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Technology and Engineering Education (5053)



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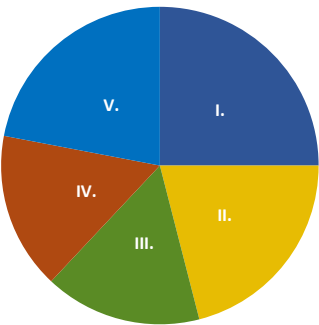
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Technology and Engineering Education (5053)

Test at a Glance

Test Name	Technology and Engineering Education		
Test Code	5053		
Time	120 minutes		
Number of Questions	120 selected response questions		
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices. You can review the possible question types in Understanding Question Types.		
Test Delivery	Computer Delivered		
	Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
	I. Fundamentals of Technology and Engineering	30	25%
	II. Design and Application of Products and Systems	25	21%
	III. Technology Contexts 1: Energy, Materials, and the Built Environment	19	16%
	IV. Technology Contexts 2: Information, Computation, and Technological Applications	19	16%
	V. Pedagogy and Professional Responsibilities	27	22%

About The Test

The Technology and Engineering Education test is designed for candidates seeking certification as a middle school or high school teacher. The test focuses on the knowledge and skills a teacher must have to support the technology education curriculum. It incorporates essential concepts from the Technological Literacy Standards prepared by the International Technology and Engineering Educators Association (ITEEA). In addition, the test reflects concepts from the International Society for Technology Standards for Teachers (ISTE® Standards•T).

The 120 selected-response questions cover topics in technology education, including knowledge of information and communication; construction, manufacturing, and energy/power/transportation technologies; and the impact of these areas on individuals, the environment, and society. The test taker is required to apply pedagogical and professional knowledge to answer questions focused on the individual understanding and application of current technology education principles. This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Note: The use of “e.g.” to start a list of examples implies that only a few examples are offered and the list is not exhaustive, whereas the use of “i.e.” to start a list of examples implies that the given list of examples is complete.

Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. Answers for the discussion questions are **not** provided; however, thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. The questions are intended to help you gain increased understanding and facility with the test’s subject matter. You may want to discuss these questions with a teacher or mentor.

I. Fundamentals of Technology and Engineering

A. Core Concepts and Characteristics

1. Knows technological and engineering systems as interrelated components (e.g., inputs, processes, outputs, and feedback) that are designed collectively to achieve desired goals
2. Knows technology and engineering resources (or inputs), including tools and machines, materials, capital, knowledge, energy, time, and people
3. Understands the development of criteria, constraints, and opportunities during the design process and how these factors affect solutions
4. Understands trade-offs encompass a choice or exchange of one quality over another and how such choices are evaluated with respect to their economic, social, political, environmental, and ethical impacts
5. Understands optimization as an iterative process or methodology of designing or making a product, process, or system that is functional, efficient, safe, and effective
6. Knows controls as the mechanisms or activities that apply information to cause systems to behave in desired ways, and knows how controls are implemented within design

B. Integration of Knowledge and Practices

1. Understands and can apply interdisciplinary knowledge (e.g., from STEM and the arts and humanities) to develop technological products that serve a broad range of needs

2. Knows the economic, environmental, and social impacts of technological and engineering systems
3. Understands how advancements in knowledge, technologies, and practices may impact or enhance the iterative process of innovation

C. Influences, Impacts, and History of Technology

1. Understands the influence of culture and society on technological and engineering products/systems as well as the influence of interdisciplinary knowledge on technological development
2. Understands the difference between invention and innovation and how significant inventions and innovations were influenced by their historical contexts
3. Knows the impact of technology and engineering on the social institutions (e.g., the family, community interaction) and the influence of technological innovation on human history and contemporary society
4. Knows the outcomes and effects (e.g., intended/unintended, desirable/undesirable) of technological products/systems on individuals, society, and the environment
5. Knows the development, analysis, and evaluation of sustainable technological solutions and how to minimize negative impacts on the environment

Discussion Questions: Fundamentals of Technology and Engineering

- How do science, engineering, and mathematics influence technological developments?
- What impacts can a new technological innovation (e.g., a new type of water-purification system) have on a developing country?
- What are the primary differences between science, technology, mathematics, and engineering?
- What ethical issues should be considered when biotechnology (i.e., a technology that utilizes biological systems, living organisms, or parts of biological systems or organisms to develop or create different products) is developed and implemented?
- How have changes in societal norms directed the evolution of technological innovations?
- How have technological innovations influenced the evolution of societal norms?
- What technological innovations have been developed to reduce negative environmental impacts in developed and developing countries (e.g., pollution and depletion of resources)?
- How has technological evolution contributed to the interrelationship of each of the disciplines of science, technology, engineering, and mathematics (STEM)?
- How do cultural and economic factors influence both technological inventions and innovations?

