Foundations of Technology
Semester B Exam Review Guide

Guidance on Student Use

Test Description
Length: 2 hours
Questions: 2 Design Challenge prompts
- Design Challenge 1 consists of three (3) prompts
- Design Challenge 2 consists of three (3) prompts

Upon successful completion of the second semester, students should be able to do the following:

Unit 7 - Agriculture and Biotechnology:

- **3.1 Develop an understanding of the attributes of design. (ITEA, STL 8)**
  - Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
  - Explain that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results. (ITEA, STL 8-H)
  - Explain that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA, STL 8-K)

- **3.2 Develop an understanding of engineering design. (ITEA, STL 9)**
  - Explain that a prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (ITEA, STL 8-K)
  - Explain constraints on the engineering design process.
    - At least-safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and human factors engineering (ergonomics).

- **3.3 Develop abilities to apply and analyze the design process. (ITEA, STL 11)**
  - Identify criteria and constraints and determine how these will affect the design process. (ITEA, STL 11-N)
  - Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (ITEA, STL 11-O)
  - Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (ITEA, STL 11-P)
  - Develop and produce a product or system using a design process. (ITEA, STL 11-Q)
  - Evaluate final solutions and communicate observations, processes, and results of the entire design process, suing verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (ITEA, STL 11-R)
  - Apply the design process including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results.
• 3.4 Select and use tools and equipment correctly and safely.
  o Select and use the appropriate tools and equipment in making two-dimensional and three-dimensional representations of design solutions, forming and molding processes, machining processes, and assembly processes.
• 3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)
  o Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.
• 4.10 Analyze the functioning and application of biotechnology systems.
  o Identify and describe applications of biotechnology in the designed world such as genetically modified food, DNA fingerprinting, oil biodegradation, insulin production, and bioethics.
  o Explain science concepts and mathematical concepts applied in biotechnology such as genes, genetic code, DNA structure, enzymes, proteins, cloning, mutations, chromosome number, genetic recombination, anaerobic conversion, and fermentation.
• 5.3 Develop and understanding of agricultural and related biotechnologies. (ITEA, STL 15)
  o Explain the production and application of agricultural processes and products such as food, fiber, fuel, and chemical.
  o Explain the application of biotechnology processes and products including agricultural, pharmaceuticals, food and beverage, medicine, and energy.
  o Explain that agricultural includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.
  o Explain that biotechnology has application in such as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering. (ITEA, STL 15-L)

Unit 8-Natural vs. Technological Processes:

• 1.3 Develop an understanding of the relationship among technologies and the connections between technology and other fields of study. (ITEA, STL 3)
  o Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.
• 2.3 Develop an understanding of the effects of technology on the environment (ITEA, STL 5)
  o Explain that humans devise technologies to reduce the negative consequences of other technologies. (ITEA, STL 5-K)
  o Analyze the relationship between technological processes and natural processes.
  o Investigate technologies designed to reduce the negative consequences of other technologies.
  o Research and report on processes (reusing, reducing, and recycling) that conserve water, soil, and energy.

Unit 6a-Core Technologies:
• 3.1 Develop an understanding of the attributes of design. (ITEA, STL 8)
  o Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
Explain that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results. (ITEA, STL 8-H)

- Explain that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA, STL 8-K)

- **3.2 Develop an understanding of engineering design. (ITEA, STL 9)**
  - Explain that a prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (ITEA, STL 8-K)
  - Explain constraints on the engineering design process. At least—safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and human factors engineering (ergonomics).

- **3.3 Develop abilities to apply and analyze the design process. (ITEA, STL 11)**
  - Identify criteria and constraints and determine how these will affect the design process. (ITEA, STL 11-N)
  - Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (ITEA, STL 11-O)
  - Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (ITEA, STL 11-P)
  - Develop and produce a product or system using a design process. (ITEA, STL 11-Q)
  - Evaluate final solutions and communicate observations, processes, and results of the entire design process, suing verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (ITEA, STL 11-R)
  - Apply the design process including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results.

- **3.4 Select and use tools and equipment correctly and safely.**
  - Select and use the appropriate tools and equipment in making two-dimensional and three-dimensional representations of design solutions, forming and molding processes, machining processes, and assembly processes.

- **3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)**
  - Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.

