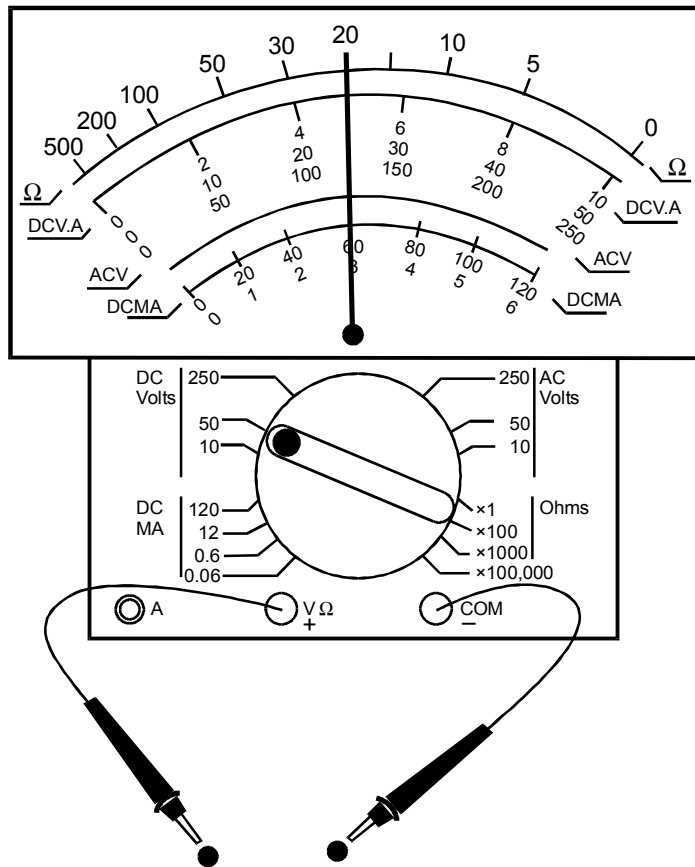


Which of the following gears in the diagram is rotating at a slower speed than, but in the same direction as, the gear labeled X?

- A. A
- B. B
- C. C
- D. D

4. Which of the following best describes how geothermal energy is used to produce electricity?
- A. Wells drilled into large underground caverns release a steady stream of highly pressurized hot air that is used to power turbines at the surface.
 - B. Warm water from underground reservoirs rises upward through wells and powers turbines that are placed in the well casings.
 - C. Hot water from deep underground is pumped into reservoirs where it is used to heat local homes and generate electricity in turbines placed in spillways.
 - D. Hot water from deep underground turns to steam, which rises upward through wells and is used to power turbines at the surface.

5. Use the diagram below to answer the question that follows.

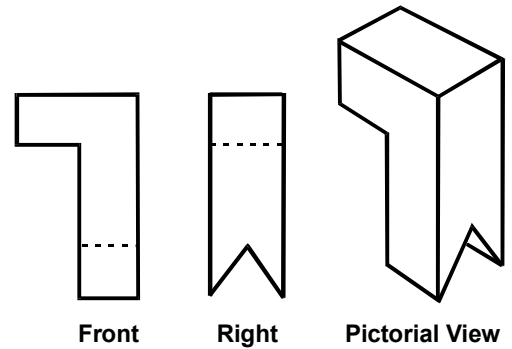


The multimeter in the diagram above is indicating a voltage of:

- A. 5 V.
- B. 20 V.
- C. 25 V.
- D. 125 V.

6. Which of the following best describes the concept of open-source computer software?
- A. The software can be run on a variety of different platforms.
 - B. The software code is made available and can be modified by the user.
 - C. Software is designed using interchangeable program modules.
 - D. The software is developed using a bottom-up methodology.

7. Use the diagram below to answer the question that follows.



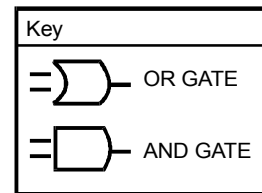
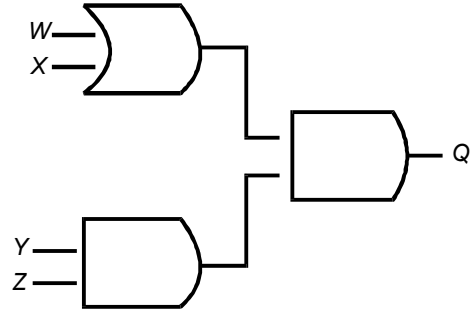
Which of the following is the correct top-view drawing for this object?

