Maryland Technology Education Standards

Grades 9-12

The Nature of Technology - Students will develop an understanding of the nature of technology. 9-12.1

1 **Characteristics and Scope of Technology** 9-12.1.1

- a Analyze factors that drive technological invention and innovation. 9-12.1.1.A
- b Describe factors that may limit the development or use of technology (e.g. resources, societal concerns). 9-12.1.1.B
- c Assess the effects of technology on supply and demand. 9-12.1.1.C

2 **Core Concepts of Technology** 9-12.1.2

- a Analyze the functionality and interaction of various technological systems. 9-12.1.2.A
- b Analyze how technology can be repurposed for applications beyond their intended use. 9-12.1.2.B
- c Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interaction between systems (HS-ETS 1-4). 9-12.1.2.C
- d Employ constraint-based modeling to describe a biological system. 9-12.1.2.D
- e Assemble and operate simple and complex systems. 9-12.1.2.E
- f Diagnose a system that is malfunctioning and use tools, materials, and knowledge to repair it (STL, 12M). 9-12.1.2.F
- g Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision. 9-12.1.2.G
- h Create a model of a feedback control system. 9-12.1.2.H
- i Demonstrate how trade-offs can impact a design product. 9-12.1.2.I

3 **Connections Between Technology and Other Fields of Study** 9-12.1.3

- a Correlate technological advances to progress in other fields of study such as science and mathematics (STL, 3J). 9-12.1.3.A
- b Analyze the purpose and functionality of subject matter (SMEs) on a team. 9-12.1.3.B
- c Assess ways to protect intellectual property (e.g. patent, trademark, copyright). 9-12.1.3.C
- d Differentiate between open source and proprietary technology. 9-12.1.3.D

Impacts of Technology - Students will evaluate the impact of technology. 9-12.2	**1 Effects of Technology** 9-12.2.1 a Evaluate the desirable and undesirable consequences of technological advancements. 9-12.2.1.A b Apply assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology (STL, 13L). 9-12.2.1.B c Analyze legal and ethical considerations in the development and application of technology. 9-12.2.1.C d Analyze the relationship between technological and natural systems. 9-12.2.1.D e Design a forecasting technique to evaluate the results of altering natural systems (STL, 13M). 9-12.2.1.E f Create and design a product to mitigate the undesirable consequences of an existing technology. 9-12.2.1.F
	2 Role of Society in the Development and Use of Technology 9-12.2.2 a Distinguish factors that affect the scaling of technology. 9-12.2.2.A b Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values. 9-12.2.2.B c Compare and contrast the development, availability, and application of technology in developed and underdeveloped countries. 9-12.2.2.C d Draw connections between technological advances and evolution of civilization through different archaeological periods (e.g. stone age, bronze age, iron age) (STL, 4H). 9-12.2.2.D
Engineering Design and Development - Students will demonstrate knowledge of and apply the engineering design process to develop solutions to problems. 9-12.3	**3 Engineering Design and Development - Students will demonstrate knowledge of and apply the engineering design process to develop solutions to problems.** 9-12.3
Apply the design process to develop solutions to real-world problems. 9-12.3.1.A	**a Apply the design process to develop solutions to real-world problems.** 9-12.3.1.A
Document the design process and solutions in a journal, notebook, or portfolio. 9-12.3.1.B	**b Document the design process and solutions in a journal, notebook, or portfolio.** 9-12.3.1.B
Assess the reliability and validity of researched	**c Assess the reliability and validity of researched information.** 9-12.3.1.C