- **4.7 Analyze the functioning and application of thermal technology systems.**
  - Identify and describe applications of thermal technology in the designed world such as thermometer, refrigerator, furnace, air conditioner, and heat engines.
  - Explain science concepts and mathematical concepts applied in thermal technology such as convection, conduction, radiation, insulation, and efficiency.

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**Unit 9: Medical Technologies:**

- **2.2 Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)**
Cite instances where ethical considerations have impacted the development, selection, and use of technologies. (ITEA, STL 4-J)

2.4 Develop an understanding of the role of society in the development and use of technology. (ITEA, STL 6)
- Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
- Defend the proposition that the evolution of civilization has been directly affected by, and has been in turn affected, the development and use of tools and materials.
- Explain that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.

2.5 Develop an understanding of the influence of technology on history. (ITEA, STL 7)
- Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
- Explain that the Iron Age was defined by the use of iron and steel as the primary materials for tools. (ITEA, STL 7-K)
- Explain that the Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society. (ITEA, STL 7-L)
- Explain that the Renaissance, a time of rebirth of the arts and humanities, was also an important period in the history of technology. (ITEA, STL 7-M)
- Explain that the Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time. (ITEA, STL 7-N)
- Explain that the Information Age places emphasis on the processing and exchange of information. (ITEA, STL 7-O)

3.1 Develop an understanding of the attributes of design. (ITEA, STL 8)
- Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
- Explain that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specification, refining a design, creating or making it and communicating processes and results. (ITEA, STL 8-H)
- Explain that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA, STL 8-K)

3.2 Develop and understanding of engineering design. (ITEA, STL 9)
- Explain that a prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (ITEA, STL 8-K)
- Explain constraints on the engineering design process.
  - At least-safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and human factors engineering (ergonomics).

3.3 Develop abilities to apply and analyze the design process. (ITEA, STL 11)
- Identify criteria and constraints and determine how these will affect the design process. (ITEA, STL 11-N)
• Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (ITEA, STL 11-O)

• Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (ITEA, STL 11-P)

• Develop and produce a product or system using a design process. (ITEA, STL 11-Q)

• Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (ITEA, STL 11-R)

• Apply the design process including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results.

• 3.4 Select and use tools and equipment correctly and safely.
  o Select and use the appropriate tools and equipment in making two-dimensional and three-dimensional representations of design solutions, forming and molding processes, machining processes, and assembly processes.

• 3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)
  o Explain that not all problems are technological, and not every problem can be solved using technology. (ITEA, STL 10-K)
  o Apply the research and development problem solving approach to prepare devices and systems for the marketplace.
  o Identify and describe problems that cannot be solved through the use of technology.

• 5.2 Develop an understanding of medical technologies. (ITEA, STL 14)
  o Explain the functioning and application of medical processes and products such as prevention and rehabilitation, vaccines and pharmaceuticals, and surgical procedures.
  o Explain that medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering and the systems within which health is protected and maintained. (ITEA, STL 14-K)
  o Explain that telemedicine reflect the convergence of technological advanced and advances in other fields including medicine, telecommunications, virtual presence, and computer engineering.

Unit 10: Manufacturing

• 4.4 Analyze the functioning and applications of materials technology.
  o Identify and describe applications of materials technology in the designed world such as metals, alloys, nonmetals, composites, and biomaterials.
  o Explain science concepts and mathematical concepts applied in materials technology such as strength of shapes, forces, center of gravity, moments of inertia, stress, strain, deflection, and efficiency.

• 5.7 Develop an understanding of manufacturing technologies (ITEA, STL 19)
o Analyze manufacturing processes including designing, development, producing, and servicing.
o Describe mechanical processes that change the form of materials including separating, forming, combining, and conditioning.
o Explain that materials have different qualities and may be classified as natural, synthetic, or mixed. (ITEA, STL 19-M)
o Explain that durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time. (ITEA, STL 19-N)
o Classify manufacturing systems as being customized production, batch production, or continuous production.
o Describe how the interchangeability of parts increases the effectiveness of a manufacturing process.
o Research chemical technologies used to modify or alter chemical substances in the manufacturing process including synthetic fibers, pharmaceuticals, plastics, and fuels.

