Physics Quarter 2 Curriculum Map Curriculum Map Feedback Survey											
Quarter 1			Quarter 2			Quarter 3			Quarter 4		
Unit 1 One Dimensional Kinematics	Unit 2 Two Dimensional Kinematic	Unit 3 Forces	Unit 4 Work and Energy	Unit 5 Momentum	Unit 6 Circular Motion and Gravitation	Unit 7 Heat Energy and Thermo.	Unit 8 Electric Forces, Fields and Energy	Unit 9 Capacitors, Resistors and Circuits	Unit 10 Waves and Sound	Unit 11 Light and Light Behaviors	Unit 12 Nuclear Physics
3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 4: Work and Energy **[3 week]**			
Overarching Question(s)			
What is meant by conservation of energy? How is energy transferred between objects or systems?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 4 **Work and Energy**	**1 week**	**Essential Questions** • How do you know something has energy? • In what ways do we witness the effects of something having energy?	Work, Potential & Kinetic Energy, Conservation of Energy, Momentum Rocketry, Collisions
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**

<table>
<tr>
<td>
<u>DCI</u>

PS3: Energy

<u>Standard</u>

PHYS.PS3.3 Use the principle of energy conservation and mathematical representations to quantify the change in energy of one component of a system when the energy that flows in and out of the system and the change in energy of the other components is known.

<u>Explanation</u>

In PHYS.PS3.1 students quantify the various types of energy and consider methods for energy transfer. If a student is able to evaluate the total energy of a system, such evaluations before and after a change to a system provide a mechanism to show that energy of a system has been conserved. For example, students might use pie charts to show the distribution of the total energy. For an object about to freefall, the pie chart might be 100% gravitational potential energy. Mid-descent, the energy might be half gravitational potential energy and half kinetic energy. After colliding with the ground, the total energy may have decreased, which can be represented as heat energy lost from the pie chart.

<u>Misconceptions</u>

• Conservation of mechanical energy with the general energy conservation law.

<u>Science and Energy Practices</u>
1. Asking questions and defining problems
2. Developing and using models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in Argument from Evidence
</td>
<td>
<u>Learning Outcomes</u>

• Relate the variables of work, power, kinetic energy, and potential energy to mechanical situations and solve for these variables.
• Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
</td>
<td>
<u>Curricular Materials</u>

<u>Engage</u>

<u>Explore</u>

<u>Explain</u>

<u>Elaborate</u>

<u>Evaluate</u>

Collisions

<u>Curricular Materials</u>

HMH Physics – Work and Energy Chapter 5

Bung Jumping: Energy

https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap05/hssp0502t_stem.pdf

Graphing Calculator:
TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension:
https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/graphing_calculator/hssp0200t_graphcalc_ti84.pdf

Virtual Lab:
Work and Energy:
https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/workandmechanicalenergy/wmehomeframeset.html
</td>
</tr>
</table>

8. Obtaining, evaluating, and communicating information **<u>Cross Cutting Concepts:</u>** **Energy and Matter**		Web Resource- http://hmdscienceexplore.hmhco.com/physics/ch05/ **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Physics Quarter 2 Curriculum Map

Curriculum Map Feedback Survey

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3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 4: Work and Energy [3 **week**]

Overarching Question(s)

What is meant by conservation of energy?
How is energy transferred between objects or systems?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 4 Work and Energy	**1 week**	**Essential Questions** • What are some situations in which conservation of mechanical energy is valid? • **Learning Outcomes** • Given various examples of quantities, categorize them as scalar or vector quantities. • Given a projectile launched at an angle, select the correct equation from a list for	**Vocabulary** Work, kinetic energy, work-kinetic energy theorem, potential energy, gravitational potential energy, elastic potentials energy, spring constant, mechanical energy, power, momentum, impulse, perfectly inelastic collision, elastic collision

		calculating: the maximum height of travel, time of flight and/or the maximum horizontal distance covered. • Given a scenario where a projectile is being launched at an angle, answer the following conceptual questions.	**Curricular Materials** **HMH Physics – Work and Energy - Chapter 5-Section-3** **Conservation of Mechanical Energy Lab:** https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap05/hssp0503t_coreskilllab.pdf **Graphing Calculator:** TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/graphing_calculator/hssp0200t_graphcalc_ti84.pdf **Virtual Lab:** **Conservation of Energy:** https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/conservationofenergy/coehomeframeset.html Web Resource- http://hmdscienceexplore.hmhco.com/physics/ch05/ **Additional Resources:**

