GRADE LEVEL: 11, 12 **SUBJECT: PHYSICS** **DATE: 2017-2018**

GRADING PERIOD: QUARTER 1 **MASTER COPY 4-2-2018**

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
CONSTANT VELOSITY					
• Measure of Science • Uncertainties in measurement • Data Visualization • Uniform Motion • Position versus time graphs	**PI.1.1** Develop graphical, mathematical, and pictorial representations (e.g. a motion map) that describe the relationship between the clock reading (time) and position of an object moving at a uniform rate and apply those representations to qualitatively and quantitatively describe the motion of an object.	• Graph position versus time. • Perform calculations involving speed, distance, and time. • Make measurement in SI units. • Present result in lab report. • Make graphs using computer software/graphing calculators. • Compute significant figures. • Compute standard error.	• Written lab reports • Tests: Problems, multiple choice, true/false, essay • Lab performance	• Time • Position • Uniform rate • Qualitatively • Quantitatively • Motion	IMPORTANT
• Picturing motion • Velocity	**PI.1.2** Describe the slope of the graphical representation of position vs. clock reading (time) in terms of the velocity of the object.	• Qualitatively describe the speed and direction of an object.	• Written lab reports • Tests: Problems, multiple choice, true/false, essay • Lab performance	• Velocity	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
CONSTANT VELOSITY					
• Slope • Vector manipulation • Linear Motion	**PI.1.3** Rank the velocities of objects in a system based on the slope of a position vs. clock reading (time) graphical representation. Recognize that the magnitude of the slope representing a negative velocity can be greater than the magnitude of the slope representing a positive velocity.	• Compare position versus time graphs to rank velocities.	• Written lab reports • Tests: Problems, multiple choice, true/false, essay • Lab performance	• System • Magnitude • Slope	IMPORTANT
• Distance • Displacement • Speed • Velocity • Average speed • Average velocity • Vectors versus scalars	**PI.1.4** Describe the differences between the terms “distance,” “displacement,” “speed,” “velocity,” “average speed,” and “average velocity” and be able to calculate any of those values given an object moving at a single constant velocity or with different constant velocities over a given time interval.	• Compare and contrast vectors and scalars.	• Written lab reports • Tests: Problems, multiple choice, true/false, essay • Lab performance	• Distance • Displacement • Speed • Velocity • Average speed • Average velocity	CRITICAL

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
CONSTANT ACCELERATION					
• Velocity versus time graphs	**PI.2.1** Develop graphical, mathematical, and pictorial representations (e.g. a motion map) that describe the relationship between the clock reading (time) and velocity of an object moving at a uniformly changing rate and apply those representations to qualitatively and quantitatively describe the motion of an object.	• Make graphs using computer software/graphing calculators. • Compute significant figures. • Compute standard error.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving		IMPORTANT
• Velocity versus time graphs • Acceleration	**PI.2.2** Describe the slope of the graphical representation of velocity vs. clock reading (time) in terms of the acceleration of the object.	• Qualitatively describe the acceleration of an object based off its velocity versus time graph.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Acceleration	IMPORTANT
• Velocity versus time graphs • Relationship between velocity and acceleration	**PI.2.3** Rank the accelerations of objects in a system based on the slope of a velocity vs. clock reading (time) graphical representation. Recognize that the magnitude of the slope representing a negative acceleration can be greater than the magnitude of the slope representing a positive acceleration.	• Compare velocity versus time graphs to rank accelerations.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving		IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
CONSTANT ACCELERATION					
• Position versus time graphs • Velocity versus time graphs • Acceleration versus time graphs • Derivatives • Integrals	**PI.2.4** Given a graphical representation of the position, velocity, or acceleration vs. clock reading (time), be able to identify or sketch the shape of the other two graphs.	• Derive the velocity versus time graph from the position versus time graph and vice versa. • Derive the acceleration versus time graph from the velocity versus time graph and vice versa.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving		IMPORTANT
• Free Fall	**PI.2.5** Qualitatively and quantitatively apply the models of constant velocity and constant acceleration to determine the position or velocity of an object moving in free fall near the surface of the Earth.	• Calculate the velocity and position of a falling object at a given point of time.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Constant velocity • Constant acceleration • Free fall	CRITICAL
FORCES					
• Force and motion • Newton's First Law	**PI.3.1** Understand Newton's first law of motion and describe the motion of an object in the absence of a net external force according to Newton's first law.	• Compare and rank the inertia of objects. • Model the motion of objects with no net external force.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Newton's first law of motion • Net external force	CRITICAL

