Everett Public Schools Framework: Physic by Design

Course: Pre-Engineering Technologies	**Total Framework Hours:** 180 Hours
CIP Code: 140102	**Type:** Exploratory
Career Cluster: Science, Technology, Engineering and Math	**Date Last Modified:** Monday, January 06, 2014

Resources and Standard used in Framework Development:

Standards used in this framework are taken from the OSPI Model Framework for 140102 Pre-Engineering Technologies

Unit 1 MECHANICS — Hours: 90

Performance Assessment(s):

Formative: (informs teacher and student) - chapter challenge
balloon car, catapult, video analysis, physics of sports. collision of cars,

Summative:
individaul analysis of catapult i.e. chapter challenge
individual analysis of car crash

Leadership Alignment:

Design and build a catapult that meets the design criteria within the specified constraints. (see design brief)

Standards and Competencies

C-3 Standard: Students will develop an understanding of the attributes of design and apply them to develop and produce a product.

C-3.1 Students will show their understanding of the design process by performing the steps involved: defining the problem, brainstorming and researching to come up with ideas, identifying criteria and specifying constraints, exploring ideas, selecting an approach, coming up with a design and making a proto-type model, testing and evaluating the design and refining if necessary, and communicating processes and results.

C-3.3 Students will demonstrate, through the proper construction of a product, their ability to interpret drawings, use a materials list, and follow a steps-of-procedures document.

C-3.5 Product designer and builder will meet to discuss and fill out an evaluation sheet summarizing how well they feel they did on their part of the product development.

C-3.6 Students will participate in a discussion about all the types of design careers there are and the job titles and functions of those who may be involved in design.

C-3.7 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-5 Standard: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

C-5.1 Understand and apply concepts of velocity, acceleration, force, kinetic energy, potential energy, and rolling drag.

C-5.2 Applying learned knowledge of Newton's three laws of motion in designing the car.

C-5.3 Understand and utilize relevant vocabulary (circumference, diameter, Pi, bearing, lever, axel, sprocket, friction, and rolling drag).

C-5.4 Use all machines and tools in accordance with all safety regulations (Miter Saw, Drill Press, Band Saw, Power Sanders, Scroll Saw, and others required) to complete the performance assessment.

C-5.5 Successfully perform the following tasks: formulate ideas, create a sketch, complete a front and top view drawing with parts labeled, create a materials list, construct and test, make any necessary modifications, complete calculation sheet to estimate how far the car will travel, participate in the Mousetrap-Snap-Off contest, and complete the car evaluation report.

C-5.6 Demonstrate technical writing, testing, data collection and math skills by completing the mousetrap car evaluation sheet.

C-5.7 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-7 Standard: Students will develop an understanding of the influence of technology on history.

C-7.1 Demonstrate the completion of the following engineering design process steps: define the problem, generate ideas, select a solution, test the solution(s), build the item, evaluate it, and report the results.

C-7.2 Applying learned knowledge of Newton's three laws of motion in designing and explaining function of the trebuchet.

C-7.3 Apply their understanding of simple machines/levers and explain that the trebuchet is an example of a Class 1 lever.

C-7.4 Demonstrate sketching ability by creating 4 different sketch ideas of trebuchet designs with the different parts labeled.

C-7.7 Use all machines and tools in accordance with all safety regulations (Miter Saw, Drill Press, Band Saw, Power Sanders, Scroll Saw, and others required) to complete the performance assessment.

C-7.8 Demonstrate technical writing, testing, data collection and math skills by completing the trebuchet evaluation sheet.

C-7.9 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-8 Standard: Students will develop an understanding of the core concepts of technology.

C-8.1 Apply an understanding and knowledge of simple machines by including them in the design of their pinball machine.

C-8.2 Applying learned knowledge of Newton's three laws of motion in designing and explaining function of the pinball machine (ball movement).

C-8.3 Demonstrate the completion of the following engineering design process steps: define the problem, generate ideas, select a solution, test the solution(s), build the item, evaluate it, and report the results.

C-8.4 Produce sketch drawings and a full size pattern drawing of the pinball machines game's playing surface.

C-8.5 Use all machines and tools in accordance with all safety regulations (Miter Saw, Drill Press, Band Saw, Power Sanders, Scroll Saw, and others required) to complete the performance assessment.

