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| Central florida assessment collaborative |
| Individual Test Item Specifications |
| Introduction to Technology |
| 2014 |

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**Table of Contents**

[I. Guide to the Individual Benchmark Specifications 1](#_Toc362246932)

[Benchmark Classification System 1](#_Toc362246933)

[Definitions of Benchmark Specifications 2](#_Toc362246934)

[II. Individual Benchmark Specifications 3](#_Toc362246935)

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 NGSSS and 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.



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 **Standard**.



**Definitions of Benchmark Specifications**

The *Individual Benchmark Specifications* provides standard-specific guidance for assessment item development for CFAC item banks. For each benchmark assessed, the following information is provided.

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| **Reporting Category** | is a grouping of related benchmarks that can be used to summarize and report achievement. |
| **Standard** | refers to the standard statement presented in the NGSSS or domain in the Florida Standards. |
| **Benchmark** | refers to the benchmark statement presented in the NGSSS or standard statement in the Florida Standards. In some cases, two or more related benchmarks are grouped together because the assessment of one benchmark addresses another benchmark. Such groupings are indicated in the Also Assesses statement. |
| **Item Types**  **Cognitive**  **Complexity** | are used to assess the benchmark or group of benchmark.  ideal level at which item should be assessed. |
| **Benchmark Clarifications** | 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. |
| **Content Limits** | define the range of content knowledge and that should be assessed in the items for the benchmark. |
| **Stimulus Attributes** | 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. |
| **Response Attributes** | define the characteristics of the answers that a student must choose or provide. |
| **Sample Items** | are provided for each type of question assessed. The correct answer for all sample items is provided. |

**II. Individual Benchmark Specifications**

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| **Benchmark Number** | 1.02 |
| **Standard** | Demonstrate an understanding of the characteristics and scope of technology. |
| **Benchmark** | Describe the development of technology as a human activity that is the result of individual or collective needs and the ability to be creative. |
| **Also Assesses** | 01.01 |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to describe the relationship between creativity and innovation in developing technology.  The student will be able to discuss why creativity is hard to measure while innovation is completely measurable.  The student will be able to explain how innovation introduces change into a relatively stable system while creativity is using the potential of the mind to conceive new ideas. |
| **Content Limits** | Product demand, usefulness of technology – products and systems, development of technology, human creativity and motivation, product and demand and rate of technological development |
| **Stimulus Attribute** | May include the changes to a product that improves human use. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Cover technology in our daily lives, defining Technology, comparing technology and science. Cover how technology has improved our lives, creates new challenges, technological literacy and people in technology: Dean Kamen. Key words: systems, resources, requirements, trade-offs and optimization, processes and control. |

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| **Sample Item** | What is needed in technology in order to turn resources into the goods and services that people need?   1. artificial intelligence 2. computer input 3. human knowledge 4. human labor     Correct Answer: C |

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| **Benchmark Number** | 1.03 |
| **Standard** | Demonstrate an understanding of the characteristics and scope of technology. |
| **Benchmark** | Explain how technology is closely linked with creativity, which has resulted in innovation. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)knowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to describe the relationship between creativity and innovation as it leads to developing technology to make life better. |
| **Content Limits** | Content should be limited to technology and innovation in the last 200 years. |
| **Stimulus Attribute** | May include charts, graphs or images. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: product demand, usefulness of technology – products and systems, development of technology, human creativity and motivation, product and demand and rate of technological development. |
| **Sample Item** | Alexander Graham Bell invented the telephone in 1876. Which of the following is the innovation to the 1876 telephone?   1. cellphone 2. gaming system 3. portable laptop 4. tablet   Correct Answer: A |

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| **Benchmark Number** | 2.01 |
| **Standard** | Demonstrate an understanding of the core concepts of technology. |
| **Benchmark** | Identify technological systems including input, processes, output and at times feedback. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to identify input, processes, output, and feedback as parts of the technological systems. |
| **Content Limits** | Every system involves the use of seven basic resources, people, capital, time, information, energy, materials, tools and machines. |
| **Stimulus Attribute** | May include timelines, excerpts from passages, images that show the basic system model. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards,  benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: the content limits are tools, systems, systems thinking, resources, management and quality control. Key terms: consumers, capital, stock, dividends, interest, data and nanoseconds. |
| **Sample Item** | The output of a system must be watched to be sure that the system is solving a problem it was intended to solve and to be sure that the system is not creating new problems. What helps to determine if the system is doing what it is designed to do?   1. feedback 2. input 3. output 4. process   Correct Answer: A |

