Standards Addressed in G6-8

Lesson 1

Science:

NSES Content Standards	
Code	**Standard**
8SI1.3	Use appropriate tools and techniques to gather, analyze, and interpret data.
	Develop descriptions, explanations, predictions, and models using evidence. • Think critically and logically to make the relationships between evidence and explanations. • Use mathematics in all aspects of scientific inquiry.
	Physical Science • Transfer of energy
	Science and Technology • Abilities of technological design o Identify appropriate problems for technological design o Design a solution or product
	Science in Personal and Social Perspectives • Populations, resources, and environments • Risks and benefits • Science and technology in society

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
8C/M7**	Energy is required for technological processes such as taking apart, putting together, moving around, and communicating.

Math:

NCTM Standards	
Code	**Standard**
	Work flexibly with fractions, decimals, and percents to solve problems
	Find, use, and interpret measures of center and spread, including mean and interquartile range
	Solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
2B/M1	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.
2C/M2B	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M3	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1	One way to describe something is to say how it is and isn't like something else. Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2a	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. ▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and advertising it.
Standard 2.	• **Students will develop an understanding of the core concepts of technology.**

	○ ***In order to comprehend the core concepts of technology, students should learn that:*** ▪ N. Systems thinking involves considering how every part relates to others. ▪ P. Technological systems can be connected to one another. ▪ R. Requirements are the parameters placed on the development of a product or system. ▪ S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.
Standard 4.	• **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** ○ ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. ▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. ▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** ○ ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
Standard 6.	• **Students will develop an understanding of the role of society in the development and use of technology.** ○ ***In order to realize the impact of society on technology, students should learn that:*** ▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. ▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.**

	○ ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** ○ ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** ○ ***In order to comprehend other problem-solving approaches, students should learn that:*** ▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
Standard 11	• **Students will develop the abilities to apply the design process.** ○ ***As part of learning how to apply design processes, students should learn that:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design. ▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. ▪ L. Make a product or system and document the solution.
Standard 12.	• **Students will develop the abilities to use and maintain technological products and systems.** ○ ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ J. Use computers and calculators in various applications.
Standard 13.	• **Students will develop the abilities to assess the impact of products and systems.**

	○ ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development. ▪ I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** ○ ***In order to select, use, and understand energy and power technologies, students should learn that:*** ▪ I. Much of the energy used in our environment is not used efficiently.
Standard 18	• **Students will develop an understanding of and be able to select and use transportation technologies.** ○ ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles. ▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively. ▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	Standard
Global Awareness	Using 21st century skills to understand and address global issues
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions

	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural Skills	Working appropriately and productively with others
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)
Leadership & Responsibility	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind

Lesson 2

Science:

NSES Content Standards	
Code	**Standard**
8ASI1.3	Use appropriate tools and techniques to gather, analyze, and interpret data.
8ASI1.4	Develop descriptions, explanations, predictions, and models using evidence.
8ASI1.5	Think critically and logically to make the relationships between evidence and explanations.
8ASI1.8	Use mathematics in all aspects of scientific inquiry.
8ASI2.3	Mathematics is important in all aspects of scientific inquiry.
8ASI2.4	Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
8BPS3.1	Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei and the nature of a chemical. Energy is transferred in many ways.

8EST1.1	Identify appropriate problems for technological design
8EST1.2	Design a solution or product
8FSPSP2.2	Causes of environmental degradation and resource depletion vary from region to region and from country to country.
8FSPSP4.4	Important personal and social decisions are made based on perceptions of benefits and risks.
8FSPSP5.1	Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
8FSPSP5.2	Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
8FSPSP5.3	Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
4B/M10ab*	Some material resources are very rare and some exist in great quantities. The ability to obtain and process resources depends on where they are located and the form they are in. As resources are depleted, they may become more difficult to obtain.
8C/M6*	Industry, transportation, urban development, agriculture, and most other human activities are closely tied to the amount and kind of energy available. People in different parts of the world have different amounts and kinds of energy resources to use and use them for different purposes.
8C/M7** (SFAA)	Energy is required for technological processes such as taking apart, putting together, moving around, and communicating.
8C/M10** (SFAA)	Some resources are not renewable or renew very slowly. Fuels already accumulated in the earth, for instance, will become more difficult to obtain as the most readily available resources run out. How long the resources will last, however, is difficult to predict. The ultimate limit may be the prohibitive cost of obtaining them.
8C/M11**	By burning fuels, people are releasing large amounts of carbon dioxide into the atmosphere and transforming chemical energy into thermal energy which spreads throughout the environment.

