Standards for Technological Literacy

The following chart lists the standards and the benchmark topics for grades 9–12. Adjacent to each standard and benchmark topic are the chapter and page references identifying material in *Engineering Fundamentals* relating to the item.

Standards for Technological Literacy	
1. Students will develop an understanding of the	Chapter 1: pages 4–7
characteristics and scope of technology.	Chapter 4: pages 62–65
The nature and development of technological knowledge and processes are functions of the setting.	Chapter 1: pages 6-7
Inventions and innovations are the results of specific, goal- directed research.	Chapter 1: pages 4-5
Most development of technologies these days is driven by the profit motive and the market.	Chapter 4: pages 62–65
2. Students will develop an understanding of the core	Chapter 1: pages 4–5
concepts of technology.	Chapter 2: page 26
	Chapter 3: pages 44–45
	Chapter 4: pages 66–68
	Chapter 5: pages 91–92
	Chapter 7: page 129
	Chapter 10: pages 201, 212– 213
	Chapter 11: page 240
	Chapter 12: page 268
	Chapter 16: pages 360, 363, 367
The stability of a technological system is influenced by all of	Chapter 11: page 240
the components in the system, especially those in the feedback loop.	Chapter 12: page 268
Selecting resources involves trade-offs between competing	Chapter 5: pages 91–92
values, such as availability, cost, desirability, and waste.	Chapter 10: page 201
Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.	Chapter 1: pages 4–5
	Chapter 3: pages 44–45
	Chapter 4: pages 66–68
	Chapter 5: pages 91–92
Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.	Chapter 1: page 5
New technologies create new processes.	Chapter 16: pages 360, 363, 367
Quality control is a planned process to ensure that a product, service, or system meets established criteria.	Chapter 10: pages 212–213
Management is the process of planning, organizing, and controlling work.	Chapter 2: page 26
Complex systems have many layers of controls and feedback	Chapter 7: page 129
loops to provide information.	Chapter 11: page 240

Standards for Technological Literacy	
3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Chapter 1: pages 6–7 Chapter 2: page 32 Chapter 5: page 85 Chapter 17: page 374
Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.	Chapter 5: page 85
Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.	Chapter 17: page 374
Technological ideas are sometimes protected through the process of patenting.	Chapter 2: page 32
Technological progress promotes the advancement of science and mathematics.	Chapter 1: pages 6–7
4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.	Chapter 2: pages 28–30, 31–32 Chapter 5: pages 91–92 Chapter 16: page 367
Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.	Chapter 5: pages 91–92
Ethical considerations are important in the development, selection, and use of technologies.	Chapter 2: pages 28–30 Chapter 16: page 367
The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.	Chapter 2: pages 31–32
5. Students will develop an understanding of the effects of technology on the environment.	Chapter 2: pages 32–35 Chapter 5: pages 91–92 Chapter 7: page 130 Chapter 10: pages 198–201
Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.	Chapter 2: pages 32–35
When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.	Chapter 2: pages 32–35 Chapter 7: page 130
With the aid of technology, various aspects of the environment can be monitored to provide information for decision making.	Chapter 7: page 130
The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.	Chapter 10: pages 198–201
Humans devise technologies to reduce the negative consequences of other technologies.	Chapter 7: page 130
Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment	Chapter 5: pages 91–92 Chapter 7: page 130
6. Students will develop an understanding of the role of society in the development and use of technology.	Chapter 2: pages 31–32 Chapter 7: pages 130, 132
Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.	Chapter 2: pages 31-32

