

Physics I

Unit 1 Methods in Science (Systems of Units)

Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
10 Days	Tools are needed for the study of Physics, such as measurement, conversions, significant figures, experimental design, data collection and analysis.	<p>What is Physics?</p> <p>How are Mathematical models constructed and used in our daily lives?</p>	<p>Physics is the study of matter and energy and their relationships.</p> <p>Significant digit identification and operations</p> <p>The result of any mathematical operation with measurements never can be more precise than the least-precise measurement involved in the operation.</p> <p>The scientific method is a systematic method of observing, experimenting, and analyzing to answer questions about the natural world.</p>	<p>Students should be able to demonstrate scientific methods.</p> <p>Students should be able to use the metric system.</p> <p>Students should be able to evaluate answers using dimensional analysis.</p> <p>Students should be able to perform arithmetic operations using scientific notation.</p>	Physics-Principals and Problems Glencoe (2005) Section 1-1 (pgs. 3-10)	<p>Physics</p> <p>Dimensional analysis</p> <p>Significant digits</p> <p>Scientific methods</p> <p>Scientific theory</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p>

			<p>Scientific ideas change in response to new data.</p> <p>Scientific laws and theories are well established descriptions and explanations of nature.</p>			<p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
	<p>Tools are needed for the study of Physics, such as measurement, conversions, significant figures, experimental design, data collection and analysis.</p>	<p>What is Physics?</p> <p>How are Mathematical models constructed and used in our daily lives?</p>	<p>New scientific findings must be reproducible.</p> <p>All measurements are subject to some uncertainty.</p> <p>Precision is the degree of exactness with which a quantity is measured.</p> <p>Scientific Notation shows how precise a measurement is.</p> <p>Accuracy is the extent to which a measurement matches its true value.</p>	<p>Students should be able to distinguish between accuracy and precision.</p> <p>Students should be able to explain the importance of accuracy and precision in making valid measurements.</p> <p>Students should be able to determine the precision of measured quantities.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 1-2 (pgs. 11-14)</p>	<p>Measurement</p> <p>Precision</p> <p>Accuracy</p> <p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and</p>

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	<p>Tools are needed for the study of Physics, such as measurement, conversions, significant figures, experimental design, data collection and analysis.</p>	<p>What is Physics?</p> <p>How are Mathematical models constructed and used in our daily lives?</p>	<p>Data is plotted in graphical form to show the relationship between two variables.</p> <p>The line that best passes through or near graphed data is called the line of best fit and is used to describe the data in order to predict where new data would lie on the graph.</p> <p>A graph in which data points lie on a straight line is the graph of a linear relationship.</p> <p>The slope of a line graph is the vertical change (rise) divided by the horizontal change (run) and often has a physical meaning.</p>	<p>Students should be able to graph the relationship between independent and dependent variables.</p> <p>Students should be able to interpret graphs.</p> <p>Students should be able to recognize common relationships in graphs.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 1-3 (pgs. 15-19)</p>	<p>Independent Variables</p> <p>Dependent variables</p> <p>Line of best fit</p> <p>Linear relationship</p> <p>Quadratic relationship</p> <p>Inverse relationship</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct</p>

			<p>The graph of a quadratic relationship is a parabolic curve.</p> <p>The graph of an inverse relationship between is a hyperbolic curve.</p>				<p>and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
Review Unit 1 Methods in Science (Systems of Units)							
Assessment Unit 1 Methods in Science (Systems of Units)							
Unit 2 One Dimensional (Linear) Motion							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
25 Days	Objects that move in translational motion are described in terms of position, velocity and acceleration.	How can the motion of an object be described in a measurable and quantitative way?	<p>The position of an object is its separation form a reference point.</p> <p>A motion diagram shows the position of an object at successive times.</p>	<p>Students should be able to draw motion diagrams to describe motion.</p> <p>Students should be able to develop a particle model to represent a moving object.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 2-1 (pgs. 31-33)</p> <p>Physics-Principals and Problems Glencoe (2005) Section 2-2</p>	<p>Motion Diagrams</p> <p>Particle model</p> <p>Coordinate system</p> <p>Origin</p>	CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.

			<p>In a particle model, the object in the motion diagram is replaced by a series of single points.</p> <p>One can define any coordinate system in describing motion; however some are more useful than others.</p>	<p>Students should be able to define coordinate systems for motion problems.</p> <p>Students should be able to recognize that the chosen coordinate system affects the sign of objects' position.</p>	(pgs. 34-37)	Position	<p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
	Objects that move in translational	How can the motion of an object be	Time interval is the difference between	Students should be able to define	Physics-Principals and Problems	Distance	<p>CC.3.5.11-12.C Follow precisely a complex multi-step</p>

	<p>motion are described in terms of position, velocity and acceleration.</p>	<p>described in a measurable and quantitative way?</p>	<p>two times.</p> <p>A vector drawn from the origin of the coordinate system to the object indicates the object's position.</p> <p>Change in position is displacement, which has both magnitude and direction.</p> <p>Displacement is a vector quantity indicating the magnitude and direction of the objects change of position.</p>	<p>displacement.</p> <p>Students should be able to determine a time interval.</p> <p>Students should be able to use a motion diagram to answer questions about an objects position or displacement.</p> <p>Students should be able to discriminate between the distance an object moves and the displacement of an object.</p>	<p>Glencoe (2005) Section 2-2 (pgs. 34-37)</p>	<p>Displacement</p> <p>Time interval</p>	<p>procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and</p>
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	Objects that move in translational motion are described in terms of position, velocity and acceleration.	How can the motion of an object be described in a measurable and quantitative way?	<p>The length of a displacement vector represents how far the object was displaced and the vector points in the direction of the displacement.</p> <p>A Scalar quantity is described completely by its magnitude, while a vector quantity requires both magnitude and direction.</p>	<p>Students should be able to define velocity.</p> <p>Students should be able to discriminate between speed and velocity of an object.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 2-2 (pgs. 34-37)</p> <p>Physics-Principals and Problems Glencoe (2005) Section 2-4 (pgs. 43-47)</p>	<p>Magnitude</p> <p>Vector</p> <p>Scalar</p> <p>Resultant</p> <p>Speed</p> <p>velocity</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p>

