Alvord Secondary Science Education RCD Unit Planning Organizer

Subject	Physics
Grade	9-12
Unit Name	Mechanical Energy
Length of Unit (Include days and minutes per day)	3 weeks + 1 buffer week
Overview of Unit	In this unit students will… • Know the kinds of mechanical energy (Potential, Kinetic) • Energy conversion / Conservation of Mechanical Energy

Performance Expectations

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. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.]

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 position of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.]

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.* [Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.] [Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. ▪ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2)(HS-ES1-1)(HS-ES2-3) **Using Mathematics and Computational Thinking** Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ▪ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) **Analyzing and Interpreting Data** Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.	**PS3.A: Definitions of Energy** ▪ Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) ▪ At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3) ▪ These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2) **PS3.B: Conservation of Energy and Energy Transfer** ▪ Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) ▪ Energy cannot be created or destroyed, but it can be transported from one	**Systems and System Models** ▪ When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-PS3-4) ▪ Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1) **Energy and Matter** ▪ Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS3-3) ▪ Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) --- **Connections to Engineering, Technology, and Applications of Science** **Influence of Science, Engineering, and Technology on Society and the Natural World** ▪ Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while

▪ Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2) **Connections to Nature of Science** ▪ Science knowledge is based on empirical evidence. (HS-ESS2-3) ▪ Science disciplines share common rules of evidence used to evaluate explanations about natural systems. (HS-ESS2-3) ▪ Science includes the process of coordinating patterns	place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) ▪ Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) ▪ The availability of energy limits what can occur in any system. (HS-PS3-1) **PS3.D: Energy in Chemical Processes** ▪ Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4) **ESS1.A: The Universe and Its Stars** ▪ The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1) **PS3.D: Energy in Chemical Processes and Everyday Life** ▪ Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1) **ETS1.A: Defining and Delimiting Engineering Problems** ▪ Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to HS-PS3-3)	decreasing costs and risks. (HS-PS3-3) --- **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS3-1) **Scale, Proportion, and Quantity** ▪ The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1) **Energy and Matter** ▪ Energy drives the cycling of matter within and between systems. (HS-ESS2-3) **Stability and Change** ▪ Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS2-2) --- **Connections to Engineering, Technology, and Applications of Science** **Interdependence of Science, Engineering, and Technology** ▪ Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS2-3) **Influence of Engineering, Technology, and Science on Society and the Natural World** ▪ New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)

Supporting Standards

CCSS Mathematics	CCSS ELA/Literacy

MP.2 Reason abstractly and quantitatively. (HS-PS3-1),(HS-PS3-2),(HS-PS3-3),(HS-PS3-4), (HS-ESS1-1), (HS-ESS2-2),(HS-ESS2-3) **MP.4** Model with mathematics. (HS-PS3-1),(HS-PS3-2),(HS-PS3-3),(HS-PS3-4),(HS-ESS1-1) , (HS-ESS2-3) **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. (HS-PS3-1),(HS-PS3-3), (HS-ESS1-1), (HS-ESS2-2),(HS-ESS2-3) **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS3-1),(HS-PS3-3) , (HS-ESS1-1) **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS3-1),(HS-PS3-3),(HS-ESS1-1) , (HS-ESS2-2),(HS-ESS2-3) **HSA-SSE.A.1** Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1) **HSA-CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1),(HS-ESS2-3) **HSA-CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1)	**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. (HS-PS3-4) , (HS-ESS1-1), (HS-ESS2-2),(HS-ESS2-3) **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. (HS-ESS2-2) **WHST.9-12.7** 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, demonstrating understanding of the subject under investigation. (HS-PS3-3),(HS-PS3-4) **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 information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS3-4) **WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS3-4) **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS3-1),(HS-PS3-2) **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-3)