- Describe whether science, technology, engineering, and mathematics are equally valued among students, technologists, and society as a whole.
- How does technology influence local, state, national, and international political systems?
- Describe when and how desirable and undesirable technological developments occur and how they are shaped by economic interests and advanced marketing.
- How have the different historical ages and eras (e.g., the Iron Age, the Renaissance, the Industrial Revolution, and the information age) influenced technological evolution?

II. Design and Application of Products and Systems

A. Design in Technology and Engineering

1. Understands design-and its core elements and principles-as a fundamental human activity
2. Understands the development, implementation, and documentation of iterative design processes and the analysis/evaluation of specific design requirements (i.e., criteria and constraints)
3. Understands the development of analytical solutions to design problems through modeling, evaluation, and optimization of complex designs

B. Applying, Maintaining, and Assessing Products and Systems

1. Understands the influence of dependent and related components within larger systems
2. Understands the use of appropriate tools, materials, and machines to maintain, troubleshoot, and repair technological and engineering products/systems
3. Understands the interpretation of data to accurately measure performance of technological and engineering products/systems
4. Understands effective communication of technological information to improve products, systems, and their outcomes

Discussion Questions: Design and Application of Products and Systems

- What are some common techniques used for troubleshooting technological systems, and how are they documented and communicated?
- How can a design process be systematically created and applied to a problem that is connected to each of the disciplines of science, technology, engineering, and mathematics (STEM)?
- What are the common steps used in a technological and engineering problem-solving process?
- How is the universal systems model applied to various technology sectors (e.g., transportation, manufacturing, and biotechnology)?
- How are design specifications (e.g., criteria, constraints, form, function, cost, and testing) applied?

- What factors of a system's design contribute to proper maintenance and feedback to optimize the system's operation?
- A student is disappointed that the design for a vehicle that uses alternative fuels has failed. How should the technology and engineering education teacher use the information as an opportunity to teach the student about the advantages of design failure?
- How might the concept of using appropriate technology to influence the design of products and systems differ in a developing country compared to a developed country?

III. Technology Contexts 1: Energy, Materials, and the Built Environment

A. Energy and Power

1. Knows fundamental concepts and interrelationships of energy, work, and power and the application of these concepts to solve problems (e.g., those involving harness, transfer, circuitry, loss, transmissions, and conversion)
2. Knows societal and environmental impacts of the tradeoffs involved in energy and power technologies and engineering systems

B. Materials, Manufacturing, and the Built Environment

1. Knows the appropriate use of tools, machines, and material processes that lead to technological progress for physical goods within the built environment

2. Knows materials processing, production, and the methods/sequences involved to convert raw materials into industrial materials and industrial materials into finished products
3. Knows fundamental concepts, processes, and properties of materials for construction and manufacturing of physical goods and structures
4. Knows structural systems and subsystems in the context of the built environment, including considerations of functionality, efficiency, safety, and sustainability
5. Is familiar with the characteristics and interrelationships of transportation modes, systems and subsystems, and logistical systems and operations

Discussion Questions: Technology Contexts 1: Energy, Materials, and the Built Environment

- How does a hybrid automobile differ from a traditional internal-combustion automobile?
- What information is needed for a designer to build an effective wind turbine?
- What are some common methods used to transport people and goods?
- Describe the three basic electronic circuits (i.e., series, parallel, and series-parallel) .
- How are various forms of energy (e.g., mechanical, thermal, and electrical) used, measured, and transformed?

- What safety procedures must be followed when someone is working with and around mechanical, electrical, and power systems?
- Explain how a subsystem is part of a larger system, and describe how the system and subsystem are related (e.g., gears are part of a vehicle's transmission system, which is a subsystem of the drive system).
- How are logistics and distribution processes interrelated among local, state, national, and international transportation systems?
- What are some common building materials that can be used to construct a deck on the back of a house?
- What types of information does a designer need to consider when building a house in the mountains near a ski resort?
- Explain the components of the universal systems model as it is applied to the manufacturing and construction sectors.
- What are some quality processes (e.g., just-in-time strategy, total quality management (TQM), and various Six Sigma methodologies) and how are they used by the manufacturing sector?
- How and why are secondary processes (e.g., conditioning, separating, and assembling) applied to various materials (e.g., ceramics, metals, plastics, and wood)?