C-8.6 Examine and apply specific criteria in the design and production of the pinball machine.

C-8.7 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-8.8 Apply writing skills to complete the evaluation summary worksheet that explains how their pinball machine works and how it performed.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Geometry (G)

Congruence (G-CO)

12 - Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

Similarity, Right Triangles, and Trigonometry (G-SRT)

6 - Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

7 - Explain and use the relationship between the sine and cosine of complementary angles.

8 - Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

11 (+) - Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

4 (+) - Construct a tangent line from a point outside a given circle to the circle.

CC: Algebra (A)

Arithmetic with Polynomials and Rational Expressions (A-APR)

6 - Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

Creating Equations (A-CED)

2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*

4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.*

Reasoning with Equations and Inequalities (A-REI)

2 - Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

4 - Solve quadratic equations in one variable.

4b - Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

10 - Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

CC: Mathematical Practices (MP)

1 - Make sense of problems and persevere in solving them.

2 - Reason abstractly and quantitatively.

3 - Construct viable arguments and critique the reasoning of others.

4 - Model with mathematics.

5 - Use appropriate tools strategically.

6 - Attend to precision.

7 - Look for and make use of structure.

8 - Look for and express regularity in repeated reasoning.

Reading

CC: Reading Informational Text

Key Ideas and Details (11-12)

RI.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RI.11-12.2 Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.

RI.11-12.3 Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.

Craft and Structure (11-12)

RI.11-12.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Ma

Integration of Knowledge and Ideas (11-12)

RI.11-12.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

Range of Reading and Level of Text Complexity

RI.11-12.10 By the end of grade 11, read and comprehend literary nonfiction in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literary nonfiction

CC: Reading for Literacy in Science and Technical Subjects

Key Ideas and Details (11-12)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure (11-12)

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas (11-12)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Range of Reading and Level of Text Complexity (11-12)

RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Science

Physical Sciences

HS-PS2 Motion and Stability: Forces and Interactions

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-PS3 Energy

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 either motions of particles or energy stored in fields.

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.

Engineering, Technology, and Applications of Science

HS-ETS1 Engineering Design

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.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environme

HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions

7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Science Crosscutting Concepts

1. Patterns.
2. Cause and effect: Mechanism and explanation.
3. Scale, proportion, and quantity.
4. Systems and system models.
5. Energy and matter: Flows, cycles, and conservation.
6. Structure and function.
7. Stability and change.

Social Studies

Writing

CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects (11-12)

Text Types and Purposes (11-12)

WHST.11-12.1 Write arguments focused on discipline-specific content.

WHST.11-12.1a Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons,

WHST.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that a

WHST.11-12.1c Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counter

WHST.11-12.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.11-12.1e Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.11-12.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and mult

WHST.11-12.2b Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

WHST.11-12.2d Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as

WHST.11-12.2e Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing (11-12)

WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11-12.5 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.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge (11-12)

WHST.11-12.7 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, demonstratin

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate infor

WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing (11-12)

WHST.11-12.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☑ Think Creatively
- ☑ Work Creatively with Others
- ☑ Implement Innovations

Creative Thinking and Problem Solving
- ☑ Reason Effectively
- ☑ Use Systems Thinking
- ☑ Make Judgements and Decisions
- ☑ Solve Problems

Communication and Collaboration
- ☑ Communicate Clearly
- ☑ Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- ☑ Access and Evaluate Information
- ☑ Use and Manage Information

Media Literacy
- ☑ Analyze Media
- ☑ Create Media Products

Information, Communications, and Technology (ICT Literacy)
- ☑ Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- ☑ Adapt to Change
- ☑ Be Flexible

Initiative and Self-Direction
- ☑ Mange Goals and Time
- ☑ Work Independently
- ☑ Be Self-Directed Learners

Social and Cross-Cultural
- ☑ Interact Effectively with Others
- ☑ Work Effectively in Diverse Teams

Productivity and Accountability
- ☑ Manage Projects
- ☑ Produce Results

Leadership and Responsibility
- ☑ Guide and Lead Others
- ☑ Be Responsible to Others

Unit 2 ELECTRICITY & MAGNETISM, WAVES | Hours: 90

Performance Assessment(s):

Engineering Performance Assessments:

1. Students consider themselves members of an engineering team that is developing a system that will communicate from one room in the school to another. The challenge is to send and receive, then measure the speed of the transmission. The final report must describe both the design and the physics of the system and a discussion of how the system is better than the methods explored in the chapter. Students work collaboratively on activities with codes, electricity and magnetism, sound waves, and light rays. They also use the iterative process of engineering design; refining designs based on effectiveness and physics concepts.

