Maryland Technology Education Standards

# Advanced Technology: Grades 10-12

**The Nature of Technology - Students will develop an understanding of the nature of technology.** 10-12.1

1 **Characteristics and Scope of Technology** 10-12.1.1

- a Assess factors that shape the design of and demand for various technologies. 10-12.1.1.A
- b Demonstrate how research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace. 10-12.1.1.B

2 **Core Concepts of Technology** 10-12.1.2

- a 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). 10-12.1.2.A
- b Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it. 10-12.1.2.B
- c Create representation of a system in another form or a higher level of abstraction. 10-12.1.2.C
- d Design and create a complex system. 10-12.1.2.D
- e Test and evaluate the operation of a system based on its specified purpose. 10-12.1.2.E
- f Design instructions for system maintenance. 10-12.1.2.F
- g Repurpose a technological device for an application beyond its intended use. 10-12.1.2.G
- h Differentiate between quality control and quality assurance. 10-12.1.2.H
- i Apply the quality control process to a designed product. 10-12.1.2.I

2 **Connections Between Technology and Other Fields of Study** 10-12.1.3

- a Collaborate with subject matter experts to develop solutions to problems. 10-12.1.3.A
- b Analyze and apply the process for protecting intellectual property. 10-12.1.3.B

**Impacts of Technology - Students will evaluate the impact of technology.** 10-12.2

1 **Effects of Technology** 10-12.2.1

- a Conduct research on technological issues that currently affect a society. 10-12.2.1.A
- b Assess the unintended consequences of technology on a society. 10-12.2.1.B
- c Assess the impact of technological advances on the environment. 10-12.2.1.C
- d Predict future consequences of technological solutions on a society. 10-12.2.1.D
- e Weigh available information about the benefits, risks, costs, and trade-offs of technology in a systematic way. 10-12.2.1.E

2 **Role of Society in the Development and Use of Technology** 10-12.2.2

- a Explain the ethical considerations that inform the development, selection, and use of technologies. 10-12.2.2.A
- b Analyze the impact that technology transfer between societies has on the economy, culture, and government of each society. 10-12.2.2.B
- c Assess the impact that technological invention and innovation has on economic competitiveness and shifts in employment opportunities (job creation and destruction). 10-12.2.2.C
- d Assess how technology stimulates changes in society, influence cultural patterns, political movements, and local and global economies. 10-12.2.2.D

---

**Engineering Design and Development - Students will demonstrate knowledge of and apply the engineering design process to develop solutions to problems.** 10-12.3

3 **Engineering Design and Development - Students will demonstrate knowledge of and apply the engineering design process to develop solutions to problems.** 10-12.3

---

**Conduct market research to make informed decisions about product development.** 10-12.3.1.A

- a **Conduct market research to make informed decisions about product development.** 10-12.3.1.A

---

**Develop or refine products based on the results of market research.** 10-12.3.1.B

- b **Develop or refine products based on the results of market research.** 10-12.3.1.B

---

**Apply the engineering design process to develop solutions to**

- c **Apply the engineering design process to develop solutions to real-world problems.** 10-12.3.1.C

| | |
|---|---|
| real-world problems. 10-12.3.1.C | |
| Engage in the reverse engineering process to deduce design features in a novel product. 10-12.3.1.D | d Engage in the reverse engineering process to deduce design features in a novel product. 10-12.3.1.D |
| Document the design process and solutions in a journal, notebook, or portfolio. 10-12.3.1.E | e Document the design process and solutions in a journal, notebook, or portfolio. 10-12.3.1.E |
| Evaluate the reliability and validity of researched information. 10-12.3.1.F | f Evaluate the reliability and validity of researched information. 10-12.3.1.F |
| Employ risk analysis to minimize the likelihood of unwanted side effects. 10-12.3.1.G | g Employ risk analysis to minimize the likelihood of unwanted side effects. 10-12.3.1.G |
| Engage in cost-benefit analysis. 10-12.3.1.H | h Engage in cost-benefit analysis. 10-12.3.1.H |
| Use assessment techniques to ascertain if a solution should be pursed to design and development. 10-12.3.1.I | i Use assessment techniques to ascertain if a solution should be pursed to design and development. 10-12.3.1.I |
| Compare trade-offs between competing values. 10-12.3.1.J | j Compare trade-offs between competing values. 10-12.3.1.J |
| Implement current industry standard systems for quality control. 10-12.3.1.K | k Implement current industry standard systems for quality control. 10-12.3.1.K |
| Analyze how the engineering code of | l Analyze how the engineering code of ethics impact product design. 10-12.3.1.L |

**ethics impact product design.** 10-12.3.1.L

**Engage in ethical engineering practices.** 10-12.3.1.M

m **Engage in ethical engineering practices.** 10-12.3.1.M

**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.** 10-12.4

2 **Medical Technologies** 10-12.4.2

- a Assess the social, cultural, political, and environmental forces impacting the design, development, application, and access to a variety of medical technologies. 10-12.4.2.A
- b Analyze factors that need to be established to make emerging medical technologies viable in the marketplace. 10-12.4.2.B
- c Describe the application of bioinformatics in health and wellness. 10-12.4.2.C
- d Apply bioinformatics to analyze and interpret biological data. 10-12.4.2.D
- e Analyze and evaluate health data collection tools (e.g. patient monitoring equipment, medical wearable devices). 10-12.4.2.E
- f Analyze technological advances that allow for identification of disease pathogens. 10-12.4.2.F
- g Design and build a medical device that meets a specific medical need. 10-12.4.2.G

