# Scope & Sequence

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| **Course Name:** Principles of Technology **TSDS PEIMS Code:** 13037100 | | | **Course Credit:** 1.0  **Course Requirements:** Recommended for students in Grades 10-12.  **Prerequisites:** One credit of high school science and Algebra I. |
| **Course Description:** In Principles of Technology, students will conduct laboratory and field investigations, use scientific practices during investigations, and make informed decisions using critical thinking and scientific problem solving. Various systems will be described in terms of space, time, energy, and matter. Students will study a variety of topics that include laws of motion, conservation of energy, momentum, electricity, magnetism, thermodynamics, and characteristics and behavior of waves. Students will apply physics concepts and perform laboratory experimentations for at least 40% of instructional time using safe practices. This course satisfies a high school science graduation requirement. | | | |
| **NOTE:** This is a suggested scope and sequence for the course content. This content will work with any textbook or instructional materials. If locally adapted, make sure all TEKS are covered. | | | |
| **Total Number of Periods**  **Total Number of Minutes**  **Total Number of Hours** | 175 Periods  7,875 Minutes  131.25 Hours | \*Schedule calculations based on 175/180 calendar days. For 0.5 credit courses, schedule is calculated out of 88/90 days. Scope and sequence allows additional time for guest speakers, student presentations, field trips, remediation, extended learning activities, etc. | |

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| **Unit Number, Title, and Brief Description** | **# of Class Periods\***  (assumes 45-minute periods)  Total minutes per unit | **TEKS Covered**  **130.404. (c) Knowledge and skills** |
| **Unit 1: What is Science?**  To understand STEM (Science, Technology, Engineering, and Math) principles of technology, students must first understand what Science is. Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. In this unit, the student will define science and its limitations. The culminating activity for this unit will have students distinguish between scientific hypotheses and scientific theories and design and implement investigative procedures. | 14 Periods  630 Minutes | (3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:  (A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section;  (B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power, which have been tested over a wide variety of conditions, are incorporated into theories;  (C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed;  (D) distinguish between scientific hypotheses and scientific theories;  (E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness. |
| **Unit 2: Technology Laboratory and Field Investigations**  The STEM Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services. In this unit, students will gather, organize, and measure various technological data using a variety of equipment. The culminating activity will have students evaluate the data and communicate their conclusions and inferences through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, and oral reports. | 14 Periods  630 Minutes | (3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:  (F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), balances, batteries, dynamics demonstration equipment, collision apparatus, lab masses, magnets, plane mirrors, convex lenses, stopwatches, trajectory apparatus, graph paper, magnetic compasses, protractors, metric rulers, spring scales, thermometers, and slinky springs;  (G) use a wide variety of additional course equipment as appropriate such as ripple tank wave generator, wave motion rope, tuning forks, hand-held visual spectroscopes, discharge tubes with power supply (H, He, Ne, Ar), electromagnetic spectrum charts, laser pointers, micrometer, caliper, computer, data acquisition probes, scientific calculators, graphing technology, electrostatic kits, electroscope, inclined plane, optics bench, optics kit, polarized film, prisms, pulley with table clamp, motion detectors, photogates, friction blocks, ballistic carts or equivalent, resonance tube, stroboscope, resistors, copper wire, switches, iron filings, and/or other equipment and materials that will produce the same results;  (H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units;  (I) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs;  (J) communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports; and  (K) express relationships among physical variables quantitatively, including the use of graphs, charts, and equations. |
| **Unit 3: Safety Precautions and Regulations in Technology**  In this unit, students will comply with federal and state safety regulations in the field and laboratory environments. Students will identify and obey safety symbols and signs in the technology industry. The culminating activity will have students demonstrate appropriate safety procedures, and guidelines, including chemical hygiene and personal protection as well as explain the reason for conservation of resources and the proper disposal or recycling of materials. | 14 Periods  630 Minutes | (6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:  (A) master relevant safety procedures;  (B) comply with safety guidelines as described in various manuals, instructions, and regulations;  (C) identify and classify hazardous materials and wastes; and  (D) make prudent choices in the conservation and use of resources and the appropriate disposal of hazardous materials and wastes.  (2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:  (A) demonstrate safe practices during laboratory and field investigations; and  (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials. |
| **Unit 4: Scientific Reasoning in Technology**  Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation can be experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked. In this unit, students will use critical thinking, scientific reasoning, and problem solving to make informed decisions about information extracted from various sources such as news reports, articles and social media. The unit will culminate with an activity where students will explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society. | 14 Periods  630 Minutes | (4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:  (A) analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking;  (B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;  (C) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society;  (D) research and describe the connections between physics and future careers; and  (E) express, manipulate, and interpret relationships symbolically to make predictions and solve problems mathematically. |
| **Unit 5: Using the Scientific Process to Investigate Physical Concepts in Technology**  In this unit, students will perform functions such as testing theories of physical concepts. The unit culminates with an activity in which students design and implement investigative procedures. | 14 Periods  630 Minutes | (5) The student uses the scientific process to investigate physical concepts. The student is expected to:  (A) demonstrate an understanding that scientific hypotheses are tentative and testable statements that must be capable of being supported by observational evidence;  (B) demonstrate an understanding that scientific theories are based on physical phenomena and are capable of being tested by multiple independent researchers;  (C) design and implement investigative procedures;  (D) demonstrate the appropriate use and care of laboratory equipment;  (E) demonstrate accurate measurement techniques using precision instruments;  (F) record data using scientific notation and International System (SI) of units. |
| **Unit 6: Using the Scientific Process to Evaluate and Communicate Physical Concepts in Technology**  In this unit, students will build upon the prior unit and perform functions such as organizing and evaluating data to justify physical concepts. The unit culminates with an activity in which students communicate conclusions supported through various methods such as laboratory reports, labeled drawings, graphic organizers, journals, summaries, oral reports, or technology-based reports. | 7 Periods  315 Minutes | (5) The student uses the scientific process to investigate physical concepts. The student is expected to:  (G) identify and quantify causes and effects of uncertainties in measured data;  (H) organize and evaluate data, including the use of tables, charts, and graphs;  (I) communicate conclusions supported through various methods such as laboratory reports, labeled drawings, graphic organizers, journals, summaries, oral reports, or technology-based reports; and  (J) record, express, and manipulate data using graphs, charts, and equations. |
| **Unit 7: Application of the Laws Governing Motion**  Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable by empirical science. In this unit, students will perform functions such as describing and calculating the effects of forces on objects. Students will summarize their findings as they describe and calculate the effects of forces on objects, and develop and interpret free-body force diagrams. | 14 Periods  630 Minutes | (7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:  (A) generate and interpret relevant equations using graphs and charts for one- and two-dimensional motion, including:  (i) using and describing one-dimensional equations and graphical vector addition for displacement, distance, speed, velocity, average velocity, frames of reference, acceleration, and average acceleration;  (ii) using and describing two-dimensional equations for projectile and circular motion; and  (iii) using and describing vector forces and resolution; and  (B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum, using methods, including free-body force diagrams. |
| **Unit 8: Forces in the Physical World**  A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. In this unit, students will perform functions such as researching and describing the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces. The culminating activity for this unit will have students explain the relationship between electric and magnetic fields in applications such as generators, motors, and transformers. | 14 Periods  630 Minutes | (8) The student describes the nature of forces in the physical world. The student is expected to:  (A) describe the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces;  (B) describe and calculate the magnitude of gravitational forces between two objects;  (C) describe and calculate the magnitude of electric forces;  (D) describe the nature and identify everyday examples of magnetic forces and fields;  (E) describe the nature and identify everyday examples of electromagnetic forces and fields;  (F) characterize materials as conductors or insulators based on their electric properties; and  (G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits. |
| **Unit 9: Application of the Laws of Energy Conservation and Momentum**  This unit will cover the laws of energy conservation and momentum. Students will participate in activities from describing the transformational process between work, potential energy, and kinetic energy to analyzing and calculating the relationships amongst these energies. The culminating activity for this unit will have students explain the laws of the conservation of energy and momentum. | 14 Periods  630 Minutes | (9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:  (A) describe the transformational process between work, potential energy, and kinetic energy (work-energy theorem);  (B) use examples to analyze and calculate the relationships among work, kinetic energy, and potential energy;  (C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system; and  (D) describe and apply the laws of conservation of energy and conservation of momentum. |
| **Unit 10: The Concept of Thermal Energy**  Students will conduct activities such as comparing and contrasting various thermal energy transfer processes. The culminating activity for this unit will be for students to describe technological advancements in society. | 14 Periods  630 Minutes | (10) The student analyzes the concept of thermal energy. The student is expected to:  (A) explain technological examples such as solar and wind energy that illustrate the four laws of thermodynamics and the processes of thermal energy transfer. |
| **Unit 11: Properties of Wave Motion and Optics**  In this unit, students will engage in activities such as investigating and analyzing characteristics of behaviors of various waves. The culminating activity will have students describe the role of wave characteristics and behaviors as they relate to applications in the fields if medicine and industry. | 14 Periods  630 Minutes | (11) The student analyzes the properties of wave motion and optics. The student is expected to:  (A) examine and describe oscillatory motion and wave propagation in various types of media;  (B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength;  (C) investigate and calculate the relationship between wave speed, frequency, and wavelength;  (D) compare and contrast the characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and longitudinal waves, including sound waves;  (E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect; and  (F) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens. |
| **Unit 12: The Concepts of Atomic, Nuclear, and Quantum Phenomena**  Scientific decision-making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (science methods) and ethical and social decisions that involve science (the application of scientific information). This unit will have students cover the natures of light, emission produced by atoms nuclear stability, fission, and fusion. Amongst other activities, students will describe radioactive decay. The culminating activity will have students explore technology applications of atomic, nuclear, and quantum phenomena such as nanotechnology, radiation therapy, diagnostic imaging, and nuclear power. | 14 Periods  630 Minutes | (12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:  (A) describe the photoelectric effect and the dual nature of light;  (B) compare and explain emission spectra produced by various atoms;  (C) calculate and describe the applications of mass-energy equivalence;  (D) describe the process of radioactive decay given an isotope and half-life;  (E) describe the role of mass-energy equivalence for areas such as nuclear stability, fission, and fusion; and  (F) explore technology applications of atomic, nuclear, and quantum phenomena using the standard model such as nuclear stability, fission, and fusion, nanotechnology, radiation therapy, diagnostic imaging, semiconductors, superconductors, solar cells, and nuclear power. |
| **Unit 13: Employability Skills**  This unit offers students basic technical skills necessary to fulfill careers in the workforce. In this unit, students are encouraged to expand their learning experiences through avenues such as STEM organizations and other leadership or extracurricular organizations. By connecting with these networks, students will be able to show their ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome in the field of technology.  Through group activities, students will demonstrate interpersonal skills, such as: communication, cooperation, professionalism, efficiency and dependability. The unit culminates with a peer review evaluation and reflection upon skills needed for success in the workforce. | 14 Periods  630 Minutes | (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:  (A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;  (B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;  (C) present written and oral communication in a clear, concise, and effective manner;  (D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and  (E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed. |