- A.
- B.
- C.
- D.

8. Which of the following is the primary function of an oscillator circuit in a radio broadcast transmitter?

- A. converting sound waves into electrical signals
- B. boosting the output signal power
- C. encoding the information at carrier frequency
- D. generating the carrier signal

9. Use the diagram below to answer the question that follows.



The diagram above shows three logic gates connected with inputs at W , X , Y , and Z . Which of the following input values will produce a logical 1 at the output, Q ?

- A. $W = 0, X = 0, Y = 1, Z = 1$
- B. $W = 1, X = 1, Y = 0, Z = 0$
- C. $W = 0, X = 1, Y = 0, Z = 1$
- D. $W = 0, X = 1, Y = 1, Z = 1$

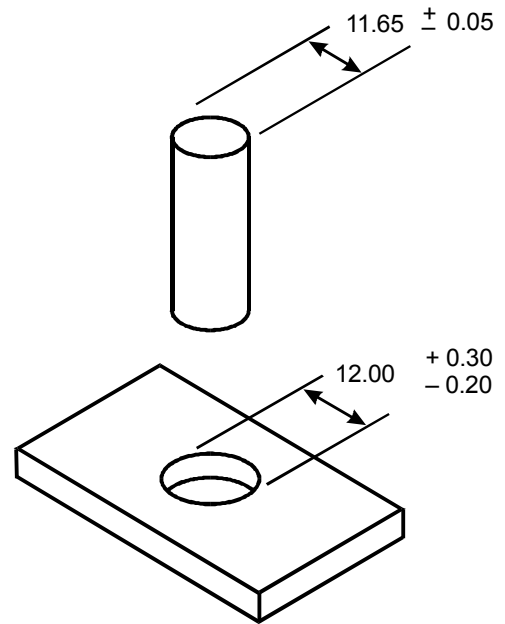
10. In passing information from one computer to another, a checksum is most commonly used to ensure that data:

- A. came from a particular source.
- B. have been analyzed correctly.
- C. were transmitted without error.
- D. can be retrieved efficiently.

11. Which of the following steps occurs *first* in project design?

- A. needs assessment
- B. product analysis
- C. production design
- D. prototyping

12. Use the diagram below to answer the question that follows.



A machinist is to manufacture two parts as specified by the diagram above. According to the given tolerances, which of the following best describes the range of clearances between the two parts?

- A. 0.05 to 0.30
- B. 0.10 to 0.70
- C. 0.20 to 0.50
- D. 0.30 to 0.65

13. Use the table below to answer the question that follows.

Resistor Type	Number Needed
500 Ω	20,000
1,000 Ω	20,000
1,500 Ω	30,000
2,000 Ω	30,000

A manufacturer of electrical resistors with one assembly line has an order for the types and numbers of resistors listed in the table above. The resistors must be shipped in one month. Which of the following manufacturing processes is most appropriate for meeting this order?

- A. continuous
 - B. just-in-time
 - C. batch
 - D. custom
14. In which of the following applications would a thermoplastic be the most appropriate material choice for a manufactured product?
- A. a handle for a nonstick frying pan
 - B. a timing gear for an internal combustion engine
 - C. an electrical insulator for a high-power step-down transformer
 - D. a recyclable packaging container for a child's toy
15. Which of the following strategies would be most appropriate for reducing the need for change orders on residential construction projects?
- A. overbidding all construction projects by at least 25%
 - B. devoting more effort to the discussion and planning phase of the project
 - C. encouraging customers to choose expensive materials and processes
 - D. establishing a written policy that contracts will not be modified

16. Use the information below to complete the exercise that follows.

You have been asked to design a vehicle for delivering mail and packages within a 50-story office building.