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
FORCES					
• Newton's Second Law	**PI.3.2** Develop graphical and mathematical representations that describe the relationship among the inertial mass of an object, the total force applied, and the acceleration of an object in one dimension where one or more forces is applied to the object and apply those representations to qualitatively and quantitatively describe how a net external force changes the motion of an object.	• Construct graphs involving force, mass, and acceleration. • Compare and rank the force, mass, and acceleration of different objects.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Inertial mass • One dimension	CRITICAL
• Free Body Diagrams	**PI.3.3** Construct force diagrams using appropriately labeled vectors with magnitude, direction, and units to qualitatively and quantitatively analyze a scenario and make claims (i.e. develop arguments, justify assertions) about forces exerted on an object by other objects for different types of forces or components of forces.	• Construct free body diagrams showing all the forces acting on an object. • Add vectors to determine the direction of net force.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Vectors • Magnitude • Direction • Units • Forces	IMPORTANT
• Newton's Third Law.	**PI.3.4** Understand Newton's third law of motion and describe the interaction of two objects using Newton's third law and the representation of action-reaction pairs of forces.	• Describe action-reaction pairs in terms of their magnitudes and direction. • Illustrate examples of action-reaction pairs.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Newton's third law of motion • Action - reaction pairs	CRITICAL

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
FORCES					
• Weight versus mass	**PI.3.5** Develop graphical and mathematical representations that describe the relationship between the gravitational mass of an object and the force due to gravity and apply those representations to qualitatively and quantitatively describe how changing the gravitational mass will affect the force due to gravity acting on the object.	• Distinguish between mass and weight. • Calculate the weight of objects on Earth, as well as other planets.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Gravitational mass	IMPORTANT
• Gravitational force • Gravitational field	**PI.3.6** Describe the slope of the force due to gravity vs. gravitational mass graphical representation in terms of gravitational field.	• Construct and interpret force versus mass graphs.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Gravitational field	ADDITIONAL
• Air resistance • Free fall • Terminal velocity	**PI.3.7** Explain that the equivalence of the inertial and gravitational masses leads to the observation that acceleration in free fall is independent of an object's mass.	• Perform calculations involving free falling objects. • Demonstrate that objects, in the absence of air resistance, fall at equal rates.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Independent • Mass	ADDITIONAL

STANDARD INDICATORS	SCIENCE AND ENGINEERING	LITERACY IN SCIENCE
PI.1.1 Develop graphical, mathematical, and pictorial representations (e.g. a motion map) that describe the relationship between the clock reading (time) and position of an object moving at a uniform rate and apply those representations to qualitatively and quantitatively describe the motion of an object.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.4.2:** 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. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. **11-12.LST.6.2:** Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
PI.1.2 Describe the slope of the graphical representation of position vs. clock reading (time) in terms of the velocity of the object.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences.

PI.1.3 Rank the velocities of objects in a system based on the slope of a position vs. clock reading (time) graphical representation. Recognize that the magnitude of the slope representing a negative velocity can be greater than the magnitude of the slope representing a positive velocity.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.
PI.1.4 Describe the differences between the terms “distance,” “displacement,” “speed,” “velocity,” “average speed,” and “average velocity” and be able to calculate any of those values given an object moving at a single constant velocity or with different constant velocities over a given time interval.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.3.1:** 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. **11-12.LST.3.2:** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
PI.2.1 Develop graphical, mathematical, and pictorial representations (e.g. a motion map) that describe the relationship between the clock reading (time) and velocity of an object moving at a uniformly changing rate and apply	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4 A**nalyzing and interpreting data.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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.

those representations to qualitatively and quantitatively describe the motion of an object.	**SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.3.1:** 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. **11-12.LST.4.2:** 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. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. **11-12.LST.6.2:** Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
PI.2.2 Describe the slope of the graphical representation of velocity vs. clock reading (time) in terms of the acceleration of the object.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6 Co**nstructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences.
PI.2.3 Rank the accelerations of objects in a system based on the slope of a velocity vs. clock reading (time) graphical representation.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.4** Analyzing and interpreting data.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.