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	<p>Objects that move in translational motion are described in terms of position, velocity and acceleration.</p>	<p>How can the motion of an object be described in a measurable and quantitative way?</p>	<p>Average velocity is the displacement (change in position) divided by the time interval.</p>	<p>Students should be able to describe motion of an object in terms of a reference frame.</p> <p>Students should be able to create a mathematical model for the relationship between velocity, displacement and time.</p> <p>Students should be able to algebraically manipulate mathematical models of constant velocity to solve for variables.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 2-3 (pgs. 38-42)</p> <p>Physics-Principals and Problems Glencoe (2005) Section 2-4 (pgs. 43-47)</p>	<p>Time interval</p> <p>Instantaneous position</p> <p>Average velocity</p> <p>Average speed</p> <p>Instantaneous velocity</p>	<p>CC.3.5.11-12.C</p> <p>Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D</p> <p>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 grade 11-12 texts and topics</p> <p>3.2.P.B.1</p> <p>Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7</p>

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	<p>Objects that move in translational motion are described in terms of position, velocity and acceleration.</p>	<p>How can the motion of an object be described in a measurable and quantitative way?</p>	<p>The slope of an object's position-time graph is the average velocity of the objects motion.</p> <p>When the position-time graph is a straight line, the object is moving with a constant velocity.</p> <p>A velocity - time graph can be used to find velocity and acceleration of an object.</p>	<p>Students should be able to create velocity – time graphs.</p> <p>Students should be able to determine the velocity from a position –time graph.</p> <p>Students should be able to interpret the motion of an object moving with constant velocity using a position-time graph as well as a velocity-time graph.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 2-3 (pgs. 38-42)</p> <p>Physics-Principals and Problems Glencoe (2005) Section 2-4 (pgs. 43-47)</p> <p>Physics-Principals and Problems Glencoe (2005) Section 3-1 (pgs. 57-64)</p>	<p>Slope</p> <p>Velocity-time graph</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among</p>

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	Objects that move in translational motion are described in terms of position, velocity and acceleration.	How can the motion of an object be described in a measurable and quantitative way?	<p>Acceleration is the ratio of the change in velocity to the time interval over which it occurs.</p> <p>The average acceleration of an object is the slope of the velocity – time graph.</p> <p>If an objects average</p>	<p>Students should be able to relate velocity and acceleration to the motion of an object.</p> <p>Students should be able to interpret position-time graphs for motion with constant acceleration.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 3-1 (pgs. 57-64)</p> <p>Physics-Principals and Problems Glencoe (2005) Section 3-2 (pgs. 65-71)</p>	<p>Acceleration</p> <p>Average Acceleration</p> <p>Instantaneous acceleration</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D Determine the meaning of symbols, key terms, and other domain specific words and</p>

			<p>acceleration during a time interval is known, the change in velocity during that time period can be found.</p> <p>Average acceleration vectors on a motion diagram indicate the size and direction of the average acceleration during a time interval.</p> <p>When the acceleration and velocity are in the same direction, the object speeds up; when they are in opposite directions, the object slows down.</p> <p>Velocity – time graphs and motion diagrams can be used to determine sign of an object's acceleration.</p> <p>The area under an objects velocity time graph is it's displacement.</p> <p>In motion with constant acceleration,</p>	<p>Students should be able apply graphical and mathematical relationships to solve problems related to constant acceleration.</p> <p>Student should be able to create mathematical models for the relationship between constant acceleration, initial and final velocities, time and displacement.</p> <p>Students should be able to algebraically manipulate mathematical models of constant acceleration to solve for variables.</p> <p>Students should be able to relate velocity and acceleration to the motion of an object.</p>			<p>phrases as they are used in a specific scientific or technical context; relevant to grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
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			there is a relationship among position, velocity, acceleration, and time.				
	Objects that move in translational motion are described in terms of position, velocity and acceleration.	How can the motion of an object be described in a measurable and quantitative way?	<p>Constant acceleration on the y-axis (free fall)</p> <p>The acceleration due to gravity on earth is 9.8 m/s^2 downward.</p> <p>The sign associated with gravity in equations depends upon the choice of the coordinate system.</p> <p>Equations for motion with constant acceleration can be used to solve problems involving free fall.</p>	<p>Students should be able to define acceleration due to gravity.</p> <p>Students should be able to solve problems involving objects in free fall.</p> <p>Students should be able to explain factors that affect the rate of a falling object.</p>	Physics-Principals and Problems Glencoe (2005) Section 3-3 (pgs. 72-75)	<p>Free Fall</p> <p>Acceleration due to gravity</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p>

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Review Unit 2 One Dimensional (Linear) Motion							
Assessment Unit 2 One Dimensional (Linear) Motion							
Unit 3 Two Dimensional Motion							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
15 Days	Objects that move in translational motion are described in terms of position, velocity and acceleration.	How does the motion in the vertical direction affect motion in the horizontal direction?	<p>Projectile motion</p> <p>Vector trigonometry</p> <p>When two vectors are at right angles, you can use the Pythagorean Theorem to determine the magnitude of the resultant vector.</p> <p>The law of sines and</p>	<p>Students should be able to evaluate the sum of two or more vectors in two dimensions graphically.</p> <p>Students should be able to determine the components of vectors.</p> <p>Students should be</p>	Physics-Principals and Problems Glencoe (2005) Section 5-1 (pgs. 119-125)	<p>Components</p> <p>Vector resolution</p> <p>Hypotenuse</p> <p>Opposite side</p> <p>Adjacent side</p> <p>Sine</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D Determine the meaning of symbols, key terms, and other domain</p>

			<p>cosines can be used to find the magnitude of the resultant of any two vectors.</p> <p>The components of a vector are projections of the component vectors.</p> <p>Vectors can be summed by separately adding the x- and y- components.</p>	able to solve the sum of two or more vectors algebraically by adding the components of the vectors.		<p>Cosine</p> <p>Tangent</p> <p>Right triangles</p> <p>Pythagorean Theorem</p> <p>Law of Sines</p> <p>Law of cosines</p>	<p>specific words and phrases as they are used in a specific scientific or technical context; relevant to grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
	Objects that move in translational motion are described in terms	How does the motion in the vertical direction affect motion in the	Vertical and horizontal behaviors of a projectile, forces (or the lack thereof)	Students should be able to recognize that the vertical and horizontal motions	Physics-Principals and Problems Glencoe (2005) Section 6-1	<p>Projectile</p> <p>Trajectory</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking</p>

