



Standards Addressed in G9–12

Lesson 1

Science:

<i>NSES Content Standards</i>	
Code	Standard
12AS12.1	How physical, living, or designed systems function
12BPS3.2	Chemical reactions may release or consume energy. Some reactions such as the burning fossil fuels release large amounts of energy by losing heat and by emitting light. Light can initiate many chemical reactions such as photosynthesis and the evolution of urban smog.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
4E/H1*	Although the various forms of energy appear very different, each can be measured in a way that makes it possible to keep track of how much of one form is converted into another. Whenever the amount of energy in one place diminishes, the amount in other places or forms increases by the same amount.
4F/H1*	The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
4G/H5c*	The interplay of electric and magnetic forces is the basis for many modern technologies, including electric motors, generators, and devices that produce or receive electromagnetic waves.

Math:

<i>NCTM Standards</i>	
Code	Standard
	Recognize and apply mathematics in contexts outside of mathematics

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3B/H2	The value of any given technology may be different for different groups of people and at different points in time.
3C/H1	Social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk

	capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.
3C/H3*	In deciding on proposals to introduce new technologies or curtail existing ones, some key questions arise concerning possible alternatives, who benefits and who suffers, financial and social costs, possible risks, resources used (human, material, or energy), and waste disposal.
8C/H2*	When selecting fuels, it is important to consider the relative advantages and disadvantages of each fuel.

<i>ITEA Standards</i>	
Code	Standard
Standard 1.	<ul style="list-style-type: none"> • Students will develop an understanding of the characteristics and scope of technology. <ul style="list-style-type: none"> ○ In order to understand the scope of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ J. The nature and development of technological knowledge and processes are a function of the setting. ▪ M. Most development of technologies these days is driven by the profit motive and the market.
Standard 2.	<ul style="list-style-type: none"> • Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems. ▪ Z. Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste. ▪ AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Standard 3.	<ul style="list-style-type: none"> • Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study. <ul style="list-style-type: none"> ○ In order to appreciate the relationships among technologies, as well as with other fields of study, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
Standard 4.	<ul style="list-style-type: none"> • Students will develop an understanding of the cultural, social, economic, and political effects of technology.

	<ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Changes caused by the use of technology can range from gradual to rapid and subtle to obvious. ▪ Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects. ▪ J. Ethical considerations are important in the development, selection, and use of technologies.
Standard 5.	<ul style="list-style-type: none"> ● Students will develop an understanding of the effects of technology on the environment. <ul style="list-style-type: none"> ○ In order to discern the effects of technology on the environment, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling. ▪ H. When new technologies are developed to reduce the use of resources, considerations of trade-offs are important. ▪ K. Humans devise technologies to reduce the negative consequences of other technologies. ▪ L. Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.
Standard 6.	<ul style="list-style-type: none"> ● Students will develop an understanding of the role of society in the development and use of technology. <ul style="list-style-type: none"> ○ In order to realize the impact of society on technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> I. The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.

21st-Century Skills:

Code	Standard
<i>Communication and Collaboration</i>	Articulating thoughts and ideas clearly and effectively through speaking and writing
<i>Information Literacy</i>	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand

Lesson 2

Science:

<i>NSES Content Standards</i>	
Code	Standard
	Evaluate the solution and its consequences
	Progress in science and technology can be affected by social issues

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
	Progress in science and invention depends heavily on what else is happening in society.
	The value of any given technology may be different for different groups of people and at different points in time.
	The decisions of one generation both provide and limit the range of the possibilities open to the next generation.

Math:

<i>NCTM Standards</i>	
Code	Standard
	Use symbolic algebra to represent and explain mathematical relationships

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
9C/H6**	Both shape and scale can have important consequences for the performance of systems.

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3A/H3a*	Technology usually affects society more directly than science does because technology solves practical problems and serves human needs.
3A/H4**	Engineers use knowledge of science and technology, together with strategies of design, to solve practical problems. Scientific knowledge provides a means of estimating what the behavior of things will be even before they are made. Moreover, science often suggests new kinds of behavior that had not even been imagined before, and so leads to new technologies.