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| **Benchmark Number** | 3.01 |
| **Standard** | Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. |
| **Benchmark** | Explain how technological systems interact with one another. |
| **Also Assesses** | 3.02 |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Short Response, Extended Response |
| **Cognitive Complexity** | Moderate, High |
| **Benchmark Clarifications** | The student will be able to recognize different technological systems and identify if or how they can relate to each other.  The student will be able to define and explain the Communication Technological System.  The student will know the definition of a system and explain how it produces a desired result. |
| **Content Limits** | Limited to systems. Parts of the basic system model: input, process, output, and subsystem. |
| **Stimulus Attribute** | A diagram may be used to visually show the process of input, controller, process then output. |
| **Response Attributes** | The student must be able to explain the process of the system model. The input is the desired result, then there is a process which leads to the output of the actual result. |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: All systems include inputs, process, and outputs. Keywords: system, input, process, output, and subsystem. |
| **Sample Item** | Explain why a microwave is a technological system.  **Possible Correct Answer:** A microwave is a technological system because it provides a desired response. The desired response is a hot meal. When preparing a bag of popcorn, you must INPUT a time for the popcorn to be cooked. Based on the input you entered, the popcorn can be PROCESSed. Once the process is complete, you have an OUTPUT of your actual result.  **Short Response Rubric**  2 Points:  The response indicates that the student has a thorough understanding of the concept embodied in the task. Response is accurate, complete, and fulfills all the requirements of the task. Necessary support and/or examples are included.  1 Point:  The response indicates that the student has a partial understanding of the concept embodied in the task. Some of the support and/or examples and requirements of the task may be incomplete or omitted.  0 Points:  The response indicates that the student does not demonstrate an understanding of the concept embodied in the task. The response has insufficient amount of information to determine the student’s understanding of the task or the student has failed to respond. |

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| **Benchmark Number** | 4.01 |
| **Standard** | Demonstrate an understanding of the cultural, social, economic, and political effects of technology. |
| **Benchmark** | Identify the ways that use of technology affects humans, including their safety, comfort, choices, and attitudes about technology’s development and use. |
| **Also Assesses** | N/A |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)knowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will show an understanding of technological advances and their relation to historical timeframes.  The student will be able to explain how technology affects people, how it impacts and its consequences. |
| **Content Limits** | Content should be limited to technological advances made during the Industrial Revolution (late 1700s) until the mid-1900s. |
| **Stimulus Attribute** | May focus on the impact of technology and timeline. Use an increase of invention over time timeline, which begins in the 8000 BC to present day. The timeline covers important inventions from Agriculture to space travel. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Economic, political, and cultural issues are influenced by technology. Combining simple technologies can create more powerful technologies. Keywords: Industrial Revolution, factory system, Information Age, exponential rate of change, linear rate of change. |
| **Sample Item** | Changes in technology have led to the development of different types of jobs in different eras. In which century did the Industrial Revolution begin?   1. 1700 2. 1800 3. 1900 4. 2000   Correct Answer: A |

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| **Benchmark Number** | 4.02 |
| **Standard** | Demonstrate an understanding of the cultural, social, economic, and political effects of technology. |
| **Benchmark** | Explain that technology, by itself, is neither good nor bad; but decisions about the use of products and systems can result in desirable or undesirable consequences. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Moderate, High |
| **Benchmark Clarifications** | The student will be able recognize and evaluate technology as having consequences.  The student will be able to explain how technology affects people, how it impacts and its consequences. |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | May include scenarios, text passages, and excerpts from primary source documents. A scenario: A power plant that produces electricity and heat. The expected, desirable output are electricity and heat. Undesirable output is noise and smoke. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards,  benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Economic, political, and cultural issues are influenced by technology. Combining simple technologies can create more powerful technologies. Keywords: Industrial Revolution, factory system, Information Age, exponential rate of change, linear rate of change. |
| **Sample Item** | Which is **not** a technological negative when it comes to highways?   1. Cars create traffic jams. 2. Cars can cause accidents. 3. Cars create noise and pollution, particularly for nearby homes. 4. Cars provide the ability to travel greater distances in less time.   Correct Answer: D |