	of position, velocity and acceleration.	horizontal direction?	<p>that influence these behavior</p> <p>The vertical and horizontal motions of a projectile are independent.</p> <p>A projectile moves with constant velocity in the horizontal direction and a changing velocity in the vertical direction.</p> <p>When there is no air resistance, the horizontal motion component does not experience acceleration, and has constant velocity. Projectile problems are solved by first using the vertical motion to relate height, time in the air and initial vertical velocity. Then the distance traveled horizontally if found.</p> <p>The range of a projectile depends on the acceleration due to gravity and on both components of the initial velocity.</p>	<p>of a projectile are independent.</p> <p>Student should be able to relate the height, time in the air, and initial vertical velocity of a projectile using its vertical motion, and then determine the range using the horizontal motion.</p> <p>Students should be able to explain the trajectory of a projectile based on the frame of reference from which it is observed.</p> <p>Students should be able to solve problems involving projectiles launched horizontally from an elevated position.</p> <p>Students should be able to solve problems involving projectiles fired at an angle above zero.</p>	(pgs. 147-154)	Range	<p>measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p>
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			The curved flight path of a projectile is called a parabola				Recognize and analyze alternative explanations and models.
	Objects that move in translational motion are described in terms of position, velocity and acceleration.	How does the motion in the vertical direction affect motion in the horizontal direction?	<p>Vertical and horizontal behaviors of a projectile, forces (or the lack thereof) that influence these behaviors</p> <p>Vector addition can be used to solve problems of relative velocity.</p> <p>The key to properly analyzing a two-dimensional relative velocity problem is drawing a proper triangle to represent all three velocity vectors.</p> <p>When a coordinate system is moving, two velocities are added together if both motions are in the same direction.</p> <p>When a coordinate system is moving, one vector is subtracted from the other when</p>	<p>Students should be able to analyze situations in which the coordinate system is moving.</p> <p>Students should be able to solve relative-motion problems.</p>	Physics-Principals and Problems Glencoe (2005) Section 6-3 (pgs. 157-159)	Relative velocity	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used</p>

			the motions are in opposite directions.				<p>by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
Review Unit 3 Two Dimensional Motion							
Assessment Unit 3 Two Dimensional Motion							
Unit 4 Newton's Law's							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
20 days	All changes in translational motion are due to forces.	How can the linear motion of an object be determined by analyzing the forces on it?	Newton's First Law states that an object that is at rest will remain at rest, and an object that is moving will continue to move in a straight line with constant speed, if and only if the net force acting upon it is zero	<p>Students should be able to define force.</p> <p>Students should be able to explain the meaning of Newton's first law.</p> <p>Students should be able to solve problems with net</p>	Physics-Principals and Problems Glencoe (2005) Section 4-1 (pgs. 87-95)	<p>Force</p> <p>Free-body diagram</p> <p>Net force</p> <p>Newton's First Law</p> <p>Newton's</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D Determine the meaning</p>

			<p>An object with no net force acting on it is in equilibrium.</p> <p>Newton's Second Law states that the acceleration of a system equals the net force acting on it, divided by its mass.</p> <p>An object that experiences a push or a pull has a force exerted on it.</p> <p>Forces have both direction and magnitude.</p> <p>Forces may be divided into contact and field forces.</p> <p>In a free body diagram, always draw the force vectors leading away from the object, even if the force is a push.</p> <p>The forces acting upon an object can be added using vector addition to find net force.</p>	<p>force equal to zero, simple angle forces or inclines.</p> <p>Students should be able to apply Newton's second law to solve problems with non-zero net force, some using the coefficient of friction.</p> <p>Students should be able to construct a free body diagram indicating the magnitude and direction of the forces on an object and use information from the diagram to determine the motion of the object.</p>		<p>Second Law</p> <p>Inertia</p> <p>Equilibrium</p>	<p>of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context; relevant to grade 11-12 texts and topics.</p> <p>CC.3.6.11-12.B Write informational and explanatory text, including the narration of historical events, scientific procedures/experiments or technical processes.</p> <p>CC.3.6.11-12.C Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.</p> <p>3.2.P.B.1 Use force and mass to explain translational motion or simple harmonic motion.</p> <p>3.2.P.B6 Patterns scale models constancy/change; use Newton's laws of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p>
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							<p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
	All changes in translational motion are due to forces.	How can the linear motion of an object be determined by analyzing the forces on it?	<p>Newton's First Law states that an object that is at rest will remain at rest, and an object that is moving will continue to move in a straight line with constant speed, if and only if the net force acting upon it is zero</p> <p>Newton's Second Law states that the acceleration of a system equals the net force acting on it, divided by its mass.</p> <p>The weight of an object depends upon the acceleration due</p>	<p>Students should be able to describe how the weight and mass of an object are related.</p> <p>Student should be able to differentiate between actual weight and apparent weight.</p>	Physics-Principals and Problems Glencoe (2005) Section 4-2 (pgs. 96-101)	<p>Apparent weight</p> <p>Weightlessness</p> <p>Drag force</p> <p>Terminal velocity</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>CC.3.6.11-12.B Write informational and explanatory text,</p>

			<p>to gravity and the mass of the object.</p> <p>An object's apparent weight is the force an object experiences as a result of the contact forces acting upon it, giving the object acceleration.</p> <p>An object with no apparent weight experiences weightlessness.</p> <p>The effect of drag on an object's motion is determined by the objects weight, size and shape.</p> <p>If a falling object reaches a velocity such that the drag force is equal to the object's weight, it maintains that velocity, called terminal velocity</p>			<p>including the narration of historical events, scientific procedures/experiments or technical processes.</p> <p>CC.3.6.11-12.C Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.</p> <p>3.2.P.B.1 Use force and mass to explain translational motion or simple harmonic motion.</p> <p>3.2.P.B6 Patterns scale models constancy/change; use Newton's laws of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p>
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	<p>All changes in translational motion are due to forces.</p>	<p>How can the linear motion of an object be determined by analyzing the forces on it?</p>	<p>Action/ reaction pairs</p> <p>All forces result from interactions between objects.</p> <p>Newton's third law states that the two forces that make up an interaction pair of forces are equal in magnitude, but opposite in direction and act on different objects.</p> <p>Tension is the specific name for the force exerted by a rope or a string.</p> <p>The normal force is a support force resulting from the contact between the two objects.</p>	<p>Students will be able to define Newton's third law.</p> <p>Students will be able to explain the tension in ropes and strings in terms of Newton's third law.</p> <p>Students will be able to define the normal force.</p> <p>Students will be able to determine the value of the normal force by applying Newton's second law.</p> <p>Students will be able to identify action/ reaction pairs.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 4-3 (pgs. 102-107)</p>	<p>Interaction Pairs</p> <p>Newton' third law</p> <p>Tension</p> <p>Normal force</p>	<p>CC.3.5.11-12.C</p> <p>Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D</p> <p>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 grade 11-12 texts and topics.</p> <p>CC.3.6.11-12.B</p> <p>Write informational and explanatory text, including the narration of historical events, scientific procedures/experiments or technical processes.</p> <p>CC.3.6.11-12.C</p> <p>Produce clear and coherent writing in which the development, organization and style are appropriate to task,</p>