<i>ITEA Standards</i>	
Code	Standard
Standard 2.	<ul style="list-style-type: none"> • Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ Y. The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop. ▪ AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Standard 4.	<ul style="list-style-type: none"> • Students will develop an understanding of the cultural, social, economic, and political effects of technology. <ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
Standard 5.	<ul style="list-style-type: none"> • Students will develop an understanding of the effects of technology on the environment. <ul style="list-style-type: none"> ○ In order to discern the effects of technology on the environment, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.

21st-Century Skills:

Code	Standard
<i>Financial, economic, business, and entrepreneurial literacy</i>	Knowing how to make appropriate personal economic choices
<i>Critical Thinking and Problem Solving</i>	Framing, analyzing and synthesizing information in order to solve problems and answer questions

Lesson 3

Science:

<i>NSES Content Standards</i>	
Code	Standard
12EST1.1	Identify a problem or design an opportunity. Students should be able to identify new problems or needs and to change and improve current technological designs.
12EST1.2	Propose designs and choose between alternative solutions. Students should demonstrate thoughtful planning for a piece of technology or technique. Students should be introduced to the roles of models and simulations in these processes.
12EST1.4	Evaluate the solution and its consequences. Students should test any solution against the needs and criteria it was designed to meet. At this stage, new criteria not originally considered may be reviewed.
12BPS2.4	The physical properties of compounds reflect the nature of the interactions among its molecules.
	The magnitude of the change in motion can be calculated using the relationship $F=ma$, which is independent of the nature of the force.
12BPS4.5	Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces.
12BPS5.1	The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less organized.
12FSPSP1.1	Hazards and the potential for accidents exist. Regardless of the environment, the possibility of injury, illness, disability, or death may be present. Humans have a variety of mechanisms — sensory, motor, emotional, social, and technological — that can reduce and modify hazards.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
4D/H10**	The physical properties of compounds reflect the nature of the interactions among its molecules. These interactions are determined by the structure of the molecule, including the constituent atoms and the distances and angles between them.

4E/H1*	Although the various forms of energy appear very different, each can be measured in a way that makes it possible to keep track of how much of one form is converted into another. Whenever the amount of energy in one place diminishes, the amount in other places or forms increases by the same amount.
4G/H5c*	The interplay of electric and magnetic forces is the basis for many modern technologies, including electric motors, generators, and devices that produce or receive electromagnetic waves.

Math:

<i>NCTM Standards</i>	
Code	Standard
	Use symbolic algebra to represent and explain mathematical relationships
	Solve problems that arise in mathematics and other contexts

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
2B/H1*	Mathematical modeling aids in technological design by simulating how a proposed system might behave.
2B/H6** (SFAA)	Mathematics is useful in business, industry, music, historical scholarship, politics, sports, medicine, agriculture, engineering, and the social and natural sciences.

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3A/H3a*	Technology usually affects society more directly than science does because technology solves practical problems and serves human needs (and also creates new problems and needs).
3A/H4** (SFAA)	Engineers use knowledge of science and technology, together with strategies of design, to solve practical problems. Scientific knowledge provides a means of estimating what the behavior of things will be even before they are made. Moreover, science often suggests new kinds of behavior that had not even been imagined before, and so leads to new technologies.
8B/H4*	Increased knowledge of the properties of particular molecular structures helps in the design and synthesis of new materials for special purposes.
8C/H6** (SFAA)	The useful energy output of a device—that is, what energy is available for further change—is always less than the energy input, with the difference usually appearing as thermal energy. One goal in the design of such

	devices is to make them as efficient as possible—that is, to maximize the useful output for a given input.
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<i>ITEA Standards</i>	
Code	Standard
Standard 1.	<ul style="list-style-type: none"> • Students will develop an understanding of the characteristics and scope of technology. <ul style="list-style-type: none"> ○ In order to understand the scope of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ J. The nature and development of technological knowledge and processes are a function of the setting.
Standard 2.	<ul style="list-style-type: none"> • Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ Z. Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste. ▪ AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. ▪ BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.
Standard 4.	<ul style="list-style-type: none"> • Students will develop an understanding of the cultural, social, economic, and political effects of technology. <ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
Standard 5.	<ul style="list-style-type: none"> • Students will develop an understanding of the effects of technology on the environment. <ul style="list-style-type: none"> ○ In order to discern the effects of technology on the environment, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling. ▪ H. When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.