- Explain how different forces (e.g., tension, compression, and torsion) are calculated and accounted for in the design of a structure (e.g., a bridge, a house, a highway, a skyscraper).
- What are some common regulations construction managers face regarding building permits, building codes, safety, and hiring practices?

IV. Technology Contexts 2: Information, Computation, and Technological Applications

A. Information and Communications

1. Knows fundamental concepts and terminology related to information and communication systems (i.e., audio, video, electronic, data, technical, and graphic) and the issues/trends informing their design and use
2. Knows the influence of information and communication technologies on both physical and digital design as well as appropriate ways to address relevant problems and tasks by combining them
3. Understands applications of digital communications and the practical implications of digital citizenship, including associated legal/ethical issues

B. Computation, Automation, Robotics, and Evolving Technologies

1. Knows principles of computational thinking (i.e., decomposition, pattern recognition, abstraction, and algorithm design) that help solve technological and engineering problems

2. Knows automation principles and concepts and their application to technological and engineering systems
3. Knows robotic concepts that support the modeling of physical, mechanical, technical, and programmable systems
4. Is familiar with artificial intelligence (AI) technologies, their applications, and associated ethical implications

Discussion Questions: Technology Contexts 2: Information, Computation, and Technological Applications

- How does a wireless local area network (LAN) differ from a wired LAN?
- What is a cable modem, and how does it work?
- How does using the rule of thirds help a person take better digital pictures?
- Describe some of the causes of new technologies and the effects that have resulted from their use.
- Explain how copyright laws apply to students using music in a video.
- What are the various printing processes used today and in the past?
- Describe the elements of design in print and digital layout (e.g., balance, weight, rhythm, harmony, and proportion).
- What are the different modes of communication systems (e.g., fiberoptic, satellite, and microwave), and how do they carry various signals?

- Explain how computer software is installed and maintained on a computer in a lab or classroom network.
- Describe the principles of computational thinking (i.e., decomposition, pattern recognition, abstraction, and algorithm design).
- What are the main steps typically associated with computational thinking?
- Explain how robotics is used in manufacturing, and describe what “degree of freedom” means in a robotics system.
- Describe some positive and negative impacts that automation has had on the manufacturing workforce.
- How are unmanned aerial vehicles (UAVs), commonly known as drones, being used in today’s world?
- What is generative AI and how is it having an impact on society?
- Explain how artificial intelligence is having an impact on student work in Pre-K–12 schools.
- What are some pros and cons of using artificial intelligence?

V. Pedagogy and Professional Responsibilities

A. Pedagogical Foundations

1. Understands how to select and adapt appropriate materials and activities as well as plan instruction to promote technological and engineering literacy
2. Understands how to provide students with learning experiences that expand their knowledge and skills in technology and engineering

3. Understands project- and problem-based learning methodologies that employ making and doing to support critical thinking, problem solving, creativity, collaboration, and ethics in technology and engineering
4. Understands how to select, create, and modify appropriate assessments to inform instruction and evaluate student learning in technology and engineering
5. Understands how to differentiate instruction that effectively addresses a variety of student needs
6. Understands how to create a nurturing and supportive learning environment using knowledge of social and emotional principles, student behavior, organizational skills, and classroom management
5. Knows professional contexts (e.g., organizational, advisory, governmental) and relevant platforms to promote technology and engineering programs beyond the classroom
6. Knows strategies for professional development, lifelong learning, and maintaining and improving technical and pedagogical skills used in technology and engineering education
7. Is familiar with the benefits, offerings, and resources (e.g., professional networking) of professional organizations for technology and engineering educators (e.g., ITEEA, ACTE, ASEE)

B. Principles of Technology and Engineering Education

1. Understands collaborative relationships of technology and engineering education to other academic subject areas
 2. Understands principles and practices that ensure the safety of students in technology and engineering classrooms and laboratories
 3. Knows how to access resources and apply strategies to help engage students with technological and engineering content outside the classroom and within the greater community and society
 4. Knows how to support professional growth in students by promoting technology student organizations (e.g., Technology Student Association) and encouraging career exploration
- How can the ITEEA's *Standards for Technological and Engineering Literacy (STEL)* be used to develop an effective technology and engineering curriculum?
 - What are some typical instructional strategies or teaching methods used by today's technology and engineering teachers (i.e., design-based learning, problem-based learning, and project-based learning)?
 - How can technology and engineering teachers stay informed and current in their field by affiliating themselves with professional associations and organizations (e.g., TSA, SkillsUSA, FFA, HOSA, ITEEA, ACTE)?