Learning Progressions

Prior Learning	Future Learning	New to NGSS
MS-PS3-1. Graph data about the mass, speed and kinetic energy of an object and describe the relationships of mass or speed to kinetic energy. **MS-PS3-2.** Model the relationship between the potential energy of a system and the distance between interacting objects. **MS-PS3-4.** Investigate the relationships between energy transferred, the type of matter, the mass and the change in the average kinetic energy of the particles (temperature). MS-PS3-5. Argue that when an object speeds up or slows down it gains or loses energy.	**Applicable to High School AP Physics & College Physics and Engineering** Students should have completed geometry and be concurrently taking Algebra II or an equivalent course. Although the AP Physics 1 course includes basic use of trigonometric functions, this understanding can be gained either in the concurrent math course or in the AP Physics 1 course itself. Furthermore, the understandings of linear, circular & harmonic motion are foundations of this and many future Physics or Engineering courses.	**The NGSS High School standards do not include foundational terms and principals of linear motion such as: Vector vs Scalar measure as well as how measures of distance & time are related to velocity and acceleration. NGSS, also, devotes no curriculum to the development of the significant differences between velocity and acceleration.**

Unwrapped Standards			
Performance Expectation Code	**“Unwrapped” Concepts (Students need to know)**	**“Unwrapped” Skills (Students need to be able to do)**	**Bloom’s Taxonomy Levels of Cognitive Rigor**
HS-PS3-1	**A Computational Model**	**Create**	**6**
	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 systems are known	**To calculate**	**6**
HS-PS3-2	**Models**	**Develop and use**	**6**
	That energy can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)	**To illustrate**	**6**
	The total energy involved in an object’s motion and position	**Accounting for**	**6**
HS-PS3-3	**A device that works to convert one from of energy into another form of energy.**	**Design, build and refine**	**6**

Essential Questions & Big Ideas

Essential Questions	Corresponding Big Ideas
How do crash investigators determine how fast a vehicle was moving before the collision?	**Energy is neither created nor destroyed but moved from one place to another. (focusing on mechanical energy)**
Why do roller coasters not need any outside energy added to the system if it starts from a large height?	**Kinetic energy is the energy of moving objects and potential energy is the stored energy (commonly height)**
How can a device (Rube Goldberg or roller coaster) be designed to maximize the initial energy to complete the circuit.	Devices can be built to convert one form of mechanical energy to another form of mechanical energy.

Unit Vocabulary Words		
Specific Performance Expectation Vocabulary	**Academic Cross-Curricular Words Tier 2**	**Content/Domain Specific Vocabulary Tier 3**
HS-PS3-1, H S-PS3-2, HS-PS3-3 **Students need to understand and differentiate among these terms: systems of 2 or 3 components, *potential (in magnetic, gravitational & electric fields) & kinetic energy*, and conservation as applied to momentum and energy.**	Energy, work, power	Potential Energy, Kinetic Energy, Work, Power, Conservation of Energy.

Resources for Vocabulary Development (Include at least one resource for English Learner)
This area will have links and resources for teachers to use when teaching vocabulary throughout the unit.

Overview of the Engaging Scenario (situation, challenge, role, audience, product or performance)	
The **Engaging Scenario** includes a specific situation and challenge, and is written for the student to take on a specific role for an intended audience in order to complete a product or give a performance. Often, the **Culminating Task** is the conclusion of the previous performance tasks, and allows the students to showcase the final product or performance. Often, Culminating Tasks include: • A real-world goal • A meaningful role for the students • Authentic (or simulated) real-world audience(s) • A contextualized situation that involves real-world application • Student-generated culminating products or performances • Consensus-drive performance criteria for judging success RCD Book: Chapter 13 p. 159-165 RCD Training Manual: p. 73	**Suggested Length of Time** (Include days and minutes per day)

Synopsis of Authentic Performance Tasks			
Authentic Performance Tasks	**Description**	**Instructional Targets**	**Suggested Length of Time** **(Include days and minutes per day)**
Performance Task 1: **Swing Life Away (Rise Aginst)** **Performance Expectation** HS-PS3-2 **Supporting Standards** Math: MP.2, MP.4, Literacy: SL.11-12.5	Create a pendulum and vary the height of the mass. The mass would hit another object to see how much work was done on the object and then the velocity of the mass would be found.	• Develop models • Use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of objects and energy associated with the relative position of objects. • Calculate Kinetic Energy • Calculate potential energy	**2 Days; 50 Min**