							<p>purpose, and audience.</p> <p>3.2.P.B.1 Use force and mass to explain translational motion or simple harmonic motion.</p> <p>3.2.P.B6 Patterns scale models constancy/change; use Newton's laws of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
	Objects that move in translational motion are	How does the motion in the vertical direction	Vertical and horizontal behaviors of an object, forces	Students should be able to define the friction force.	Physics-Principals and Problems Glencoe (2005)	Kinetic friction Static friction	<p>CC.3.5.11-12.C Follow precisely a complex multi-step</p>

	described in terms of position, velocity and acceleration.	affect motion in the horizontal direction?	<p>(or the lack thereof) that influence these behavior</p> <p>A frictional force acts when two surfaces touch</p> <p>The frictional force is proportional to the force pushing the surfaces together.</p> <p>Kinetic friction force is equal to the coefficients of kinetic friction times the normal force.</p> <p>The static friction force is less than or equal to the coefficient of static friction times the normal force.</p>	Students should be able to distinguish between static and kinetic friction.	Section 5-2 (pgs. 126-130)	<p>Coefficient of kinetic friction</p> <p>Coefficient of static friction</p>	<p>procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and</p>
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							<p>evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
	<p>Objects that move in translational motion are described in terms of position, velocity and acceleration.</p>	<p>How does the motion in the vertical direction affect motion in the horizontal direction?</p>	<p>Vertical and horizontal behaviors of an object, forces (or the lack thereof) that influence these behavior</p> <p>The force that must be exerted on an object to cause it to be in equilibrium is called the equilibrant.</p> <p>The equilibrant is found by finding the net force on an object, then applying a force with the same magnitude but in the opposite direction.</p> <p>An object on an incline plane has a component of the force of gravity in a direction parallel to the plane; the component can accelerate the object down the plane.</p>	<p>Students should be able to determine the force that produces equilibrium when three forces act on an object.</p> <p>Student should be able to analyze the motion of an object on an incline plane.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 5-3 (pgs. 131-135)</p>	<p>Equilibrium</p> <p>Equilibrant</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used</p>

							<p>by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
Review Unit 4 Newton's Law's							
Assessment Unit 4 Newton's Law's							
Unit 5 Uniform Circular Motion and Gravity							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
15 Days	All forces arise from the interaction between different objects.	How do we apply uniform circular motion to object in gravitational orbit?	<p>Uniform circular motion is applied to objects that change directions</p> <p>An object moving in circular motion at a constant speed accelerates toward the center of the</p>	<p>Students should be able to describe the motion of an object in Uniform Circular Motion, pictorially, verbally and mathematically.</p> <p>Students should be able to algebraically</p>	Physics-Principals and Problems Glencoe (2005) Section 6-3 (pgs. 153-156)	<p>Uniform Circular motion</p> <p>Centripetal Acceleration</p> <p>Centripetal Force</p> <p>Newton's</p>	CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.

			<p>circle.</p> <p>F_{net} is called a centripetal force and must be directed to the center of the circular motion for an object to move in Uniform circular motion</p> <p>Centripetal acceleration depends directly on the square of the objects speed and inversely on the radius of the circle.</p> <p>The centripetal acceleration for an object traveling in a circle can also be expressed as a function of its period.</p> <p>Period is the time for one revolution.</p> <p>A net force must be exerted toward the circle's center to cause centripetal acceleration.</p> <p>The velocity vector of a object with a centripetal acceleration is always</p>	<p>manipulate mathematical models of Uniform Circular Motion to predict unknown variables.</p> <p>Students should be able to draw free body diagrams of objects in circular motion, apply to turning vehicles and swinging objects, e.g. Pendulum, yo-yo, roller coaster.</p> <p>Students should be able to explain why an object moving in a circle at constant speed is accelerating.</p> <p>Students should be able to describe how centripetal acceleration depends on the object's speed and the radius of the circle.</p> <p>Students should be able to identify the force that causes centripetal acceleration.</p>		<p>Second Law for Circular Motion</p>	<p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>CC.3.6.11-12.B Write informational and explanatory text, including the narration of historical events, scientific procedures/experiments or technical processes.</p> <p>CC.3.6.11-12.C Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>Relate torque and rotational inertia to explain rotational motion</p> <p>3.2.P.B2 Describe the rotational motion of objects using conservation of energy</p>
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			tangent to the circular path				<p>and conservation of angular momentum.</p> <p>Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	All forces arise from the interaction between different	How do we apply uniform circular motion to object in	Kepler's three laws describe the motion of objects in orbit.	Students should be able to apply Kepler's law to the	Physics-Principals and Problems Glencoe (2005)	Kepler's First Law	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out</p>

	objects.	gravitational orbit?	<p>When an object is in orbit around a planet (e.g. a satellite), gravity provides the centripetal force that can be calculated with Newton's law of universal gravitation.</p> <p>Newton's law of universal gravitation Can also be applied to any two masses separated by a distance.</p> <p>Newton's law of universal gravitation states that the gravitational force between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers. The force is attractive and along a line connecting their centers.</p> <p>Newton's law of universal gravitation can be used to rewrite Kepler's third law to</p>	<p>motion of celestial objects and/or satellites.</p> <p>Students should be able to describe the importance of the Cavendish experiment.</p> <p>Students should be able to use the gravitational force equation for celestial objects and celestial orbits.</p> <p>Students should be able to calculate orbital speeds and periods.</p>	Section 7-1 (pgs. 171-178)	<p>Kepler's Second Law</p> <p>Kepler's Third Law</p> <p>Gravitational force</p> <p>Law of Universal Gravitation</p>	<p>experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>CC.3.6.11-12.B Write informational and explanatory text, including the narration of historical events, scientific procedures/experiments or technical processes.</p> <p>CC.3.6.11-12.C Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>Relate torque and rotational inertia to</p>
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			relate the radius and period of a planet to the mass of the sun.				<p>explain rotational motion</p> <p>3.2.P.B2 Describe the rotational motion of objects using conservation of energy and conservation of angular momentum.</p> <p>Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental</p>
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							information for relevance to science process
	All forces arise from the interaction between different objects.	How do we apply uniform circular motion to object in gravitational orbit?	<p>All objects have gravitational fields around them.</p> <p>Gravitational mass and inertial mass are two essentially different concepts.</p> <p>The gravitational and inertial masses of an object are numerically equal.</p> <p>Einstein's general theory of relativity describes gravitational attraction as a property of space itself.</p>	<p>Students should be able to solve orbital problems.</p> <p>Students should be able to relate weightlessness to objects in free fall.</p> <p>Students should be able to describe gravitational fields.</p> <p>Students should be able to compare views on gravitation.</p> <p>Students should be able to calculate the properties of geosynchronous orbits.</p>	Physics-Principals and Problems Glencoe (2005) Section 7-2 (pgs. 179-185)	<p>Gravitational Field</p> <p>Inertial mass</p> <p>Gravitational mass</p> <p>Geosynchronous orbits</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>CC.3.6.11-12.B Write informational and explanatory text, including the narration of historical events, scientific procedures/experiments or technical processes.</p> <p>CC.3.6.11-12.C Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic</p>