Using your knowledge of power and energy technology, write a response in which you:

- identify your choice for an energy source and explain why this is an appropriate choice;
- describe one design feature that will help maximize the vehicle's efficiency; and
- describe one design limitation imposed by existing infrastructure.

17. Use the information below to complete the exercise that follows.

You have been asked to lead the roll-out team for promoting a new personal digital audio device developed by your national corporation. Your team members include marketing, information and communication, and design professionals located throughout the United States. Your team will be responsible for developing marketing materials and product packaging.

Using your knowledge of information and communication technology, write a response in which you:

- identify the hardware that will be needed for this task;
- describe the different working teams that will be needed for the task;
- describe appropriate security and privacy safeguards, including software, that will be needed; and
- describe how the likely target market for this product affects your communication decisions.

18. **Use the information below to complete the exercise that follows.**


You have been assigned to lead a team responsible for manufacturing a new coffee maker.

Using your knowledge of project development, write a response in which you:

- identify three professions needed to complete this project;
- identify three major tasks that must take place in the manufacturing of this product and explain why the order in which these three tasks are implemented is important; and
- diagram the process flow for fabricating this product.

Sample Written Response Sheets for CSET: Industrial and Technology Education Subtest II

For questions 16–18, examinees would record their written response to each question on a one-page response sheet located in their answer document. The length of their response to each question is limited to the lined space available on the response sheet. A sample of the response sheet is provided below.

Seat 00712 Site 436B ATA 007 PM Form # 116 CS 07/17/2004	ID# : 4-031-070-9 DO NOT WRITE IN THIS BOX <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 30px;"></div> <div style="border: 1px solid black; width: 30px; height: 30px;"></div> </div>	<div style="border: 2px solid black; padding: 5px; display: inline-block;"> Assignment <h1 style="margin: 0;">1</h1> Response Sheet </div>
DIRECTIONS The directions and assignment are presented in your test booklet. Read them carefully before you begin to write. The lined page(s) of this response sheet are the only page(s) that will be scored for this assignment. RESPONSES WRITTEN IN THE TEST BOOKLET OR ANYWHERE ELSE IN THIS DOCUMENT WILL NOT BE SCORED. DO NOT WRITE YOUR NAME ANYWHERE IN THIS SECTION.		
<div style="border: 1px solid black; min-height: 400px; position: relative;"> <div style="position: absolute; left: -30px; top: 50%; transform: translateY(-50%); white-space: nowrap;">DO NOT WRITE OUTSIDE THESE MARGINS</div> <div style="position: absolute; right: -30px; top: 50%; transform: translateY(-50%); white-space: nowrap;">DO NOT WRITE OUTSIDE THESE MARGINS</div> <div style="position: absolute; bottom: -30px; left: 50%; transform: translate(-50%, -50%); white-space: nowrap;">DO NOT WRITE OUTSIDE THESE MARGINS</div> <div style="position: absolute; left: 50%; top: 50%; transform: translate(-50%, -50%);"> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <small>40310709116H001</small> </div> <div style="border: 1px solid black; padding: 5px;">H PAGE 3</div> <div style="text-align: right; font-size: small;">STOP. END OF ASSIGNMENT 1.</div> </div> </div> </div>		

Annotated Responses to Sample Multiple-Choice Questions for CSET: Industrial and Technology Education Subtest II