Performance Task 2: **Last Kiss** **(Pearl Jam)** **Performance Expectation** HS-PS3-1 **Supporting Standards** Math: MP.2, MP.4, HSN-QA1 Literacy: WHST.9-12.7, WHST.9-12.9, SL.11-12.5	Students will be given a skid mark to measure and a tire with cement to use to find the coefficient of friction between the tire and the road. Using this information the students will calculate the velocity of the car using the work energy theorem.	• Create a computational model • Calculate change in mechanical energy in a system. • Calculate kinetic energy • Calculate work • Calculate work and energy using the work energy theorem.	**3 days; 50 min**
Performance Task 3: **Love Rollercoaster (Red Hot Chili Peppers)** Performance Expectation HS-PS3-1 **Supporting Standards** Math: MP.2, MP.4, HSN-QA1 Literacy: WHST.9-12.7, WHST.9-12.9, SL.11-12.5	Students collect data from the simulation and use it to better understand the factors that contribute to an objects potential and kinetic energy.	• Create a computational model • Calculate change in mechanical energy in a system. • Calculate kinetic energy • Calculate work Calculate work and energy using the work energy theorem.	**1 Day; 50 Min**

Final Performance Task 4: **Machine Head (Bush)** **Performance Expectation** HS-PS3-3 **Supporting Standard** Math: MP.2, MP-4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3 Literacy: WHST.9-12.7, SL.11-12.5 ****Designated to upload in Illuminate****	Students will be designing a roller coaster or a Rube Goldberg machine.	• Design a device • Build a device • Refine a device •	**2 Days; 50 Min**

PERFORMANCE TASK 1

<table>
<tr><td rowspan="2">Title of Authentic Performance Task 1</td><td rowspan="2">Swing Life Away (Rise Against)</td><td>Length:</td></tr>
<tr><td>2 days; 50 Min</td></tr>
<tr><td rowspan="4">Standards Addressed in Authentic Performance Task 1</td><td rowspan="2">Performance Expectation(s):
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 position of particles (objects).</td><td>Bloom's Taxonomy Levels</td></tr>
<tr><td>6</td></tr>
<tr><td rowspan="2">Supporting Standards:
HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
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.
MP.4 Model with mathematics.
MP.2 Reason abstractly and quantitatively.
SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</td><td>Webb's DOK</td></tr>
<tr><td>4</td></tr>
<tr><td>Detailed Description of Authentic Performance Task 1</td><td colspan="2">Interchange of Gravitational Potential and Mechanical Kinetic Energy. All about us are bodies whose potential energy is changing to kinetic energy or whose kinetic energy is changing to potential energy.

A ball thrown vertically upward leaves the hand with a certain speed and a corresponding amount of kinetic energy. This kinetic energy is completely converted to gravitational potential energy as the ball rises and comes to a complete stop at its highest point. Then, as the ball falls back to Earth, its potential energy is gradually converted to kinetic energy. If the ball returns to the level from which started it possesses the same speed with which it left the hand. Therefore it also possesses the same kinetic energy at the end of the flight as it had at the beginning. Thus, although its energy changed from kinetic to potential and back to kinetic again, none of its original energy was lost.

A pendulum bob passes through a similar series of energy changes. At the highest point of the swing, the bob is momentarily at rest and all its energy is potential. As the bob swings downward toward the center (equilibrium) position, its potential energy changes to kinetic. Then, as the bob passes through the equilibrium position and rise to the opposite end of its swing its kinetic energy changes back again into potential energy. If we measure the heights of the bob above the table at each end of its swing, we note that they are approximately equal. This shows that the bob has just as much gravitational potential energy at the end of the swing as it had at the beginning. Again, in spite of the changes from potential to kinetic energy and then back again into potential energy, there should be no loss in energy, as long as any frictional resistance is neglected.</td></tr>
</table>