21st-Century Skills:

Code	Standard
<i>Global Awareness</i>	Using 21st century skills to understand and address global issues
<i>Financial, economic, business and entrepreneurial literacy</i>	Knowing how to make appropriate personal economic choices
<i>Critical Thinking and Problem Solving</i>	Understanding the interconnections among systems
<i>Communication and Collaboration</i>	Demonstrating ability to work effectively with diverse teams
<i>Information Literacy</i>	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
<i>Flexibility & Adaptability</i>	Adapting to varied roles and responsibilities
<i>Initiative & Self-Direction</i>	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
<i>Social & Cross-Cultural Skills</i>	Working appropriately and productively with others
<i>Productivity & Accountability</i>	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)
<i>Leadership & Responsibility</i>	Using interpersonal and problem-solving skills to influence and guide others toward a goal
	Leveraging strengths of others to accomplish a common goal

Lesson 4

Science:

<i>NSES Content Standards</i>	
Code	Standard
12ASI2.3	Scientists rely on technology to enhance the gathering and manipulation of data.
12ASI2.4	Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results.
12FSPSP3.1	Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.
12FSPSP3.2	The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources,

	and it depletes those resources that cannot be renewed.
12FSPSP6.2	Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science - and technology - related challenges. However, understanding science alone will not resolve local, national or global challenges.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
7A/H1	Cultural beliefs strongly influence the values and behavior of the people who grow up in the culture, often without their being fully aware of it. Responses to these influences vary among individuals.
7C/H2	The decisions of one generation both provide and limit the range of the possibilities open to the next generation.
7C/H4	To various degrees, governments try to bring about social change or impede it through policies, laws, incentives, or direct coercion. Sometimes such efforts achieve their intended results and sometimes they do not.

Math:

<i>NCTM Standards</i>	
Code	Standard
	Develop a deeper understanding of very large and very small numbers and of various representations of them
	Judge the reasonableness of numerical computations and their results
	Evaluate published reports that are based on data by examining the design of the study, the appropriateness of the data analysis, and the validity of conclusions

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
2B/H3*	Mathematics provides a precise language to describe objects and events and the relationships among them. In addition, mathematics provides tools for solving problems, analyzing data, and making logical arguments.
9B/H5	When a relationship is represented in symbols, numbers can be substituted for all but one of the symbols and the possible value of the remaining symbol computed. Sometimes the relationship may be satisfied by one value, sometimes by more than one, and sometimes not at all.

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3A/H3a*	Technology usually affects society more directly than science does because technology solves practical problems and serves human needs (and also creates new problems and needs).
3C/H1	Social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.
8C/H2*	When selecting fuels, it is important to consider the relative advantages and disadvantages of each fuel.
8C/H5*	Decisions to slow the depletion of energy resources can be made at many levels, from personal to national, and they always involve trade-offs involving economic costs and social values.