						<p>motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>Relate torque and rotational inertia to explain rotational motion</p> <p>3.2.P.B2 Describe the rotational motion of objects using conservation of energy and conservation of angular momentum.</p> <p>Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
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Review Unit 5 Uniform Circular Motion and Gravity							
Assessment Unit 5 Uniform Circular Motion and Gravity							
Unit 6 Rotational Motion							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
20 Days	<p>The rotational motion of an object is described in terms of angular position, angular velocity, and angular acceleration.</p> <p>All changes in rotational motion are due to torques.</p>	How can we change the rotational motion of an object?	<p>The behavior of a rotating object results both from the torque applied to the object as well as the rotational inertia.</p> <p>Angular position and its changes are measured in radians.</p> <p>One complete revolution is 2π radians</p>	<p>Students should be able to describe angular displacement.</p> <p>Students should be able to calculate angular velocity.</p> <p>Students should be able to calculate angular acceleration.</p> <p>Students should be</p>	Physics-Principals and Problems Glencoe (2005) Section 8-1 (pgs. 197-200)	<p>Radian</p> <p>Angular displacement</p> <p>Angular velocity</p> <p>Angular acceleration</p>	<p>CC.3.5.11-12.C</p> <p>Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D</p> <p>Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a</p>

			For a rotating, rigid object, the angular displacement is equal for all radii.	able to solve problems involving rotational motion.			<p>specific scientific or technical context; relevant to grade 11-12 texts and topics.</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>Relate torque and rotational inertia to explain rotational motion</p> <p>3.2.P.B2 Describe the rotational motion of objects using conservation of energy and conservation of angular momentum.</p> <p>Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect</p>
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							<p>observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	<p>The rotational motion of an object is described in terms of angular position, angular velocity, and angular acceleration.</p> <p>All changes in</p>	How can we change the rotational motion of an object?	<p>Torque measurements and calculations.</p> <p>Newton's second law for rotation (effect of rotational inertia on acceleration, given a set torque)</p>	<p>Students should be able to describe torque and the factors that determine it.</p> <p>Students should be able to calculate net torque.</p>	Physics-Principals and Problems Glencoe (2005) Section 8-2 (pgs. 201-210)	<p>Lever arm</p> <p>Torque</p> <p>Moment of inertia</p> <p>Newton's second law for rotational</p>	<p>CC.3.5.11-12.C</p> <p>Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D</p>

	rotational motion are due to torques.		<p>Newton's second law for rotational motion states that angular acceleration is directly proportional to the net torque and inversely proportional to the moment of inertia.</p> <p>When torque is exerted on an object, if angular velocity changes.</p> <p>Torque depends on the magnitude of the force and the radius from the axis of rotation to the point where the force is applied.</p> <p>The moment of inertia of an object depends on the way the object's mass is distributed about the rotational axis.</p>	Students should be able to calculate the moment of inertia.		<p>motion</p> <p>Axis of rotation</p>	<p>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 grade 11-12 texts and topics.</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>Relate torque and rotational inertia to explain rotational motion</p> <p>3.2.P.B2 Describe the rotational motion of objects using conservation of energy and conservation of angular momentum.</p> <p>Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.</p>
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							<p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	The rotational motion of an object is described in terms of angular	How can we change the rotational motion of an object?	The center of mass of an object is the point on the object that moves in the same	Students should be able to define center of mass.	Physics-Principals and Problems Glencoe (2005) Section 8-3	Center of mass Centrifugal “force”	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out</p>

	<p>position, angular velocity, and angular acceleration.</p> <p>All changes in rotational motion are due to torques.</p>		<p>way that a point particle would move.</p> <p>An object is stable against rollover if its center of mass is above its base.</p> <p>An object is in equilibrium if there are no net forces exerted on it and if there are no net torques acting on it.</p> <p>Equilibrium is a state of no change whether moving or not.</p> <p>Static equilibrium (rest)</p> <p>Dynamic equilibrium (moving)</p> <p>Centrifugal “force” and Coriolis “force” are two apparent forces that appear when rotating objects are analyzed from a coordinate system that rotates with it.</p>	<p>Students should be able to explain how the location of the center of mass affects the stability of an object.</p> <p>Students should be able to define the conditions for equilibrium.</p> <p>Students should be able to describe how rotating frames of reference give rise to apparent forces.</p> <p>Students should be able to solve for unknown quantities in order to establish rotational equilibrium for a system.</p>	(pgs. 211-217)	<p>Coriolis “force”</p> <p>Equilibrium</p> <p>Static equilibrium</p> <p>Dynamic equilibrium</p> <p>Rotational equilibrium</p>	<p>experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>3.2.P.B.1 Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity and acceleration.</p> <p>Relate torque and rotational inertia to explain rotational motion</p> <p>3.2.P.B2 Describe the rotational motion of objects using conservation of energy and conservation of angular momentum.</p>
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						<p>Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate</p>
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							experimental information for relevance to science process
Review Unit 6 Rotational Motion							
Assessment Unit 6 Rotational Motion							
Unit 7 Momentum							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
20 Days	All simple harmonic motion can be explained using force and/or torque.	In a closed system, how do conservation laws predict the behavior of an object?	<p>The momentum of an object is the product of its mass and velocity and is a vector quantity.</p> <p>The impulse of an object is the average net force exerted on the object multiplied by the time interval over which a force acts.</p> <p>Lengthening the time of impact minimizes the force in a collision.</p> <p>The angular</p>	<p>Students should be able to define the momentum of an object.</p> <p>Students should be able to determine the impulse given an object.</p> <p>Students should be able to define the angular momentum of an object.</p> <p>Students should be able to solve impulse-momentum problems.</p>	Physics-Principals and Problems Glencoe (2005) Section 9-1 (pgs. 229-235)	<p>Impulse</p> <p>Momentum</p> <p>Impulse-momentum theorem</p> <p>Angular momentum</p> <p>Angular impulse-angular momentum theorem</p>	<p>CC.3.5.11-12.B 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.</p> <p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D Determine the meaning</p>