- What are the benefits and challenges of collaborating with core academic colleagues (i.e., language arts, mathematics, science, and history) on cross-curricular activities and lessons?
- How should a technology and engineering teacher address the local chamber of commerce to promote and educate local business leaders about the program?
- What strategies should a technology and engineering teacher use to attract students to the program?
- Why must proper safety procedures be followed in an advanced manufacturing training lab?
- What problem-solving methods can a technology and engineering teacher use with students to help solve the challenge of budget cuts in career and technical education?
- What differentiated instructional strategies can technology and engineering teachers use to ensure that students with physical, behavioral or emotional, developmental, or other disabilities or impairments have access to career and technical education?

Technology and Engineering Education (5053) Sample Test Questions

Sample Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Each of the questions or statements below is followed by suggested answers or completions. Select the one that is best in each case.

1. A technology and engineering education teacher is conducting a bridge-design experiment with students. By having students calculate the efficiency of the structure rather than total weight held, the teacher is best conveying which of the following areas of design?
 - (A) Written documentation of designs
 - (B) Appropriate research to drive solutions
 - (C) Data results of different designs
 - (D) Importance of managing trade-offs
2. An eighth-grade teacher is having a STEM class complete a design challenge based on a written project brief. One student's Individualized Education Program (IEP) specifies a reading disability, and the student seems to be struggling to comprehend the challenge. Which of the following is the most appropriate next step for the teacher to take?
 - (A) Asking the student's case manager to help develop an appropriate instructional strategy
 - (B) Utilizing the modifications and accommodations in the student's IEP
 - (C) Providing the student with video or audio instructions for the design challenge
 - (D) Working with the student's parents to develop the best instructional strategy
3. The seven well-established elements of design are key concepts that can be applied to any visual product and are used by engineers and artists to design products that are visually pleasing to the consumer. Which **TWO** of the following are considered elements of design?
 - (A) Cost
 - (B) Texture
 - (C) Cohesiveness
 - (D) Form
 - (E) Appeal

4. A student who is pursuing a mechanical engineering degree is most likely required to take classes in which **THREE** of the following subject areas?
 - (A) Management information systems
 - (B) Differential equations
 - (C) Journalism
 - (D) Circuits and electronics
 - (E) Statistics

5. A new technology and engineering education teacher wants to ensure that the classroom objectives and activities are preparing students to fill local industry needs. Which of the following actions will best help the teacher identify local industry needs and the corresponding classroom objectives and activities?
 - (A) Participating in career and technical student organizations
 - (B) Discussing classroom objectives with students and school staff
 - (C) Attending monthly district board meetings
 - (D) Consulting with an advisory committee

6. Robotic wrist movement is defined by three terms that relate to spherical angles. Which of the following lists accurately identifies these three terms?
 - (A) Shoulder, elbow, arm
 - (B) Left-right, up-down, back-forth
 - (C) Pitch, roll, yaw
 - (D) Translation, rotation, application

7. A construction worker drives a metal spike into the ground using a sledgehammer. As a result of being struck, the metal spike heats up as it enters the ground. Which of the following energy transformations explains the spike heating up?
 - (A) Potential to kinetic
 - (B) Potential to thermal
 - (C) Kinetic to thermal
 - (D) Kinetic to chemical

8. Which of the following organizations is most appropriate for students to join if they are enrolled in K–12 general technology education courses?
 - (A) Business Professionals of America (BPA)
 - (B) Association for Career and Technical Education (ACTE)
 - (C) Technology Student Association (TSA)
 - (D) Children’s Council of the International Technology and Engineering Educators Association (ITEEA)

9. A high school engineering class is building a small, wireless communication device so it can send a message to a group of students at a neighboring school. Which of the following communication system components best describes the student-built communication device?
 - (A) Multiplexer
 - (B) Transmitter
 - (C) Storage
 - (D) Decoder