The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures. Chapter 2: pages 31–32 A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies. Chapter 1: pages 16–19 T. Students will develop an understanding of the influence of technology on history. Chapter 1: pages 16–19 Most technological development has been evolutionary, the result of a series of refinements to a basic invention. Chapter 1: pages 16–19 The evolution of civilization has been directly alfected by, and materials. Chapter 1: pages 16–19 Throughout history, technology the development of many tools and machines was based not on scientific knowledge but on technological know-how. Chapter 1: pages 16–19 The IonAge was defined by the use of iron and steel as the primary materials for tools. Chapter 1: pages 17–18 The Industrial Revolution saw the development of continuous and improved education and leisure time. Chapter 1: pages 18–19 R. Students will develop an understanding of the attributes of design. Chapter 3: pages 42–54 The Indomation Age places emphasis on the processing and exchange of information. Chapter 3: pages 42–54 The design process includes defining a problem, braitstorming, researching and generating ideas, identifying specifications, refining the design, creating or making it, and cormunicating specitying coessibilit	Standards for Technological Literacy	
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efficiency, sometimes compete with each other. Chapter 4: pages 66–68	Requirements of a design, such as criteria, constraints, and	Chapter 3: pages 44–45
Chapter F: pages 01 02	efficiency, sometimes compete with each other.	Chapter 4: pages 66–68
		Chapter 5: pages 91–92

Standards for Technological Literacy	
9. Students will develop an understanding of engineering	Chapter 1: pages 7–8
design.	Chapter 3: pages 48–50
	Chapter 4: pages 60–73
	Chapter 5: pages 78–93
	Chapter 6: pages 98–111
	Chapter 7: pages 116–134
Established design principles are used to evaluate existing	Chapter 4: pages 60–73
designs, to collect data, and to guide the design process.	Chapter 5: pages 78–93
	Chapter 6: pages 98–111
	Chapter 7: pages 116–134
Engineering design is influenced by personal characteristics,	Chapter 1: pages 7–8
such as creativity, resourcefulness, and the ability to visualize	Chapter 4: pages 70–72
	Chapter 6: page 102
A prototype is a working model used to test a design concept	Chapter 3: pages 48–50
by making actual observations and necessary adjustments.	Chapter 7: page 119
The process of engineering design takes into account a	Chapter 4: pages 60–73
number of factors.	Chapter 5: pages 78–93
	Chapter 6: pages 98–111
	Chapter 7: pages 116–134
10. Students will develop an understanding of the role of	Chapter 2: page 26
troubleshooting, research and development, invention	Chapter 3: pages 40–41, 43, 47
and innovation, and experimentation in problem solving.	Chapter 4: page 69
	Chapter 5: pages 83–91
Research and development is a specific problem-solving	Chapter 3: page 47
prepare devices and systems for the marketplace.	Chapter 5: pages 83–91
Technological problems must be researched before they can	Chapter 3: page 47
be solved.	Chapter 5: pages 83–91
Not all problems are technological, and not every problem	Chapter 3: pages 40-41, 43
can be solved using technology.	Chapter 4: page 69
Many technological problems require a multidisciplinary approach.	Chapter 2: page 26
11. Students will develop abilities to apply the design	Chapter 3: pages 43-45, 48-50
process.	Chapter 4: pages 60–73
	Chapter 5: pages 78–93
	Chapter 6: pages 98–111
	Chapter 7: pages 116–134
Identify the design problem to solve and decide whether or	Chapter 3: pages 43-45
not to address it.	Chapter 4: pages 60–68
Identify criteria and constraints and determine how these will	Chapter 3: pages 44–45
affect the design process.	Chapter 4: pages 66–68
	Chapter 5: pages 91–92