Power and Energy

1. **Correct Response: A.** (SMR Code: 2.1) A photovoltaic cell consists of two layers of semiconductor material. Light energy striking its surface frees electrons in one layer, resulting in a potential difference between the two sides. This potential difference can then cause a current flow in a circuit connected to the cell.
2. **Correct Response: C.** (SMR Code: 2.1) Pressure is defined as force per unit area ($P = F/A$). An equivalent form of this equation is $F = PA$. The pressure in the example is 60 pounds per square inch (60 psi). The area is 20 square inches (20 in.²). The force produced in the example can be calculated by finding the product of the pressure and the area: $60 \frac{\text{lbs.}}{\text{in.}^2} \times 20 \text{ in.}^2 = 1,200 \text{ lbs.}$
3. **Correct Response: C.** (SMR Code: 2.2) Gears that are in direct contact with each other turn in opposite directions. Therefore, gears that are in a straight line and separated by an odd number of intervening gears will turn in the same direction. Gears A and C will turn in the same direction as gear X. A larger gear in contact with a smaller gear will turn more slowly than the smaller gear. The gears in contact with gear X have the same diameter as gear X and will therefore turn at the same speed as gear X. Gear C is larger than these intermediary gears and will therefore turn more slowly than they will, and thus more slowly than gear X.
4. **Correct Response: D.** (SMR Code: 2.3) Geothermal energy is produced from reservoirs of hot water found underground. In dry-steam technology, the hot water rises to the surface as steam and is directed onto turbine blades. The energy of the spinning turbine is used to operate an electric generator.
5. **Correct Response: C.** (SMR Code: 2.3) The multimeter in the diagram is set to read a maximum of 50 volts DC. The voltage scale having a maximum value of 50 is the middle set of numbers, labeled DCVA. Since the needle is midway between 20 and 30, and since this is a linear scale, the correct reading is 25 volts.

Information and Communication

6. **Correct Response: B.** (SMR Code: 3.1) Open-source computer software is software whose code is made available to users and programmers. This allows the software to be adapted or modified to meet the specific needs of the user and allows new applications for the software to be developed.
7. **Correct Response: A.** (SMR Code: 3.1) The top view of the object in the diagram must correctly indicate the location of the groove in the bottom of the object and the 90-degree angle or bend in the object. In answer choice A, the dashed lines used to represent hidden lines represent both of these features geometrically centered.
8. **Correct Response: D.** (SMR Code: 3.2) In broadcast systems, a signal is produced in the form of a sine wave by an electronic oscillator circuit. This sine wave is the carrier wave and is encoded by modulating either its amplitude (AM) or its frequency (FM).

9. **Correct Response: D.** (SMR Code: 3.3) Logical AND gates produce a logical 1 only when each of their inputs is 1. For output Q to have a value of 1, the AND gate immediately preceding it must have an input of 1 at each of its inputs. This means that the lower left AND gate must also have an input of 1 at each of its inputs, which are labeled X and Y . Answer choices A and D satisfy this condition. For the upper left OR gate to generate a logical 1, at least one of its inputs must be a logical 1. This restriction eliminates answer choice A as a possible solution. Answer choice D, in which $W = 0$, $X = 1$, $Y = 1$, and $Z = 1$, satisfies the conditions.
10. **Correct Response: C.** (SMR Code: 3.4) Checksum is an error-detecting technique sometimes used when information is transmitted and received in digital format. Using this technique, information indicating the number of bytes sent is included in the transmitted message. This information is compared with the actual data received to determine whether any data were lost in the transmission.

Project and Product Development

11. **Correct Response: A.** (SMR Code: 4.1) The first step in project design is to determine exactly what is needed. Based on the results of this needs assessment, a design team can begin to generate ideas and formulate a product design.
12. **Correct Response: B.** (SMR Code: 4.1) The range of clearances for the machined parts is found by determining the differences between the maximum and minimum dimensions of each. The rod has a maximum size of $11.65 + 0.05 = 11.70$. It has a minimum size of $11.65 - 0.05 = 11.60$. The hole has a maximum diameter of $12.00 + 0.30 = 12.30$. It has a minimum diameter of $12.00 - 0.20 = 11.80$. The smallest clearance is $11.80 - 11.70 = 0.10$. The largest clearance is $12.30 - 11.60 = 0.70$.
13. **Correct Response: C.** (SMR Code: 4.2) To fill this manufacturing order, the manufacturer will have to fill a large one-time order. This type of manufacturing, in which the production line produces a number of items and then retools, is called batch or intermittent manufacturing.
14. **Correct Response: D.** (SMR Code: 4.3) Thermoplastics soften when heated and cooled. They can go through many melt/freeze cycles, making them suitable for recycling and suitable for injection molding.
15. **Correct Response: B.** (SMR Code: 4.4) A change order is an authorization to make a change in a contract after specifications have been agreed upon. Time spent in the preplanning phase of a project can help ensure that all involved parties agree on the features of the project.