3 **Agricultural Technologies** 10-12.4.3

- a Assess the impact that technologies such as automation, sensors, mobile computing, and telematics have on agriculture. 10-12.4.3.A
- b Assess governmental regulations on agricultural practices. 10-12.4.3.B
- c Explore sustainable farming practices. 10-12.4.3.C
- d Analyze the advantages and disadvantages of innovation farming techniques (e.g. vertical farms, hydroponics, rooftop farming). 10-12.4.3.D
- e Design and build a model of agricultural technology that meets a specific need. 10-12.4.3.E

4 **Biotechnology** 10-12.4.4

- a Conduct research on emerging trends in biotechnology. 10-12.4.4.A
- b Apply biotechnology techniques to assess how genetic engineering can alter the function of cellular processes for a specific purpose. 10-12.4.4.B
- c Assess the connection between biotechnology and other fields of study. 10-12.4.4.C

5 **Energy and Power Technologies** 10-12.4.5

- a Examine renewable and conventional energy production technologies. 10-12.4.5.A
- b Analyze the global production, distribution, and consumption of energy. 10-12.4.5.B
- c Compare and contrast means to transfer and store energy. 10-12.4.5.C
- d Create models and design experiments to improve energy efficiency. 10-12.4.5.D
- e Create models that demonstrate energy and power flow in electromechnical systems and optoelectronic devices. 10-12.4.5.E

6 **Information and Communication Technologies** 10-12.4.6

- a Analyze the interconnectivity of telecommunication, computer, and audiovisual systems required to access, store, transmit, and manipulate information. 10-12.4.6.A
- b Assess a variety of communication methods, techniques, and devices. 10-12.4.6.B
- c Analyze factors that impact the design, development, use, and access to information and communication technologies. 10-12.4.6.C
- d Design and assemble a communication system to fulfill a specific need. 10-12.4.6.D
- e Assess the local, national, and global economic impact of information and communication technologies. 10-12.4.6.E

7 **Transportation Technologies** 10-12.4.7

- a Analyze how systems (e.g. structural, suspension) in vehicles, aircrafts and other means of transportation impact passenger and cargo safety. 10-12.4.7.A
- b Utilize a variety of systems for controlling distance and direction of a vehicle, hovercraft, or other means of transportation. 10-12.4.7.B
- c Develop a model of an intelligent transportation system. 10-12.4.7.C
- d Design systems to modify the speed, torque, or direction of power. 10-12.4.7.D

8 **Manufacturing Technologies** 10-12.4.8

- a Assess of the role of manufacturing technologies in society. 10-12.4.8.A
- b Assess the advantages and disadvantages of a variety of manufacturing systems. 10-12.4.8.B
- c Analyze manufacturing systems in terms of material flow and storage, information flow, capacities, and times and durations of events. 10-12.4.8.C
- d Analyze strategies to control quantity and quality in manufacturing systems. 10-12.4.8.D
- e Evaluate advances in design and manufacturing technologies. 10-12.4.8.E
- f Design a product using a computer controlled manufacturing process. 10-12.4.8.F

| | |
|---|---|
| | **9 Construction Technologies** 10-12.4.9<br>a Analyze how architectural designs can promote human health, well-being and social interaction. 10-12.4.9.A<br>b Design and construct an architectural model that serves a specified purpose. 10-12.4.9.B<br>c Design or model buildings that utilize optimum value engineering. 10-12.4.9.C<br>d Analyze and apply the process and requirements for LEED certification. 10-12.4.9.D |
| **Apply knowledge of core technologies in the development of solutions to problems.** 10-12.4.1.A | **a Apply knowledge of core technologies in the development of solutions to problems.** 10-12.4.1.A |
| **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.** 10-12.5 | **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.** 10-12.5 |
| **Demonstrate proficiency in using a variety of programming languages to develop solutions to problems or accomplish tasks.** 10-12.5.1.A | **a Demonstrate proficiency in using a variety of programming languages to develop solutions to problems or accomplish tasks.** 10-12.5.1.A |
| **Analyze data and identify patterns through modeling and simulation.** 10-12.5.1.B | **b Analyze data and identify patterns through modeling and simulation.** 10-12.5.1.B |
| **Analyze and/or design algorithms necessary for developing solutions to problems.** 10-12.5.1.C | **c Analyze and/or design algorithms necessary for developing solutions to problems.** 10-12.5.1.C |
| **Select and apply the appropriate software to facilitate collaboration** | **d Select and apply the appropriate software to facilitate collaboration and project management.** 10-12.5.1.D |

| | |
|---|---|
| **and project management.** 10-12.5.1.D | |
| **Select and apply productivity technology tools to collect and analyze data, and to record, share, publish, and present information.** 10-12.5.1.E | **e** **Select and apply productivity technology tools to collect and analyze data, and to record, share, publish, and present information.** 10-12.5.1.E |
| **Use advanced technology tools to create digital artifacts (e.g. web design, animation, video, multimedia).** 10-12.5.1.F | **f** **Use advanced technology tools to create digital artifacts (e.g. web design, animation, video, multimedia).** 10-12.5.1.F |
| **Apply responsible legal and ethical behaviors in the use of technology systems and software.** 10-12.5.1.G | **g** **Apply responsible legal and ethical behaviors in the use of technology systems and software.** 10-12.5.1.G |