2. Students design a sound and light show that demonstrates the physics principles they learned yet is low budget. They are limited to using only sounds that come from human voices or homemade instruments and light from conventional household lamps. Students work collaboratively on activities to learn about wave motion, sound waves, light rays, and how mirrors and lenses change the direction of light rays and result in formation of images. They learn to use the iterative process of engineering design, refining designs based on the physics they learn.

3. Wind is given as the universally available source for generating electricity. Students are challenged to write a manual that describes how to obtain electricity from the generator. They then must determine which electrical appliances can and should be provided for use in all homes. Students collaborate on activities in which they learn about electromagnetic motors, how electricity is generated, the use of wind to generate electricity, and the relative efficiency of different appliances. These experiences engage students in the content identified in the National Science Education Standards.

4. Students are challenged to prepare a kit, with materials and instructions, that children use to build a toy with a motor and/or generator. This toy will serve as a tool to illustrate how the electric motors in home appliances work or how electricity can be produced from an energy source such as wind, moving water, or some external force. To gain understanding of the science concepts of energy conversions necessary to meet this project, students are engaged in activities to learn about electricity and magnetism. These experiences engage students in the content from the National Science Education Standards.

5. A medical technology company is exploring the possibility of becoming active in vision technology. Helping people to see better may prove to be very profitable and serves humanity. Students write a preliminary report for the company that will help them decide whether to invest any time and labor in new vision technologies. To gain knowledge and understanding of physics principles necessary to meet this challenge, students work collaboratively on activities in which they explore concepts of light waves and lenses, and then apply this to focal length.

Leadership Alignment:

Students work in groups to design five engineering projects that incorporate the physics concepts studied. Leadership skills are emphasized through student interdependency within the project.

Associated CTSO: high school robotics (TSA)

Standards and Competencies

C-3 Standard: Students will develop an understanding of the attributes of design and apply them to develop and produce a product.

C-3.1 Students will show their understanding of the design process by performing the steps involved: defining the problem, brainstorming and researching to come up with ideas, identifying criteria and specifying constraints, exploring ideas, selecting an approach, coming up with a design and making a proto-type model, testing and evaluating the design and refining if necessary, and communicating processes and results.

C-3.3 Students will use their knowledge of hand tool and power machinery usage to create a materials list and steps-of-procedure document to communicate processes in building their product.

C-3.5 Product designer and builder will meet to discuss and fill out an evaluation sheet summarizing how well they feel they did on their part of the product development.

C-3.6 Students will participate in a discussion about all the types of design careers there are and the job titles and functions of those who may be involved in design.

C-3.7 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-5 Standard: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

C-5.1 Understand and apply concepts of velocity, acceleration, force, kinetic energy, potential energy, and rolling drag.

C-5.2 Applying learned knowledge of Newton's three laws of motion in designing the car.

C-5.3 Understand and utilize relevant vocabulary (circumference, diameter, Pi, bearing, lever, axel, sprocket, friction, and rolling drag).

C-5.4 Use all machines and tools in accordance with all safety regulations (Miter Saw, Drill Press, Band Saw, Power Sanders, Scroll Saw, and others required) to complete the performance assessment.

C-5.5 Successfully perform the following tasks: formulate ideas, create a sketch, complete a front and top view drawing with parts labeled, create a materials list, construct and test, make any necessary modifications, complete calculation sheet to estimate how far the car will travel, participate in the Mousetrap-Snap-Off contest, and complete the car evaluation report.

C-5.6 Demonstrate technical writing, testing, data collection and math skills by completing the mousetrap car evaluation sheet.

C-5.7 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-7 Standard: Students will develop an understanding of the influence of technology on history.

C-7.1 Demonstrate the completion of the following engineering design process steps: define the problem, generate ideas, select a solution, test the solution(s), build the item, evaluate it, and report the results.

C-7.2 Applying learned knowledge of Newton's three laws of motion in designing and explaining function of the trebuchet.