Recognize that the magnitude of the slope representing a negative acceleration can be greater than the magnitude of the slope representing a positive acceleration.	**SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences.
PI.2.4 Given a graphical representation of the position, velocity, or acceleration vs. clock reading (time), be able to identify or sketch the shape of the other two graphs.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.4.2:** 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. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. **11-12.LST.6.2:** Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
PI.2.5 Qualitatively and quantitatively apply the models of constant velocity and constant acceleration to determine the position or velocity of an object	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences.

moving in free fall near the surface of the Earth.	**SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering) **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.6.1:** Plan and develop; draft; revise using appropriate reference materials; rewrite; try a new approach, focusing on addressing what is most significant for a specific purpose and audience; and edit to produce and strengthen writing that is clear and coherent. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
PI.3.1 Understand Newton's first law of motion and describe the motion of an object in the absence of a net external force according to Newton's first law.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.3** Constructing and performing investigations. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8 Ob**taining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.2:** 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. **11-12.LST.3.3:** 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. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **11-12.LST.5.1:** Write arguments focused on discipline-specific content. **11-12.LST.7.2:** Gather relevant information from multiple types of authoritative sources, using advanced searches effectively; annotate sources; assess the strengths and

		limitations of each source in terms of the specific task, purpose, and audience; synthesize and 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 (e.g., *APA or CSE*). **11-12.LST.7.3:** Draw evidence from informational texts to support analysis, reflection, and research.
PI.3.2 Develop graphical and mathematical representations that describe the relationship among the inertial mass of an object, the total force applied, and the acceleration of an object in one dimension where one or more forces is applied to the object and apply those representations to qualitatively and quantitatively describe how a net external force changes the motion of an object.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.4.2:** 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. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. **11-12.LST.6.2:** Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
PI.3.3 Construct force diagrams using appropriately labeled vectors with magnitude, direction, and units to qualitatively and quantitatively	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.

analyze a scenario and make claims (i.e. develop arguments, justify assertions) about forces exerted on an object by other objects for different types of forces or components of forces.	**SEPS.3** Constructing and performing investigations. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences. **11-12.LST.2.2:** 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. **11-12.LST.3.2:** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. **11-12.LST.4.1:** Integrate and evaluate multiple sources of information presented in diverse formats and media. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. quantitative data, video, multimedia) in order to address a question or solve a problem.
PI.3.4 Understand Newton's third law of motion and describe the interaction of two objects using Newton's third law and the representation of action-reaction pairs of forces.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.5** Using mathematics and computational thinking. **SEPS.7 E**ngaging in argument from evidence. **SEPS.8 Ob**taining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences. **11-12.LST.2.1:** 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. **11-12.LST.2.2:** 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.

		11-12.LST.3.3: 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.
PI.3.5 Develop graphical and mathematical representations that describe the relationship between the gravitational mass of an object and the force due to gravity and apply those representations to qualitatively and quantitatively describe how changing the gravitational mass will affect the force due to gravity acting on the object.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5 U**sing mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.4.2:** 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. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. **11-12.LST.6.2:** Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
PI.3.6 Describe the slope of the force due to gravity vs. gravitational mass graphical representation in terms of gravitational field.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking.	**11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline specific tasks, purposes, and audiences. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

	SEPS.6 Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	
PI.3.7 Explain that the equivalence of the inertial and gravitational masses leads to the observation that acceleration in free fall is independent of an object's mass.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.2.1**: 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. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **11-12.LST.7.3:** Draw evidence from informational texts to support analysis, reflection, and research.

GRADE LEVEL: 11, 12 **SUBJECT: PHYSICS** **DATE: 2017-2018**

GRADING PERIOD: QUARTER 2 **MASTER COPY 4-2-2018**

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
ENERGY					
• Translational Kinetic Energy • Gravitational Potential Energy • Elastic Potential Energy	**PI.4.1** Evaluate the translational kinetic, gravitational potential, and elastic potential energies in simple situations using the mathematical definitions of these quantities and mathematically relate the initial and final values of the translational kinetic, gravitational potential, and elastic potential energies in the absence of a net external force.	• Evaluate the translational kinetic, gravitational potential, and elastic potential in simple situations.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Translational kinetic • Gravitational potential • Elastic potential	CRITICAL
• Forms of Energy • Energy Conversions	**PI.4.2** Identify the forms of energy present in a scenario and recognize that the potential energy associated with a system of objects and is not stored in the object itself.	• Identify the types of energy present in a scenario.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Potential energy	CRITICAL
• Work versus energy • Work-energy theorem	**PI.4.3** Conceptually define “work” as the process of transferring of energy into or out of a system when an object is moved under the application of an external force and operationally define “work” as the area under a force vs. change in position curve.	• Define work. • Graph force versus change in position to determine work. • Evaluate the work done in different scenarios.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Work • Energy • Area	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
ENERGY					
• Two Dimensions • Unbalanced forces vs versus balanced forces	**PI.4.4** For a force exerted in one or two dimensions, mathematically determine the amount of work done on a system by an unbalanced force over a change in position in one dimension.	• Perform work calculations using force and distance.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Unbalanced force	CRTICICAL
• Conservation of energy • Friction	**PI.4.5** Understand and apply the principle of conservation of energy to determine the total mechanical energy stored in a closed system and mathematically show that the total mechanical energy of the system remains constant as long as no dissipative (i.e. non-conservative) forces are present.	• Given an initial condition, find the different types of energies some time later (i.e. a rock falls from a bridge, calculate it's kinetic energy after 2 seconds).	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving • Coefficient of Friction Lab	• Conservation of energy • Mechanical energy • Closed system • Dissipative	CRITICAL
• Graphing mechanical energy • Friction	**PI.4.6** Develop and apply pictorial, mathematical or graphical representations to qualitatively and quantitatively predict changes in the mechanical energy (e.g. translational kinetic, gravitational, or elastic potential) of a system due to changes in position or speed of objects or non-conservative interactions within the system.	• Perform calculations involving coefficients of friction. • Determine the coefficient of friction for certain materials.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Speed	CRTICICAL