10. Which of the following best describes a potential security risk associated with the Internet of Things (IoT) ?
 - (A) Unauthorized access to personal information
 - (B) Slower Internet access speed
 - (C) Increased difficulty fixing devices
 - (D) Higher chance of incompatible devices

11. A high school teacher wants to assess her students’ understanding of potential ethical concerns related to a group project involving a complex transportation problem. To evaluate each student’s grasp of ethical issues, the teacher should use which of the following approaches?
 - (A) Having a full-class discussion of potential ethical concerns related to the project
 - (B) Having students provide peer reviews of each other’s contributions to the project
 - (C) Having each student provide a written technical report after the project is complete
 - (D) Having each student develop a list of potential ethical concerns for discussion in class

12. A national image storage Web site unexpectedly receives multiple phone calls from users stating that they cannot access their private images. Which **THREE** of following explanations are most likely the causes of this problem?
- (A) The software that confirms a user's identity is not working.
 - (B) The database in which the users' images are stored is corrupt.
 - (C) The servers on which the users' images reside are down.
 - (D) The users do not have any private images stored on the Web site.
 - (E) The users' Internet service providers are malfunctioning.
13. When students are faced with an engineering problem, which of the following is the most important step for them to consider?
- (A) Finding the simplest solution to the problem
 - (B) Solving the problem as quickly as possible
 - (C) Generating many solutions to the problem
 - (D) Focusing on one solution to the problem
14. As the Internet has become a greater part of daily life, the use of virtual private networks (VPNs) has become more common. Which of the following statements describes a benefit of using a VPN in conjunction with the Internet?
- (A) It protects local network users from phishing attacks.
 - (B) It prevents remote devices from connecting to a private network.
 - (C) It prevents hackers from logging in to a local network.
 - (D) It provides increased security for private data sent over the Internet.
15. Which of the following processes enhances performance at both the product design and manufacturing stages through the guiding principles of elimination of waste, continuous improvement, leveled production, and respect for workers?
- (A) Six Sigma
 - (B) Green manufacturing
 - (C) Total Quality Management (TQM)
 - (D) Lean manufacturing

16. Often companies will improve an existing product through an iterative process of optimization after the product has become unpopular because of safety issues, poor performance, or a government recall. Which of the following scenarios best describes a product that was redesigned to improve its safety, functionality, or effectiveness?
- (A) A pharmaceutical company had to recall bottles of medicine after evidence emerged of tampering in stores. This led to the company redesigning the bottles to make them tamperproof.
 - (B) A particular model of cell phone was recalled because its batteries could potentially overheat and explode. The defective phones were replaced with a different type of cell phone that did not have the same safety issues.
 - (C) Many automobiles were recalled because they were equipped with critically defective airbags. The faulty parts were removed and replaced with airbags produced by a different manufacturer.
 - (D) A product designed by a children's toy company contained several small parts that were later found to be a choking hazard to toddlers. The company then rebranded the toy under a new name and added a warning label.
17. Which of the following types of tasks is best to automate?
- (A) A customized task requiring customer input
 - (B) A dangerous task with repeatable steps
 - (C) A sizeable task with variable elements
 - (D) A complex task requiring a broad knowledge base
18. Electrostatic discharge (ESD) is a major concern with electronic devices and components. Which of the following actions will best protect sensitive electronic devices and components from ESD damage?
- (A) Keeping electronic systems and components near an air-circulating system
 - (B) Placing electronic components near synthetic materials, such as plastics
 - (C) Using an electrostatic wrist strap when handling electronic components
 - (D) Storing electronic devices and components in temperature-controlled environments
19. If the load on a structure increases beyond a certain design limit, the structure may suddenly lose elastic stability and undergo material failure. The type of load failure that is caused by two equal and opposite collinear forces acting perpendicular to a structure is known as
- (A) axial tension
 - (B) bending
 - (C) torsion
 - (D) shear