			ACT & SAT TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI PHYS.PS3: Energy **Standard** PHYS.PS3.3 Use the principle of energy conservation and mathematical representations to quantify the change in energy of one component of a system when the energy that flows in and out of the system and the change in energy of the other components is known. **Explanation** In PHYS.PS3.1 students quantify the various types of energy and consider methods for energy transfer. If a student is able to evaluate the total energy of a system, such evaluations before and after a change to a system provide a mechanism to show that energy of a system has been conserved. For example, students might use pie charts to show the distribution of the total energy. For an object about to		• How can understanding various physical properties about motion be useful in understanding everyday occurrences? • What variables can you manipulate to affect the movement of objects?	**Curricular Materials** **HMH Physics – Motion in One Dimension - Chapter 2** Acceleration Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/hssp0202t_probewarelab.pdf

freefall, the pie chart might be 100% gravitational potential energy. Mid-descent, the energy might be half gravitational potential energy and half kinetic energy. After colliding with the ground, the total energy may have decreased, which can be represented as heat energy lost from the pie chart. **Misconceptions** • Conservation of mechanical energy with the general energy conservation law. **Science and Energy Practices** Mathematical Computational Thinking **Cross Cutting Concepts** Systems and System Models		

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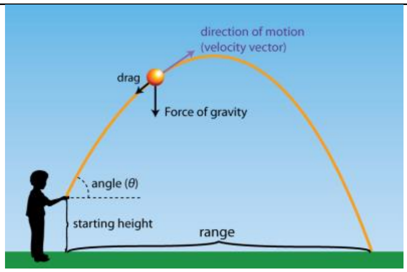
3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 4: Work and Energy [3 **weeks]**

Overarching Question(s)			
What is meant by conservation of energy? How is energy transferred between objects or systems?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 4 Work and Energy	**1 week**	**Essential Questions** • What is power, and how is it related to work and energy? • How can we calculate power in two different ways?	**Vocabulary** Work, kinetic energy, work-kinetic energy theorem, potential energy, gravitational potential energy, elastic potentials energy, spring constant, mechanical energy, power, momentum, impulse, perfectly inelastic collision, elastic collision **Curricular Materials**

			HMH Physics – Work and Energy - Chapter 5-Section-4 Graphing Calculator: TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/graphing_calculator/hssp0200t_graphcalc_ti84.pdf **Virtual Lab:** **Web Resource** http://hmdscienceexplore.hmhco.com/physics/ch05/ **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI PHYS.PS3: Energy **Standard** PHYS.PS3.6 Define power and solve problems involving the rate of energy production or consumption (P = ΔE/Δt). Explain and predict changes in power consumption based on changes in energy		**Learning Outcomes** ● Define power and give its unit. ● Give the relationship between work and power Relate the variables of work, power, kinetic energy, and potential energy to mechanical situations and solve for these variables. **Phenomenon**	**Curricular Materials** **HMH Physics – Motion in One Dimension - Chapter 2** Acceleration Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/hssp0202t_probewarelab.pdf

demand or elapsed time. Investigate power consumption and power production systems in common use. PHYS.PS3.15 Compare and contrast the process, design and performance of numerous next -generation energy sources (hydropower, wind power, solar power, geothermal power, biomass power, etc.). **Explanation** This standard pairs well with PHYS.PS3.6. Students should understand that a given task will require a certain minimum amount of energy. In accordance with the work-energy theorem, this would be described as work done on the system. Power incorporates a rate element into this discussion. An object can be lifted to an identical height by two different mechanisms. The total energy input into the system (the object and Earth's gravitational field) will be the same in either case. However, if one mechanism for lifting the object does this in a smaller amount of time, it is said to be more powerful. Students may compare two different devices that accomplish the same task, but have different power ratings and explain the impact of the different power ratings on how the devices are used. For		