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
LINEAR MOMENTUM IN ONE DIMENTION					
• Momentum	**PI.5.1** For an object moving at constant rate, define linear momentum as the product of an object's mass and its velocity and be able to quantitatively determine the linear momentum of a single object.	• Perform momentum calculation.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Linear momentum	IMPORTANT
• Impulse	**PI.5.2** Operationally define "impulse" as the area under a force vs. change in clock reading (time) curve and be able to determine the change in linear momentum of a system acted on by an external force. Predict the change in linear momentum of an object from the average force exerted on the object and time interval during which the force is exerted.	• Calculate the impulse in different scenarios. • Describe ways we use impulse to make things safer (i.e. airbags). • Calculate the change in momentum of an object when a force is exerted on it for a period of time.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Impulse	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
LINEAR MOMENTUM IN ONE DIMENTION					
• Conservation of momentum	**PI.5.3** Demonstrate that when two objects interact through a collision or separation that both the force experienced by each object and change in linear momentum of each object are equal and opposite, and as the mass of an object increases, the change in velocity of that object decreases.	• Investigate collisions on an air track. • Recognize that the force and change in linear momentum of each object in the collision are equal and opposite.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Collision • Separation	CRITICAL
• Conservation of momentum • Newton's Third Law	**PI.5.4** Determine the individual and total linear momentum for a two-body system before and after an interaction (e.g. collision or separation) between the two objects and show that the total linear momentum of the system remains constant when no external force is applied consistent with Newton's third law.	• Perform conservation of momentum calculations involving collisions in one and two dimensions. • Investigate real-world collisions.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving		CRITICAL
• Elastic versus inelastic collisions	**PI.5.5** Classify an interaction (e.g. collision or separation) between two objects as elastic or inelastic based on the change in linear kinetic energy of the system.	• Distinguish between elastic and inelastic collisions. • Distinguish between conservation of momentum and conservation of kinetic energy.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving •	• Elastic • Inelastic	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
LINEAR MOMENTUM IN ONE DIMENTION					
• Center of mass	**PI.5.6** Mathematically determine the center of mass of a system consisting of two or more masses. Given a system with no external forces applied, show that the linear momentum of the center of mass remains constant during any interaction between the masses.	• Calculate the center of mass of a system given the mass of objects and their positions in space.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Center of mass	IMPORTANT
SIMPLE HARMONIC OSCILLATING SYSTEMS					
• Springs • Spring Constants • Restoring Force	**PI.6.1** Develop graphical and mathematical representations that describe the relationship between the amount of stretch of a spring and the restoring force and apply those representations to qualitatively and quantitatively describe how changing the stretch or compression will affect the restoring force and vice versa, specifically for an ideal spring.	• Graph the restoring force versus change in length of a spring.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Stretch • Spring • Restoring force • Compression • Ideal spring	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
SIMPLE HARMONIC OSCILLATING SYSTEMS					
• Spring Constants • Hooke's Law	**PI.6.2** Describe the slope of the graphical representation of restoring force vs. change in length of an elastic material in terms of the elastic constant of the material, specifically for an ideal spring.	• Calculate the spring constant from a graph of restoring force versus change in length.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving • Hooke's Law Lab	• Elastic material • Elastic constant	IMPORTANT

STANDARD INDICATORS	SCIENCE AND ENGINEERING	LITERACY IN SCIENCE
PI.4.1 Evaluate the translational kinetic, gravitational potential, and elastic potential energies in simple situations using the mathematical definitions of these quantities and mathematically relate the initial and final values of the translational kinetic, gravitational potential, and elastic potential energies in the absence of a net external force.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5 U**sing mathematics and computational thinking. **SEPS.**6 Constructing explanations (for science) and d. **SEPS.7** Engaging in argument from evidence esigning solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.