information. 9-12.3.1.C	
Apply design principles (e.g. flexibility, balance, function, proportion) to evaluate existing designs, to collect data, and to guide the design process (STL, 9I). 9-12.3.1.D	**d** Apply design principles (e.g. flexibility, balance, function, proportion) to evaluate existing designs, to collect data, and to guide the design process (STL, 9I). 9-12.3.1.D
Evaluate design solutions using software and other tools to develop conceptual, physical, and mathematical models at various intervals of the design process in order to ensure compliance with design requirements (STL, 11P). 9-12.3.1.E	**e** Evaluate design solutions using software and other tools to develop conceptual, physical, and mathematical models at various intervals of the design process in order to ensure compliance with design requirements (STL, 11P). 9-12.3.1.E
Assess how design requirements such as criteria, constraints, and efficiency can compete with each other (STL, 8K). 9-12.3.1.F	**f** Assess how design requirements such as criteria, constraints, and efficiency can compete with each other (STL, 8K). 9-12.3.1.F
Identify the capital and other resources needed to develop solutions to problems. 9-12.3.1.G	**g** Identify the capital and other resources needed to develop solutions to problems. 9-12.3.1.G
Apply assessment techniques (e.g. trend analysis) to determine if a solution should be pursued to design and development. 9-12.3.1.H	**h** Apply assessment techniques (e.g. trend analysis) to determine if a solution should be pursued to design and development. 9-12.3.1.H
Engage in failure analysis and optimization. 9-12.3.1.I	**i** Engage in failure analysis and optimization. 9-12.3.1.I

Assess the validity of a research results. 9-12.3.1.J	**j Assess the validity of a research results.** 9-12.3.1.J
Apply the research and development problem-solving approach to prepare devices and systems for the marketplace. 9-12.3.1.K	**k Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.** 9-12.3.1.K
Apply knowledge of core technologies in the development of solutions to problems. 9-12.3.1.L	**l Apply knowledge of core technologies in the development of solutions to problems.** 9-12.3.1.L
Core Technologies and The Designed World - Students will demonstrate knowledge of the core technologies that underpin the designed world and major enterprises that produce the goods and services of the designed world. Core technologies include but are not limited to biotechnology, electrical, electronics, fluid, material, mechanical, optical, structural, and thermal technologies. Major enterprises include medical, agriculture, biotechnology, energy and power, information and communication, transportation, and manufacturing and construction technologies. 9-12.4	**1 Medical Technologies** 9-12.4.1 a Employ trends, research, and forecasting techniques to analyze emerging health and medical technologies. 9-12.4.1.A b Investigate the benefits and consequences of advances in medicine made through the use of technology. 9-12.4.1.B c Analyze ethical issues and global concerns surrounding the development, access, application, and effects of health and medical technologies. 9-12.4.1.C d Assess how advances in medical technology have improved the health of multicellular organisms (e.g. reducing the instances of serious diseases in humans). 9-12.4.1.D **2 Agricultural Technologies** 9-12.4.2 a Analyze how advancement in technology has improved the yield and quality of food. 9-12.4.2.A b Assess the products and systems used to produce, process, and distribute food, fiber, fuel, chemical, and other products (STL, 16K). 9-12.4.2.B c Assess the need for regulations governing technologies used in agriculture. 9-12.4.2.C d Examine the social side effects and trade-offs of using various technologies in the production of food. 9-12.4.2.D

3 Biotechnology 9-12.4.3

a Analyze the application of biotechnology processes and products in medicine, agriculture, food processing, and the environment. 9-12.4.3.A

b Assess the ethical, social, and legal issues regarding the use of biotechnology (e.g. genetic engineering). 9-12.4.3.B

c Assess the application and impacts of biotechnology on other fields of study such as bioinformatics, bioprocess engineering, and biorobotics. 9-12.4.3.C

4 Energy and Power Technologies 9-12.4.4

a Analyze the production, conversion, transmission, and application of different forms of energy (e.g. mechanical, radiant, chemical, thermal, electrical, nuclear). 9-12.4.4.A

b Analyze energy inputs, processes and outputs. 9-12.4.4.B

c Assess energy efficiency at generation, distribution, and point of use. 9-12.4.4.C

d Create computational models to calculate the change in the energy of one component in a system when the change in the energy of the other component(s) an energy flows in and out of the system are known (HS-PS3-1). 9-12.4.4.D

e Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy (HS-PS3-3). 9-12.4.4.E

5 Information and Communication Technologies 9-12.4.5

a Analyze the inputs, processes, and outputs associated with sending and receiving information (STL, 17I). 9-12.4.5.A

b Investigate components of a communication system (STL, 17O). 9-12.4.5.B

c Assess approaches to reduce noise and promote clear communication. 9-12.4.5.C

d Analyze the function and application of different forms of communication technologies (e.g. internet, wireless networks). 9-12.4.5.D

e Demonstrate the transfer of information through different communication systems. 9-12.4.5.E

f Analyze factors that influence messages (e.g. timing, sequencings, processing). 9-12.4.5.F

g Design, use, and assess various types of information and communication systems (e.g. graphic, optical, radio, tactical). 9-12.4.5.G