	Suggested teaching and learning sequence:
	Explain Kinetic Energy Practice Kinetic Energy problems Practice Potential Energy Problems

Response to Instruction and Intervention
Instructional Strategies (Minimum of 3)
This section will have internet links, resources or references to instructional materials for teachers to choose and use as needed to differentiate.
Laboratory Instructional Strategies (Minimum of 3)
This section will have internet links, resources or references to laboratory materials for teachers to choose and use as needed to differentiate.
Science Safety
This section will have internet links, resources or references to science safety materials for teachers to reference. This section should also include MSDS sheets, if necessary.
Differentiated Strategies for Intervention (Minimum of Six: 2 for EL, 2 for Special Ed, and 2 for Intensive)
This section will have internet links, resources or references to instructional materials for teachers to choose and use as needed to differentiate.
Differentiation Strategies for Enrichment (Minimum of 3)
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Interdisciplinary Connections, ELD Standards, Digital Literacy and Technology Skills
Interdisciplinary Connections
This section will have suggestions for **interdisciplinary connections** and **Linked Learning connections for HS.**
ELD Standards
This section will provide a link to the **ELD standards** for the grade level. The **ELD standards** that correlate with the performance task will be highlighted in green, bolded, and underlined.
Digital Literacy and Technology
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Standards for Career Ready Practice
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PERFORMANCE TASK 2

Title of Authentic Performance Task 2	**Last Kiss (Pearl Jam)**	**Length:** 4 days; 50 Min
Standards Addressed in Authentic Performance Task 2	**Performance Expectation(s):** 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.	**Bloom's Taxonomy Levels** 6
	Supporting Standards: **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. **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. **MP.4** Model with mathematics. **MP.2** Reason abstractly and quantitatively. **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.	**Webb's DOK** 4
Detailed Description of Authentic Performance Task 2	As an investigator for the Coroner's Office you were called to the scene of a single vehicle motor crash. When you arrived at the scene you observed a single vehicle on its side against a tree. You noted a very long skid mark, but because it is dark and your available lighting was limited, you were only able to photograph portions of the skid. The victim in this vehicle had been ejected because he had not been wearing a seat belt. Upon further investigation and interviews the following facts came to light. The 19 year old male victim had come to a friend's party with his girlfriend. Alcohol was being served even though no one was of legal age. While at the party the victim had an argument with his girlfriend, and he jumped into his car and left traveling at a high speed. The victim had only driven about a mile, came around a mild curve and the vehicle went out of control and off the side of the road. He was not an experienced driver and had been drinking and overcorrected the steering which caused his car to cross the center line where his car began to skid. The vehicle turned sideways and when it came to the opposite edge of the road began to roll. The vehicle rolled over sideways at least three times and during one of the rolls the victim was ejected. The vehicle came to rest on the passenger side wheels against a tree. As can be seen in the photo, the vehicle was a listed as a total loss.	

	****See Unit 4 skid mark lab A "skid" mark will need to be made for this lab using a tire and some paint. Pieces of tires (about 12 inches) will also be needed.
	Suggested teaching and learning sequence:
	Review Kinetic Energy Practice Kinetic Energy problems Explain work Practice work problems Explain work/energy theorem Practice work/energy theorem Awesome Suggest Teaching: If you call your local CHP office they can put you in touch with an officer who investigates collisions and can possibly come out to speak with the students.

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PERFORMANCE TASK 3

<table>
<tr><td>Title of Authentic Performance Task 3</td><td>Love Rollercoaster (Red Hot Chili Peppers)</td><td>Length:
1 days; 50 Min</td></tr>
<tr><td rowspan="2">Standards Addressed in Authentic Performance Task 3</td><td>Performance Expectation(s):
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.</td><td>Bloom’s Taxonomy Levels
6</td></tr>
<tr><td>Supporting Standards:
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HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
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.
MP.4 Model with mathematics.
MP.2 Reason abstractly and quantitatively.
SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</td><td>Webb’s DOK
4</td></tr>
<tr><td rowspan="3">Detailed Description of Authentic Performance Task 3</td><td colspan="2">Students collect data from the simulation and use it to better understand the factors that contribute to an objects potential and kinetic energy.

