Accelerated Freshman Physics Curriculum Map 2020

updated 8/12/2020

	Pacing Guide	
Unit	**Topics**	**Time Frame**
Describing Motion (Kinematics)	❑ Describing Motion with Words ❑ Describing Motion with Diagrams ❑ Position vs. Time Graphs ❑ Velocity vs. Time Graphs ❑ Free-Fall and Acceleration due to Gravity ❑ Describing Motion with Equations	8 weeks
Newton's Laws	❑ Newton's First Law ❑ Force and its Representation ❑ Newton's Second Law ❑ Newton's Third Law	8 weeks
Work and Energy	❑ Basic Terminology and Concepts ❑ The Work-Energy Relationship	6 weeks
Momentum	❑ The Impulse-Momentum Change Theorem ❑ The Law of Momentum Conservation	5 weeks
UCM	❑ Motion Characteristics for Circular Motion ❑ Applications of Circular Motion	5 weeks
Waves	❑ Vibrations ❑ The Nature of a Wave ❑ Properties of a Wave ❑ Behavior of Waves ❑ Standing Waves	5 weeks

Accelerated Freshman Physics Curriculum Map 2020

updated 8/12/2020

QUICK GUIDE: Standards for Learning; Sample Questions for Lesson Planning

Unit 1 Summary: Describing Motion

Kinematics is a branch of physics that describes ***how*** objects move. How something moves can be expressed as words, measurements, diagrams, equations, and/or graphs. These descriptions can be scalar (size only) or vector (size and direction) in nature. In this unit, students will learn the major kinematics terms (distance, displacement, speed, velocity, and acceleration) and how they are used to describe the motion of an object. This unit will emphasize the importance of using motion diagrams, graphical analysis, and equations to describe and predict the motion of an object. Students will use a combination of student inquiry, data collection, simulation work, and video analysis to strengthen their conceptual understanding of these terms as they pertain to motion.

This unit will be broken into six major topics with varying numbers of subtopics. Each lesson will be supplemented with various activities and labs that will be selected by the individual instructor. The suggested number of days for each lesson is indicated in parentheses.

1. Describing Motion with Words
2. Describing Motion with Diagrams
3. Describing Motion with Position-Time Graphs
4. Describing Motion with Velocity-Time Graphs
5. Free Fall and Acceleration Due to Gravity
6. Describing Motion with Equations

Essential Questions:

How do scalar measurements differ from vector measurements?
Which aspects of an object's motion can be described using a motion diagram?
Which aspects of an object's motion can be described using a position-time graph?
Which aspects of an object's motion can be described using a velocity-time graph?
How are kinematics equations and graphs used to describe an object's motion in free-fall?

Evidence of Learning:

Summative/Performance Assessments (Tests/Projects = 40%)

- Kinematics: Terms and Diagrams
- Kinematics: Graphical Analysis
- Kinematics: Freefall and Mathematical Analysis

Quizzes (20%)

Labs (30%)

Lab work will involve data collection using traditional data collection methods, sensor collection, video analysis, and/or simulation based material. While many sample labs will be listed here, only those denoted with a ⋆ will be required.

- Studying Motion with Toy Cars Lab⋆
- Graph Matching Lab⋆

Back to top

- Video Analysis of Motion Lab (Pivot or LoggerPro Analysis)
- Free Fall Lab⭐
- Falling with Air Resistance Lab
- Modelling Motion with Desmos Lab

Practice (Homework/Classwork = 10%)

Classwork will involve questioning techniques utilizing a variety of strategies. Student learning will be monitored using responder systems, whiteboard responses, and student polling. The usage of Concept Builders will be used for students and instructors to gauge student performance on conceptual tasks. Students will be provided with a unit packet, which will be modified over time to help work with conceptual examples. Other materials that can be used include, but are not limited to:

- Pivot Interactives
- Desmos Graphing Activities
- Physics Interactives
- Physics Aviary Tasks

Formative Assessments:

Student progress will be assessed on a daily basis through ***Objective Checkpoint*** questions embedded in the lesson presentations. Concept Builders will be used at the conclusion of lessons (as homework or classwork) to check for individual student mastery. Small quizzes should be administered after every lesson or couple of lessons.