			<p>momentum of a rotating object is the product of its moment of inertia and its angular velocity.</p> <p>The impulse- angular momentum theorem states that the angular impulse on an object is equal to the change in the object's angular momentum.</p>			<p>of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context; relevant to grade 11-12 texts and topics.</p> <p>CC.3.5.11-12.G integrate and evaluate multiple sources of information presented in diverse formats and media (quantitative data, video, multimedia) in order to address a question or solve problems.</p> <p>CC. 3.5.11-12.I Synthesize information from a range of sources (texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept resolving conflicting information when possible.</p> <p>CC.3.6.11-12.A Write arguments focused on discipline specific content.</p> <p>CC.3.6.11-12.H Draw evidence from informational text to support analysis, reflection and research.</p> <p>3.2.P.B2 Explain the translation</p>
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							<p>and simple harmonic motion of objects using conservation of energy and conservation of momentum.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	All simple harmonic motion can be explained using force and/or torque.	In a closed system, how do conservation laws predict the behavior of an object?	<p>Conservation of momentum</p> <p>Types of collisions</p> <p>Conceptual and</p>	Students should be able to relate law of conservation of momentum to Newton's third law of motion.	Physics-Principals and Problems Glencoe (2005) Section 9-2 (pgs. 236-245)	<p>Closed system</p> <p>Isolated system</p> <p>Law of conservation of</p>	<p>CC.3.5.11-12.B Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing</p>

			<p>mathematical analysis of isolated systems involving two colliding objects</p> <p>According to Newton's law third law of motion and the law of conservation of momentum, the forces exerted by colliding objects on each other are equal in magnitude and opposite in direction.</p> <p>A closed system is one in which no objects enters or leave the system.</p> <p>An isolated system is one in which no net external force is exerted on the objects in the system.</p> <p>Momentum is conserved in a closed, isolated system.</p> <p>The law of conservation of momentum can be used to explain the propulsion of rockets.</p> <p>Vector analysis is used</p>	<p>Students should be able to recognize the conditions under which momentum is conserved.</p> <p>Students should be able to solve conservation of momentum problems.</p> <p>Students should be able to algebraically manipulate mathematical models of conservation of momentum to predict unknown variables for collisions and explosions.</p>		<p>momentum</p> <p>Law of conservation of angular momentum</p>	<p>them in simpler but still accurate terms.</p> <p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>CC.3.5.11-12.G integrate and evaluate multiple sources of information presented in diverse formats and media (quantitative data, video, multimedia) in order to address a question or solve problems.</p> <p>CC. 3.5.11-12.I Synthesize information from a range of sources (texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept resolving</p>
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			<p>to solve momentum-conservation problems in two dimensions.</p> <p>The law of conservation of angular momentum states that if there are no external torques acting on a system, then the angular momentum is conserved.</p> <p>Because angular momentum is conserved, the direction of a rotation of a spinning object can be changed by applying torque.</p>			<p>conflicting information when possible.</p> <p>CC.3.6.11-12.A Write arguments focused on discipline specific content.</p> <p>CC.3.6.11-12.H Draw evidence from informational text to support analysis, reflection and research.</p> <p>3.2.P.B2 Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p>
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							Examine the importance of accuracy and precision in making valid measurements Evaluate experimental information for relevance to science process
Review Unit 7 Momentum							
Assessment Unit 7 Momentum							
Unit 8 Energy							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
15 days	All motion can be explained using the laws of conservation of energy, the conservation of momentum, and/or the conservation of angular momentum.	In a closed system, how do the conservation laws predict the behavior of an object?	<p>When a net force is exerted on an object over a linear displacement, the product of these two quantities describes the work done.</p> <p>Work is the transfer of energy by mechanical means.</p> <p>Work is energy and has the same units as energy.</p> <p>Work done on a</p>	<p>Students should be able to describe the relationship between work and energy.</p> <p>Students should be able to calculate work.</p> <p>Students should be able to calculate the power used.</p> <p>Students should be able to identify cases in which work is done/not done.</p>	Physics-Principals and Problems Glencoe (2005) Section 10-1 (pgs. 257-265)	<p>Work</p> <p>Energy</p> <p>Kinetic energy</p> <p>Work-energy theorem</p> <p>Joule</p> <p>Power</p> <p>Watt</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p>

			<p>system is equal to the change in energy of the system.</p> <p>Work can be put into a system (positive) or can be removed from a system (negative)</p> <p>A moving object has kinetic energy</p> <p>Kinetic Energy is the energy of an object moving at a speed</p> <p>Power is the rate of doing work that is the rate in which energy is transferred.</p>				<p>3.2.P.B2 Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	All motion can be explained using the laws of	In a closed system, how do the conservation laws	Machines, whether powered by engines or humans, do not	Students should be able to demonstrate the	Physics-Principals and Problems Glencoe (2005)	Machine Effort force	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out</p>