example, two microwaves might both pop a bag of popcorn, but a more powerful microwave might do it faster or be more likely to burn the popcorn at recommended time settings. The physics phenomena explored throughout this course are utilized engineers in designing energy capturing systems that are not reliant on non-renewable resources. Students can research these processes and relate them to both the scientific principles underlying the various processes, as well as implications of system design and efficiency behind improvements to these processes over time. **<u>Misconceptions</u>** Often students make the mistake of thinking force is the same as work and power. Yet force is a vector quantity (meaning it includes direction), work is a scalar quality (meaning it does not include direction), and power describes the time rate of doing work. Learn more and teach your students the difference between the three with an activity in UCLA's Force, Work and Power. **<u>Science and Engineering Practice</u>**		

Obtaining, evaluating, and communicating information **<u>Cross Cutting Concepts</u>** <u>Energy and Matter</u>		

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3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 5: Momentum **[3 week]**			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Momentum	**1 week**	**<u>Essential Questions</u>**	**<u>Vocabulary</u>**

		• How can understanding various physical properties about motion be useful in understanding everyday occurrences? • how the momentum of an object can be increased or decreased? • how objects with greatly different masses can have the same momentum? • What variables can you manipulate to affect the movement of objects?	Momentum, impulse, perfectly inelastic collision, elastic collision
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**
DCI PS2: Motion and Stability: Forces and Interactions PS3: Energy **Standard** PHYS.PS3.4 Assess the validity of the law of conservation of linear momentum (p=mv) by planning and constructing a controlled scientific investigation involving two objects moving in one -dimension. **Explanation**		**Learning Outcomes** Given the mass, velocity and time it takes to stop an object in an inelastic collision, determine the momentum and impulse of the collision. Analyze and solve problems related to elastic and inelastic collisions related to change in momentum. **Phenomenon**	**Curricular Materials** **HMH Physics – Momentum and Collisions - Chapter 6- Section1** Momentum and Impulse Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/momentumandimpulse/mihomeframeset.html **Graphing Calculator:** TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/

Momentum is a useful tool when considering conservation of energy when two objects interact. Attempts to quantify all energy transformation in such a system often fail to account for energies lost due to the production of sound and heat. Collisions where energy is dissipated from the system are known as inelastic collisions. Though system energy may be lost to the surroundings, the conservation of momentum will still be observed. Thus the conservation of momentum can provide a tool to evaluate inelastic collisions. **Misconceptions** 1. Momentum is the same as force. 2. Conservation of momentum applies only to collisions.		data/chap02/graphing_calculator/hssp0200t_graphcalc_ti84.pdf **Virtual Lab:** https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/index.html Web Resource- http://hmdscienceexplore.hmhco.com/physics/ch06/ **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Physics Quarter 2 Curriculum Map Curriculum Map Feedback Survey											
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3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 5: Momentum **[1 week]**			
Overarching Question(s)			
How can one explain and predict interactions between objects and within systems of objects?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Momentum	**1 week**	<u>**Essential Questions**</u> • How impulse is influenced by changes in the acting force and the length of time the force acts?	<u>**Vocabulary**</u>

		• why an increase in the time in which a forces acts on an object to change its momentum is so important to safety? • How is momentum conserved in collisions? • Explain the law of conservation of momentum using the example of a cannon firing a cannonball.	Momentum, impulse, perfectly inelastic collision, elastic collision
Standards and Related Background Information		**Instructional Focus**	**Instructional Resources**