Resources

Content and structure of this course is based on the material as presented by The Physics Classroom.

Science Recommended Accommodations & Modifications for Curriculum Implementation

Accommodations and Modifications

STANDARDS for Learning Targets			
NGSS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS8)**
HS-PS2-1: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration	RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.	Mathematics - MP.2: Reason abstractly and quantitatively.	CTE- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
	RST.11-12.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video,	MP.4: Model with mathematics.	9.3.ST-ET.2 Display and communicate STEM information

Back to top

	multimedia) in order to address a question or solve a problem.		
	WHST.11-12.9: Draw evidence from informational texts to support analysis, reflection, and research.	HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Technology- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.	8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
		HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	
		HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context.	
		HSA.SSE.B.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	
		HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems.	
		HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	
		HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	
		HSF-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Sample Measurable Objectives for Lesson Planning
Determine whether a mathematically described quantity is scalar or vector
Determine the distance traveled and displacement of an object
Determine the average speed and/or velocity of a moving object for a given time interval
Determine whether an object is accelerating
Determine the size and direction of an object's acceleration from motion data
Construct a diagram to accurately depict motion
Use a motion diagram to describe how an object is moving (direction, type, and relative size)
Use a vector diagram to determine whether an object is accelerating
Use a vector diagram to determine the direction of an object's acceleration
Determine the direction of an object's motion from a position-time graph
Determine whether an object is at rest, constant velocity, or accelerating from a position-time graph
Calculate the velocity of a moving object from a position-time graph
Determine the direction of an object's motion from a velocity-time graph
Determine whether an object is at rest, constant velocity, or accelerating from a velocity-time graph
Calculate the acceleration of a moving object from a velocity-time graph
Determine the displacement of a moving object from a velocity-time graph
Describe the characteristics of a true free-falling object
Describe the acceleration due to gravity
Describe the motion of free-falling objects using position-time and velocity-time graphs
Determine the displacement and speed of a free-falling object based on the time it has been falling
Explain that mass does not play a role in free fall
Describe the effects of air resistance on free-falling objects
Describe the motion of objects using equations
Solve kinematics problems using appropriate equations
Apply kinematics equations to objects in free fall

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Unit 2 Summary: Newton's Laws

Newton's Laws describe ***why*** an object is moving in a particular way. In this unit, students will learn the concept of force as a push or a pull and the major types of forces. This unit will examine in full detail each of Newton's Three laws of motion. These laws are commonly misunderstood and often lead to faulty conclusions in explaining the behavior (i.e. forces sustain motion) of an object or a system of objects. In order to fully understand why an object moves the way it does, students will learn how to select an object of interest, identify all external forces acting on that object, and construct a force diagram to represent the interactions that will lead to the changes in motion of the object. By the conclusion of this unit, students will be expected to be able to make qualitative and quantitative predictions about how an object will move as it interacts with its surroundings. Students will use a combination of student inquiry, data collection, simulation work, and video analysis in order to observe each of Newton's Laws in action in order to correct previous misconceptions and to learn how to use mechanics as a problem solving tool when studying advanced situations.

This unit will be broken into four major topics with varying numbers of subtopics. Each lesson will be supplemented with various activities and labs that will be selected by the individual instructor. The number of days for each lesson is indicated in parentheses.

1. Newton's First Law of Motion
2. Force and its Representation
3. Newton's Second Law of Motion
4. Newton's Third Law of Motion

Essential Questions:

How does inertia relate to an object's motion?
What is a force and how can it be represented in a diagram?
Which aspects of an object's motion are related to force?
How does Newton's laws explain the principles of force and motion?

Evidence of Learning:

Summative/Performance Assessments (Tests/Projects = 40%)

- Newton's Laws: Inertia and Force Representations
- Newton's Laws: Second and Third Law

Quizzes (20%)

Labs (30%)

Lab work will involve data collection using traditional data collection methods, sensor collection, video analysis, and/or simulation based material. While many sample labs will be listed here, only those denoted with a ⋆ will be required.