Unit 11: Information and Communication:

• 2.4 Develop and understanding of the role of society in the development and use of technology. (ITEA, STL 6)
o Explain that a number of different factors, such as advertising, the strength of the economy, the goals of the company, and the latest fads contribute to shaping the design of and demand for various technologies. (ITEA, STL 6-J)

• 3.1 Develop an understanding of the attributes of design. (ITEA, STL 8)
o Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
o Explain that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results. (ITEA, STL 8-H)
o Explain that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA, STL 8-K)

• 3.2 Develop an understanding of engineering design. (ITEA, STL 9)
o Explain that a prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (ITEA, STL 8-K)
o Explain constraints on the engineering design process.
  ▪ At least-safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and human factors engineering (ergonomics).

• 3.3 Develop abilities to apply and analyze the design process. (ITEA, STL 11)
o Identify criteria and constraints and determine how these will affect the design process. (ITEA, STL 11-N)
o Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (ITEA, STL 11-O)
o Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (ITEA, STL 11-P)

o Develop and produce a product or system using a design process. (ITEA, STL 11-Q)

o Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (ITEA, STL 11-R)

o Apply the design process including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results.

• 3.4 Select and use tools and equipment correctly and safety.

o Select and use the appropriate tools and equipment in making two-dimensional and three-dimensional representations of design solutions, forming and molding processes, machining processes, and assembly processes.

• 3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)

o Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.

• 3.6 Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)

o Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (ITEA, STL 12-L)

• 5.5 Develop an understanding of information and communication technologies. (ITEA, STL 17)

o Explain that information and communication systems include inputs, processes, and outputs associated with sending and receiving information. (ITEA, STL 17-L)

o Explain that information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine. (ITEA, STL 17-M)

o Explain that information and communication systems can be used to inform, persuade, entertain, control, manage, and educate (ITEA, STL 17-N)

o Identify and describe the parts of a communication system (ITEA, STL 17-O) including source, encoder, transmitter, receiver, decoder, and destination.

o Explain that there are many ways to communicate information, such as graphic and electronic means. (ITEA, STL 17-P)

o Explain that technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. (ITEA, STL 17-Q)

o Analyze the functioning and applications of information processing machine including printing, telephone, radio and television, and computer.
Prompt 1:
Discuss how biotechnology has been used to improve agriculture, medicine, food and beverage, and genetic engineering. Using the examples you identify, explain how these products are produced and applied in daily life.

Assessed Indicators:
•  5.3 Develop an understanding of agricultural and related biotechnologies. (ITEA, STL 15)
  o Explain the production and application of agricultural processes and products such as food, fiber, fuel, and chemical.
  o Explain the application of biotechnology processes and products including agricultural, pharmaceuticals, food and beverage, medicine, and energy.
  o Explain that biotechnology has application in areas such as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering. (ITEA, STL 15-L)

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Prompt 2:
On December 26, 2012, Hong Kong began running service on the longest high-speed rail line, which is able to cover a distance equal to that from New York to Key West, Florida in 8 hours. The fastest speed the rail line has been clocked at is 186 miles per hour. However, designers are hoping to make design improvements so the rail line is able to reach and maintain a top speed of 202 miles per hour.

Using what you know about the engineering design and development process, explain the constraints that must be considered for engineers to accomplish the design improvements.

Assessed Indicators:
- 3.2 Develop and understanding of engineering design.
  - 3.2 Explain constraints on the engineering design process
- 3.3 Develop abilities to apply and analyze the design process.
  - 3.3b Identify criteria and constrains and determine how these will affect the design process.
  - 3.3c Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

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Prompt 3:

You work as a human resource hiring manager at BIOindustries, a local biotechnology company in town. There is an upcoming job fair, and you are in charge of presenting the companies available job opportunities.

Choose three (3) of the nine (9) core technologies and identify the biotechnical job opportunities that BIOindustries could advertise jobs for. In your advertisements, be sure to list the core technology area, what the job duties are, and explain the impact of working in that job field.