<i>ITEA Standards</i>	
Code	Standard
Standard 1.	<ul style="list-style-type: none"> • Students will develop an understanding of the characteristics and scope of technology. <ul style="list-style-type: none"> ○ In order to understand the scope of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ J. The nature and development of technological knowledge and processes are a function of the setting.
Standard 2.	<ul style="list-style-type: none"> • Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ Z. Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste. ▪ AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Standard 4.	<ul style="list-style-type: none"> • Students will develop an understanding of the cultural, social, economic, and political effects of technology. <ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Changes caused by the use of technology can range from gradual to rapid and subtle to obvious. ▪ I. Making decisions about the use of technology

	<ul style="list-style-type: none"> ▪ J. Ethical considerations are important in the development, selection, and use of technologies.
Standard 5.	<ul style="list-style-type: none"> • Students will develop an understanding of the effects of technology on the environment. <ul style="list-style-type: none"> ○ In order to discern the effects of technology on the environment, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling. ▪ H. When new technologies are developed to reduce the use of resources, considerations of trade-offs are important. ▪ I. With the aid of technology, various aspects of the environment can be monitored to provide information for decision making.

21st-Century Skills:

Code	Standard
<i>Global Awareness</i>	Using 21st century skills to understand and address global issues
	Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work and community contexts
<i>Financial, economic, business and entrepreneurial literacy</i>	Understanding the role of the economy in society
<i>Civic Literacy</i>	Understanding the local and global implications of civic decisions
<i>Creativity and Innovation</i>	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
<i>Critical Thinking and Problem Solving</i>	Exercising sound reasoning in understanding
	Making complex choices and decisions
	Understanding the interconnections among systems
	Framing, analyzing and synthesizing information in order to solve problems and answer questions
<i>Communication and Collaboration</i>	Demonstrating ability to work effectively with diverse teams
<i>Information Literacy</i>	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
<i>ICT Literacy</i>	Using digital technology, communication tools and/or networks appropriately to access, manage, integrate, evaluate, and create

	information in order to function in a knowledge economy
	Using technology as a tool to research, organize, evaluate and communicate information, and the possession of a fundamental understanding of the ethical/legal issues surrounding the access and use of information
<i>Initiative & Self-Direction</i>	Monitoring one's own understanding and learning needs
	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
<i>Productivity & Accountability</i>	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)

Lesson 5

Science:

<i>NSES Content Standards</i>	
Code	Standard
12ASI2.3	Scientists rely on technology to enhance the gathering and manipulation of data
12BPS3.1	Chemical reactions occur all around us, for example in health care, cooking, cosmetics, and automobiles. Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our bodies.
12EST1.2	Propose designs and choose between alternative solutions.
12EST2.3	Creativity, imagination, and a good knowledge base are all required in the work of science and engineering.
12FSPSP3.2	The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
12FSPSP6.2	Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science - and technology - related challenges. However, understanding science alone will not resolve local, national or global challenges.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
7A/H1	Cultural beliefs strongly influence the values and behavior of the people who grow up in the culture, often without their being fully aware of it. Responses to these influences vary among individuals.

7C/H2	The decisions of one generation both provide and limit the range of the possibilities open to the next generation.
7C/H4	To various degrees, governments try to bring about social change or impede it through policies, laws, incentives, or direct coercion. Sometimes such efforts achieve their intended results and sometimes they do not.

Math:

<i>NCTM Standards</i>	
Code	Standard
	Judge the reasonableness of numerical computations and their results.
	Solve problems that arise in mathematics and in other contexts.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
2B/H3*	Mathematics provides a precise language to describe objects and events and the relationships among them. In addition, mathematics provides tools for solving problems, analyzing data, and making logical arguments.
9B/H5	When a relationship is represented in symbols, numbers can be substituted for all but one of the symbols and the possible value of the remaining symbol computed. Sometimes the relationship may be satisfied by one value, sometimes by more than one, and sometimes not at all.

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3C/H1	Social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.
8C/H2*	When selecting fuels, it is important to consider the relative advantages and disadvantages of each fuel.
8C/H5*	Decisions to slow the depletion of energy resources can be made at many levels, from personal to national, and they always involve trade-offs involving economic costs and social values.

<i>ITEA Standards</i>	
Code	Standard
Standard 1.	<ul style="list-style-type: none"> Students will develop an understanding of the characteristics and scope of technology.

	<ul style="list-style-type: none"> ○ In order to understand the scope of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ M. Most development of technologies these days is driven by the profit motive and the market.
Standard 2.	<ul style="list-style-type: none"> ● Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems. ▪ Z. Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste.
Standard 4.	<ul style="list-style-type: none"> ● Students will develop an understanding of the cultural, social, economic, and political effects of technology. <ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.

21st-Century Skills:

Code	Standard
<i>Global Awareness</i>	Using 21st century skills to understand and address global issues
<i>Financial, economic, business and entrepreneurial literacy</i>	Knowing how to make appropriate personal economic choices
	Understanding the role of the economy in society
<i>Creativity and Innovation</i>	Developing, implementing, and communicating new ideas to others
	Being open and responsive to new and diverse perspectives
<i>Critical Thinking and Problem Solving</i>	Exercising sound reasoning in understanding
	Making complex choices and decisions
<i>Communication and Collaboration</i>	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
<i>Information Literacy</i>	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
<i>Initiative & Self-Direction</i>	Monitoring one's own understanding and learning needs
	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Demonstrating initiative to advance skill levels toward a professional level

	Defining, prioritizing, and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
<i>Social & Cross-Cultural Skills</i>	Working appropriately and productively with others
<i>Productivity & Accountability</i>	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)
<i>Leadership & Responsibility</i>	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:

<i>NSES Content Standards</i>	
Code	Standard
12ASI2.3	Scientists rely on technology to enhance the gathering and manipulation of data
12ASI2.4	Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results
12EST1.2	Propose designs and choose between alternative solutions.
12EST2.3	Creativity, imagination, and a good knowledge base are all required in the work of science and engineering.
12FSPSP3.2	The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
12FSPSP6.2	Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science - and technology - related challenges. However, understanding science alone will not resolve local, national or global challenges.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
7A/H1	Cultural beliefs strongly influence the values and behavior of the people who grow up in the culture, often without their being fully aware of it. Responses to these influences vary among individuals.
7C/H2	The decisions of one generation both provide and limit the range of the possibilities open to the next generation.

7C/H4	To various degrees, governments try to bring about social change or impede it through policies, laws, incentives, or direct coercion. Sometimes such efforts achieve their intended results and sometimes they do not.
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Math:

<i>NCTM Standards</i>	
Code	Standard
	Understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each
	Know the characteristics of well-designed studies, including the role of randomization in surveys and experiments
	Compute basic statistics and understand the distinction between a statistic and a parameter
	Solve problems that arise in mathematics and in other contexts

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
2B/H3*	Mathematics provides a precise language to describe objects and events and the relationships among them. In addition, mathematics provides tools for solving problems, analyzing data, and making logical arguments.
9B/H5	When a relationship is represented in symbols, numbers can be substituted for all but one of the symbols and the possible value of the remaining symbol computed. Sometimes the relationship may be satisfied by one value, sometimes by more than one, and sometimes not at all.

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3C/H1	Social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.
8C/H2*	When selecting fuels, it is important to consider the relative advantages and disadvantages of each fuel.
8C/H5*	Decisions to slow the depletion of energy resources can be made at many levels, from personal to national, and they always involve trade-offs involving economic costs and social values.

<i>ITEA Standards</i>	
Code	Standard
Standard 2.	<ul style="list-style-type: none"> • Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ Z. Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste. ▪ AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Standard 4.	<ul style="list-style-type: none"> • Students will develop an understanding of the cultural, social, economic, and political effects of technology. <ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Changes caused by the use of technology can range from gradual to rapid and subtle to obvious. ▪ I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
Standard 5.	<ul style="list-style-type: none"> • Students will develop an understanding of the effects of technology on the environment. <ul style="list-style-type: none"> ○ In order to discern the effects of technology on the environment, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ L. Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.
Standard 6.	<ul style="list-style-type: none"> • Students will develop an understanding of the role of society in the development and use of technology. <ul style="list-style-type: none"> ○ In order to realize the impact of society on technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values. ▪ I. The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures. ▪ J. A number of different factors such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.

21st-Century Skills:

Code	Standard
<i>Global Awareness</i>	Using 21st century skills to understand and address global issues
<i>Financial, economic, business and entrepreneurial literacy</i>	Knowing how to make appropriate personal economic choices
	Understanding the role of the economy in society
<i>Creativity and Innovation</i>	Developing, implementing, and communicating new ideas to others
	Being open and responsive to new and diverse perspectives
<i>Critical Thinking and Problem Solving</i>	Exercising sound reasoning in understanding
	Making complex choices and decisions
<i>Communication and Collaboration</i>	Articulating thoughts and ideas clearly and effectively through speaking and writing
	Demonstrating ability to work effectively with diverse teams
<i>Information Literacy</i>	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
<i>Initiative & Self-Direction</i>	Monitoring one's own understanding and learning needs
	Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
	Demonstrating initiative to advance skill levels toward a professional level
	Defining, prioritizing, and completing tasks without direct oversight
	Utilizing time efficiently and managing workload
	Demonstrating commitment to learning as a lifelong process
<i>Social & Cross-Cultural Skills</i>	Working appropriately and productively with others

Lesson 7

Science:

<i>NSES Content Standards</i>	
Code	Standard
12ASI1.3	Use technology and mathematics to improve investigations and communications.
12EST1.1	Identify a problem or design an opportunity
12EST1.2	Propose designs and choose between alternative solutions.
12EST1.3	Implement a proposed solution.
12EST1.4	Evaluate the solution and its consequences.
12EST1.5	Communicate the problem, process, and solution.
12EST2.3	Creativity, imagination, and a good knowledge base are all required in the work of science and engineering.
12FSPSP3.2	The earth does not have infinite resources; increasing human consumption

	places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
12FSPSP4.2	Materials from human societies affect both physical and chemical cycles of the earth.
12FSPSP4.3	Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.
12FSPSP6.3	Progress in science and technology can be affected by social issues and challenges. Funding priorities for specific health problems serve as examples of ways that social issues influence science and technology.

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
7A/H1	Cultural beliefs strongly influence the values and behavior of the people who grow up in the culture, often without their being fully aware of it. Responses to these influences vary among individuals.
7C/H2	The decisions of one generation both provide and limit the range of the possibilities open to the next generation.
7C/H4	To various degrees, governments try to bring about social change or impede it through policies, laws, incentives, or direct coercion. Sometimes such efforts achieve their intended results and sometimes they do not.
7D/H1	Benefits and costs of proposed choices include consequences that are long-term as well as short-term, and indirect as well as direct. The more remote the consequences of a personal or social decision, the harder it usually is to take them into account in considering alternatives. But benefits and costs may be difficult to estimate.
7D/H2	In deciding among alternatives, a major question is who will receive the benefits and who (not necessarily the same people) will bear the costs.

Math:

<i>NCTM Standards</i>	
Code	Standard
	Solve problems that arise in mathematics and other contexts
	Develop a deeper understanding of very large and very small numbers and of various representations of them
	Solve problems that arise in mathematics and in other contexts
	Recognize and apply mathematics in contexts outside of mathematics
	Use representations to model and interpret physical, social, and mathematical phenomena

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
2B/H1*	Mathematical modeling aids in technological design by simulating how a proposed system might behave.
2B/H3*	Mathematics provides a precise language to describe objects and events and the relationships among them. In addition, mathematics provides tools for solving problems, analyzing data, and making logical arguments.
9A/H1	Comparison of numbers of very different size can be made approximately by expressing them as nearest powers of ten.
9B/H4	Tables, graphs, and symbols are alternative ways of representing data and relationships that can be translated from one to another.