Math:

NCTM Standards	
Code	**Standard**
	work flexibly with fractions, decimals, and percents to solve problems
	solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
2B/M1*	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.
2C/M2b	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M3*	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1*	Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2a	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.
3C/M5	New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.
3C/M6*	Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters. That is because contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
3C/M7	Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.
3C/M8** (BSL)	Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. ▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and advertising it.
Standard 2.	• **Students will develop an understanding of the core concepts of technology.** o ***In order to comprehend the core concepts of technology, students should learn that:*** ▪ R. Requirements are the parameters placed on the development of a product or system. ▪ S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.
Standard 3.	• **Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.** o ***In order to appreciate the relationships among technologies and other fields of study, students should learn that:*** ▪ E. A product, system, or environment developed for one setting may be applied to another setting.
Standard 4.	• **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** o ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. ▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.

	▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** o ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ D. The management of waste produced by technological systems is an important societal issue. ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
Standard 6.	• **Students will develop an understanding of the role of society in the development and use of technology.** o ***In order to realize the impact of society on technology, students should learn that:*** ▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. ▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.** o ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** o ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** o ***In order to comprehend other problem-solving***

	▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
Standard 11.	• **Students will develop the abilities to apply the design process.** o ***As part of learning how to apply design processes, students should learn to:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design. ▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. ▪ L. Make a product or system and document the solution.
Standard 12.	• **Students will develop the abilities to use and maintain technological products and systems.** o ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ J. Use computers and calculators in various applications.
Standard 13.	• **Students will develop the abilities to assess the impact of products and systems.** o ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development.
Standard 15.	• **Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.** o ***In order to select, use, and understand agricultural and related biotechnologies, students should learn that:*** ▪ G. A wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.
Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** o ***In order to select, use, and understand energy and power technologies, students should learn that:***

	▪ I. Much of the energy used in our environment is not used efficiently.
Standard 18.	• **Students will develop an understanding of and be able to select and use transportation technologies.** o ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles. ▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively. ▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	**Standard**
Global Awareness	Using 21st century skills to understand and address global issues
Creativity and Innovation	Demonstrating originality and inventiveness in work
	Developing, implementing and communicating new ideas to others
	Acting on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
	Assuming shared responsibility for collaborative work
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand

Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural Skills	Working appropriately and productively with others
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)
Leadership & Responsibility	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind

Lesson 3

Science:

NSES Content Standards	
Code	**Standard**
8ASI1.3	Use appropriate tools and techniques to gather, analyze, and interpret data.
8ASI1.4	Develop descriptions, explanations, predictions, and models using evidence.
8ASI1.5	Think critically and logically to make the relationships between evidence and explanations.
8ASI1.8	Use mathematics in all aspects of scientific inquiry.
8ASI2.3	Mathematics is important in all aspects of scientific inquiry.
8ASI2.4	Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
8BPS1.2	Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. Substances often are placed in categories or groups if they react in similar ways; metals is an example of such a group.
8DESS1.8	The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.
8DESS1.10	Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
8EST1.1	Identify appropriate problems for technological design