C-7.3 Apply their understanding of simple machines/levers and explain that the trebuchet is an example of a Class 1 lever.

C-7.4 Demonstrate sketching ability by creating 4 different sketch ideas of trebuchet designs with the different parts labeled.

C-7.7 Use all machines and tools in accordance with all safety regulations (Miter Saw, Drill Press, Band Saw, Power Sanders, Scroll Saw, and others required) to complete the performance assessment.

C-7.8 Demonstrate technical writing, testing, data collection and math skills by completing the trebuchet evaluation sheet.

C-7.9 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-8 Standard: Students will develop an understanding of the core concepts of technology.

C-8.1 Apply an understanding and knowledge of simple machines by including them in the design of their pinball machine.

C-8.2 Applying learned knowledge of Newton's three laws of motion in designing and explaining function of the pinball machine (ball movement).

C-8.3 Demonstrate the completion of the following engineering design process steps: define the problem, generate ideas, select a solution, test the solution(s), build the item, evaluate it, and report the results.

C-8.4 Produce sketch drawings and a full size pattern drawing of the pinball machines game's playing surface.

C-8.5 Use all machines and tools in accordance with all safety regulations (Miter Saw, Drill Press, Band Saw, Power Sanders, Scroll Saw, and others required) to complete the performance assessment.

C-8.6 Examine and apply specific criteria in the design and production of the pinball machine.

C-8.7 Applying organizational skills and time management will be required to finish the unit work in a timely manner.

C-8.8 Apply writing skills to complete the evaluation summary worksheet that explains how their pinball machine works and how it performed.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

1 - Make sense of problems and persevere in solving them.

2 - Reason abstractly and quantitatively.

3 - Construct viable arguments and critique the reasoning of others.

4 - Model with mathematics.

5 - Use appropriate tools strategically.

6 - Attend to precision.

7 - Look for and make use of structure.

8 - Look for and express regularity in repeated reasoning.

Reading

CC: Reading for Literacy in Science and Technical Subjects

Key Ideas and Details (11-12)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas (11-12)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Range of Reading and Level of Text Complexity (11-12)

RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Science

Physical Sciences

HS-PS2 Motion and Stability: Forces and Interactions

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 Energy

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 either motions of particles or energy stored in fields.

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 th

HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

HS-PS4 Waves and Their Applications in Technologies for Information Transfer

HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.

HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter

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.

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Science Crosscutting Concepts

1. Patterns.
2. Cause and effect: Mechanism and explanation.
3. Scale, proportion, and quantity.
4. Systems and system models.
5. Energy and matter: Flows, cycles, and conservation.
6. Structure and function.
7. Stability and change.

Engineering, Technology, and Applications of Science

HS-ETS1 Engineering Design

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 trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environme

Social Studies

Writing

CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects (11-12)

Text Types and Purposes (11-12)

WHST.11-12.1 Write arguments focused on discipline-specific content.

WHST.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that a

WHST.11-12.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.11-12.1e Provide a concluding statement or section that follows from or supports the argument presented.

Production and Distribution of Writing (11-12)

WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11-12.5 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.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge (11-12)

WHST.11-12.7 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, demonstratin

Range of Writing (11-12)

WHST.11-12.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☑ Think Creatively
- ☑ Work Creatively with Others
- ☑ Implement Innovations

Creative Thinking and Problem Solving
- ☑ Reason Effectively
- ☑ Use Systems Thinking
- ☑ Make Judgements and Decisions
- ☑ Solve Problems

Communication and Collaboration
- ☑ Communicate Clearly
- ☑ Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- ☑ Access and Evaluate Information
- ☑ Use and Manage Information

Media Literacy
- ☐ Analyze Media
- ☐ Create Media Products

Information, Communications, and Technology (ICT Literacy)
- ☑ Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- ☑ Adapt to Change
- ☑ Be Flexible

Initiative and Self-Direction
- ☑ Mange Goals and Time
- ☑ Work Independently
- ☑ Be Self-Directed Learners

Social and Cross-Cultural
- ☑ Interact Effectively with Others
- ☑ Work Effectively in Diverse Teams

Productivity and Accountability
- ☑ Manage Projects
- ☑ Produce Results

Leadership and Responsibility
- ☑ Guide and Lead Others
- ☑ Be Responsible to Others