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| **Benchmark Number** | 5.01 |
| **Standard** | Demonstrate an understanding of the effects of technology on the environment. |
| **Benchmark** | Describe the management of waste produced by technological systems as an important societal issue. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to determine environmental causes and effects produced as technology develops. |
| **Content Limits** | Limited to technology waste. Limited how technology affects the environment, i.e. power plant and the need for hybrid vehicles. |
| **Stimulus Attribute** | May include technology and environment. Passages related to technology affects to the environment and minimizing environmental impacts. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: The use of technology affects humans in various ways, including their safety, comfort, and attitudes. Technology must fit the needs of people, society, and the environment. Keywords: hybrid electric vehicle, ethical dilemma. |
| **Sample Item** | A hybrid electric vehicle is a technology created to solve an environmental issue. Which problem was it designed to reduce?   1. illegal dumping 2. landfills space reduction 3. pollution prevention from emissions 4. recycling metal and parts   Correct Answer: C |

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| **Benchmark Number** | 6.02 |
| **Standard** | Demonstrate an understanding of the role of society in the development and use of technology. |
| **Benchmark** | Identify changes in society and the creation of new needs and wants caused by the use of inventions and innovations. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to place technologies in a timeline based on societal needs or wants and evaluate their impact. |
| **Content Limits** | Content should be limited to changes in society and the creation of new needs and wants during the Industrial Revolution until the Late 1900s and the Information Age (Late 1900s-present day). |
| **Stimulus Attribute** | May include text passages or excerpts from primary source documents and a technology timeline. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Development driven by demands, values, and interests. Inventions and innovations lead to social changes. Keywords: functionality, quality, safety. |
| **Sample Item** | Which technology is **not** part of the digital revolution?   1. communications networks 2. computers 3. digital electronic devices 4. hybrid cars   Correct Answer: D |

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| **Benchmark Number** | 7.01 |
| **Standard** | Demonstrate an understanding of the influence of technology on history. |
| **Benchmark** | Identify inventions and innovations that have evolved by using slow and methodical processes of tests and refinements. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate, High |
| **Benchmark Clarifications** | The student will demonstrate an understanding of the origin and evolution of technology as it relates to human progress.  The student will be able to create a timeline that demonstrates an understanding of the origin and evolution of technology as it relates to the human progress, i.e. Cave man to present man. |
| **Content Limits** | Content should be limited to inventions and innovations beginning in 8000 B.C (Agriculture) to present day (Space Travel). |
| **Stimulus Attribute** | May include technology timeline. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: written words, printing press, telegraph, telephone, radio, cellular communication. Processes of invention and innovations. Evolutionary developments of technology, and technology shapes course of history. Keywords: invention, innovation, evolution |
| **Sample Item** | Prehistoric humans made the first tools approximately how many years ago?   1. 10,000 2. 300,000 3. one million 4. two million   Correct Answer: D |

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| **Benchmark Number** | 9.02 |
| **Standard** | Demonstrate an understanding of engineering design. |
| **Benchmark** | Define brainstorming as a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)knowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to define group-brainstorming techniques.  The student will be able to discuss the process of brainstorming.  The student will be able to work in small groups, choose a leader, and set a time limit to reach a goal.  The student will be able to share multiple concepts.  The student will be able to evaluate results time and concepts have been exhausted. |
| **Content Limits** | The process of design. The process of design, The need for problem solving, good design in problem solving, and informed design. |
| **Stimulus Attribute** | None Specified |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: topic, problem. Informed design: clarify, research, generate, choose and justify, develop, test and evaluate, redesign and communicate. Keywords: brain storming, prototype, design specifications |
| **Sample Item** | Brainstorming is a method by which a person or group of people can come up with alternative solutions. Which of the following should **not** occur during brainstorming?   1. criticize 2. review the ideas 3. share your ideas 4. take notes   Correct Answer: A |

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| **Benchmark Number** | 10.02 |
| **Standard** | Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. |
| **Benchmark** | Define invention as a process of turning ideas and imagination into devices and systems and innovation as the process of modifying an existing product or system to improve it. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark Clarifications** | Students will be able to differentiate between invention (development) and innovation (improvement). |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | Items may include charts. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Troubleshooting, inventions and innovations, experimentation, research and development. Keywords: Inventions, Innovations |
| **Sample Item** | What is the difference between invention and innovation?   1. new product versus improved 2. new product with no changes 3. old product versus improved 4. old product versus no changes   Correct Answer: A |