8EST1.2	Design a solution or product
8FSPSP2.2	Causes of environmental degradation and resource depletion vary from region to region and from country to country.
8FSPSP3.2	Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.
8FSPSP4.4	Important personal and social decisions are made based on perceptions of benefits and risks.
8FSPSP5.1	Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
8FSPSP5.2	Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
8FSPSP5.3	Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
4B/M11bc*	The benefits of Earth's resources—such as fresh water, air, soil, and trees—can be reduced by deliberately or inadvertently polluting them. The atmosphere, the oceans, and the land have a limited capacity to absorb and recycle waste materials. In addition, some materials take a long time to degrade. Therefore, cleaning up polluted air, water, or soil can be difficult and costly.
4B/M14**	The earth has a variety of climates, defined by average temperature, precipitation, humidity, air pressure, and wind, over time in a particular place.
4B/M15** (NSES)	The atmosphere is a mixture of nitrogen, oxygen, and trace amounts of water vapor, carbon dioxide, and other gases.
4C/M7	Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed the earth's land, oceans, and atmosphere. Some of these changes have decreased the capacity of the environment to support some life forms.
7G/M5*	The global environment is affected by national and international policies and practices relating to energy use, waste disposal, ecological

	management, manufacturing, and population.
8C/M6*	Industry, transportation, urban development, agriculture, and most other human activities are closely tied to the amount and kind of energy available. People in different parts of the world have different amounts and kinds of energy resources to use and use them for different purposes.
8C/M7** (SFAA)	Energy is required for technological processes such as taking apart, putting together, moving around, and communicating.
8C/M11** (BSL)	By burning fuels, people are releasing large amounts of carbon dioxide into the atmosphere and transforming chemical energy into thermal energy which spreads throughout the environment.

Math:

NCTM Standards	
Code	**Standard**
	Work flexibly with fractions, decimals, and percents to solve problems
	Solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
2B/M1*	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.
2C/M2b	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M3*	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1*	Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2a	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.
3C/M5	New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.

3C/M6*	Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters. That is because contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
3C/M7	Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.
3C/M8** (BSL)	Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. ▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and advertising it.
Standard 2.	• **Students will develop an understanding of the core concepts of technology.** o ***In order to comprehend the core concepts of technology, students should learn that:*** ▪ R. Requirements are the parameters placed on the development of a product or system. ▪ S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.
Standard 4.	• **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** o ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and

	▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. ▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** o ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ D. The management of waste produced by technological systems is an important societal issue. ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
Standard 6.	• **Students will develop an understanding of the role of society in the development and use of technology.** o ***In order to realize the impact of society on technology, students should learn that:*** ▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. ▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.** o ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** o ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.

Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** o ***In order to comprehend other problem-solving approaches, students should learn that:*** ▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
Standard 11.	• **Students will develop the abilities to apply the design process.** o ***As part of learning how to apply design processes, students should learn to:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design. ▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. ▪ L. Make a product or system and document the solution.
Standard 12.	• **Students will develop the abilities to use and maintain technological products and systems.** o ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ J. Use computers and calculators in various applications.
Standard 13.	• **Students will develop the abilities to assess the impact of products and systems.** o ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development. ▪ I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
Standard 15.	• **Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.** o ***In order to select, use, and understand agricultural and related biotechnologies, students should learn that:*** ▪ G. A wide range of specialized equipment and practices is used to improve the production of

Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** o ***In order to select, use, and understand energy and power technologies, students should learn that:*** ▪ I. Much of the energy used in our environment is not used efficiently.
Standard 18.	• **Students will develop an understanding of and be able to select and use transportation technologies.** o ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles. ▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively. ▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	**Standard**
Global Awareness	Using 21st century skills to understand and address global issues
Creativity and Innovation	Demonstrating originality and inventiveness in work
	Developing, implementing and communicating new ideas to others
	Acting on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams

	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
	Assuming shared responsibility for collaborative work
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural Skills	Working appropriately and productively with others
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)
Leadership & Responsibility	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind

Lesson 4

Science:

NSES Content Standards	
Code	**Standard**
8ASI1.1	Identify questions that can be answered through scientific investigations.
8ASI1.2	Design and conduct a scientific investigation.
8ASI1.3.	Use appropriate tools and techniques to gather, analyze, and interpret data.
8ASI1.4	Develop descriptions, explanations, predictions, and models using evidence.
8ASI1.5	Think critically and logically to make the relationships between evidence and explanations.
8ASI1.7	Communicate scientific procedures and explanations.
8ASI1.8	Use mathematics in all aspects of scientific inquiry.
8ASI2.3	Mathematics is important in all aspects of scientific inquiry.
8ASI2.4	Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
8BPS2.1	The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.