PI.4.2 Identify the forms of energy present in a scenario and recognize that the potential energy associated with a system of objects and is not stored in the object itself.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.4.3 Conceptually define “work” as the process of transferring of energy into or out of a system when an object is moved under the application of an external force and operationally define “work” as the area under a force vs. change in position curve.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.4.4 For a force exerted in one or two dimensions, mathematically determine the amount of work done on a system by an unbalanced force	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** Follow precisely a complex multistep procedure when carrying out experiments, taking

over a change in position in one dimension.	**SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.8** Obtaining, evaluating, and communicating information.	measurements, or performing technical tasks; analyze the specific results based on explanations in the text. **11-12.LST.3.1:** 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.
PI.4.5 Understand and apply the principle of conservation of energy to determine the total mechanical energy stored in a closed system and mathematically show that the total mechanical energy of the system remains constant as long as no dissipative (i.e. non-conservative) forces are present.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.**5 Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.2:** 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. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.3.1:** 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.
PI.4.6 Develop and apply pictorial, mathematical or graphical representations to qualitatively and quantitatively predict changes in the	**SEPS.1** Posing questions (for science) and defining problems (for engineering) **SEPS.2** Developing and using models and tools	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.

mechanical energy (e.g. translational kinetic, gravitational, or elastic potential) of a system due to changes in position or speed of objects or non-conservative interactions within the system.	**SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.5.1 For an object moving at constant rate, define linear momentum as the product of an object's mass and its velocity and be able to quantitatively determine the linear momentum of a single object.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.5.2 Operationally define "impulse" as the area under a force vs. change in clock reading (time) curve and be able to determine the change in linear momentum of a system acted on by an external force. Predict the change in linear momentum of an object from the average force exerted on the object and time	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are

interval during which the force is exerted.	**SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
PI.5.3 Demonstrate that when two objects interact through a collision or separation that both the force experienced by each object and change in linear momentum of each object are equal and opposite, and as the mass of an object increases, the change in velocity of that object decreases.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.5** Using mathematics and computational thinking. **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.2:** 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. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.5.4 Determine the individual and total linear momentum for a two-body system before and after an interaction (e.g. collision or separation) between the two objects and show that the total linear momentum of the system remains constant when no external force is applied consistent with Newton's third law.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.

PI.5.5 Classify an interaction (e.g. collision or separation) between two objects as elastic or inelastic based on the change in linear kinetic energy of the system.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.5** Using mathematics and computational thinking. **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.2:** 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. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.3.1:** 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. **11-12.LST.5.1:** Write arguments focused on discipline-specific content.
PI.5.6 Mathematically determine the center of mass of a system consisting of two or more masses. Given a system with no external forces applied, show that the linear momentum of the center of mass remains constant during any interaction between the masses.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are

	SEPS.8 Obtaining, evaluating, and communicating information	used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
PI.6.1 Develop graphical and mathematical representations that describe the relationship between the amount of stretch of a spring and the restoring force and apply those representations to qualitatively and quantitatively describe how changing the stretch or compression will affect the restoring force and vice versa, specifically for an ideal spring.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.4.1:** 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. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
PI.6.2 Describe the slope of the graphical representation of restoring force vs. change in length of an elastic material in terms of the elastic constant of the material, specifically for an ideal spring.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