	conservation of energy, the conservation of momentum, and/or the conservation of angular momentum.	predict the behavior of an object?	<p>change the amount of work done, but they do make the task easier.</p> <p>A machine eases the load, either by changing the magnitude or the direction of the force exerted to do the work.</p> <p>The mechanical advantage is the ratio of resistance force to effort force</p> <p>The ideal mechanical advantage is the ratio of the distances moved.</p> <p>The efficiency of a machine is the ratio to output work to input work.</p> <p>In all real machines, mechanical advantage is less than ideal mechanical advantage.</p> <p>The efficiency of a machine can be found from the real and ideal mechanical</p>	<p>usefulness of simple machines.</p> <p>Students should be able to use simple machines to determine how much work is actually done by the machine versus what is put into it.</p> <p>Students should be able to differentiate between ideal and real machines in terms of efficiency.</p> <p>Students should be able to analyze compound machines in terms of combinations of simple machines.</p>	Section 10-2 (pgs. 266-273)	<p>Resistance force</p> <p>Mechanical advantage</p> <p>Ideal mechanical advantage</p> <p>Efficiency</p> <p>Compound machines</p>	<p>experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>3.2.P.B2 Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p>
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			advantage.				<p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	<p>All motion can be explained using the laws of conservation of energy, the conservation of momentum, and/or the conservation of angular momentum.</p>	<p>In a closed system, how do the conservation laws predict the behavior of an object?</p>	<p>The kinetic energy of an object is proportional to its mass and the square of its velocity.</p> <p>The rotational kinetic energy of an object is proportional to the object's moment of inertia and the square of its angular velocity.</p> <p>When the earth is included in the system, the work done by gravity is replaced by gravitational potential energy.</p> <p>The gravitational potential energy of an object depends upon the object's weight and its distance from the earth's surface.</p>	<p>Students should be able to use models to relate work and energy.</p> <p>Students should be able to calculate kinetic energy.</p> <p>Students should be able to determine the gravitational potential energy of a system.</p> <p>Students should be able to show that gravitational potential energy can be interpreted as the work done by the Earth.</p> <p>Students should be able to predict/show how gravitational potential energy</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 11-1 (pgs. 285-292</p>	<p>Rotational kinetic energy</p> <p>Gravitational potential energy of a system</p> <p>Reference level</p> <p>Elastic potential</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>3.2.P.B2 Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p>

			<p>The reference level is the position where the gravitational potential energy is defined as zero.</p> <p>Elastic energy may be stored in an object as a result of its change in shape.</p> <p>Albert Einstein recognized that mass itself has potential energy and this energy is called rest energy.</p>	<p>can be transformed into kinetic energy or work.</p> <p>Students will be able to identify how elastic potential energy is stored.</p>			<p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	All motion can be explained using the laws of conservation of energy, the conservation of momentum, and/or the conservation of angular momentum.	In a closed system, how do the conservation laws predict the behavior of an object?	<p>The sum of kinetic and potential energy is called mechanical energy.</p> <p>If no objects enter or leaves the system, the system is considered to be a closed system.</p> <p>If there are no forces acting on a system, the system is considered to be an</p>	<p>Students should be able to solve problems using law of conservation of energy.</p> <p>Students should be able to use the laws of conservation to predict quantities that describe motion.</p> <p>Students should be</p>	Physics-Principals and Problems Glencoe (2005) Section 11-2 (pgs. 293-301)	<p>Law of conservation of energy</p> <p>Mechanical energy</p> <p>Non-mechanical energy</p> <p>Thermal energy</p> <p>Elastic collision</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used</p>

			<p>isolated system.</p> <p>The total energy of a closed system is constant.</p> <p>Within a system, energy can change form, but the total amount of energy does not change. Thus, energy is conserved.</p> <p>The type of collision in which the kinetic energy after the collision is less than the kinetic energy before the collision is called an inelastic collision.</p> <p>The type of collision in which kinetic energy before and after the collision is the same is called an elastic collision.</p> <p>Momentum is conserved in collisions if the external force is zero.</p> <p>Not only is momentum conserved in</p>	<p>able to analyze collisions to find the change in kinetic energy.</p> <p>Students should be able to use the conservation of momentum and kinetic energy to determine the final velocities of colliding objects when elastic collisions take place.</p> <p>Students should be able to use the laws of conservation of energy to predict the quantities that describe motion.</p>		<p>Inelastic collision</p>	<p>in a specific scientific or technical context; relevant to grade 11-12 texts and topics.</p> <p>3.2.P.B2 Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
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			<p>collisions, but elastic collisions are a class of collisions in which kinetic energy is conserved as well.</p> <p>The mechanical energy may be unchanged or decreased by the collisions, depending on whether the collision is elastic or inelastic.</p>				
Review Unit 8 Energy							
Assessment Unit 8 Energy							
Unit 9 Simple Harmonic Motion and Waves							
Estimated Time Frame for Units	Big Ideas	Essential Questions	Concepts (Know)	Competencies (Do)	Suggested Resources and Materials	Vocabulary	Standards
25 Days	All simple harmonic motion can be explained using force and/or torque.	How do waves transfer energy and information?	<p>Periodic motion is a motion that repeats in a regular cycle.</p> <p>Restoring forces contribute to periodic motion.</p>	<p>Students should be able to describe the force on an elastic spring.</p> <p>Students should be able to determine</p>	Physics-Principals and Problems Glencoe (2005) Section 14-1 (pgs. 375-380)	<p>Periodic motion</p> <p>Simple harmonic motion</p> <p>Period</p>	CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on

			<p>Simple harmonic motion results when the restoring force on an object is directly proportional to the objects displacement from equilibrium.</p>	<p>the energy stored in an elastic spring.</p> <p>Students should be able to compare simple harmonic motion and the motion of a pendulum.</p>		<p>Amplitude</p> <p>Hooke's law</p> <p>Pendulum</p> <p>Resonance</p>	<p>explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>3.2.P.B5 Explain how waves transfer energy without transferring matter.</p> <p>Explain how waves carry information from remote sources that can be directed and interpreted.</p> <p>Determine the causes of wave frequency, speed and wave length.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and</p>
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							<p>evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	<p>All simple harmonic motion can be explained using force and/or torque.</p>	<p>How do waves transfer energy and information?</p>	<p>Waves transfer energy without transferring matter.</p> <p>In transverse waves, the displacement of the medium is perpendicular to the direction of wave motion.</p> <p>In longitudinal waves, the displacement of the medium is parallel to the direction of wave motion.</p> <p>Frequency is the number of cycle per second.</p>	<p>Students should be able to identify how waves transfer energy without transferring matter.</p> <p>Students should be able to compare and contrast transverse and longitudinal waves.</p> <p>Students should be able to relate wave speed wavelength, and frequency.</p>	<p>Physics-Principals and Problems Glencoe (2005) Section 14-2 (pgs. 381-386)</p>	<p>Wave</p> <p>Wavelength</p> <p>Wave pulse</p> <p>Periodic wave</p> <p>Transverse wave</p> <p>Longitudinal wave</p> <p>Surface wave</p> <p>Trough</p> <p>Crest</p> <p>Frequency</p>	<p>CC.3.5.11-12.C</p> <p>Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D</p> <p>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 grade 11-12 texts and topics.</p> <p>3.2.P.B5</p> <p>Explain how waves transfer energy without transferring matter.</p> <p>Explain how waves carry information from remote sources that can</p>