- Basic Forces Lab
- Newton's Second Law Lab⋆
- Newton's Third Law Lab⋆

Practice (Homework/Classwork = 10%)

Classwork will involve questioning techniques utilizing a variety of strategies. Student learning will be monitored using responder systems, whiteboard responses, and student polling. The usage of Concept Builders will be used for students and instructors to gauge student performance on conceptual tasks. Students will be provided with a unit packet, which will be modified over time to help work with conceptual examples. Other materials that can be used

Back to top

include, but are not limited to:

- Pivot Interactives
- Desmos Graphing Activities
- Physics Interactives
- Physics Aviary Tasks

Formative Assessments:
Student progress will be assessed on a daily basis through ***Objective Checkpoint*** questions embedded in the lesson presentations. Concept Builders will be used at the conclusion of lessons (as homework or classwork) to check for individual student mastery. Small quizzes should be administered after every lesson or couple of lessons.

Resources

Content and structure of this course is based on the material as presented by The Physics Classroom.

Science Recommended Accommodations & Modifications for Curriculum Implementation

Accommodations and Modifications Document

STANDARDS for Learning Targets			
NGSS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS8)**
HS-PS2-1: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration	RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.	Mathematics - MP.2: Reason abstractly and quantitatively.	CTE- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
	RST.11-12.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.	MP.4: Model with mathematics.	9.3.ST-ET.2 Display and communicate STEM information
	WHST.11-12.9: Draw evidence from informational texts to support analysis, reflection, and research.	HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Technology- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.

Back to top

Accelerated Freshman Physics Curriculum Map 2020

	HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.	8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
	HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	
	HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context.	
	HSA.SSE.B.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	
	HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems.	
	HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	
	HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	
	HSF-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	

Sample Measurable Objectives for Lesson Planning
Predict the future motion of an object when provided with or without an unbalanced force
Use the concept of inertia to predict the motion of a light object compared to a heavy object
Predict whether an object will accelerate when provided with forces that are applied to it
List the individual forces acting on an object from a written description of the object's motion
Construct a free-body diagram for an object from a written description of the object's motion
Use a force diagram to determine the net force acting on an object

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Use Newton's Second Law to calculate the acceleration of an object, given the object's mass and size of the net force
Calculate an object's acceleration when multiple forces are acting upon it
Calculate individual forces acting on an object when provided with the object's mass and kinematic data
Calculate the acceleration of objects that fall in the air and compare them to objects that fall freely
Calculate the acceleration and/or individual forces acting on an object when multiple objects interact with each other
Describe Newton's Third Law of Motion
Identify action-reaction force pairs in an interaction between a group of objects

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Unit 3 Summary: Work and Energy

In this unit, students will learn the concepts of work, mechanical energy, and power. Students will learn the different types of mechanical energy and to differentiate between open and closed systems. This unit will focus on students analyzing situations and determining if work was done and how energy was transferred. Students will use a combination of student inquiry, data collection, simulation work, and video analysis to strengthen their conceptual understanding of work and energy.

This unit will be broken into four major topics with varying numbers of subtopics. Each lesson will be supplemented with various activities and labs that will be selected by the individual instructor. The number of days for each lesson is indicated in parentheses.

1. Basic Terminology and Concepts
2. The Work-Energy Relationship

Essential Questions:

When is work done on an object?
How are work and power related?
What are the major forms of energy?
What factors influence the potential and kinetic energy of an object?
How is energy conserved when changing from one form to another?

Evidence of Learning:

Summative/Performance Assessments (Tests/Projects = 40%)

- Work and Energy

Quizzes (20%)

Labs (30%)

Lab work will involve data collection using traditional data collection methods, sensor collection, video analysis, and/or simulation based material. While many sample labs will be listed here, only those denoted with a ⋆ will be required.