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| **Benchmark Number** | 11.03 |
| **Standard** | Demonstrate the ability to apply the design process. |
| **Benchmark** | Make a two-dimensional and three-dimensional representations of the designed solution. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (P)erformance |
| **Item Types** | Performance Task |
| **Cognitive Complexity** | Moderate, High |
| **Benchmark Clarifications** | Students will use a 2-D graphic to represent the steps in the design process.  The student will create a 2-D orthographic drawing per the instructor’s specifications. |
| **Content Limits** | Limit the 2-D drawing to something specified by the instructor. |
| **Stimulus Attribute** | May include illustrations of the design process. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: The use of symbols and drawings promotes clear communication. Objects can be shown using two- or three- dimensional representations. Drawings and sketches are used to organize, record, and communicate ideas. Keywords: crating, orthographic drawing, pictorial drawing, oblique drawing, isometric drawing, perspective drawing, rendering. |

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| **Sample Item** | Rocket-Blast Skateboard, Inc. wants to increase its sales. Use a Basic Cycle design to represent the steps they take to make this happen.  Performance assessment items require more detailed instructions and a scoring rubric. The scoring rubric should have elements that will need to be included for students to earn credit. Will grammar/spelling count? What software if any should they use for this project?  Software is based on the individual school/county availability. |

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| **Benchmark Number** | 12.03 |
| **Standard** | Demonstrate the abilities to use and maintain technological products and systems. |
| **Benchmark** | Use computers and calculators in various applications. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (P)erformance |
| **Item Types** | Performance Task |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will identify outcomes of program specific software.  The student will be able to use computers and calculators in various applications in order to get their desired output. For example, producing drawings, outlines and tables, graphs and other visual aids. |
| **Content Limits** | Software is based on the individual school/county availability. |
| **Stimulus Attribute** | May review design applications. May include samples of computer generated drawings, outlines and tables, and graphs. |
| **Response Attributes** | None Specified |
| **Sample Item** | Kale needs to complete a function in his spreadsheet software to average the scores of his basketball players’ past three games. Using the information above, open a spreadsheet program and complete the task to find all of the players’ averages.  Performance assessment items require more detailed instructions and a scoring rubric. The scoring rubric should have elements that will need to be included for students to earn credit. Will grammar/spelling count? What software if any should they use for this project?    Software is based on the individual school/county availability. |

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| **Benchmark Number** | 13.02 |
| **Standard** | Design and use instruments to gather data. |
| **Benchmark** | Use data collected to analyze and interpret trends in order to identify the positive or negative effects of a technology. |
| **Also Assesses** | 13.03, 13.04 |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate, High |
| **Benchmark Clarifications** | The student determine value of content that displays collected data for analyzing and interpretation.  The student will be able to demonstrate how to collect, organize, and display information for interpretation. |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | May include scenarios, excerpts from passages such as primary source documents, etc.  May use charts and graphs. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards,  Benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Design involves making a product or system and documenting a solution. Design is a creative planning process that leads to useful products and systems. Keywords: informed design, specification, design brief, constraint, brainstorming, scale model, variable, and market research. |
| **Sample Item** | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Which graphic is a function of a spreadsheet application such as Excel?  A.   |  |  | | --- | --- | | B. | A. | | C. |  | | D. |  | |  |  |   Correct Answer: B | |

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| **Benchmark Number** | 13.03 |
| **Standard** | Design and use instruments to gather data. |
| **Benchmark** | Identify trends and monitor potential consequences of technological development. |
| **Also Assesses** | 13.01, 13.04 |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to make decisions about trends of technology by analyzing a timeline.  The student will be able to identify how trends in technology relate to the digital revolution. |
| **Content Limits** | Content should be limited to trends of technology within the Information Age (also known as the Computer Age or Digital Age). |
| **Stimulus Attribute** | May include scenarios or excerpts from passages such as primary source documents. May use a chart the displays the trend. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Design involves making a product or system and documenting a solution. Design is a creative planning process that leads to useful products and systems. Keywords: informed design, specification, design brief, constraint, brainstorming, scale model, variable, and market research. |
| **Sample Item** | The beginning of the Twentieth Century marked the first uses of which technology?   1. automobiles 2. computers 3. fax machines 4. printing press   Correct Answer: A |