							<p>be directed and interpreted.</p> <p>Determine the causes of wave frequency, speed and wave length.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	All simple harmonic motion can be explained using force and/or torque.	How do waves transfer energy and information?	When a wave crosses a boundary between two media, it is partially transmitted and partially	Students should be able to relate a wave's speed to the medium in which the wave travels.	Physics-Principals and Problems Glencoe (2005) Section 14-3 (pgs. 387-391)	Incident wave Reflective wave Principle of	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or</p>

			<p>reflected.</p> <p>The principal of superposition states that the displacement of a medium resulting from two or more waves is the algebraic sum of the displacements of the individual waves.</p> <p>Interference occurs when two or more waves move through a medium at the same time.</p> <p>Constructive interference occurs when the displacements of the two waveforms are in the same direction.</p> <p>Destructive interference occurs when the displacements of the two waveforms are in the opposite direction.</p> <p>When two-dimensional waves are reflected from boundaries, the angles of incidence</p>	<p>Students should be able to describe how waves are reflected and refracted at boundaries between media.</p> <p>Students should be able to apply the principle of superposition to the phenomenon of interference and predict interference effects.</p>		<p>superposition</p> <p>Interference</p> <p>Node</p> <p>Antinode</p> <p>Standing wave</p> <p>Wave front</p> <p>Ray</p> <p>Law of reflection</p> <p>refraction</p>	<p>performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>3.2.P.B5 Explain how waves transfer energy without transferring matter.</p> <p>Explain how waves carry information from remote sources that can be directed and interpreted.</p> <p>Determine the causes of wave frequency, speed and wave length.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p>
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			<p>and reflection are equal.</p> <p>The change in direction of waves at the boundary between two different media is called refraction.</p> <p>Standing waves are formed when the waves are reflected off of fixed or open ends of a medium interfere.</p> <p>Nodes are areas of total destructive interference.</p> <p>Antinodes are areas of total constructive interference.</p>				<p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
	All simple harmonic motion can be explained using force and/or torque.	How do waves transfer energy and information?	<p>Sound is a pressure variation transmitted through matter as a longitudinal wave.</p> <p>A sound wave has frequency, wavelength, speed, and amplitude.</p> <p>Sound waves reflect and interfere.</p> <p>The speed of sound in</p>	<p>Students should be able to demonstrate the properties that sound shares with other waves.</p> <p>Students should be able to relate the physical properties of sound waves to our perception of sound.</p>	Physics-Principals and Problems Glencoe (2005) Section 15-1 (pgs. 403-410)	<p>Sound wave</p> <p>Pitch</p> <p>Loudness</p> <p>Sound level</p> <p>Decibel</p> <p>Doppler effect</p>	<p>CC.3.5.11-12.C</p> <p>Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D</p> <p>Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used</p>

			<p>air at room temperature (20 degrees Celsius) is 343m/s.</p> <p>The speed increases approximately 0.6 m/s with each 1 degree Celsius increase in temperature.</p> <p>Sound detectors convert the energy carried into another form of energy.</p> <p>The human ear is a highly efficient and sensitive detector of sound waves.</p> <p>The frequency of a sound is heard as its pitch.</p> <p>The pressure amplitude of a sound wave can be measured in decibels.</p> <p>The loudness of sound as perceived by the ear and brain depends mainly on its amplitude.</p> <p>The Doppler effect is the change in</p>	<p>Students should be able to identify applications of the Doppler effect.</p>		<p>in a specific scientific or technical context; relevant to grade 11-12 texts and topics.</p> <p>3.2.P.B5 Explain how waves transfer energy without transferring matter.</p> <p>Explain how waves carry information from remote sources that can be directed and interpreted.</p> <p>Determine the causes of wave frequency, speed and wave length.</p> <p>3.2.P.B.7 Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid</p>
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			frequency of sound caused by the motion of either the source or the detector.				measurements Evaluate experimental information for relevance to science process
	All simple harmonic motion can be explained using force and/or torque.	How do waves transfer energy and information?	<p>Visible light can have a wavelength between 400 and 700 nm.</p> <p>Light can be described as a particle, wave, or particle-wave duality/photon.</p> <p>Light is an electromagnetic wave which can propagate through space</p> <p>Speed of light is 3.0×10^8 m/s in a vacuum.</p> <p>White light is the combination of the spectrum of colors, each color having a different wavelength.</p> <p>Combining primary colors, red, blue and green forms white light.</p> <p>Combinations of two primary colors form</p>	<p>Students should be able to describe how diffraction demonstrates that light is a wave.</p> <p>Students should be able to predict the effect of combining colors of light and mixing pigments.</p> <p>Students should be able to explain phenomena such as polarization and the Doppler effect.</p>	Physics-Principals and Problems Glencoe (2005) Section 16-2 (pgs. 439-447)	<p>Diffraction</p> <p>Primary color</p> <p>Secondary color</p> <p>Complimentary color</p> <p>Primary pigment</p> <p>Polarization</p> <p>Malus's law</p>	<p>CC.3.5.11-12.C Follow precisely a complex multi-step procedure carrying out experiments, taking measurements, or performing technical tasks; analyze the results based on explanations in the text.</p> <p>CC.3.5.11-12.D 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 grade 11-12 texts and topics.</p> <p>3.2.P.B5 Explain how waves transfer energy without transferring matter.</p> <p>Explain how waves carry information from remote sources that can be directed and interpreted.</p> <p>Determine the causes of wave frequency, speed and wave length.</p> <p>3.2.P.B.7</p>

			<p>the secondary colors, yellow, cyan, and magenta.</p> <p>The primary pigments cyan, magenta and yellow are used in combination of two to produce secondary pigments, red blue and green.</p> <p>Polarized light consists of waves oscillating in the same plane.</p> <p>When two polarizing filters are used to polarize light, the intensity of the light coming out of the last filter is dependent upon the angle between polarizing axis of the two filters.</p> <p>Light waves traveling through a vacuum can be characterized in terms of frequency, wavelength, and the speed of light.</p> <p>Light waves are Doppler shifted based upon the relative speed along the axis</p>			<p>Compare and contrast scientific theories.</p> <p>Know that both direct and indirect observations are used by scientists to study the natural world and universe.</p> <p>Identify questions and concepts that guide scientific investigations.</p> <p>Formulate and revise explanations and models using logic and evidence.</p> <p>Recognize and analyze alternative explanations and models.</p> <p>Examine the importance of accuracy and precision in making valid measurements</p> <p>Evaluate experimental information for relevance to science process</p>
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			of the observer and the source of light.				
Review Unit 9 Simple Harmonic Motion and Waves							
Assessment Unit 9 Simple Harmonic Motion and Waves							