- Work and Energy Video Analysis
- Conservation of Mechanical Energy
- Power Lab

Practice (Homework/Classwork = 10%)

Classwork will involve questioning techniques utilizing a variety of strategies. Student learning will be monitored using responder systems, whiteboard responses, and student polling. The usage of Concept Builders will be used for students and instructors to gauge student performance on conceptual tasks. Students will be provided with a unit packet, which will be modified over time to help work with conceptual examples. Other materials that can be used include, but are not limited to:

- Pivot Interactives
- Desmos Graphing Activities
- Physics Interactives
- Physics Aviary Tasks

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Formative Assessments:
Student progress will be assessed on a daily basis through ***Objective Checkpoint*** questions embedded in the lesson presentations. Concept Builders will be used at the conclusion of lessons (as homework or classwork) to check for individual student mastery. Small quizzes should be administered after every lesson or couple of lessons.

Resources

Content and structure of this course is based on the material as presented by The Physics Classroom.

Science Recommended Accommodations & Modifications for Curriculum Implementation

Accommodations and Modifications Document

STANDARDS for Learning Targets			
NGSS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS8)**
HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest	Mathematics- MP.2: Reason abstractly and quantitatively.	CTE- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
HS-PS3-2: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).	WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation	MP.4: Model with mathematics.	9.3.ST-ET.2 Display and communicate STEM information
		HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Technology- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.	8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
		HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Sample Measurable Objectives for Lesson Planning
Describe work in terms of force and displacement
Calculate work done in given situations
Describe potential energy as energy stored due to position
Differentiate between gravitational potential energy and elastic potential energy
Calculate an object's potential energy
Describe kinetic energy as energy due to an object's motion
Calculate an object's kinetic energy
Describe mechanical energy as the energy acquired when work is done on the object
Describe power as the rate at which work is done
Characterize forces as internal or external based on their ability to do work
Determine the change in mechanical energy of a system experiencing external forces
Determine the change in position and/or velocity of an object that is experiencing only internal (conservative) forces

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Unit 4 Summary: Momentum

In this unit, students will learn the concepts of impulse and momentum. Students will study interactions between objects when momentum changes and when momentum is conserved. Students will apply Newton's Laws to collisions and apply impulse and momentum concepts to real world situations. Students will use a combination of student inquiry, data collection, simulation work, and video analysis to strengthen their conceptual understanding of momentum and impulse.

This unit will be broken into four major topics with varying numbers of subtopics. Each lesson will be supplemented with various activities and labs that will be selected by the individual instructor. The number of days for each lesson is indicated in parentheses.

1. The Impulse-Momentum Change Theorem
2. The Law of Momentum Conservation

Essential Questions:

What is momentum?
How can the momentum of an object be changed?
How does momentum change during collisions?
Does the law of conservation of momentum apply to explosions?
How can impulse and momentum be applied to everyday situations?

Evidence of Learning:

Summative/Performance Assessments (Tests/Projects = 40%)

- Momentum

Quizzes (20%)

Labs (30%)

Lab work will involve data collection using traditional data collection methods, sensor collection, video analysis, and/or simulation based material. While many sample labs will be listed here, only those denoted with a ⋆ will be required.

- Verifying Impulse-Momentum Theorem
- Conservation of Momentum

Practice (Homework/Classwork =10%)

Classwork will involve questioning techniques utilizing a variety of strategies. Student learning will be monitored using responder systems, whiteboard responses, and student polling. The usage of Concept Builders will be used for students and instructors to gauge student performance on conceptual tasks. Students will be provided with a unit packet, which will be modified over time to help work with conceptual examples. Other materials that can be used include, but are not limited to:

- Pivot Interactives
- Desmos Graphing Activities
- Physics Interactives
- Physics Aviary Tasks

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Formative Assessments:
Student progress will be assessed on a daily basis through ***Objective Checkpoint*** questions embedded in the lesson presentations. Concept Builders will be used at the conclusion of lessons (as homework or classwork) to check for individual student mastery. Small quizzes should be administered after every lesson or couple of lessons.

Resources

Content and structure of this course is based on the material as presented by The Physics Classroom.