Examples of Responses to Sample Constructed-Response Questions for CSET: Industrial and Technology Education Subtest II

Power and Energy

Question #16 (Strong Response)

An effective mail delivery system begins with efficient sorting of incoming mail. Automatic mail sorters with optical character reading (OCR) capability could sort and bar code mail by floor before depositing it in a floor-specific bin. The OCR system could allow for personal e-mail notification when a person has mail waiting. Bar coding could be used to track registered and certified mail until it is delivered to the proper recipient. To maximize efficiency, a pneumatic tube powered by an electric motor could be used to deliver much of the mail from the sorter to individual floors. Each floor could have its own mail collection room, from which a human-powered, large wheeled cart with a carrying bin could be used to make deliveries on the floor. The cart would be quiet and non-polluting and would be sufficiently quick and efficient for an interior delivery operation. It could blend with the flow of pedestrian traffic in the corridors.

The design should be well proportioned--low and wide enough for stability yet small and streamlined enough for maneuverability--so that the operator will not become overly fatigued.

The vehicle must also be small enough to fit in existing corridors, offices, and elevators.

Question #16 (Weak Response)

There are several options for energy sources for a mail delivery vehicle--for example, gasoline or electric. A small cart similar to a golf cart would be useful. Such a vehicle could get up enough speed to allow for rapid delivery.

Older buildings are not as desirable or attractive as newer ones, and lack many of the amenities that are so important to businesses. An older building might also have smaller, slower elevators. This would have to be taken into account. It might be necessary to resort to a pushcart.

Information and Communication

Question #17 (Strong Response)

In order to coordinate their efforts over such a large geographic range, the roll-out team will have to have a communications system in place. If the company does not already have an intranet, they will need to set one up or consider an alternative such as a virtual private network (VPN). The system should have adequate encryption since much of the information will be proprietary. For some applications, videoconferencing would be most appropriate. In setting up the videoconferencing system, they should pay special attention to the system's bandwidth as this is the system resource that is most apt to cause problems if it is not sufficient. Because much of the work will involve assessment of visual material, the printing equipment at each node should be capable of producing design ideas at a quality that facilitates decision making.

continued on next page

Question #17 (Strong Response) *continued*

The group should include a market research team, a product and service support team, a wholesaling and logistics management team, and an advertising and public relations team.

Security will be especially important for transmissions between the nodes of the computer system. Data should be adequately encrypted by a private key encryption system. A firewall and virus-protection software should protect the system from unauthorized access from the outside. Log-on procedures should include passwords of sufficient sophistication to minimize the threat from code-breaking software. All hard copies at each location, and the hardware itself, should be protected by adequate physical security measures.

A marketing campaign for a personal digital audio device is most likely to be aimed at the teen market and the young adult market. Style will be more important than it would be for some other market segments. Also, media outlets that focus on this group will be important in gaining acceptance for the device.

Question #17 (Weak Response)