DCI PS3: Energy **Standard** PHYS.PS2.11 Develop and apply the impulse - momentum theorem along with scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on an object during a collision (e.g., helmet, seatbelt, parachute). **Explanation** This topic can be related to conservation of energy and work energy theorem to explore that bringing an object to rest requires a set amount of energy to be dissipated. By increasing the stopping distance of the object during the time when the force is applied, the required force is decreased since the total work done on the stopping object remains constant. Students can design systems to maximize the stopping distance and in turn decrease the force required to stop the object. Working with constraints on their designs provides students an opportunity to make design decisions in applying their scientific knowledge. **Misconceptions** • Conservation of momentum applies only to collisions. **Science and Engineering Practice** Constructing explanations and designing solutions **Cross Cutting Concepts** Scale, Proportion, and Quantity	**Learning Outcomes** • Describe the interaction between two objects in terms of change in momentum of each. • Compare the total momentum of two objects before and after they interact. • Predict the final velocities of objects after collisions **Phenomenon**	**Curricular Materials** **HMH Physics – Momentum and Collisions - Chapter 6-Section2** Conservation of Momentum Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/conservationofmomentum/cmhomeframeset.html **Graphing Calculator:** TI-83/84 Graphing Calculator Activity Guide Sheet: Motion in One Dimension: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/graphing_calculator/hssp0200t_graphcalc_ti84.pdf **Virtual Lab:** https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/index.html Web Resource- http://hmdscienceexplore.hmhco.com/physics/ch06/ **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Physics Quarter 2 Curriculum Map

[Curriculum Map Feedback Survey]

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3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 5: Momentum **[1 week]**

Overarching Question(s)

How can one explain and predict interactions between objects and within systems of objects?

Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Momentum	**1 week**	**<u>Essential Questions</u>**	**<u>Vocabulary</u>** Momentum, impulse, perfectly inelastic collision, elastic collision

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.6 Using experimental evidence and investigations, determine that Newton's second law of motion defines force as a change in momentum, F = Δp/Δt. **Explanation** Previous examinations of Newton's second law have been limited to instances with constant forces. This standard expands that discussion to include instances where the objects interact with each other. To maximize the quality of experimental investigations, magnets might be used to create situations where objects "collide" in an elastic manner. Newton's second law can be expressed as F = ma. Viewing acceleration as a change in velocity over a period of time, one arrives at F=m(Δv/Δt). Distributing mass into this equation yields F = (mV-mVo)/Δt. A final recognition that momentum (p) is a property described by an object's mass and velocity allows for substitution to produce F = Δp/Δt. **Misconceptions** Students may think that elastic materials can undergo only elastic collisions. Consider a large brass bell with a clapper. The material, brass, is very elastic. After the collision, the bell continues to vibrate and give off sound (energy!) for a long time afterwards. The collision isn't elastic even though the materials are. Inelastic materials undergo only inelastic collisions. Elastic materials may undergo either elastic or inelastic collisions.	**Learning Outcomes** • Identify different types of collisions. • Determine the changes in kinetic energy during perfectly inelastic collisions. • Compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions. • Find the final velocity of an object in perfectly inelastic and elastic collisions. • Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. **Phenomenon**	**Curricular Materials** **HMH Physics – Momentum and Collisions - Chapter 6-Section3** Collision-Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap06/hssp0603t_inquiry.pdf Newton's Second Law of Motion **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Science and Engineering Practice **Planning and carrying out investigations** **Cross Cutting Concepts** **Energy and Matter**		

Physics Quarter 2 Curriculum Map

Curriculum Map Feedback Survey

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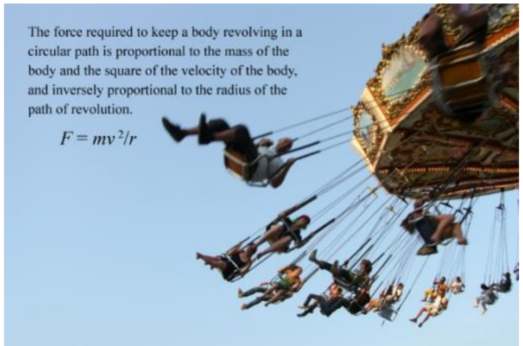
UNIT 6: Circular Motion and Gravitation **[3 week]**

Overarching Question(s)

What underlying forces explain the variety of interactions observed?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 6 Circular Motion and Gravitation	**1 week**	**Essential Questions** • What is meant by uniform circular motion? • What does the term centripetal mean? • Which one of Newton's Laws explains the motion of an object that is traveling with uniform circular motion? Why? • How can rotational motion be described in a measurable and quantitative way?	**Vocabulary** Centripetal acceleration, gravitational force, torque, lever arm