20. During a lesson on the nature of technological inventions and innovations, a teacher discusses how inventions and innovations occur both by design and by chance. Which of the following inventions resulted from the attempt to develop another product?
- (A) Microwave ovens
 - (B) Automobiles
 - (C) Lightbulbs
 - (D) Steam engines
21. Which of the following best describes the main advantage of abstraction?
- (A) It permits programmers to create efficient and scalable solutions to complex problems.
 - (B) It allows engineers to focus on the most important aspects of a problem and ignore irrelevant details.
 - (C) It makes common features and similarities among different problems easier to identify.
 - (D) It ensures that software programs are compatible with a wide range of hardware and software platforms.
22. After being popularized in the United States by Eli Whitney for use in the manufacture of muskets, which of the following contributed to the rise of the Industrial Revolution?
- (A) The moving assembly line
 - (B) Uniform interchangeable parts
 - (C) The division of labor
 - (D) Just-in-time production
23. Which of the following would provide the most appropriate and comprehensive assessment of a middle school student's practical application of the engineering design process (EDP)?
- (A) A rubric that includes performance criteria for each step of the design process
 - (B) An analysis of the student's technical documentation and report
 - (C) A critique in which the student presents their solution idea to a group of peers
 - (D) An individual consultation with the teacher on each step of the design process
24. Which **THREE** of the following types of energy sources are renewable?
- (A) Petroleum
 - (B) Wind
 - (C) Solar
 - (D) Geothermal
 - (E) Natural gas

25. Which of the following activities will best allow a group of engineering students to demonstrate their understanding of the application of forces and motion?
- (A) Designing, constructing, and testing a working catapult for launching marshmallows
 - (B) Reviewing and analyzing published data comparing different propulsion systems for aircraft
 - (C) Researching the differences among subway, train, and airline transportation systems
 - (D) Developing a more efficient lunch distribution system for the school cafeteria
26. A mixed-level high school class is learning how to use a drill press. The class contains learners of varied abilities and experience levels. Which **TWO** of the following are the best instructional methods for teaching this skill?
- (A) Providing written safety rules and instructions for operating the drill press
 - (B) Facilitating a whole-group discussion on the safe operation of the drill press
 - (C) Demonstrating the safe operation of the drill press to all students
 - (D) Pairing students for self-guided exploration of the drill press
 - (E) Assigning homework to watch a video on the safe operation of the drill press
27. When a speedometer in a car shows the speed of the car, which of the following components of the universal systems model is being demonstrated?
- (A) Input
 - (B) Output
 - (C) Feedback
 - (D) Process
28. Homes that are built in sections in a central facility and then moved and assembled at the home site best illustrate the construction practices associated with
- (A) on-site construction
 - (B) repetitive manufacturing
 - (C) prefabrication
 - (D) mass production

29. An engineering design challenge requires students to build and test a new type of bicycle. Before building their prototype, the students must present their proposed solution to the class. Which of the following is the best way for students to present the technical aspects of their design idea to the class?
- (A) Verbally explaining what the proposed product looks like
 - (B) Sketching a picture of the proposed product on a chalkboard
 - (C) Displaying the working drawings developed for the proposed product
 - (D) Showing a CAD-developed 3-D sketch of the proposed product
30. Which of the following best describes how the use of 3-D printing technology has streamlined the iterative process of innovation?
- (A) Final products can be inexpensively 3-D printed for distribution.
 - (B) Working prototypes can be created quickly and inexpensively.
 - (C) Prototypes can now be sent to the end user for testing.
 - (D) Extensive design prior to prototyping is no longer necessary.

Answers

1. Option (D) is correct. By creating an experiment that is centered on efficiency rather than total weight held, students are required to make decisions about whether a particular part is worth the added weight in the structure. Efficiency involves optimizing the performance of a structure while considering various factors such as material usage, cost, and structural integrity. This approach encourages students to make informed design decisions that balance different aspects of the project, which is a key aspect of engineering and technology design.
2. Option (B) is correct. The teacher should be familiar with and utilize the modifications and accommodations that are in a student's IEP. An IEP is a legally mandated and individually tailored education plan developed for students with disabilities in the United States. It is designed to ensure that students with special needs receive appropriate educational services, support, and accommodations to help them succeed in school. The IEP specifies the specialized services, interventions, accommodations, and modifications that students will receive to help them access the curriculum and participate in the educational environment.
3. Options (B) and (D) are correct. Texture and form are two of the seven well-established elements of design. The others are line, color, shape, value, and space.
4. Options (B), (D), and (E) are correct. Differential equations, circuits and electronics, and statistics are often required subject areas for people who pursue a degree in mechanical engineering.
5. Option (D) is correct. Advisory committees are convened to assist educators in establishing objectives that will fill local industry needs. An advisory committee is typically composed of industry professionals, educators, parents, and community members who can provide valuable insights and guidance on current industry trends, workforce needs, and skills that are in demand. By engaging with an advisory committee, the teacher can gather firsthand information about local industry needs and expectations. This information can then be used to shape classroom objectives and design activities that align with the skills and knowledge required by the local job market.
6. Option (C) is correct. Robotics uses the same terminology as flight. "Pitch", "roll", and "yaw" describe rotation about the x-, y-, and z-axes. "Pitch" refers to the rotation around the lateral (side-to-side) axis. It is similar to nodding your head up and down. "Roll" refers to the rotation around the longitudinal (front-to-back) axis. It is similar to tilting your head from side to side. "Yaw" refers to the rotation around the vertical (up-down) axis. It is similar to turning your head left and right.