Assessed Indicators:

- 1.3 Develop an understanding of the relationship among technologies and the connections between technology and other fields of study. (ITEA, STL 3)
  - Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.
- 3.6 Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)
  - Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (ITEA, STL 12-L)
- 4.10 Analyze the functioning and application of biotechnology systems.
  - Identify and describe applications of biotechnology in the designed world such as genetically modified food, DNA fingerprinting, oil biodegradation, insulin production, and bioethics.
- 5.3 Develop an understanding of agricultural and related biotechnologies. (ITEA, STL 15)
  - Explain the production and application of agricultural processes and products such as food, fiber, fuel, and chemical.
  - Explain the application of biotechnology processes and products including agricultural, pharmaceuticals, food and beverage, medicine, and energy.
  - Explain that agricultural includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.
  - Explain that biotechnology has application in such as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering. (ITEA, STL 15-L)
  - Explain science concepts and mathematical concepts applied in biotechnology such as genes, genetic code, DNA structure, enzymes, proteins, cloning, mutations, chromosome number, genetic recombination, anaerobic conversion, and fermentation.
Prompt 4:
Recently, the local and federal governments have been giving tax breaks, grants, and funding for new local businesses marketing fresh fruits and vegetables. As a result, you have been given one acre, (which is about the size of a football field), with a square shaped building on one half. You are to use this property to start your own business that produces fresh fruits and vegetables and provides these resources to local grocery stores. Sketch, annotate, and explain your plan for producing/growing fresh fruits and vegetables.

In you answer, be sure to include responses to the following questions:
1. Name the two biotechnologies to be used in the growing or processing of your produce.
2. How you are going to maximize production using the building and open ground.

Assessed Indicators:
- 3.1 Develop and understanding of the attributes of design (ITEA, STL 8)
  - Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
  - Explain that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results. (ITEA, STL 8-H)
  - Explain that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA, STL 8-K)
- 3.3 Develop abilities to apply and analyze the design process (ITEA, STL 11)
  - Identify criteria and constraints and determine how these will affect the design process. (ITEA, STL 11-N)
  - Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (ITEA, STL 11-O)
  - Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (ITEA, STL 11-P)
  - Develop and produce a product or system using a design process. (ITEA, STL 11-Q)
  - Evaluate final solutions and communicate observations, processes, and results of the entire design process, suing verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (ITEA, STL 11-R)
  - Apply the design process including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results.
- 3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)
- Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.

- **5.3 Develop and understanding of agricultural and related biotechnologies. (ITEA, STL 15)**
  - Explain the production and application of agricultural processes and products such as food, fiber, fuel, and chemical.
  - Explain the application of biotechnology processes and products including agricultural, pharmaceuticals, food and beverage, medicine, and energy.
  - Explain that agricultural includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.
  - Explain that biotechnology has application in such as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering. (ITEA, STL 15-L)

- **5.7 Develop an understanding of manufacturing technologies (ITEA, STL 19)**
  - Analyze manufacturing processes including designing, development, producing, and servicing.
Notes:

Sketch with Annotations here:
**Prompt 5:**
The Japanese beetle is an invasive species to Maryland. It feeds on more than 500 types of vegetation. Due to its destructive nature, the Maryland Forest Service (MFS) has asked you to propose two biotechnical ideas to solve the overpopulation of the Beetle. Explain in detail what you would do to solve the overpopulation problem?

**Assessed Indicators:**

- **2.3 Develop an understanding of the effects of technology on the environment (ITEA, STL 5)**
  - Explain that humans devise technologies to reduce the negative consequences of other technologies. (ITEA STL 5-K)
  - Analyze the relationship between technological processes and natural processes.
  - Investigate technologies designed to reduce the negative consequences of other technologies.
  - Research and report on processes (reusing, reducing, and recycling) that conserve water, soil, and energy.

- **2.4 Develop an understanding of the role of society in the development and use of technology (ITEA, STL 6)**
  - Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
  - Defend the proposition that the evolution of civilization has been directly affected by, and has been in turn affected, the development and use of tools and materials.

- **3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)**
  - Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.

- **3.6 Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)**
  - Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (ITEA, STL 12-L)

- **4.10 Analyze the functioning and application of biotechnology systems.**
  - Identify and describe applications of biotechnology in the designed world such as genetically modified food, DNA fingerprinting, oil biodegradation, insulin production, and bioethics.
  - Explain science concepts and mathematical concepts applied in biotechnology such as genes, genetic code, DNA structure, enzymes, proteins, cloning, mutations, chromosome number, genetic recombination, anaerobic conversion, and fermentation.

- **5.3 Develop and understanding of agricultural and related biotechnologies. (ITEA, STL 15)**
  - Explain the production and application of agricultural processes and products such as food, fiber, fuel, and chemical.
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- Explain that agricultural includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.
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Prompt 6:
Offshore drilling could raise millions in revenue to boost the United States economy. On the other hand, accidents could jeopardize the environment. Do you support or object off shore drilling? What would need to be done to prevent environmental catastrophes? **Defend your opinion and explain** what methods should be considered to prevent catastrophes.