8BPS3.1	Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei and the nature of a chemical. Energy is transferred in many ways.
8EST1.1	Identify appropriate problems for technological design
8EST1.2	Design a solution or product
8FSPSP4.3	Individuals can use a systematic approach to thinking critically about risks and benefits. Examples include applying probability estimates to risks and comparing them to estimated personal and social benefits.
8FSPSP4.4	Important personal and social decisions are made based on perceptions of benefits and risks.
8FSPSP5.1	Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves and others.
8FSPSP5.2	Societal challenges often inspire questions for scientific research and social priorities often influence research priorities through the availability of funding for research.
8FSPSP5.3	Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
8B/M1*	The choice of materials for a job depends on their properties.
8B/M5** (SFAA)	Efforts to find replacements for existing materials are driven by an interest in finding materials that are cheaper to obtain or produce or that have more desirable properties.

Math:

NCTM Standards	
Code	**Standard**
	Work flexibly with fractions, decimals, and percents to solve problems
	Solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
2B/M1*	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.

2C/M2b	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M3*	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1*	Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2a	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.
3C/M5	New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.
3C/M6*	Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters. That is because contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
3C/M7	Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.
3C/M8** (BSL)	Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective needs and the

	▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and advertising it.
Standard 2.	• **Students will develop an understanding of the core concepts of technology.** o ***In order to comprehend the core concepts of technology, students should learn that:*** ▪ R. Requirements are the parameters placed on the development of a product or system. ▪ S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.
Standard 3.	• **Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.** o ***In order to appreciate the relationships among technologies and other fields of study, students should learn that:*** ▪ D. Technological systems often interact with one another. ▪ E. A product, system, or environment developed for one setting may be applied to another setting. ▪ F. Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.
Standard 4.	• **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** o ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. ▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. ▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** o ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.

Standard 6.	• **Students will develop an understanding of the role of society in the development and use of technology.** o ***In order to realize the impact of society on technology, students should learn that:*** ▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. ▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.** o ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** o ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** o ***In order to comprehend other problem-solving approaches, students should learn that:*** ▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it. ▪ H. Some technological problems are best solved through experimentation.
Standard 11.	• **Students will develop the abilities to apply the design process.** o ***As part of learning how to apply design processes, students should learn to:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design.

	▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. ▪ L. Make a product or system and document the solution.
Standard 12.	• **Students will develop the abilities to use and maintain technological products and systems.** o ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ I. Use tools, materials, and machines safely to diagnose, adjust, and repair systems. ▪ J. Use computers and calculators in various applications. ▪ K. Operate and maintain systems in order to achieve a given purpose.
Standard 13.	• **Students will develop the abilities to assess the impact of products and systems.** o ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development. ▪ I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** o ***In order to select, use, and understand energy and power technologies, students should learn that:*** ▪ I. Much of the energy used in our environment is not used efficiently.
Standard 18	• **Students will develop an understanding of and be able to select and use transportation technologies.** o ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles. ▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively.

	▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	Standard
Global Awareness	Using 21st century skills to understand and address global issues
Creativity and Innovation	Demonstrating originality and inventiveness in work
	Developing, implementing and communicating new ideas to others
	Acting on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
	Assuming shared responsibility for collaborative work
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural Skills	Working appropriately and productively with others
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)
Leadership &	Using interpersonal and problem-solving skills to influence and guide

Responsibility	others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind

Lesson 5

Science:

NSES Content Standards	
Code	**Standard**
8ASI1.3	Use appropriate tools and techniques to gather, analyze, and interpret data.
8ASI1.4	Develop descriptions, explanations, predictions, and models using evidence.
8ASI1.5	Think critically and logically to make the relationships between evidence and explanations.
8ASI1.8	Use mathematics in all aspects of scientific inquiry.
8ASI2.3	Mathematics is important in all aspects of scientific inquiry.
8ASI2.4	Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
8EST1.1	Identify appropriate problems for technological design
8EST1.2	Design a solution or product
8EST1.3	Implement a proposed solution.
8EST2.2	Many different people in different cultures have made and continue to make contributions to science and technology.
8EST2.4	Perfectly designed solutions do not exist. All technological solutions have tradeoffs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
8EST2.5	Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.
8EST2.6	Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.
8FSPSP4.4	Important personal and social decisions are made based on perceptions of benefits and risks.
8FSPSP5.1	Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
8FSPSP5.2	Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.

8FSPSP5.3	Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.
8FSPSP5.5	Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
1C/M1	Important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.
1C/M3	No matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone in the world.
4E/M2*	Energy can be transferred from one system to another (or from a system to its environment) in different ways: 1) thermally, when a warmer object is in contact with a cooler one; 2) mechanically, when two objects push or pull on each other over a distance; 3) electrically, when an electrical source such as a battery or generator is connected in a complete circuit to an electrical device; or 4) by electromagnetic waves.
8C/M4*	Electrical energy can be generated from a variety of energy resources and can be transformed into almost any other form of energy. Electric circuits are used to distribute energy quickly and conveniently to distant locations.
8C/M8** (SFAA)	People have invented ingenious ways of deliberately bringing about energy transformations that are useful to them.

Math:

NCTM Standards	
Code	**Standard**
	Work flexibly with fractions, decimals, and percents to solve problems
	Solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
2B/M1*	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.

2C/M2b	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M3*	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1*	Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2a	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.
3C/M5	New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.
3C/M6*	Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters. That is because contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
3C/M7	Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.
3C/M8** (BSL)	Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective

	▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and advertising it.
Standard 2.	▪ **Students will develop an understanding of the core concepts of technology.** o ***In order to comprehend the core concepts of technology, students should learn that:*** ▪ R. Requirements are the parameters placed on the development of a product or system. ▪ S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.
Standard 3.	• **Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.** o ***In order to appreciate the relationships among technologies and other fields of study, students should learn that:*** ▪ D. Technological systems often interact with one another.
Standard 4.	• **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** o ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. ▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. ▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** o ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
Standard 6.	• **Students will develop an understanding of the role of society in the development and use of technology.**

	○ ***In order to realize the impact of society on technology, students should learn that:*** ▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. ▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.** ○ ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** ○ ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** ○ ***In order to comprehend other problem-solving approaches, students should learn that:*** ▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
Standard 11.	• **Students will develop the abilities to apply the design process.** ○ ***As part of learning how to apply design processes, students should learn to:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design. ▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and

	▪ L. Make a product or system and document the solution.
Standard 12	• **Students will develop the abilities to use and maintain technological products and systems.** o ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ J. Use computers and calculators in various applications.
Standard 13	• **Students will develop the abilities to assess the impact of products and systems.** o ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development. ▪ I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** o ***In order to select, use, and understand energy and power technologies, students should learn that:*** ▪ I. Much of the energy used in our environment is not used efficiently.
Standard 18.	• **Students will develop an understanding of and be able to select and use transportation technologies.** o ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles. ▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively. ▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	Standard
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
	Assuming shared responsibility for collaborative work
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural Skills	Working appropriately and productively with others
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable
Leadership & Responsibility	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind

Lesson 6

Science:

NSES Content Standards	
Code	**Standard**
8ASI1.3	Use appropriate tools and techniques to gather, analyze, and interpret data.
8ASI1.4	Develop descriptions, explanations, predictions, and models using evidence.
	8ASI1.5 Think critically and logically to make the relationships between evidence and explanations.
8ASI1.8	Use mathematics in all aspects of scientific inquiry.
8ASI2.3	Mathematics is important in all aspects of scientific inquiry.
8ASI2.4	Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
8EST1.1	Identify appropriate problems for technological design
8EST1.2	Design a solution or product
8EST1.3	Implement a proposed solution.
8EST2.2	Many different people in different cultures have made and continue to make contributions to science and technology.
8EST2.4	Perfectly designed solutions do not exist. All technological solutions have tradeoffs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
8EST2.5	Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.
8EST2.6	Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.
8FSPSP4.4	Important personal and social decisions are made based on perceptions of benefits and risks.
8FSPSP5.1	Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
8FSPSP5.2	Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
8FSPSP5.3	Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.
8FSPSP5.5	Scientists and engineers work in many different settings, including colleges

	and universities, businesses and industries, specific research institutes, and government agencies.

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
1C/M1	Important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.
1C/M3	No matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone in the world.
4E/M2*	Energy can be transferred from one system to another (or from a system to its environment) in different ways: 1) thermally, when a warmer object is in contact with a cooler one; 2) mechanically, when two objects push or pull on each other over a distance; 3) electrically, when an electrical source such as a battery or generator is connected in a complete circuit to an electrical device; or 4) by electromagnetic waves.
8C/M4*	Electrical energy can be generated from a variety of energy resources and can be transformed into almost any other form of energy. Electric circuits are used to distribute energy quickly and conveniently to distant locations.
8C/M8** (SFAA)	People have invented ingenious ways of deliberately bringing about energy transformations that are useful to them.

Math:

NCTM Standards	
Code	**Standard**
	Work flexibly with fractions, decimals, and percents to solve problems
	Solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
(2B/M1*)	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.
(2C/M2b)	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M3*	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1*	Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2a	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.
3C/M5	New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.
3C/M6*	Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters. That is because contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
3C/M7	Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.
3C/M8** (BSL)	Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. ▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and

Standard 2.	▪ **Students will develop an understanding of the core concepts of technology.** o ***In order to comprehend the core concepts of technology, students should learn that:*** ▪ R. Requirements are the parameters placed on the development of a product or system. ▪ S. Trade-off is a decision process recognizing the need for careful compromises among competing factors.
Standard 3.	• **Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.** o ***In order to appreciate the relationships among technologies and other fields of study, students should learn that:*** ▪ D. Technological systems often interact with one another.
Standard 4.	• **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** o ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. ▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. ▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** o ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
Standard 6.	• **Students will develop an understanding of the role of society in the development and use of technology.** o ***In order to realize the impact of society on technology, students should learn that:*** ▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.

	▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.** o ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** o ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** o ***In order to comprehend other problem-solving approaches, students should learn that:*** ▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
Standard 11.	• **Students will develop the abilities to apply the design process.** o ***As part of learning how to apply design processes, students should learn to:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design. ▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. ▪ L. Make a product or system and document the solution.
Standard 12.	• **Students will develop the abilities to use and maintain technological products and systems.**

	○ ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ J. Use computers and calculators in various applications.
Standard 13.	• **Students will develop the abilities to assess the impact of products and systems.** ○ ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development. ▪ I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** ○ ***In order to select, use, and understand energy and power technologies, students should learn that:*** ▪ I. Much of the energy used in our environment is not used efficiently.
Standard 18.	• **Students will develop an understanding of and be able to select and use transportation technologies.** ○ ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles. ▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively. ▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	Standard
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
	Assuming shared responsibility for collaborative work
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural Skills	Working appropriately and productively with others
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)
Leadership & Responsibility	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind

Lesson 7

Science:

NSES Content Standards	
Code	**Standard**
8ASI1.3	Use appropriate tools and techniques to gather, analyze, and interpret data.
8ASI1.4	Develop descriptions, explanations, predictions, and models using evidence.
8ASI1.5	Think critically and logically to make the relationships between evidence and explanations.
8ASI1.6	Recognize and analyze alternative explanations and predictions.
8ASI1.7	Communicate scientific procedures and explanations.
8ASI1.8	Use mathematics in all aspects of scientific inquiry.
8ASI2.3	Mathematics is important in all aspects of scientific inquiry.
8ASI2.4	Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
8ASI2.6	Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.
8EST1.1	Identify appropriate problems for technological design
8EST1.2	Design a solution or product
8EST1.3	Implement a proposed solution.
8EST1.4	Evaluate completed technological designs or products.
8EST1.5	Communicate the process of technological design.
8EST2.2	Many different people in different cultures have made and continue to make contributions to science and technology.
8EST2.4	Perfectly designed solutions do not exist. All technological solutions have tradeoffs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
8EST2.5	Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.
8EST2.6	Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.
8FSPSP4.3	Individuals can use a systematic approach to thinking critically about risks and benefits. Examples include applying probability estimates to risks and comparing them to estimated personal and social benefits.
8FSPSP4.4	Important personal and social decisions are made based on perceptions of benefits and risks.
8FSPSP5.1	Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many

	individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
8FSPSP5.2	Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
8FSPSP5.3	Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.
8FSPSP5.5	Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.

AAAS Project 2061 Benchmarks	
Code	**Standard**
1B/M1b*	Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected data.
1C/M1	Important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.
1C/M3	No matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone in the world.
1C/M6*	Computers have become invaluable in science, mathematics, and technology because they speed up and extend people's ability to collect, store, compile, and analyze data; prepare research reports; and share data and ideas with investigators all over the world.
1C/M7	Accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.
11D/M2	As the complexity of any system increases, gaining an understanding of it depends increasingly on summaries, such as averages and ranges, and on descriptions of typical examples of that system.
12D/M6**	Present a brief scientific explanation orally or in writing that includes a claim and the evidence and reasoning that supports the claim.
12D/M7**	Seek to gain a better understanding of a scientific idea by asking for an explanation, restating an explanation in a different way, and asking questions when some aspect of an explanation is not clear.
12D/M8**	Explain a scientific idea to someone else, checking understanding and responding to questions.
12D/M9**	Prepare a visual presentation to aid in explaining procedures or ideas.
12E/M2	Compare consumer products and consider reasonable personal trade-offs among them on the basis of features, performance, durability, and cost.

Math:

NCTM Standards	
Code	**Standard**
	Work flexibly with fractions, decimals, and percents to solve problems
	Solve problems that arise in mathematics and other contexts

AAAS Project 2061 Benchmarks	
Code	**Standard**
2B/M1*	Mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.
2C/M2b	Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

Technology:

AAAS Project 2061 Benchmarks	
Code	**Standard**
3A/M2	Technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.
3A/M3*	Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. They also usually have to take human values and limitations into account.
3B/M1*	Design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical, and aesthetic ones.
3B/M2	All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
3B/M2b	Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.
3C/M5	New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.
3C/M6*	Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters. That is because contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
3C/M7	Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.

3C/M8** (BSL)	Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.

ITEA Standards	
Code	**Standard**
Standard 1.	• **Students will develop an understanding of the characteristics and scope of technology.** o ***In order to comprehend the scope of technology, students should learn that:*** ▪ F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. ▪ G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative. ▪ H. Technology is closely linked to creativity, which has resulted in innovation. ▪ I. Corporations can often create demand for a product by bringing it onto the market and advertising it.
Standard 4.	▪ **Students will develop an understanding of the cultural, social, economic, and political effects of technology.** o ***In order to recognize the changes in society caused by the use of technology, students should learn that:*** ▪ D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. ▪ E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. ▪ G. Economic, political, and cultural issues are influenced by the development and use of technology.
Standard 5.	• **Students will develop an understanding of the effects of technology on the environment.** o ***In order to discern the effects of technology on the environment, students should learn that:*** ▪ F. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
Standard 6.	• Students will develop an understanding of the role of society in the development and use of technology. o ***In order to realize the impact of society on technology,***

