

PHYSICS, SEMESTER A

COURSE OVERVIEW AND GOALS

Physics offers a curriculum that emphasizes students' understanding of fundamental physics concepts while helping them acquire tools to be conversant in a society highly influenced by science and technology.

The course provides students with opportunities to learn and practice critical scientific skills within the context of relevant scientific questions. Topics include the nature of science, math for physics, energy, kinematics, force and motion, momentum, gravitation, chemistry for physics, thermodynamics, electricity, magnetism, waves, nuclear physics, quantum physics, and cosmology.

Scientific inquiry skills are embedded in the direct instruction, wherein students learn to ask scientific questions, form and test hypotheses, and use logic and evidence to draw conclusions about the concepts. Lab activities reinforce critical thinking, writing, and communication skills and help students develop a deeper understanding of the nature of science.

Throughout this course, students are given an opportunity to understand how physics concepts are applied in technology and engineering. Journal and practice activities provide additional opportunities for students to apply learned concepts and practice their writing skills.

This course is built to state standards and informed by the American Association for the Advancement of Science (AAAS) Project 2061 benchmarks and the National Science Education Standards.

By the end of this course, you will be able to do the following:

- ❖ Analyze a range of phenomena that involve motion, from free-falling objects to the orbits of planets, drawing upon an essential knowledge of energy and force.
- ❖ Apply common equations in physics to solve practical problems, such as the effects of friction on moving objects.
- ❖ Evaluate the scientific method as it is applied in physics, asking questions, anticipating common problems, and coming to sound conclusions.

[Lab materials needed for this course](#)

COURSE COMPONENTS AND GRADING RUBRIC

The table gives a breakdown of the weight for each component in the course. Weight represents the percentage of the total score coming from each activity.

Course Components	Count	Weight
Pretest. <i>A pretest is an optional assessment, typically designed for credit recovery. If a student shows mastery of a lesson objective, the student may be automatically exempted from the upcoming activities associated with the mastered objective. Each passing pretest grade is entered into the gradebook.</i>	5	0%
Practice. <i>A practice activity provides instruction similar to that found in a study so that students can practice or review skills necessary to complete their assignment with mastery.</i>	5	5%
Discussion. <i>A discussion activity is an opportunity for students to collaborate with their peers. This activity gives students the opportunity to practice speaking and listening in a clear and logical manner and to receive feedback from peers.</i>	5	5%
Journal. <i>A journal is a short reflective writing exercise that encourages students to connect historical events and ideas to their own lives and circumstances.</i>	5	5%
Lab. <i>A lab is a hands-on investigatory activity that can be completed in a couple of class periods. It can include virtual labs, modeling exercises, and engineering design activities.</i>	5	15%
Mastery Test. <i>A mastery test is a computer-scored lesson-level summative assessment.</i>	35	30%
Posttest. <i>A posttest appears at the end of each unit.</i>	5	15%
End-Of-Semester Test. <i>An end-of-semester test (EOS) appears at the end of each course.</i>	1	5%
Teacher-Graded Posttest. <i>A posttest that prompts students for written responses appears at the end of each unit.</i>	5	15%
Teacher-Graded End-Of-Semester Test. <i>An end-of-semester test (EOS) that prompts students for written responses appears at the end of each course.</i>	1	5%
Total	72	100%

*Teachers may manually adjust these weights if desired, per district grading requirements.

UNIT 1: INTRODUCTION TO PHYSICS

In this unit, you will define the scientific method and apply mathematical principles to solve problems related to motion and physics in general.