Assessed Indicators:

- 1.3 Develop an understanding of the relationship among technologies and the connections between technology and other fields of study. (ITEA, STL 3)
  - Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.
- 2.3 Develop an understanding of the effects of technology on the environment (ITEA, STL 5)
  - Explain that humans devise technologies to reduce the negative consequences of other technologies. (ITEA STL 5-K)
  - Analyze the relationship between technological processes and natural processes.
  - Investigate technologies designed to reduce the negative consequences of other technologies.
  - Research and report on processes (reusing, reducing, and recycling) that conserve water, soil, and energy.
- 2.2 Develop and understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)
  - Cite instances where ethical considerations have impacted the development, selection, and use of technologies. (ITEA, STL 4-J)

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Prompt 7:

Natural processes and technological processes accomplish many of the same things in different ways. Please give an example of how two different processes, one natural and one technological share a common outcome.

Assessed Indicators:

- 1.3 Develop an understanding of the relationship among technologies and the connections between technology and other fields of study. (ITEA, STL 3)
  - Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.

- 2.3 Develop an understanding of the effects of technology on the environment (ITEA, STL 5)
  - Explain that humans devise technologies to reduce the negative consequences of other technologies. (ITEA STL 5-K)
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Prompt 8:
In your FOT course this year you learned about *thermodynamics*, including how heat transfers occur. If you were to place a cup of hot coffee in the freezer, explain what, if any, heat transfers would occur, and at what point would it stop occurring.

**Assessed Indicators:**
- 4.7 Analyze the functioning and application of thermal technology systems.
  - Identify and describe applications of thermal technology in the designed world such as thermometer, refrigerator, furnace, air conditioner, and heat engines.
  - Explain science concepts and mathematical concepts applied in thermal technology such as convection, conduction, radiation, insulation, and efficiency.

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Prompt 9:
One of your units this semester in FOT was manufacturing. It included topics such as producing, packaging, and shipping various items around the world. What do you think the manufacturing process for M&Ms is? Please explain on how these small candies make it from ingredients in the factory to a tasty treat on store shelves. In your answer, be sure to use vocabulary specific to the manufacturing process. In addition, draw a visual that shows these different processes to someone unfamiliar with manufacturing.

Assessed Indicators:
- 3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)
  - Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.
- 4.4 Analyze the functioning and applications of materials technology
  - Identify and describe applications of materials technology in the designed world such as metals, alloys, nonmetals, composites, and biomaterials.
  - Explain science concepts and mathematical concepts applied in materials technology such as strength of shapes, forces, center of gravity, moments of inertia, stress, strain, deflection, and efficiency.
- 5.7 Develop an understanding of manufacturing technologies (ITEA, STL 19)
  - Analyze manufacturing processes including designing, development, producing, and servicing.
  - Describe mechanical processes that change the form of materials including separating, forming, combining, and conditioning.
  - Explain that materials have different qualities and may be classified as natural, synthetic, or mixed. (ITEA, STL 19-M)
  - Explain that durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time. (ITEA, STL 19-N)
  - Classify manufacturing systems as being customized production, batch production, or continuous production.
  - Describe how the interchangeability of parts increases the effectiveness of a manufacturing process.
  - Research chemical technologies used to modify or alter chemical substances in the manufacturing process including synthetic fibers, pharmaceuticals, plastics, and fuels.
Prompt 10:
Manufacturing has progressed rapidly in the last 100 years. Select either a transportation or communication device, and explain how it has evolved from when it was created, until now. Draw a sketch with annotations explaining the major differences.