Standards for Technological Literacy	
Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.	Chapter 3: pages 48–50
	Chapter 7: pages 119, 126–130
Evaluate the design solution using conceptual, physical, and	Chapter 5: pages 78-82
mathematical models at various intervals of the design	Chapter 6: pages 99–106
where improvements are needed	Chapter 7: pages 116–126
Develop and produce a product or system using a design	Chapter 4: pages 60-73
process.	Chapter 5: pages 78–93
	Chapter 6: pages 98–111
	Chapter 7: pages 116–134
Evaluate final solutions and communicate observation,	Chapter 7: pages 132–134
processes, and results of the entire design process, using	
addition to three-dimensional models	
12. Students will develop the abilities to use and maintain technological products and systems.	Chapter 7: pages 120–125, 132–134
	Chapter 10: pages 205–206, 211, 214–215
	Chapter 11: pages 232–233, 244–245
	Chapter 14: page 307
Document processes and procedures and communicate them	Chapter 7: pages 132–134
to different audiences using appropriate oral and written	
techniques.	Chapter 11: pages 232–233
materials, machines, and knowledge to repair it.	
Troubleshoot, analyze, and maintain systems to ensure safe	Chapter 11: pages 244-245
and proper function and precision.	Chapter 14: page 307
Operate systems so that they function in the way they were designed.	Chapter 10: pages 205–206, 211, 214–215
Use computers and calculators to access, retrieve, organize,	Chapter 7: pages 120–125
process, maintain, interpret, and evaluate data and	
13. Students will develop the abilities to assess the	Chapter 2: page 35
impact of products and systems.	Chapter 3: pages 43–44
	Chapter 5: pages 83–88, 92
	Chapter 7: page 126
Collect information and evaluate its quality.	Chapter 3: pages 43–44
	Chapter 5: pages 83–88
Synthesize data, analyze trends, and draw conclusions	Chapter 5: page 92
regarding the effect of technology on the individual, society,	
and the environment.	Chapter 2: page 35
experimentation to make decisions about the future	Chapter 2: page 33
development of technology.	
14. Students will develop an understanding of and be able to select and use medical technologies.	Chapter 16: pages 352–355, 357, 359–368

Standards for Technological Literacy	
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.	Chapter 16: pages 364–367
Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.	Chapter 16: page 365
The sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.	Chapter 16: pages 352–355, 357, 359–368
15. Students will develop an understanding of and be able to select and use agricultural and related biotochaplegies	Chapter 16: pages 350, 354, 359–363
biotechnologies.	Chapter 17: pages 383–384
Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.	Chapter 16: pages 359–363
Biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.	Chapter 16: pages 350, 354, 360–361
Conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.	Chapter 17: pages 383–384
The engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.	Chapter 16: pages 359–363
16. Students will develop an understanding of and be	Chapter 3: page 53
able to select and use energy and power technologies.	Chapter 8: pages 140–142
	Chapter 11: page 223
	Chapter 14: page 303
	Chapter 15: pages 329–330
Energy cannot be created nor destroyed; however, it can be	Chapter 8: page 140
converted from one form to another.	Chapter 11: page 223
	Chapter 14: page 303
	Chapter 15: pages 329–330
Energy resources can be renewable or nonrenewable	Chapter 3: page 53
Power systems must have a source of apergy a process	Chapter 8: pages 141, 142
and loads.	Chapter 6. pages 141-142
17. Students will develop an understanding of and be	Chapter 12: pages 253–269
able to select and use information and communication technologies.	
Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.	Chapter 12: pages 253-261
Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.	Chapter 12: pages 261–266

Standards for Technological Literacy	
Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.	Chapter 12: pages 266–269
18. Students will develop an understanding of and be able to select and use transportation technologies.	Chapter 13: page 274
Transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.	Chapter 13: page 274
19. Students will develop an understanding of and be	Chapter 9: page 188
able to select and use manufacturing technologies.	Chapter 10: pages 198–201, 205–206
	Chapter 15: page 326
Materials have different qualities and may be classified as natural, synthetic, or mixed.	Chapter 10: pages 198-201
Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.	Chapter 10: pages 205–206
The interchangeability of parts increases the effectiveness of manufacturing processes.	Chapter 9: page 188
Chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.	Chapter 15: page 326
20. Students will develop an understanding of and be able to select and use construction technologies.	Chapter 13: pages 277–281
Infrastructure is the underlying base or basic framework of a system.	Chapter 13: pages 277–284
Structures are constructed using a variety of processes and procedures.	Chapter 13: pages 285–291
Structures can include prefabricated materials.	Chapter 13: pages 280-281