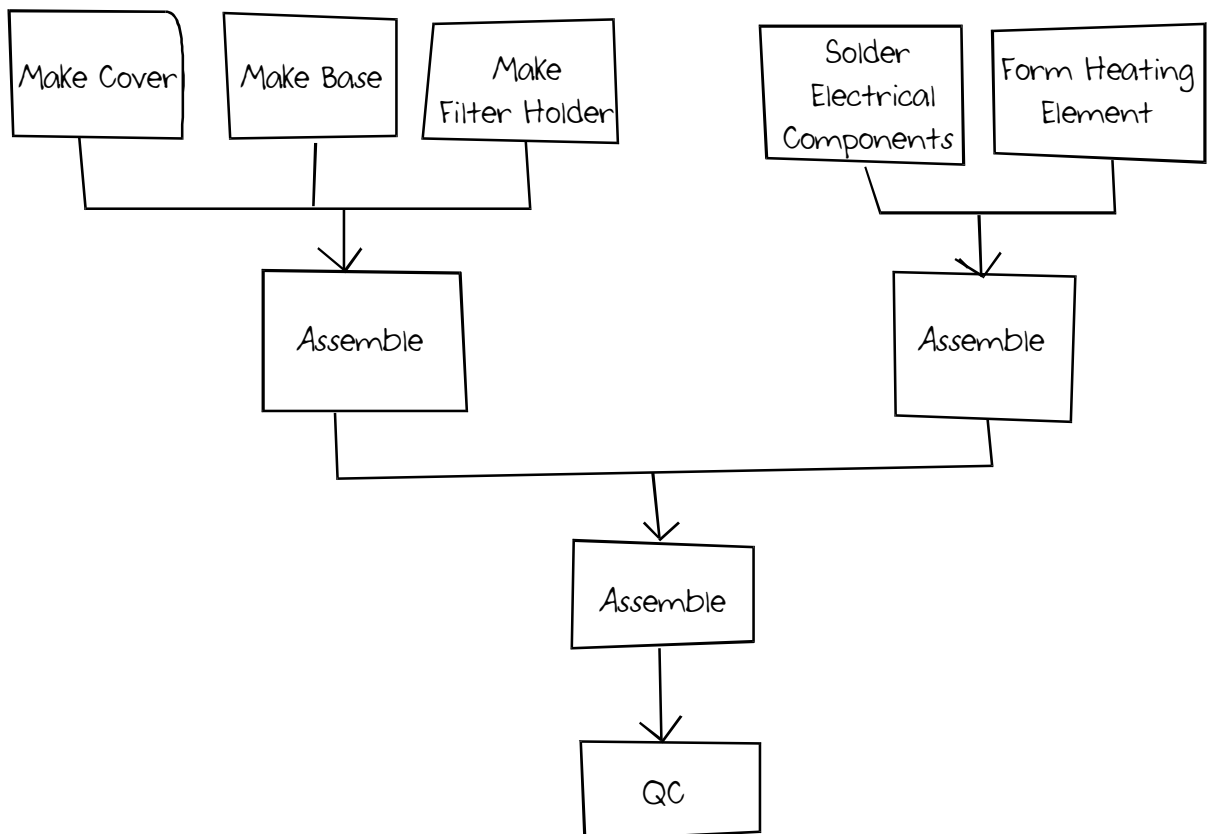
In order for the team to function effectively, each team member should have a computer and each computer should have Internet capabilities so that team members can communicate with each other. Functional teams could include a team to gather market research, a team to determine appropriate technologies and features for incorporating into the audio device, and a team to market the new product. The members of all teams should use passwords that are changed frequently, and the computer system should have virus protection that is regularly updated. The marketing strategy should involve a mix of print-based and electronic ads that target the youth market since that is the market that purchases the greatest number of digital audio devices.

Project and Product Development

Question #18 (Strong Response)

The manufacturing of a new coffee maker would require the efforts of workers from a number of professions. These would include fabricators to help make the component parts to specifications, assemblers who would work on the production line assembling the coffee maker, and quality control specialists who would ensure that the product is being made within quality control specifications. The fabricators provide the components used by the assemblers on the production line. The quality control specialists inspect the finished products coming off the production line, although they would also make inspections of the process and of intermediate outputs of the system.

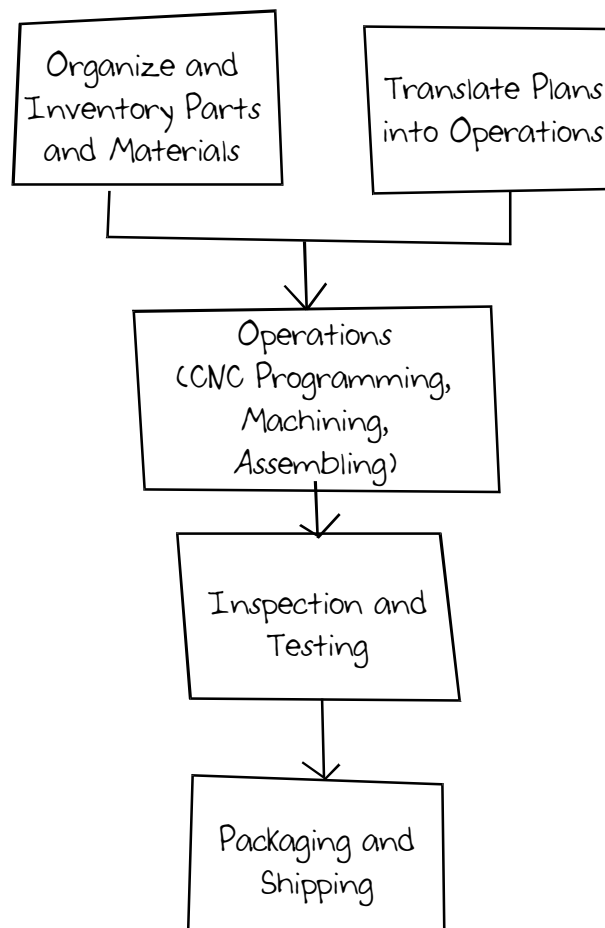
Fabricators ---> Assemblers ---> Quality Control Specialists