GRADE LEVEL: 11, 12 **SUBJECT: PHYSICS** **DATE: 2017-2018**

GRADING PERIOD: QUARTER 3 **MASTER COPY 4-2-2018**

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
SIMPLE HARMONIC OSCILLATING SYSTEMS					
• Simple harmonic motion • Conservation of mechanical energy in an oscillator	**PI.6.3** Develop graphical and mathematical representations which describe the relationship between the mass, elastic constant, and period of a simple horizontal mass-spring system and apply those representations to qualitatively and quantitatively describe how changing the mass or elastic constant will affect the period of the system for an ideal spring.	• Calculate the period of a simple harmonic oscillator. • Graph the motion of a simple harmonic oscillator.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Period	IMPORTANT
• Pendulum motion	**PI.6.4** Develop graphical and mathematical representations which describe the relationship between the strength of gravity, length of string, and period of a simple mass-string (i.e. pendulum) system apply the those representations to qualitatively and quantitatively describe how changing the length of string or strength of gravity will affect the period of the system in the limit of small amplitudes.	• Calculate period of a pendulum. • Use a pendulum's period to calculate a value for gravity.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving • Pendulum Lab	• Gravity • Length • Amplitude	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
SIMPLE HARMONIC OSCILLATING SYSTEMS					
• Elastic limits • Deformation	**PI.6.5** Explain the limit in which the amplitude does not affect the period of a simple mass-spring (i.e. permanent deformation) or mass-string (i.e. pendulum, small angles) harmonic oscillating system.	• Identify the limits of spring and pendulum systems. • Recognize the limitations of the calculations we make in regards to simple harmonic oscillators.	• Teacher Observation	• Harmonic oscillating systems	ADDITIONAL
MECHANICAL WAVES AND SOUND					
• Transverse Wave • Longitudinal Wave	**PI.7.1** Differentiate between transverse and longitudinal modes of oscillation for a mechanical wave traveling in one dimension.	• Distinguish between transverse and longitudinal waves.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Transverse wave • Longitudinal wave • Oscillation • Mechanical wave	IMPORTANT
• Speed of light through different media • Electromagnetic spectrum	**PI.7.2** Understand that a mechanical wave requires a medium to transfer energy, unlike an electromagnetic wave, and that only the energy is transferred by the mechanical wave, not the mass of the medium.	• Distinguish between mechanical waves and electromagnetic waves. • Perform calculations using Snell's Law regarding different speeds of light through different materials and refraction angles.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Medium • Electromagnetic wave	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
MECHANICAL WAVES AND SOUND					
• Inverse relationship of frequency and wavelength	**PI.7.3** Develop graphical and mathematical representations that describe the relationship between the frequency of a mechanical wave and the wavelength of the wave and apply those representations to qualitatively and quantitatively describe how changing the frequency of a mechanical wave affects the wavelength and vice versa.	• Perform calculations involving speed, wavelength and frequency. • Graph wavelength vs frequency and recognize the pattern that develops.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Wavelength • Frequency	IMPORTANT
• Relationships between speed, wavelength, and frequency	**PI.7.4** Describe the slope of the graphical representation of wavelength vs. the inverse of the frequency in terms of the speed of the mechanical wave.	• Graph wavelength versus the inverse of frequency and identify the slope.	• Group problem solving		ADDITIONAL
• Doppler Effect	**PI.7.5** Apply the mechanical wave model to sound waves and qualitatively and quantitatively determine how the relative motion of a source and observer affects the frequency of a wave as described by the Doppler Effect.	• Describe how the Doppler Effect works.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Doppler Effect	IMPORTANT
• Constructive Interference • Destructive Interference	**PI.7.6** Qualitatively and quantitatively apply the principle of superposition to describe the interaction of two mechanical waves or pulses.	• Predict the resulting wave when two waves collide in phase or out of phase.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Pulses • Constructive Interference • Destructive Interference	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
MECHANICAL WAVES AND SOUND					
• Resonance • Beat Frequencies	**PI.7.7** Qualitatively describe the phenomena of both resonance frequencies and beat frequencies that arise from the interference of sound waves of slightly different frequency and define the beat frequency as the difference between the frequencies of two individual sound wave sources.	• Describe resonance and beat frequencies.	• Classroom Discussion • Questions in class	• Resonance • Sound waves	ADDITIONAL

STANDARD INDICATORS	SCIENCE AND ENGINEERING	LITERACY IN SCIENCE
PI.6.3 Develop graphical and mathematical representations which describe the relationship between the mass, elastic constant, and period of a simple horizontal mass-spring system and apply those representations to qualitatively and quantitatively describe how changing the mass or elastic constant will affect the period of the system for an ideal spring.	**SEPS.1** Posing questions (for science). and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.4.1:** 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. **11-12.LST.4.2:** 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. **11-12.LST.7.3:** Draw evidence from informational texts to support analysis, reflection, and research.
PI.6.4 Develop graphical and mathematical representations which describe the relationship between the strength of gravity, length of string, and period of a simple mass-string (i.e. pendulum) system apply the those representations to qualitatively and quantitatively describe how changing the length of string or strength of gravity will affect the period of the system in the limit of small amplitudes.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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. **11-12.LST.4.1:** 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. **11-12.LST.5.1:** Write arguments focused on discipline-specific content. **11-12.LST.6.2:** Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
PI.6.5 Explain the limit in which the amplitude does not affect the period of a simple mass-spring (i.e. permanent deformation) or mass-string (i.e. pendulum, small angles) harmonic oscillating system.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.2:** 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.