***** See Unit 4-Energy Skate Park</td></tr>
<tr><td colspan="2">Suggested teaching and learning sequence:</td></tr>
<tr><td colspan="2">Explain Kinetic Energy
Practice Kinetic Energy problems
Explain work
Practice work problems</td></tr>
</table>

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CULMINATING TASK

<table>
<tr><td>Title of Authentic Performance Task 4</td><td>Machine Head (Bush)</td><td>Length:
2 Days; 50 Min</td></tr>
<tr><td rowspan="2">Standards Addressed in Authentic Performance Task 4</td><td>Performance Expectation(s):
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.</td><td>Bloom's Taxonomy Levels
6</td></tr>
<tr><td>Supporting Standards:
MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. 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. HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. WHST.9-12.7 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, demonstrating understanding of the subject under investigation.</td><td>Webb's DOK
4</td></tr>
<tr><td rowspan="3">Detailed Description of Authentic Performance Task 4</td><td colspan="2">Choice 1: Make their car from unit 1 into a solar powered car.

Choice 2: Pick a type of alternative energy and build it.

Choice 3: Make a small scale alternative energy ran house.</td></tr>
<tr><td colspan="2">Suggested teaching and learning sequence:</td></tr>
<tr><td colspan="2">Explain transfer of energy
Explain alternative energy</td></tr>
</table>

Response to Instruction and Intervention
Instructional Strategies (Minimum of 3)
This section will have internet links, resources or references to instructional materials for teachers to choose and use as needed to differentiate.
Laboratory Instructional Strategies (Minimum of 3)
This section will have internet links, resources or references to laboratory materials for teachers to choose and use as needed to differentiate.
Science Safety
This section will have internet links, resources or references to science safety materials for teachers to reference. This section should also include MSDS sheets, if necessary.
Differentiated Strategies for Intervention (Minimum of Six: 2 for EL, 2 for Special Ed, and 2 for Intensive)
This section will have internet links, resources or references to instructional materials for teachers to choose and use as needed to differentiate.
Differentiation Strategies for Enrichment (Minimum of 3)
This section will have internet links, resources or references to instructional materials for teachers to choose and use as needed to differentiate.
Resources and Materials (e.g., Textbook References, Multi-Media Sources, Additional Print Sources and Artifacts)
This section will have internet links, resources or references to instructional materials for teachers to choose and use as needed to differentiate.

Interdisciplinary Connections, ELD Standards, Digital Literacy and Technology Skills

Interdisciplinary Connections

This section will have suggestions for **interdisciplinary connections** and **Linked Learning connections for HS.**

ELD Standards

This section will provide a link to the **ELD standards** for the grade level. The **ELD standards** that correlate with the performance task will be highlighted in green, bolded, and underlined.

Digital Literacy and Technology

This section will provide a link to the **SBCUSD Digital Literacy and Technology Skills**. The skills that correlate with the performance task will be highlighted in green, bolded, and underlined.

Standards for Career Ready Practice

This section will provide a link to the CA's "Standards for Career Ready Practice". The standards that correlate with the Culminating Learning Task will be highlighted in green, bolded, and underlined.

Overall Reflections on the Instructional Unit (Feedback to Curriculum Team)	
Suggestions for Improvement	**Student Response**
After each unit is taught, there will be opportunities for **Teachers, Administrators and District Personnel** to provide feedback on the units in order to make suggestions, provide ideas for resources and materials that would support the unit, and to provide comments on what was successful, and what needs to be improved. More information will be given on how to provide feedback, but this feature will occur in the LMS (Learning Management System).	After each unit is taught, there will be opportunities for **Students** to provide feedback on the units in order to make suggestions, provide ideas for resources and materials that would support the unit, and to provide comments on what was successful, and what needs to be improved. More information will be given on how to provide feedback, but this feature will occur in the LMS (Learning Management System).