Question #18 (Weak Response)

To manufacture a new coffee maker, one would need a team of crafters with various skills. For example, the coffee maker might include parts made of metal, plastic, ceramic, or glass. The construction team would need to include people with skills in working with these materials. It would need to be resistant to high temperatures, safe to use, and capable of producing a good cup of coffee.

It is important to perform the production steps in the correct order. If an outside part is added to the assembly too soon in the process, the product would need to be taken apart again. This would represent a loss of time and a reduction in efficiency.



Scoring Information for CSET: Industrial and Technology Education Subtest II

Responses to the multiple-choice questions are scored electronically. Scores are based on the number of questions answered correctly. There is no penalty for guessing.

There are three constructed-response questions in Subtest II of CSET: Industrial and Technology Education. Each of these constructed-response questions is designed so that a response can be completed within a short amount of time—approximately 10–15 minutes. Responses to the constructed-response questions are scored by qualified California educators using focused holistic scoring. Scorers will judge the overall effectiveness of your responses while focusing on the performance characteristics that have been identified as important for this subtest (see below). Each response will be assigned a score based on an approved scoring scale (see page 21).

Your performance on the subtest will be evaluated against a standard determined by the California Commission on Teacher Credentialing based on professional judgments and recommendations of California educators.

Performance Characteristics for CSET: Industrial and Technology Education Subtest II

The following performance characteristics will guide the scoring of responses to the constructed-response questions on CSET: Industrial and Technology Education Subtest II.

PURPOSE	The extent to which the response addresses the constructed-response assignment's charge in relation to relevant CSET subject matter requirements.
SUBJECT MATTER KNOWLEDGE	The application of accurate subject matter knowledge as described in the relevant CSET subject matter requirements.
SUPPORT	The appropriateness and quality of the supporting evidence in relation to relevant CSET subject matter requirements.

Scoring Scale for CSET: Industrial and Technology Education Subtest II

Scores will be assigned to each response to the constructed-response questions on CSET: Industrial and Technology Education Subtest II according to the following scoring scale.

SCORE POINT	SCORE POINT DESCRIPTION
3	<p>The "3" response reflects a command of the relevant knowledge and skills as defined in the subject matter requirements for CSET: Industrial and Technology Education.</p> <ul style="list-style-type: none"> • The purpose of the assignment is fully achieved. • There is an accurate application of relevant subject matter knowledge. • There is appropriate and specific relevant supporting evidence.
2	<p>The "2" response reflects a general command of the relevant knowledge and skills as defined in the subject matter requirements for CSET: Industrial and Technology Education.</p> <ul style="list-style-type: none"> • The purpose of the assignment is largely achieved. • There is a largely accurate application of relevant subject matter knowledge. • There is acceptable relevant supporting evidence.
1	<p>The "1" response reflects a limited or no command of the relevant knowledge and skills as defined in the subject matter requirements for CSET: Industrial and Technology Education.</p> <ul style="list-style-type: none"> • The purpose of the assignment is only partially or not achieved. • There is limited or no application of relevant subject matter knowledge. • There is little or no relevant supporting evidence.
U	<p>The "U" (Unscorable) is assigned to a response that is unrelated to the assignment, illegible, primarily in a language other than English, or does not contain a sufficient amount of original work to score.</p>
B	<p>The "B" (Blank) is assigned to a response that is blank.</p>