Technology:

<i>AAAS Project 2061 Benchmarks</i>	
Code	Standard
3A/H1	Technological problems and advances often create a demand for new scientific knowledge, and new technologies make it possible for scientists to extend their research in new ways or to undertake entirely new lines of research. The very availability of new technology itself often sparks scientific advances.
3A/H2	Mathematics, creativity, logic, and originality are all needed to improve technology.
3A/H3a	Technology usually affects society more directly than science does because technology solves practical problems and serves human needs (and also creates new problems and needs).
3A/H4	Engineers use knowledge of science and technology, together with strategies of design, to solve practical problems. Scientific knowledge provides a means of estimating what the behavior of things will be even before they are made. Moreover, science often suggests new kinds of behavior that had not even been imagined before, and so leads to new technologies.
3B/H1	In designing a device or process, thought should be given to how it will be manufactured, operated, maintained, replaced, and disposed of and who will sell, operate, and take care of it. The costs associated with these functions may introduce yet more constraints on the design.
3B/H2	The value of any given technology may be different for different groups of people and at different points in time.
3B/H4	Risk analysis is used to minimize the likelihood of unwanted side effects of a new technology. The public perception of risk may depend, however, on psychological factors as well as scientific ones.
3C/H1	Social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk capital, the federal budget, local and national regulations, media attention,

	economic competition, and tax incentives.
3C/H3*	In deciding on proposals to introduce new technologies or curtail existing ones, some key questions arise concerning possible alternatives, who benefits and who suffers, financial and social costs, possible risks, resources used (human, material, or energy), and waste disposal.

<i>ITEA Standards</i>	
Code	Standard
Standard 1.	<ul style="list-style-type: none"> • Students will develop an understanding of the characteristics and scope of technology. <ul style="list-style-type: none"> ○ In order to understand the scope of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ J. The nature and development of technological knowledge and processes are a function of the setting. ▪ L. Inventions and innovations are results of specific, goal-directed research ▪ M. Most development of technologies these days is driven by the profit motive and the market.
Standard 2.	<ul style="list-style-type: none"> • Students will develop an understanding of the core concepts of technology. <ul style="list-style-type: none"> ○ In order to recognize the core concepts of technology, students in grades 9-12 should learn that <ul style="list-style-type: none"> ▪ W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems. ▪ X. Systems, which are the buildings blocks of technology, are embedded within larger technological, social and environmental systems. ▪ Z. Selecting resources involves tradeoffs between competing values, such as availability, cost, desirability, and waste. ▪ AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Standard 4.	<ul style="list-style-type: none"> • Students will develop an understanding of the cultural, social, economic, and political effects of technology. <ul style="list-style-type: none"> ○ In order to recognize the changes in society caused by the use of technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Changes caused by the use of technology can range from gradual to rapid and subtle to obvious. ▪ I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.

	J. Ethical considerations are important in the development, selection, and use of technologies.
Standard 5.	<ul style="list-style-type: none"> • Students will develop an understanding of the effects of technology on the environment. <ul style="list-style-type: none"> ○ In order to discern the effects of technology on the environment, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling. ▪ H. When new technologies are developed to reduce the use of resources, considerations of trade-offs are important. ▪ K. Humans devise technologies to reduce the negative consequences of other technologies. ▪ L. Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.
Standard 6.	<ul style="list-style-type: none"> • Students will develop an understanding of the role of society in the development and use of technology. <ul style="list-style-type: none"> ○ In order to realize the impact of society on technology, students in Grades 9-12 should learn that <ul style="list-style-type: none"> ▪ H. Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values. ▪ I. The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures. ▪ J. A number of different factors such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.

21st-Century Skills:

Code	Standard
<i>Global Awareness</i>	Using 21st century skills to understand and address global issues
<i>Creativity and Innovation</i>	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
<i>Critical Thinking and Problem Solving</i>	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
<i>Communication and Collaboration</i>	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
<i>Information Literacy</i>	Accessing information efficiently and effectively, evaluating information critically and competently and using information accurately and creatively for the issue or problem at hand
<i>Flexibility & Adaptability</i>	Adapting to varied roles and responsibilities
<i>Initiative & Self-Direction</i>	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
<i>Social & Cross-Cultural Skills</i>	Working appropriately and productively with others
<i>Productivity & Accountability</i>	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)
<i>Leadership & Responsibility</i>	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