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.3 Algebraically solve problems involving arc length, angular velocity, and angular acceleration. Relate quantities to tangential magnitudes of translational motion. PHYS.PS2.14 Plan and conduct an investigation to provide evidence that a constant force perpendicular to an object's motion is required for uniform circular motion ($F = m v^2 / r$). **Explanation** Though not explicitly stated, it is beneficial to develop this standard in the same manner which PHYS.PS2.1 is used to develop PHYS.PS2.2. In doing so, students can parallel rotational properties to translational properties, e.g., arc length can be seen as the rotational equivalent to displacement in the translational world. In doing so, radians become a logical unit of measure for rotational displacement. Since neither torque, nor moment of inertia are addressed in this course, discussions can be limited to considering only kinematics and not venturing into the realm of rotational dynamics. Circular motion requires a balance of two factors: a velocity which will carry an object forward and a force perpendicular to the object's velocity. This perpendicular force will cause the object's trajectory to curve inwards in the direction of the force, while continuing to travel forward. Building on a student's understanding of projectile motion, it should be made evident that the object's velocity will not change as there is no component to the force parallel to the object's	**Learning Outcomes** • Analyze and solve problems related to rotational motion and torque • Solve problems involving centripetal acceleration. • Explain how the apparent existence of an outward force in circular motion can be explained as inertia resisting the centripetal force. **Phenomenon** 	**Curricular Materials** **Curricular Materials** **HMH Physics Circular Motion- Chapter 7** Lab-Circular Motion: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap07/hssp0700t_lab_a.pdf Virtual Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/centripetalforce/cfhomeframeset.html Web Resource: http://hmdscienceexplore.hmhco.com/physics/ch07/ **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

motion. Investigations can be performed by selecting variables which students hypothesize will have an effect on the motion of an object moving in a circular pattern. If force sensors are available, this lab can be done by measuring the centrally directed force. Without force sensors, students can perform their investigation using a loose string passing through the center of a hollow tube. A measured hanging mass on the loose end of the string can be used to determine the tension force when the uniform circular motion is achieved. Discussions should also include circular paths that may not be complete circles, such as the apex of a hill or a curve in the road. (It is essential to clearly distinguish between uniform circular motion and rotational motion.) **Misconceptions** Some students will have difficulty with terminology at this point because of the previous familiarity with the term centrifugal. It is important to emphasize the distinction between centripetal (center-seeking) and centrifugal (center-fleeing). To avoid reinforcing this misconception, avoid using the term centrifugal **Science and Engineering Practice** **Using mathematics and computational thinking** **Planning and carrying out investigations** **Cross Cutting Concepts** **Scale, Proportion, and Quantity**		

Physics Quarter 2 Curriculum Map

[Curriculum Map Feedback Survey]

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UNIT 6: Circular Motion and Gravitation **[3 week]**

Overarching Question(s)

What underlying forces explain the variety of interactions observed?

Unit, Lesson	Lesson Length	Essential Question	Vocabulary
Unit 6 Circular Motion and Gravitation	**1 week**	**Essential Questions** • What is Newton's Law of Universal Gravitation and why is it important? • What does it mean when we say that gravitation is universal? • What is a gravitational field? What does the density of field lines have to do with the strength of the field?	**Vocabulary** Centripetal acceleration, gravitational force, torque, mass

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS2.9 Use Newton's law of universal gravitation, to calculate the gravitational forces, mass, or distance separating two objects with mass, given the information about the other quantities. **Explanation** While the focus of this standard is on determining the properties of objects interacting through gravitational fields, it may prove beneficial to relate this topic to a discussion of centrally directed net forces, or centripetal forces. Discussions of Newton's universal gravitation formula is frequently used to address satellite and planetary orbits both of which operate due to a centrally directed gravitational force. **Misconceptions** Students may not understand why gravitational field strength is equal to the force divided by the mass acted upon, rather than just the gravitational force. Explain that for a given location, the strength associated with the gravitational field must be constant but that the gravitational force exerted on two different masses at the same location will differ as the masses themselves differ. Science and Engineering Practice Obtaining, evaluating, and communicating information Cross Cutting Concepts Systems and System Models	**Learning Outcomes** • Given Newton's laws of motion, analyze scenarios related to inertia, force, and action-reaction. • Given various examples of quantities, categorize them as scalar or vector quantities. **Phenomenon**	**Curricular Materials** **HMH Physics – Circular Motion- Chapter 7** Lab: Gravitational Field Strength: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap07/hssp0702t_quicklab.pdf Virtual Lab: Centripetal Force: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/nsmedia/polyhedron_virtual_labs/centripetalforce/cfhomeframeset.html Web Resource: http://hmdscienceexplore.hmhco.com/physics/ch07/ **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