Assessed Indicators:
- 3.5 Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)
  - Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.
- 4.4 Analyze the functioning and applications of materials technology
  - Identify and describe applications of materials technology in the designed world such as metals, alloys, nonmetals, composites, and biomaterials.
  - Explain science concepts and mathematical concepts applied in materials technology such as strength of shapes, forces, center of gravity, moments of inertia, stress, strain, deflection, and efficiency.
- 5.7 Develop an understanding of manufacturing technologies (ITEA, STL 19)
  - Analyze manufacturing processes including designing, development, producing, and servicing.
  - Describe mechanical processes that change the form of materials including separating, forming, combining, and conditioning.
  - Explain that materials have different qualities and may be classified as natural, synthetic, or mixed. (ITEA, STL 19-M)
  - Explain that durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time. (ITEA, STL 19-N)
  - Classify manufacturing systems as being customized production, batch production, or continuous production.
  - Describe how the interchangeability of parts increases the effectiveness of a manufacturing process.
  - Research chemical technologies used to modify or alter chemical substances in the manufacturing process including synthetic fibers, pharmaceuticals, plastics, and fuels.
Prompt 11:
This year you learned there are two sides of healthcare; treating and preventing. Use the table below to identify and describe two medical devices, one that prevents illness or injury and one that treats illness, or injury. Afterwards, include what manufacturing relationship these devices share. (*Ex: Forming, cutting, assembling, packaging, and/or shipping*)

Assessed Indicators:
- 2.4 Develop an understanding of the role of society in the development and use of technology (ITEA, STL 6)
  - Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
  - Defend the proposition that the evolution of civilization has been directly affected by, and has been in turn affected, the development and use of tools and materials.
  - Explain that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
- 5.7 Develop an understanding of manufacturing technologies (ITEA, STL 19)
  - Analyze manufacturing processes including, designing, development, producing, and servicing.
  - Describe mechanical processes that change the form of materials including separating, forming, combining, and conditioning.

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<table>
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<tr>
<th>Medical Device Name</th>
<th>Prevent Illness or Treats Illness</th>
<th>Description</th>
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<tbody>
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<td>1.</td>
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Prompt 12:

Manufacturing processes and materials have changed throughout time, identify and describe one item that has changed from its original design.

Assessed Indicators:

- 2.5 Develop a understanding of the influence of technology on history. (ITEA, STL 7)
  - Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
  - Explain that the Iron Age was defined by the use of iron and steel as the primary materials for tools. (ITEA, STL 7-K)
  - Explain that the Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society. (ITEA, STL 7-L)
  - Explain that the Renaissance, a time of rebirth of the arts and humanities, was also an important period in the history of technology. (ITEA, STL 7-M)
  - Explain that the Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time. (ITEA, STL 7-N)
  - Explain that the Information Age places emphasis on the processing and exchange of information. (ITEA, STL 7-O)

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Prompt 13:
People from around the world have been campaigning for, and protesting against, a new, worldwide high speed rail system. Name the social, cultural, economic, and political impacts this could have.

Assessed Indicators:

- 1.3 Develop an understanding of the relationship among technologies and the connections between technology and other fields of study. (ITEA, STL 3)
  - Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.
- 2.2 Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)
  - Cite instances where ethical considerations have impacted the development, selection, and use of technologies. (ITEA, STL 4-J)
- 2.3 Develop an understanding of the effects of technology on the environment (ITEA, STL 5)
  - Explain that humans devise technologies to reduce the negative consequences of other technologies. (ITEA STL 5-K)
  - Analyze the relationship between technological processes and natural processes.
  - Investigate technologies designed to reduce the negative consequences of other technologies.
  - Research and report on processes (reusing, reducing, and recycling) that conserve water, soil, and energy.

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**Prompt 14:**

*Communication devices* have drastically changed since the beginning of time. Using the Venn diagram below, compare and contrast communication devices from early history to current communication devices. Beside your listed devices, include the parts of the communication system they represent. (Ex: *source, encoder, transmitter, receiver, decoder, and destination* )

**Assessed Indicators:**

- 3.6 Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)
  - Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (ITEA, STL 12-L)
- 5.5 Develop an understanding of information and communication technologies. (ITEA, STL 17)
  - Explain that information and communication systems include inputs, processes, and outputs associated with sending and receiving information. (ITEA, STL 17-L)
  - Explain that information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine. (ITEA, STL 17-M)
  - Explain that information and communication systems can be used to inform, persuade, entertain, control, manage, and educate (ITEA, STL 17-N)
  - Identify and describe the parts of a communication system (ITEA, STL 17-O) including source, encoder, transmitter, receiver, decoder, and destination.
  - Explain that there are many ways to communicate information, such as graphic and electronic means. (ITEA, STL 17-P)
  - Explain that technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. (ITEA, STL 17-Q)
  - Analyze the functioning and applications of information processing machine including printing, telephone, radio and television, and computer.
Notes:
Compare and Contrast forms of Communication in the Venn Diagram Below: