



Statewide Framework Document for: 400891

**Principles of Technology - Applied**

Standards may be added to this document prior to submission but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of Physics or 1 credit of laboratory science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a [three-dimensional manner](http://nextgenscience.org/three-dimensions). The details about each performance expectation can be found at [Next Generation Science Standards](http://nextgenscience.org/next-generation-science-standards).

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| **School District Name** | | |
| **Course Title:** Principles of Technology - Applied | | **Total Framework Hours:** 180 |
| **CIP Code:** 400891 | Exploratory Preparatory | **Date Last Modified:** December 30, 2020 |
| **Career Cluster:** Science, Technology, Engineering, and Mathematics | | **Cluster Pathway:** Science and Math |
| **Course Summary:**  This course introduces the science of physics in an applied manner. Instruction includes the scientific study of matter and energy, and the formulation and testing of the laws governing the behavior of the matter–energy continuum. Students will learn about classical and modern physics, electricity and magnetism, thermodynamics, mechanics, wave methods, and laboratory processes that connect the theories of science to their applications in daily work and living. | | |
| **Eligible for Equivalent Credit in:** Math and Science | | **Total Number of Units:** 8 |

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| **Unit 1:** Career Exploration and Employability | | | **Total Learning Hours for Unit:** 5 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students identify and research career opportunities and pathways related to the STEM Career Clusters. * Students present their findings in a multimedia presentation or a written report | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  1B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes  2C.5 Reflect critically on learning experiences and processes  2D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions  3B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member | | | |
| **Industry Standards and/or Competencies**:  **Resource:** International Technology and Engineering Educators Association:  <https://www.iteea.org/File.aspx?id=67767&v=b26b7852> | | | |
| **Aligned Washington State Academic Standards** | | | |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** | |
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| **Unit 2:** Mechanical, Fluid, Electrical, & Thermal: Force | | | | **Total Learning Hours for Unit:** 25 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students build a rocket and predict how high it will fly mathematically. After launching the rocket, they can shoot an azimuth to measure angles and trigonometry to find the actual rocket trajectory. Finally, they will be able to compare their predictions to actual results. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation  2C.3 Synthesize and make connections between information and arguments  2D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions  3A.5 Communicate effectively in diverse environments (including multi-lingual) | | | | |
| **Industry Standards and/or Competencies**:  **Resource:** International Technology and Engineering Educators Association:  [Standards - International Technology and Engineering Educators Association (iteea.org)](https://www.iteea.org/stel) | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.  HS-PS2-1. Analyze data to support the claim that Newton’s Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.  HS-PS2-4. Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.  HS-PS3-5. Develop and use a model of two objects interacting through electrical or magnetic fields to  illustrate the forces between objects and the changes in energy of the objects due to the interaction. | | | |
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| **Unit 3:** Mechanical, Fluid, & Electrical: Work | | | | **Total Learning Hours for Unit:** 20 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students use fluid dynamics to determine the amount of work it will take to lift a mass of one kilogram to a height of one meter. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  4A.2 Evaluate information critically and competently  4B.1 Use information accurately and creatively for the issue or problem at hand  6A.1 Use technology as a tool to research, organize, evaluate and communicate information  8B.1 Monitor, define, prioritize and complete tasks without direct oversight | | | | |
| **Industry Standards and/or Competencies**:  **Resource:** International Technology and Engineering Educators Association:  [Standards - International Technology and Engineering Educators Association (iteea.org)](https://www.iteea.org/stel) | | | | |
| **Aligned Washington State Academic Standards** | | | | |
| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-PS2-1. Analyze data to support the claim that Newton’s Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.  HS-PS2-4. Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.  HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. | | | |
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| **Unit 4:** Mechanical, Fluid, Electrical, & Thermal: Rate | | | | **Total Learning Hours for Unit:** 25 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Using a suspended bucket with a hole in it, students predict the amount of time it will take to empty. They must take into account the effects of gravity as the downward force of the water in the bucket diminishes over time. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation  2C.3 Synthesize and make connections between information and arguments  3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts  9A.1 Know when it is appropriate to listen and when to speak  9B.2 Respond open-mindedly to different ideas and values | | | | |
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| **Aligned Washington State Academic Standards** | | | | |
| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-PS2-1. Analyze data to support the claim that Newton’s Second Law of Motion describes the  mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. | | | |
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| **Unit 5:** Mechanical, Fluid, Electrical, & Thermal: Resistance | | | | **Total Learning Hours for Unit:** 25 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students create an ecologically friendly and reusable insulation system that prevents heat loss and/or heat gain. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation  2C.3 Synthesize and make connections between information and arguments  3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts | | | | |
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| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy  when two components of different temperature are combined within a closed system results in a more  uniform energy distribution among the components in the system (second law of thermodynamics). | | | |
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| **Unit 6:** Mechanical, Fluid, Electrical, & Thermal: Energy | | | | **Total Learning Hours for Unit:** 25 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students design a system that converts potential energy into mechanical energy, such as a roller coaster or a Rube Goldberg machine. | | | | |
| **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  8A.3 Utilize time and manage workload efficiently  9A.2 Conduct themselves in a respectable, professional manner  10A.2 Prioritize, plan and manage work to achieve the intended result  11B.1 Act responsibly with the interests of the larger community in mind | | | | |
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| **Aligned Washington State Academic Standards** | | | | |
| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.  HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.  HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.  HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.  HS-PS2-4. Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.  HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.  HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.  HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).  HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.  HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).  HS-PS3-5. Develop and use a model of two objects interacting through electrical or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.  HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.  HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.  HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. | | | |
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| **Unit 7:** Mechanical, Fluid, Electrical, and Thermal: Power | | | | **Total Learning Hours for Unit:** 30 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students design a simple machine that increases mechanical advantage and efficiency to move mass over distance. | | | | |
| |  | | --- | | **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  1A.1 Use a wide range of idea creation techniques (such as brainstorming)  1B.3 Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas  2B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems  3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts | | | | | |
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| **Aligned Washington State Academic Standards** | | | | |
| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more  manageable problems that can be solved through engineering. | | | |
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| **Unit 8:** Mechanical, Fluid, & Electrical: Force Transformers | | | | **Total Learning Hours for Unit:** 25 |
| **Performance Assessments**:(Districts to complete for each unit)  *Example assessments for this unit include:*   * Students build a mechanism that will move an object from the floor to a table using three mechanical systems and one electrical system. They will need to show an unbalanced system where input is higher than output. Project deliverables should include an outline of the forces that are used, a force diagram, computations for energy conversions, and advantages of each mechanism. The instructor will use a rubric, a set of supplies, and a list of constraints to direct students’ work. | | | | |
| |  | | --- | | **Leadership Alignment**: (Districts to complete for each unit)  *Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.*  *Example:*  2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation  2D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions  3B.1 Demonstrate ability to work effectively and respectfully with diverse teams  4A.2 Evaluate information critically and competently | | | | | |
| **Industry Standards and/or Competencies**:  **Resource:** International Technology and Engineering Educators Association:  [Standards - International Technology and Engineering Educators Association (iteea.org)](https://www.iteea.org/stel) | | | | |
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| **Science** | **Washington Science Standards (Next Generation Science Standards):**  HS-PS2-1. Analyze data to support the claim that Newton’s Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.  HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.  HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.  HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.  HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and  tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as  well as possible social, cultural, and environmental impacts. | | | |
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