PI.7.1 Differentiate between transverse and longitudinal modes of oscillation for a mechanical wave traveling in one dimension.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.6 C**onstructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.2:** 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.
PI.7.2 Understand that a mechanical wave requires a medium to transfer energy, unlike an electromagnetic wave, and that only the energy is transferred by the mechanical wave, not the mass of the medium.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.2.2:** 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. **11-12.LST.4.1:** 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.
PI.7.3 Develop graphical and mathematical representations that describe the relationship between the frequency of a mechanical wave and the wavelength of the wave and apply those representations to qualitatively and quantitatively describe how changing the frequency of a mechanical wave	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.

affects the wavelength and vice versa.	**SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	
PI.7.4 Describe the slope of the graphical representation of wavelength vs. the inverse of the frequency in terms of the speed of the mechanical wave.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.
PI.7.5 Apply the mechanical wave model to sound waves and qualitatively and quantitatively determine how the relative motion of a source and observer affects the frequency of a wave as described by the Doppler Effect.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or

		solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
PI.7.6 Qualitatively and quantitatively apply the principle of superposition to describe the interaction of two mechanical waves or pulses.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).. **SEPS.7** Engaging in argument from evidence **SEPS.8** Obtaining, evaluating, and communicating information	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
PI.7.7 Qualitatively describe the phenomena of both resonance frequencies and beat frequencies that arise from the interference of sound waves of slightly different frequency and define the beat frequency as the difference between the frequencies of two individual sound wave sources.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

GRADE LEVEL: 11, 12 **SUBJECT: PHYSICS** **DATE: 2017-2018**

GRADING PERIOD: QUARTER 4 **MASTER COPY 4-2-2018**

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
SIMPLE CIRCUIT ANALYSIS					
• Resistivity	**PI.8.1** Develop graphical, mathematical, and pictorial representations that describe the relationship between length, cross-sectional area, and resistivity of an ohmic device and apply those representations to qualitatively and quantitatively describe how changing the composition, size, or shape of the device affect the resistance.	• Calculate resistivity given wire length and cross-sectional area. • Compare the resistivity of wires with different lengths or cross sectional areas	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Cross sectional area • Resistivity • Ohms	IMPORTANT
• Resistivity vs. length to cross-sectional area graphs	**PI.8.2** Describe the slope of the graphical representation of resistance vs. the ratio of length to cross-sectional area in terms of the resistivity of the material.	• Graph resistivity vs. the length to cross-sectional area ratio and interpret graphs of this nature.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving		IMPORTANT
• Ohm's Law	**PI.8.3** Develop graphical and mathematical representations that describe the relationship between the amount of current passing through an ohmic device and the amount of voltage (i.e. EMF) applied across the device according to Ohm's Law and apply those representations to qualitatively and quantitatively describe how changing the current affects the voltage and vice versa.	• Perform calculations involving Ohm's Law. • Perform power calculations.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Voltage	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
SIMPLE CIRCUIT ANALYSIS					
• Current vs. voltage graphs.	**PI.8.4** Describe the slope of the graphical representation of current vs. voltage or voltage vs. current in terms of the resistance of the device.	• Graph voltage vs. current and describe the slope.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving		IMPORTANT
• Simple series circuits	**PI.8.5** Qualitatively and quantitatively describe how changing the voltage or resistance of a simple series (i.e. loop) circuit affects the voltage, current, and power measurements of individual resistive devices and for the entire circuit.	• Analyze schematic diagrams of simple series circuits, and perform voltage and current calculations at locations throughout the circuit. • Construct a simple series circuits and make voltage and current measurements. • Compare measured values of voltage and current to calculated values.	• Written lab reports • Tests: Problems, multiple choice, True/false, essay • Lab performance • Group problem solving	• Simple series circuit • Current • Power • Circuit	IMPORTANT
• Simple parallel circuits	**PI.8.6** Qualitatively and quantitatively describe how changing the voltage or resistance of a simple parallel (i.e. ladder) circuit affects the voltage, current, and power measurements of individual resistive devices and for the entire circuit.	• Analyze schematic diagrams of parallel circuits, and perform voltage and current calculations at locations throughout the circuit. • Calculate effective resistance of parallel resistors.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Parallel circuit	IMPORTANT