	▪ D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. ▪ E. The use of inventions and innovations has led to changes in society and the creation of new needs and wants. ▪ F. Social and cultural priorities and values are reflected in technological devices.
Standard 8.	• **Students will develop an understanding of the attributes of design.** o ***In order to realize the attributes of design, students should learn that:*** ▪ E. Design is a creative planning process that leads to useful products and systems. ▪ F. There is no perfect design.
Standard 9.	• **Students will develop an understanding of engineering design.** o ***In order to comprehend engineering design, students should learn that:*** ▪ F. Design involves a set of steps, which can be performed in different sequences and repeated as needed. ▪ G. Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. ▪ H. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
Standard 10.	• **Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.** o ***In order to comprehend other problem-solving approaches, students should learn that:*** ▪ G. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
Standard 11.	• **Students will develop the abilities to apply the design process.** o ***As part of learning how to apply design processes, students should learn that:*** ▪ H. Apply a design process to solve problems in and beyond the laboratory-classroom. ▪ I. Specify criteria and constraints for the design. ▪ J. Make two-dimensional and three-dimensional representations of the designed solution. ▪ K. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.

	▪ **L. Make a product or system and document the solution.**
Standard 12.	• **Students will develop the abilities to use and maintain technological products and systems.** o ***As part of learning how to use and maintain technological products and systems, students should learn that:*** ▪ **J. Use computers and calculators in various applications.**
Standard 13.	• **Students will develop the abilities to assess the impact of products and systems.** o ***As part of learning how to assess the impact of products and systems, students should learn that:*** ▪ F. Design and use instruments to gather data. ▪ G. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. ▪ H. Identify trends and monitor potential consequences of technological development. ▪ I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
Standard 16.	• **Students will develop an understanding of and be able to select and use energy and power technologies.** o ***In order to select, use, and understand energy and power technologies, students should learn that:*** ▪ I. Much of the energy used in our environment is not used efficiently.
Standard 17.	• **Students will develop an understanding of and be able to select and use information and communication technologies.** o ***In order to select, use, and understand information and communication technologies, students should learn that:*** ▪ H. Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human. ▪ J. The design of a message is influenced by such factors as intended audience, medium, purpose, and the nature of the message. ▪ K. The use of symbols, measurements, and drawings promotes a clear communication by providing a common language to express ideas.
Standard 18.	• **Students will develop an understanding of and be able to select and use transportation technologies.** o ***In order to select, use, and understand transportation technologies, students should learn that:*** ▪ F. Transporting people and goods involves a combination of individuals and vehicles.

	▪ G. Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support that must function together for a system to work effectively. ▪ H. Governmental regulations often influence the design and operation of transportation systems. ▪ I. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

21st-Century Skills:

Code	Standard
Global Awareness	Using 21st century skills to understand and address global issues
Creativity and Innovation	Demonstrating originality and inventiveness in work
	Developing, implementing and communicating new ideas to others
	Acting on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs
Critical Thinking and Problem Solving	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Identifying and asking significant questions that clarify various points of view and lead to better solutions
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
Communication and Collaboration	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
	Exercising flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
	Assuming shared responsibility for collaborative work
Information Literacy	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
Flexibility & Adaptability	Adapting to varied roles and responsibilities
Initiative & Self-Direction	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Defining, prioritizing and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
Social & Cross-Cultural	Working appropriately and productively with others

Skills	
Productivity & Accountability	Setting and meeting high standards and goals for delivering quality work on time
	Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)
Leadership & Responsibility	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal
	Demonstrating integrity and ethical behavior
	Acting responsibly with the interests of the larger community in mind