INVENTIONS AND INNOVATIONS

OVERVIEW

ENDURING UNDERSTANDINGS

This unit will allow students to explore the evolution of technology and its role in today's global society. Students will explore the history of technology and the important impacts Inventions and Innovations have made in the context of Information and communication, as well as, Advertising and Marketing.

BIG IDEA

Inventions and Innovations are a result of evolutionary technological development and systematic research and development.

Teacher's Note

Big ideas should be made explicit to students by writing them on the board, reading them aloud, and/or posting them on worksheets associated with the lessons. For deeper understanding, have students write the Big Idea in their own Engineering Design Journal (EDJ), using their own words if they choose.

PURPOSE OF THE UNIT

Unit 1, Technological Inventions and Innovations, analyzes the historical significance of technological advancements. It examines the profound effects of technology on the course of history and the ways in which it continues to shape our future. The unit also explores how the development and use of technology is influenced by cultural, social, political, economic, and environmental factors. Additionally, this unit examines how technological inventions and innovations are the results of an evolutionary process and a series of refinements. These refinements lead to new and improved technological products, as well as new technological processes. As you will see throughout this unit, technological inventions and innovations are the results of in-depth research and development and the problem-solving approach used in engineering.

INSTRUCTIONAL TIME

The Technological Inventions and Innovations requires 9 weeks of instructional time based on one hour per day. Each of the four units in the Invention and Innovation s course require the following number of hours to cover the content:

REQUIRED UNIT HOURS	ENRICHMENT HOURS	TOTAL UNIT HOURS	TOTAL UNIT WEEKS
21 Hours	24 Hours	45 Hours	9 Weeks

STANDARDS AND BENCHMARKS THAT ARE ADDRESSED

This unit is based on three sets of Standards:

1. Standards for Technological Literacy (STL)
2. Next Generation Science Standards (NGSS)
3. Common Core State Standards (CCSS)

***TECHNOLOGY*:** Standards for Technological Literacy (STL) *(ITEA/ITEEA, 2000/2002/2007)*	
STL 1	**Students will develop an understanding of the characteristics and scope of technology.**
J	The nature and development of technological knowledge and processes are functions of the setting.
STL 14	**Students will develop an understanding of and be able to select and use medical technologies.**
L	Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.
STL 15	**Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.**
K	Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.
STL 16	**Students will develop an understanding of and be able to select and use energy and power technologies.**
J	Energy cannot be created nor destroyed; however, it can be converted from one form to another.
K	Energy can be grouped into major forms: thermal, radiant, electrical mechanical, chemical, nuclear, and others.
M	Energy resources can be renewable or nonrenewable.
N	Power systems must have a source of energy, a process, and loads.
STL 17	**Students will develop an understanding of and be able to select and use information and communication technologies.**
L	Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.
M	Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.
N	Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.
O	Communication systems are made up of source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.
Q	Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.
STL 18	**Students will develop an understanding of and be able to select and use transportation technologies.**
J	Transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.
STL 19	**Students will develop an understanding of and be able to select and use manufacturing technologies.**
M	Materials have different qualities and may be classified as natural, synthetic, or mixed.
O	Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.
P	The interchangeability of parts increases the effectiveness of manufacturing processes.
STL 20	**Students will develop an understanding of and be able to select and use construction technologies.**
J	Infrastructure is the underlying base or basic framework of a system.
K	Structures are constructed using a variety of processes and procedures.

SCIENCE: **Next Generation Science Standards (NGSS, 2013)**	
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth

MATHEMATICS: **Common Core State Standards (CCSS, 2012)**	
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

ENGLISH-LANGUAGE ARTS: **Common Core State Standards (CCSS, 2012)**	
RST.9-10.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
RST.9-10.2	Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
RST.9-10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.9-10.10	By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.
WHST.9-10.1	Write arguments focused on *discipline-specific content*.
WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
WHST.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
WHST.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST. 9-10.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
WHST. 9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST. 9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
WHST. 9-10.10	Draw evidence from informational texts to support analysis, reflection, and research.

UNIT OBJECTIVES

CYCLE	BIG IDEA	OBJECTIVES
Learning Cycle 1: Lesson 1. The History of Technology (5 hours)	People are better able to understand the world around them when they explore how people of all times and places have used their unique skills to innovate, improvise, and invent.	Compare and contrast technology that was used during the different historical periods.
		Research a technological device from one of the historical periods that produced long-lasting effects on technology and society.
		Explain that the Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, improved education, and leisure time.
		Describe societal events from the 1900s that led to progress in science and invention.
		Select one of the following areas of technology and explain how technology changed the way people live and work: agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications.
		Demonstrate how Information Age devices are used to process and exchange information.
		Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.
		Actively participate in group discussions, ideation exercises, and debates.
Learning Cycle 2: Inventions and Innovations (5 hours)	Inventions and innovations are the result of an evolutionary process through a series of improvements and refinements.	Interpret charts and graphs that illustrate the rapidly increasing rate of technological development and diffusion.
		Approximate and interpret rate of change from graphical and numerical data.
		Support the statement that most technological developments have been evolutionary, the result of a series of refinements to a basic invention, through an electronic presentation.
		Present the evolutionary history of a technological device, specifically mentioning the original inventions and the series of refinements to that invention that led up to the given technological device.
		Describe a technological innovation that resulted when ideas, knowledge, or skills were shared within a technology, among technologies, or across other fields.

		Support the statement that the human ability to shape the future comes from a capacity for generating knowledge and developing new technologies—and for communicating ideas to others.
		Describe the patenting process that is sometimes used to protect technological ideas.
		Describe an example of a technology in which the development was driven by the profit motive and the market.
Learning Cycle 3: Information and Communication (6 hours)	Information and communication systems greatly impact our quality of life and are an essential component of business and industry that is rapidly expanding.	Illustrate that research and development is a specific problem.
		Demonstrate the use of research and development and other problem-solving approaches to prepare a device and/or system for the marketplace.
		List examples of inventions and/or innovations that are the result of specific, goal-oriented research.
Learning Cycle 4: Advertising and Marketing Effects on Technology (5 hours)	Many factors, including advertising, the strength of the economy, goals of the company, and fads determined by society, have an impact on the demand and design of technology.	Support the statement that 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.
		Identify how advertising, the strength of the economy, the goals of the company, and the fads of the time period contribute to the design of the product and the success or failure of the product, given various technological innovations.
		Describe how a technology may have effects other than those intended by the design, some of which may have been predicable and some not.
		Explain how the value of any given technology may be different for different groups of people and at different points in time.
Total for This Unit = 21 Hours plus 24 hours Enrichment		

ASSESSMENT TOOLS

Learning assessed using:

- Selected Response Items
- Brief Constructed Response Item
- Performance Rubrics

Specific tools are incorporated into each lesson as Supporting Files.