Science Recommended Accommodations & Modifications for Curriculum Implementation

Accommodations and Modifications Document

STANDARDS for Learning Targets			
NGSS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS8)**
HS-PS2-2: Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.	WHST.11-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	Mathematics - MP.2: Reason abstractly and quantitatively.	CTE- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
HS-PS2-3: Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.		MP.4: Model with mathematics.	9.3.ST-ET.2 Display and communicate STEM information
		HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Technology- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.	8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
		HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	
		HSA.CED.A.1: Create equations and	

Back to top

	inequalities in one variable and use them to solve problems.
	HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
	HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Sample Measurable Objectives for Lesson Planning
Describe momentum as how difficult it is to bring an object to rest or “mass in motion”
Calculate the momentum of an object
Describe impulse in terms of momentum change and force
Solve for missing variables using the impulse-momentum equation
Apply impulse-momentum theorem to real world situations
Apply Newton’s Laws to collisions
Explain that the total momentum of a closed system remains constant
Calculate for missing variables using a momentum table
Identify if a system is isolated
Solve problems involving conservation of momentum
Describe qualitatively the expected result of an interaction using momentum conservation

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Unit 5 Summary: Uniform Circular Motion

In this unit, students will learn that the same concepts and principles that are used to describe linear motion can be used to describe the motion of an object moving in a circular path. In this unit, students will learn the major circular motion terms and how they are used to describe the motion of an object in a circular path. Students will use a combination of student inquiry, data collection, simulation work, and video analysis to strengthen their conceptual understanding of circular motion.

This unit will be broken into four major topics with varying numbers of subtopics. Each lesson will be supplemented with various activities and labs that will be selected by the individual instructor. The number of days for each lesson is indicated in parentheses.

1. Motion Characteristics for Circular Motion
2. Applications of Circular Motion

Essential Questions:

What are the properties of an object moving in a circular path?
How is uniform circular motion described?
What force causes an object to move in a circular path?
What factors affect centripetal force?

Evidence of Learning:

Summative/Performance Assessments (Tests/Projects = 40%)

- UCM Unit Test

Quizzes (20%)

Labs (30%)

Lab work will involve data collection using traditional data collection methods, sensor collection, video analysis, and/or simulation based material. While many sample labs will be listed here, only those denoted with a ⋆ will be required.

- Centripetal Force Lab

Practice (Homework/Classwork = 10%)

Classwork will involve questioning techniques utilizing a variety of strategies. Student learning will be monitored using responder systems, whiteboard responses, and student polling. The usage of Concept Builders will be used for students and instructors to gauge student performance on conceptual tasks. Students will be provided with a unit packet, which will be modified over time to help work with conceptual examples. Other materials that can be used include, but are not limited to:

- Pivot Interactives
- Desmos Graphing Activities
- Physics Interactives
- Physics Aviary Tasks

Formative Assessments:

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Student progress will be assessed on a daily basis through ***Objective Checkpoint*** questions embedded in the lesson presentations. Concept Builders will be used at the conclusion of lessons (as homework or classwork) to check for individual student mastery. Small quizzes should be administered after every lesson or couple of lessons.

Resources

Content and structure of this course is based on the material as presented by The Physics Classroom.

Science Recommended Accommodations & Modifications for Curriculum Implementation

Accommodations and Modifications Document

STANDARDS for Learning Targets			
NGSS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS8)**
HS-PS2-1: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration	RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.	Mathematics - MP.2: Reason abstractly and quantitatively.	CTE- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
	RST.11-12.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.	MP.4: Model with mathematics.	9.3.ST-ET.2 Display and communicate STEM information
	WHST.11-12.9: Draw evidence from informational texts to support analysis, reflection, and research.	HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Technology- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.	8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
		HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	
		HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context.	
		HSA.SSE.B.3: Choose and produce an	

Back to top

	equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
	HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems.
	HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
	HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
	HSF-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by in hand in simple cases and using technology for more complicated cases.