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| **Benchmark Number** | 13.04 |
| **Standard** | Design and use instruments to gather data. |
| **Benchmark** | Interpret and evaluate the accuracy of the information obtained and determine if it is useful. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will identify the value of information gathered.  The student will be able to gather data and use the information to improve on a product.  The student will be able to discuss the tools engineers use to gather information in order to proceed with their design.  The student will be able to apply the tools engineers use and use them for their own design. |
| **Content Limits** | Search and discuss existing solutions to solve problem at hand. For example, the ergonomics of a chair. |
| **Stimulus Attribute** | May include information systems. Use the internet to research a product, identify a problem, issues and questions that relate to a design challenge. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Design involves making a product or system and documenting a solution. Design is a creative planning process that leads to useful products and systems. Keywords: informed design, specification, design brief, constraint, brainstorming, scale model, variable, market research Computer aided-drawing (CAD), technical drawing, sketching and freehand drawing, two-dimensional and three dimensional drawings. |
| **Sample Item** | When engineers design dams, bridges, large buildings and other structures, they need to determine whether the structure will be strong enough to withstand forces from nature and people. One way of producing scenarios for improving design is by using CAD software. What is the process called?  A. map-making  B. modeling  C. parametric design  D. stress analysis  Correct Answer: D |

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| **Benchmark Number** | 15.03 |
| **Standard** | Demonstrate an understanding of and be able to select and use agricultural and related biotechnologies. |
| **Benchmark** | Explain how biotechnology applies the principles of biology to create commercial products or processes. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to distinguish the principles of biotechnologies. Students should be able to identify the technological advances in agriculture. |
| **Content Limits** | Hydroponics and food production |
| **Stimulus Attribute** | May include passages on biotechnology. Articles on hydroponics and food production. |
| **Response Attributes** | None Specified |
| **Sample Item** | Why are agriculture, food production, and medical technology referred to as biologically related technologies?   1. They apply the principles of biology to create commercial products or process. 2. They apply the principles of physics to create commercial products or process. 3. They apply the principles of technology to create commercial products or process. 4. They apply the principles of communication to create commercial products or process.   Correct Answer: A |

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| **Benchmark Number** | 16.01 |
| **Standard** | Demonstrate an understanding of and be able to select and use energy and power technologies. |
| **Benchmark** | Define energy as the capacity to do work. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | Students will be able to explain how energy is related to work. |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | May include illustrations of energy. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Work is the product of force and distance, Energy is the capacity to do work, Energy cannot be created or destroyed. Key words: work, energy, kinetic energy, potential energy, thermal energy, heat, joule. |
| **Sample Item** | From where does solar energy come?   1. fossil fuels and wood 2. heat in the Earth 3. the sun 4. tides and falling water   Correct Answer: C |

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| **Benchmark Number** | 17.02 |
| **Standard** | Demonstrate an understanding of and be able to select and use information and communication technologies. |
| **Benchmark** | Define communication systems made up of a source, encoder, transmitter, receiver, decoder, and destination. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to relate symbols used to communicate a specific message.  The student will be able to explain the process of communicating data. |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | May include illustrations of the communication process. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Effective communication systems have an input, a process, an output, and feedback loop. The communication process includes a message, a source, an encoder, a channel, a decoder, and a receiver. Keywords: transmit, source, encoder, channel, decoder, receiver, graphic communication. |
| **Sample Item** | When a person receives an email message, they are which part of the communication system?   1. decoder 2. encoder 3. receiver 4. source   Correct Answer: C |

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| **Benchmark Number** | 17.04 |
| **Standard** | Demonstrate an understanding of and be able to select and use information and communication technologies. |
| **Benchmark** | Use symbols, measurements, and drawings to promote clear communication by providing a common language to express ideas. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to identify symbols used in communication technology.  The student will be able to identify common safety symbols. |
| **Content Limits** | Symbols should be limited to those found in the classroom, lab, and school settings. |
| **Stimulus Attribute** | Questions could include scenarios, excerpts from passages such as primary source documents, charts, graphs, etc. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: The use of symbols and drawing promote clear communication. Keywords: communication, graphics, digital image. |
| **Sample Item** | Tatiana is working in the lab and comes across a glass beaker that has this symbol:    Clipart of danger sign symbol  “ www.pixabay.com”  What does this symbol represent?   1. dangerous 2. recycling 3. safe to use 4. trash   Correct Answer: A |