Lesson and Duration	Activities	Objectives
The Process of Science 2 hours, 55 minutes	<i>Overview: The Process of Science</i> <i>Study: The Nature of Physics</i> <i>Mastery Test: The Nature of Physics</i> <i>Study: Scientific Methods</i> <i>Mastery Test: Scientific Methods</i> <i>Journal: Pseudoscience Around You</i>	- Identify what is and is not science. - Define the basics of the study of physics. - Differentiate between scientific and nonscientific questions. - Summarize the role of physics in society. - Identify careers based in physics. - Distinguish between hypotheses, theories, laws, and observations.
Math in Physics 3 hours, 20 minutes	<i>Overview: Math in Physics</i> <i>Study: Algebra in Physics</i> <i>Mastery Test: Algebra in Physics</i> <i>Study: Units and Measurement</i> <i>Mastery Test: Units and Measurement</i> <i>Study: Graphing</i> <i>Mastery Test: Graphing</i>	- Apply the correct number of significant figures. - Identify what can cause measurement error. - Convert between units. - Determine the best type of graph for a set of data. - Determine the slope of a line. - Interpolate and extrapolate data on a linear graph. - Determine the area under a curve.
Math for Motion 4 hours, 50 minutes	<i>Overview: Math for Motion</i> <i>Study: Introduction to Vectors</i> <i>Mastery Test: Introduction to Vectors</i>	- Distinguish between scalar and vector quantities. - Apply and analyze vectors graphically. - Add vector quantities.

Lesson and Duration	Activities	Objectives
	<i>Study: Vector Operations</i> <i>Mastery Test: Vector Operations</i> <i>Study: Trigonometry</i> <i>Mastery Test: Trigonometry</i> <i>Practice: Introduction to Physics</i>	- Resolve vectors into their components. - Apply trigonometry to basic problems involving angles.
Doing Science: Introduction to Physics 3 hours	<i>Overview: Doing Science: Introduction to Physics</i> <i>Study: Physics and the World</i> <i>Mastery Test: Physics and the World</i> <i>Lab: Measuring and Estimating</i> <i>Discussion: Measuring and Estimating Lab</i>	- Complete the lab titled “Measuring and Estimating.” - Discuss lab results with your peers online.
Wrap-Up: Introduction to Physics 2 hours, 30 minutes	<i>Review: Introduction to Physics</i> <i>Posttest: Introduction to Physics</i> <i>Teacher-Graded Posttest: Introduction to Physics</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 2: ENERGY

In this unit, you will differentiate among types of energy and apply calculations to solve practical problems related to energy.

Lesson and Duration	Activities	Objectives
Energy and Forces 2 hours, 15 minutes	<i>Overview: Energy and Forces</i> <i>Study: Types of Energy</i> <i>Mastery Test: Types of Energy</i> <i>Study: Forces</i> <i>Mastery Test: Forces</i>	- Differentiate among different types of energy. - Compare the four fundamental forces. - Identify everyday forces. - Determine how the strengths of the fundamental forces vary with distance.
Conservation of Energy 2 hours, 55 minutes	<i>Overview: Conservation of Energy</i> <i>Study: Calculating Energy</i> <i>Mastery Test: Calculating Energy</i> <i>Study: Conservation of Energy</i> <i>Mastery Test: Conservation of Energy</i> <i>Journal: Energy and You</i>	- Calculate the kinetic energy of a moving object. - Calculate the gravitational potential energy of a system. - Examine transformations of energy in simple and complex systems. - Perform calculations that illustrate the law of conservation of energy. - Diagram energy transfers.
Useful Energy 4 hours, 50 minutes	<i>Overview: Useful Energy</i> <i>Study: Work and Power</i> <i>Mastery Test: Work and Power</i> <i>Study: Machines and Efficiency</i> <i>Mastery Test: Machines and Efficiency</i> <i>Study: Energy and Sustainability</i> <i>Mastery Test: Energy and Sustainability</i>	- Differentiate between work, power, and energy. - Calculate the work done and power produced in simple systems. - Identify various types of simple machines. - Determine the mechanical advantage of various simple machines.

Lesson and Duration	Activities	Objectives
	<i>Practice: Energy</i>	- Compare the advantages and disadvantages of various energy sources. - Determine the energy use and efficiency of various household electronics.
Doing Science: Energy 3 hours	<i>Overview: Doing Science: Energy</i> <i>Study: Physics Experiments</i> <i>Mastery Test: Physics Experiments</i> <i>Lab: Conservation of Energy</i> <i>Discussion: Conservation of Energy Lab</i>	- Complete the lab titled "Conservation of Energy." - Discuss your lab results with your peers online.
Wrap-Up: Energy 2 hours, 30 minutes	<i>Review: Energy</i> <i>Posttest: Energy</i> <i>Teacher-Graded Posttest: Energy</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 3: KINEMATICS

In this unit, you will analyze data related to velocity, acceleration, motion, and other concepts that fall under the scope of kinematics.