7. Option (C) is correct. As the spike enters the ground, the kinetic energy of the moving spike is gradually transformed into thermal (heat) energy due to friction and resistance between the spike and the ground. Kinetic energy is the energy an object possesses due to its motion. It depends on both the object's mass and velocity (speed). Thermal energy, often simply referred to as heat, is a form of energy associated with the motion of atoms and molecules within a substance. It is transferred from one object or substance to another when there is a temperature difference between them.
8. Option (C) is correct. The Technology Student Association (TSA) is the only national student organization that is devoted exclusively to the needs of students interested in technology. The association is open to students enrolled in or who have completed technology education courses at the middle and high school levels.
9. Option (B) is correct. A transmitter is a communication system component that is responsible for sending or transmitting signals, messages, or data from one location to another. In the context described, the student-built device at the first school will transmit the message to the neighboring school. It is responsible for encoding the message and transmitting it wirelessly to the group of students at the neighboring school.
10. Option (A) is correct. Although the IoT offers many benefits, such as improved efficiency and automation, there are also several security risks associated with IoT. IoT devices may collect sensitive information about individuals, such as their location, activity, or health data, raising privacy concerns about how that data is used and shared.
11. Option (D) is correct. By having students develop a list of potential ethical concerns, the teacher can assess each student's understanding. Further, research shows that the often- complex task of assessing students' understanding of ethical concerns can be successfully and accurately assessed using discussion techniques. Using these methods together provides the teacher with the most valuable assessment artifacts.
12. Options (A), (B), and (C) are correct. If the software responsible for confirming a user's identity is not working, it could result in users being unable to access their private images. This authentication process is essential for granting users access to their private data, and if this component is malfunctioning, it can lead to access issues. In addition, if the database where images are stored is corrupt, it can prevent users from accessing their private images. Even if the authentication process is successful, if the database component that handles image retrieval and display is corrupt, users won't be able to view their images. Finally, if the servers where users' images reside are not working, it can result in users being unable to access their private images. The images need to be accessible and retrievable from the servers, and if these servers are experiencing issues or downtime, it can lead to the access problem reported by the users.
13. Option (C) is correct. Because there are many possible solutions to any engineering or technological design problem, students should first come up several ideas to consider before they jump in to solving the problem.

14. Option (D) is correct. A virtual private network (VPN) increases security by creating a secure data connection between a computing device and a computer network or between two computer networks that are using an insecure communication channel such as the public Internet.
15. Option (D) is correct. The process known as lean manufacturing is a systematic approach that aims to enhance performance at both the product design and manufacturing stages. It is built on the guiding principles of elimination of waste, respect for humanity, continuous improvement, leveled production, and built-in quality, among others.
16. Option (A) is correct. A redesign of the product packaging improved safety by reducing the likelihood that tampering could occur again.
17. Option (B) is correct. Having machines perform a dangerous task can protect human operators. Repeatable steps are the easiest to automate because the actions can be performed repeatedly by machines.
18. Option (C) is correct. Antistatic or electrostatic wrist straps are among the preventive measures used to keep sensitive electrical devices and components safe. When the straps are used in conjunction with proper grounding, electrostatic discharge can be minimized.
19. Option (D) is correct. "Shear" refers to the deformation or failure of a material that occurs when forces act parallel to each other but in opposite directions, causing the material's internal layers to slide past each other. Shear forces can cause the material to experience distortion, sliding, or tearing along a plane.
20. Option (A) is correct. Microwave ovens were an invention that came about without intentional effort toward inventing that product. Percy Spencer developed the first microwave oven after noticing that heat was generated by a magnetron during an experiment with radar in 1945. All the other inventions noted in this question occurred as a result of intentional design and effort.
21. Option (B) is correct. The main advantage of abstraction is that it simplifies the complexity of a system or problem by removing unnecessary details, allowing the user to focus on the essential characteristics and functionality, and making it easier to understand, manage, and modify.
22. Option (B) is correct. Eli Whitney introduced uniform interchangeable parts on muskets that he was making for the military. Uniform interchangeable parts refer to components or elements of a product or system that are manufactured to precise and consistent specifications, ensuring that each part is nearly identical and can be easily replaced with another identical part without requiring custom fitting or adjustment. The concept eventually spread to automobiles and became a cornerstone of mass production.