6 Transportation Technologies 9-12.4.6

a Assess the role of transportation in manufacturing, construction, communication, health, safety, recreation, entertainment, and agriculture. 9-12.4.6.A

b Analyze intermodal travel of people and goods. 9-12.4.6.B

c Investigate and propose solutions to issues associated with transportation such as cost, safety, environmental impact, energy, and government regulations. 9-12.4.6.C

7 Manufacturing Technologies 9-12.4.7

- a Analyze manufacturing processes (designing, development, producing, and servicing). 9-12.4.7.A
- b Describe mechanical processes that change the form of materials (separating, forming, combining, and conditioning). 9-12.4.7.B
- c Classify manufacturing systems as being customized production, batch production, or continuous production. 9-12.4.7.C
- d Design and develop an interchangeable part. 9-12.4.7.D
- e Create machine code to manufacture a product. 9-12.4.7.E
- f Classify materials as natural, synthetic, or mixed (STL, 19M). 9-12.4.7.F
- g Analyze the life cycle of a manufactured product. 9-12.4.7.G
- h Explore the life cycle costing of products in a manufacturing process. 9-12.4.7.H
- i Examine the need for and application of terotechnology in manufacturing. 9-12.4.7.I
- j Apply marketing techniques to build awareness of a manufactured product. 9-12.4.7.J

f Construction Technologies 9-12.4.8

- a Design and create models of a variety of structures. 9-12.4.8.A
- b Analyze the physical infrastructures that allow a society or government to function (e.g. infrastructures of roads, airports, dams, canals, rail lines, sewers). 9-12.4.8.B
- c Analyze the various materials and systems that comprise buildings. 9-12.4.8.C
- d Analyze factors used to guide the process of designing and making structures. 9-12.4.8.D
- e Examine the need for maintenance, alteration, or renovation to improve structures or to alter their intended use (STL, 20M). 9-12.4.8.E
- f Analyze the steps in the construction process (preparing the site; setting foundations; building the framework; enclosing the structure; installing utilities; finishing the interior and exterior; completing the site). 9-12.4.8.F

Computational Thinking and Computer Science Applications - Students will be able to apply computational thinking skills and computer science applications as tools to develop solutions to engineering problems. 9-12.5

5 Computational Thinking and Computer Science Applications - Students will be able to apply computational thinking skills and computer science applications as tools to develop solutions to engineering problems. 9-12.5

Decompose a complex problem or system into parts. 9-12.5.1.A	**a** **Decompose a complex problem or system into parts.** 9-12.5.1.A
Use a programming language to develop solutions to problems and/or accomplish tasks. 9-12.5.1.B	**b** **Use a programming language to develop solutions to problems and/or accomplish tasks.** 9-12.5.1.B
Design, use, and evaluate computational abstractions that model the state and behavior of real-world problems and physical systems. 9-12.5.1.C	**c** **Design, use, and evaluate computational abstractions that model the state and behavior of real-world problems and physical systems.** 9-12.5.1.C
Automate solutions through algorithmic thinking. 9-12.5.1.D	**d** **Automate solutions through algorithmic thinking.** 9-12.5.1.D
Apply strategies for identifying and solving routine hardware and software problems. 9-12.5.1.E	**e** **Apply strategies for identifying and solving routine hardware and software problems.** 9-12.5.1.E
Use a variety of productivity technology tools to collaborate with others, manage projects, collect and analyze data, share information, and/or publish findings. 9-12.5.1.F	**f** **Use a variety of productivity technology tools to collaborate with others, manage projects, collect and analyze data, share information, and/or publish findings.** 9-12.5.1.F
Apply responsible legal and ethical behaviors in the use of technology systems and software. 9-12.5.1.G	**g** **Apply responsible legal and ethical behaviors in the use of technology systems and software.** 9-12.5.1.G