Sample Measurable Objectives for Lesson Planning
Describe the speed and velocity of an object moving in a uniform circular path
Explain why object moving in a circular path is always accelerating
Explain the presence of a centripetal force using Newton's Laws of motion
Determine if a force will cause an object's speed to change
Apply the law of inertia to disprove the presence of a "centrifugal force"
Solve for the speed, acceleration, and centripetal force of an object moving in a circular path
Use a free-body diagram to determine the centripetal force, acceleration and individual forces acting on an object
Analyze the forces acting on a rider at different positions on a roller coaster
Use force concepts to explain the feelings of weightlessness and heaviness during a roller coaster ride
Apply circular motion concepts to athletics

Back to top

Accelerated Freshman Physics Curriculum Map 2020

Unit 6 Summary: Waves

In this unit, students will learn the properties of oscillating objects. Students will study the behavior of pendulums, springs, and waves. In this unit students will learn major terms associated with oscillatory motion (restoring force, amplitude, wavelength, frequency, and period) and use those terms to describe the motion of oscillating objects. Students will use a combination of student inquiry, data collection, simulation work, and video analysis to strengthen their conceptual understanding of these terms as they pertain to waves.

This unit will be broken into four major topics with varying numbers of subtopics. Each lesson will be supplemented with various activities and labs that will be selected by the individual instructor. The number of days for each lesson is indicated in parentheses.

1. Vibrations
2. The Nature of a Wave
3. Properties of a Wave
4. Behavior of Waves

Essential Questions:

What are the properties of an object in vibrational motion?
How do force and energy apply to vibrational motion?
What factors affect the period of a vibrating object?
What are the defining characteristics of wave motion?
What are the properties of waves?
How do waves interact with each other?

Evidence of Learning:

Summative/Performance Assessments (Tests/Projects = 40%)

- Waves: Vibrations and Wave Basics
- Waves: Behavior of Waves

Quizzes (20%)

Labs (30%)

Lab work will involve data collection using traditional data collection methods, sensor collection, video analysis, and/or simulation based material. While many sample labs will be listed here, only those denoted with a ⋆ will be required.

- Pendulum Lab
- Hooke's Law Lab

Practice (Homework/Classwork = 10%)

Classwork will involve questioning techniques utilizing a variety of strategies. Student learning will be monitored using responder systems, whiteboard responses, and student polling. The usage of Concept Builders will be used for students and instructors to gauge student performance on conceptual tasks. Students will be provided with a unit packet, which will be modified over time to help work with conceptual examples. Other materials that can be used

Back to top

include, but are not limited to:

- Pivot Interactives
- Desmos Graphing Activities
- Physics Interactives
- Physics Aviary Tasks

Formative Assessments:
Student progress will be assessed on a daily basis through ***Objective Checkpoint*** questions embedded in the lesson presentations. Concept Builders will be used at the conclusion of lessons (as homework or classwork) to check for individual student mastery. Small quizzes should be administered after every lesson or couple of lessons.

Resources

Content and structure of this course is based on the material as presented by The Physics Classroom.

Science Recommended Accommodations & Modifications for Curriculum Implementation

Accommodations and Modifications Document

STANDARDS for Learning Targets			
NGSS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS8)**
HS-PS4-1.: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	RST.11-12.7:Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.	Mathematics - MP.2: Reason abstractly and quantitatively. .	CTE- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
		MP.4: Model with mathematics	9.3.ST-ET.2 Display and communicate STEM information
		HSA-SSE.A.1: Interpret expressions that represent a quantity in terms of its context.	Technology- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		HSA-SSE.B.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
		HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving	

Back to top

equations.

Sample Measurable Objectives for Lesson Planning
Describe vibrational motion in terms of restoring force and equilibrium position
Determine the period, frequency, and amplitude of a vibrating object
Describe the restoring force acting on a pendulum
Describe the energy changes that occur throughout the motion of a pendulum
Identify the factors that affect the period of a pendulum
Describe the restoring force acting on a mass on a spring
Describe the energy changes that occur throughout the motion of a mass on a spring
Identify the factors that affect the period of a mass on a spring
Describe a wave as a disturbance that transfers energy
Categorize waves as longitudinal or transverse
Identify the parts of transverse and longitudinal waves
Define period and frequency
Calculate period and frequency
Relate the amplitude of a wave to the energy it carries
Identify the variables that affect the speed of a wave
Describe the speed of a wave in terms of period, frequency, and wavelength
Calculate the speed of a wave using the wave equation
Describe the behavior of a wave when it encounters a boundary
Define and describe reflection, refraction, and diffraction of waves

Back to top