23. Option (A) is correct. A performance-based rubric that includes criteria for each step of the design process is the most comprehensive and appropriate method to assess the student's understanding and inform future instruction.
24. Options (B), (C), and (D) are correct. Types of renewable energy sources include wind, solar, and geothermal as well as water and biomass. These resources are either virtually limitless or will be replaced faster than they can be consumed.
25. Option (A) is correct. This presents an effective way to teach the application of forces and motion, as students would need to calculate torque and associated forces in order to build a functional catapult. They would also learn how adjusting the angle of the launch influences the distance and direction that the marshmallows will travel in this scenario.
26. Options (A) and (C) are correct. Best practice dictates that all machine-tool instruction should include a written and visual resource for students to refer to at any time. It is also necessary to provide a practical demonstration of the tool, affording students the opportunity to observe proper operation and to ask questions.
27. Option (C) is correct. The goal of the car is to move (forward or backward), and the speedometer gives feedback on how fast the car is moving. Pressing the gas pedal is the input, burning fuel is the process, and whether the car is moving is the output.
28. Option (C) is correct. Prefabrication, often referred to as prefab, is a construction technique in which components or modules of a building or structure are manufactured off-site in a controlled environment and then transported to the construction site for assembly. Prefabricated homes are homes that are built in sections in a home-building (manufacturing) facility and then moved to a home site and assembled.
29. Option (D) is correct. 3-D sketches developed using CAD would best show what the planned product would look like.
30. Option (B) is correct. Prototypes or working models will usually go through multiple iterations. Printing in 3-D allows engineers to quickly create physical prototypes of their designs to visualize and test their concepts in a tangible form. Compared with traditional manufacturing methods for producing prototypes, 3-D printing is more cost-effective and time efficient. With 3-D printing, engineers can easily modify and improve prototypes based on testing and feedback to refine designs before committing to large-scale production. Computer modeling, coupled with 3-D printing, allows engineers to visualize and validate their designs in a realistic manner before committing to expensive manufacturing processes.

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from seeing them on other standardized tests you have taken. If not, familiarize yourself with them so that you won't have to spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions you will respond by selecting an oval to choose a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by doing the following.

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text, or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question, you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essay questions and short-answer questions are types of questions that call for a constructed response.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. For such questions, you must support your position with specific reasons and examples from your own experience, observations, or reading.

Following are a few sample essay topics to review:

- *Brown v. Board of Education of Topeka*
 “We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other ‘tangible’ factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does.”
 - A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
 - B. What was the rationale given by the justices for their 1954 ruling?
- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*
 - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
 - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.
- *“Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people who need a job.”*
 - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep the following things in mind when you respond to a constructed-response question.

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and should not be filled with unnecessary information.
5. **Take notes on scratch paper so that you don't miss any details.** Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you intended to write. Do not leave sentences unfinished or omit clarifying information.

General Assistance For The Test

***Praxis*® Interactive Practice Test**

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

ETS provides a free interactive practice test with each test registration. You can learn more [here](#).

Doing Your Best

Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your *Praxis* test and make the best use of your time. Learn more at [Strategy and Tips for Taking a *Praxis* Test](#).

Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at [Develop a Study Plan](#).

Helpful Links

[Ready to Register](#) – How to register and the information you need to know to do so.

[Disability Accommodations](#) – Testing accommodations are available for test takers who meet ETS requirements.

[PLNE Accommodations \(ESL\)](#) – If English is not your primary language, you may be eligible for extended testing time.

[What To Expect on Test Day](#) – Knowing what to expect on test day can make you feel more at ease.

[Getting Your Scores](#) – Find out where and when you will receive your test scores.

[State Requirements](#) – Learn which tests your state requires you to take.

[Other Praxis Tests](#) – Learn about other *Praxis* tests and how to prepare for them.

To search for the *Praxis* test prep resources that meet your specific needs and to purchase official test prep made by the creators of the Praxis tests, visit:

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