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| **Benchmark Number** | 18.01 |
| **Standard** | Demonstrate an understanding of and be able to select and use transportation technologies. |
| **Benchmark** | Describe how transporting people and goods involve a combination of individuals and vehicles. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to make observation of which is the best transportation method.  The student will be able to explain transportation allows people and goods to move from place to place. |
| **Content Limits** | Limited to trains, cars, subways, ships, planes and space travel. |
| **Stimulus Attribute** | Illustration of the different methods used for different goods. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Transportation systems provide the means of moving people and goods from place to place. Keywords: vehicle, transmission, freight. |
| **Sample Item** | Which is **not** a good method for transporting freight?   1. car 2. ship 3. train 4. truck   Correct Answer: A |

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| **Benchmark Number** | 19.02 |
| **Standard** | Demonstrate an understanding of and be able to select and use manufacturing technologies. |
| **Benchmark** | Classify manufactured goods as durable and non-durable. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to categorize manufactured goods as durable (not replaced often) or non-durable (replaced very often). |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | May include charts that compare durable and non-durable goods. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Manufacturing is the process of making goods in workshop or factory. Goods may be classified as durable or nondurable. Keywords: manufacturing, durable, nondurable, interchangeable part, mass production. |
| **Sample Item** | What is an example of non-durable good?   1. car 2. furniture 3. vacuum 4. water filter   Correct Answer: D |

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| **Benchmark Number** | 21.01 |
| **Standard** | Demonstrate proper and safe procedures while working with technological tools, apparatus, equipment, systems, and materials |
| **Benchmark** | Follow laboratory safety rules and procedures. |
| **Also Assesses** | 21.04 |
| **(K)nowledge, (P)erformance, or (B)oth** | (B)oth |
| **Item Types** | Selected Response, Performance Task |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to demonstrate knowledge of laboratory safety rules and procedures.  The student will be able to conduct themselves in a proper manner in a lab setting. |
| **Content Limits** | Limited to technology labs. |
| **Stimulus Attribute** | May include illustrations that demonstrate proper and improper lab safety. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Describe the purpose of safety and health rules and OSHA, Protection of eyes and ears, proper way to lift and carry objects, appropriate conduct and personal attire for the laboratory. Keywords: Safety, health, OSHA, CSHO, MSDS, ANSI. |
| **Sample Item** | Which is **not** a safety lab issue?   1. airborne contaminants 2. lab inspection 3. machine guards 4. tool condition   Correct Answer: B |

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| **Benchmark Number** | 21.05 |
| **Standard** | Demonstrate proper and safe procedures while working with technological tools, apparatus, equipment, systems, and materials |
| **Benchmark** | Identify color-coding safety standards. |
| **Also Assesses** | 21.01 |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)nowledge |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to classify color-coding safety standards on an OSHA chart. |
| **Content Limits** | None Specified |
| **Stimulus Attribute** | May include color codes for safety. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: Describe the purpose of safety and health rules and OSHA, Protection of eyes and ears, proper way to lift and carry objects, appropriate conduct and personal attire for the laboratory. Keywords: Safety, health, OSHA, CSHO, MSDS, ANSI, Type A fire, Type B fire, Type C fire, Type D fire |
| **Sample Item** | According to the OSHA safety chart, what does the color **red** designate?   1. first aid available 2. flammable or combustible material storage 3. health hazard 4. nonflammable corrosive   Correct Answer: B |

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| **Benchmark Number** | 23.02 |
| **Standard** | Discuss individual interests, aptitudes, and opportunities as they relate to a career. |
| **Benchmark** | Discuss individual interests related to a career. |
| **Also Assesses** | Not Applicable |
| **(K)nowledge, (P)erformance, or (B)oth** | (K)knowledge |
| **Item Types** | Selected Response, Short Response, Extended Response |
| **Cognitive Complexity** | Low, Moderate |
| **Benchmark Clarifications** | The student will be able to recognize skills and interests needed for specific technology related careers.  The student will be able to provide information about various skills and interests needed for a specific technology related career. |
| **Content Limits** | Limited to technology related careers. |
| **Stimulus Attribute** | May include charts that show specific careers and the skills needed. |
| **Response Attributes** | None Specified |
| **Content Focus** | These terms are given in addition to those found in the standards, benchmarks, and benchmark clarifications. Additional items may include, but are not limited to, the following: The six major career areas in the field of communications, Jobs in the field of communication technology. Keywords: drafters, engineers, scientists, designers. |
| **Sample Item** | What might be a job description for a typical CAD Drafter/Technician?   1. Mass produce consumer goods. 2. Chart the stages of a machine’s processes. 3. Use computers to prepare technical drawings. 4. Use computers to communicate with other governments.   Correct Answer: C |