Physics Quarter 2 Curriculum Map

Curriculum Map Feedback Survey

Quarter 1			Quarter 2			Quarter 3			Quarter 4		
Unit 1 One Dimensional Kinematics	Unit 2 Two Dimensional Kinematic	Unit 3 Forces	Unit 4 Work and Energy	Unit 5 Momentum	Unit 6 Circular Motion and Gravitation	Unit 7 Heat Energy and Thermo.	Unit 8 Electric Forces, Fields and Energy	Unit 9 Capacitors, Resistors and Circuits	Unit 10 Waves and Sound	Unit 11 Light and Light Behaviors	Unit 12 Nuclear Physics
3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	3 weeks	2 weeks	4 weeks	3 weeks	3 weeks	4 weeks	2 weeks

UNIT 6: Momentum **[3 week]**

Overarching Question(s)

What underlying forces explain the variety of interactions observed?

Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 6 Circular Motion and Gravitation	**1 week**	**Essential Questions** • How do you know something has energy? In what ways do we witness the effects of something having energy? • How does energy go through changes? • What limits the efficiency of a car engine?	**Vocabulary** Force, inertia, net force, equilibrium, weight, normal force, static force, kinetic friction, coefficient of friction, energy efficiency, friction, law of conservation of energy

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI PS2: Motion and Stability: Forces and Interactions **Standard** PHYS.PS3.8 Communicate scientific ideas to describe how forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space. Explain how energy is contained within the field and how the energy changes when the objects generating and interacting with the field change their relative positions. PHYS.PS3.14 Recognize and communicate information about energy efficiency and/or inefficiency of machines used in everyday life. In 6.PS3.1, students are introduced to the different types and mechanisms for storing energy. This standard should include quantification of the amount of energy stored as objects change positions within those fields. It is important that students can reconcile that objects do not store potential energy, rather that these potential energies are stored within the fields. Changing position within the field results in a change in potential energy as work	**Learning Outcomes** • Distinguish between torque and force. • Calculate the magnitude of a torque on an object. • Calculate the mechanical advantage of a simple machine. **Phenomenon**	**Curricular Materials** **HMH Physics Circular Motion- Chapter 7** Lab Machines and Efficiency: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap07/hssp0704t_coreskilllab.pdf **Additional Resources:** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy

is done either by the field (the potential energy decreases) or on the field (the potential energy increases). An understanding of conservation of energy should lead to conversations about the efficiency of a device. A well designed device should utilize as much of the available energy as possible for the desired task. Other energy will be converted to forms, such as heat and noise, which may not be immediately useful based on the intended use for the device. **Misconceptions** 1. Many students may think that any force acting on an object may cause it to rotate. 2. Reinforce the idea that machines do not create something from nothing. If friction is disregarded, machines use the same amount of energy to achieve the goal **Science and Engineering Practice** **Engaging in argument from evidence** **Cross Cutting Concepts** **Energy and Matter**		

Curriculum and Instruction- Science			
RESOURCE TOOLKIT			
Quarter 2 **Physics**			
Textbook Resources	**DCIs and Standards** **DCI** **Standard**	**Videos** Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The Teaching Channel Teachertube.com Acceleration Lab: https://my.hrw.com/content/hmof/science/hss2017/tn/gr9-12/hmd_phy_9781328833716_/teacher/tabpages/teacher/data/chap02/hssp0202t_probewarelab.pdf	**ACT & SAT** TN ACT Information & Resources ACT College & Career Readiness Mathematics Standards SAT Connections SAT Practice from Khan Academy