CONTENT	STANDARD INDICATORS	SKILLS	ASSESSMENT	VOCAB	PRIORITY
SIMPLE CIRCUIT ANALYSIS					
• Kirchoff's Loop Rule • Analysis of combined series/parallel circuits	**PI.8.7** Apply conservation of energy concepts to the design of an experiment that will demonstrate the validity of Kirchhoff's loop rule (∑ΔV = 0) in a circuit with only a battery and resistors either in series or in, at most, one pair of parallel branches.	• Demonstrate the validity of Kirchoff's Loop Rule.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Conservation of energy • Kirchhoff's Loop Rule • Battery	IMPORTANT
• Kirchoff's Junction Rule	**PI.8.8** Apply conservation of electric charge (i.e. Kirchhoff's junction rule) to the comparison of electric current in various segments of an electrical circuit with a single battery and resistors in series and in, at most, one parallel branch and predict how those values would change if configurations of the circuit are changed.	• Analyze circuits using Kirchoff's Junction Rule.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving	• Kirchoff's Junction Rule	IMPORTANT
• Analysis of current, voltage, and resistance at any point within a circuit.	**PI.8.9** Use a description or schematic diagram of an electrical circuit to calculate unknown values of current, voltage, or resistance in various components or branches of the circuit according to Ohm's Law, Kirchhoff's junction rule, and Kirchhoff's loop rule.	• Use Ohm's Law, Kirchoff's Junction Rule, and Kirchoff's Loop rule to analyze combined series/parallel circuits and perform calculations involving current, voltage, and resistance.	• Tests: Problems, multiple choice, True/false, essay • Group problem solving		IMPORTANT

STANDARD INDICATORS	SCIENCE AND ENGINEERING	LITERACY IN SCIENCE
PI.8.1 Develop graphical, mathematical, and pictorial representations that describe the relationship between length, cross-sectional area, and resistivity of an ohmic device and apply those representations to qualitatively and quantitatively describe how changing the composition, size, or shape of the device affect the resistance.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.3.1:** 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. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
PI.8.2 Describe the slope of the graphical representation of resistance vs. the ratio of length to cross-sectional area in terms of the resistivity of the material.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.3.1:** 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.
PI.8.3 Develop graphical and mathematical representations that describe the relationship between the amount of current passing through an ohmic device and the amount of voltage (i.e. EMF) applied across the device according to Ohm's Law and apply those representations to qualitatively and quantitatively describe how changing the current affects the voltage and vice versa.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.3.1:** 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. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

PI.8.4 Describe the slope of the graphical representation of current vs. voltage or voltage vs. current in terms of the resistance of the device.	**SEPS.1 P**osing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4 An**alyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.3.1:** 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. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research.
PI.8.5 Qualitatively and quantitatively describe how changing the voltage or resistance of a simple series (i.e. loop) circuit affects the voltage, current, and power measurements of individual resistive devices and for the entire circuit.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering). **SEPS.7** Engaging in argument from evidence. **SEPS.8** Obtaining, evaluating, and communicating information.	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.3.1:** 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. **11-12.LST.4.1:** 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. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent

		understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **11-12.LST.5.2:** Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. **11-12.LST.7.1:** Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
PI.8.6 Qualitatively and quantitatively describe how changing the voltage or resistance of a simple parallel (i.e. ladder) circuit affects the voltage, current, and power measurements of individual resistive devices and for the entire circuit.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.1.2:** Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences. **11-12.LST.3.1:** 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. **11-12.LST.4.3:** Synthesize information from a range of sources (e.g., *texts, experiments, simulations*) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **11-12.LST.4.1:** 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.

PI.8.7 Apply conservation of energy concepts to the design of an experiment that will demonstrate the validity of Kirchhoff's loop rule ($\sum\Delta V = 0$) in a circuit with only a battery and resistors either in series or in, at most, one pair of parallel branches.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.3** Constructing and performing investigations. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.2:** 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. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.8.8 Apply conservation of electric charge (i.e. Kirchhoff's junction rule) to the comparison of electric current in various segments of an electrical circuit with a single battery and resistors in series and in, at most, one parallel branch and predict how those values would change if configurations of the circuit are changed.	**SEPS.1** Posing questions (for science) and defining problems (for engineering). **SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12. **11-12.LST.2.2:** 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. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.
PI.8.9 Use a description or schematic diagram of an electrical circuit to calculate unknown values of current,	**SEPS.1** Posing questions (for science) and defining problems (for engineering).	**11-12.LST.1.1:** Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.

voltage, or resistance in various components or branches of the circuit according to Ohm's Law, Kirchhoff's junction rule, and Kirchhoff's loop rule.	**SEPS.2** Developing and using models and tools. **SEPS.4** Analyzing and interpreting data. **SEPS.5** Using mathematics and computational thinking. **SEPS.6** Constructing explanations (for science) and designing solutions (for engineering).	**11-12.LST.2.2:** 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. **11-12.LST.2.3:** 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. **11-12.LST.3.1:** 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.