Lesson and Duration	Activities	Objectives
Displacement, Velocity, and Acceleration	<i>Overview: Displacement, Velocity, and Acceleration</i> <i>Study: Displacement and Velocity</i> <i>Mastery Test: Displacement and Velocity</i>	- Perform calculations involving distance, speed, displacement, time, and velocity. - Create and interpret graphs representing motion versus time.

Lesson and Duration	Activities	Objectives
4 hours	<i>Study: Acceleration</i> <i>Mastery Test: Acceleration</i> <i>Study: Free Fall</i> <i>Mastery Test: Free Fall</i> <i>Journal: Vectors and Motion</i>	- Perform calculations involving the acceleration of an object. - Relate acceleration to velocity, displacement, and time. - Perform calculations that relate the force of gravity to time, distance, velocity, and maximum height of an object.
Nonlinear Motion 4 hours, 50 minutes	<i>Overview: Nonlinear Motion</i> <i>Study: Projectile Motion</i> <i>Mastery Test: Projectile Motion</i> <i>Study: Circular Motion</i> <i>Mastery Test: Circular Motion</i> <i>Study: Relative Motion</i> <i>Mastery Test: Relative Motion</i> <i>Practice: Kinematics</i>	- Perform calculations involving two-dimensional trajectory. - Solve problems involving circular motion. - Recognize that the solution to a problem involving motion depends on the frame of reference. - Solve motion problems with respect to a variety of frames of reference.
Doing Science: Kinematics 3 hours	<i>Overview: Doing Science: Kinematics</i> <i>Study: Organizing and Analyzing Experimental Results</i> <i>Mastery Test: Organizing and Analyzing Experimental Results</i> <i>Lab: Kinematics</i> <i>Discussion: Kinematics Lab</i>	- Complete the lab titled "Kinematics." - Discuss your lab results with your peers online.
Wrap-Up: Kinematics 2 hours, 30 minutes	<i>Review: Kinematics</i> <i>Posttest: Kinematics</i> <i>Teacher-Graded Posttest: Kinematics</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment.

Lesson and Duration	Activities	Objectives
		Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 4: DYNAMICS

In this unit, you will apply the laws of motion and other established principles to solve problems involving force and friction.

Lesson and Duration	Activities	Objectives
Force and Motion 2 hours, 15 minutes	<i>Overview: Force and Motion</i> <i>Study: Newton's Laws</i> <i>Mastery Test: Newton's Laws</i> <i>Study: Force Problems</i> <i>Mastery Test: Force Problems</i>	- Define and apply Newton's laws. - Identify examples of Newton's laws in everyday scenarios. - Perform calculations using Newton's second law.
Calculations with Forces 5 hours, 30 minutes	<i>Overview: Calculations with Forces</i> <i>Study: Free-Body Diagrams</i> <i>Mastery Test: Free-Body Diagrams</i> <i>Study: Multiple Forces</i> <i>Mastery Test: Multiple Forces</i> <i>Study: Friction</i> <i>Mastery Test: Friction</i> <i>Journal: Friction and You</i> <i>Practice: Dynamics</i>	- Create and interpret free-body diagrams for situations involving both balanced and unbalanced forces. - Calculate the net force on an object. - Determine the change in motion of an object acted on by multiple forces. - Differentiate between static and kinetic friction. - Solve problems involving frictional forces.

Lesson and Duration	Activities	Objectives
Doing Science: Dynamics 3 hours	<i>Overview: Doing Science: Dynamics</i> <i>Study: Errors in Experiments</i> <i>Mastery Test: Errors in Experiments</i> <i>Lab: Force of Friction</i> <i>Discussion: Force of Friction Lab</i>	- Complete the lab titled "Dynamics." - Discuss your lab results with your peers online.
Wrap-Up: Dynamics 2 hours, 30 minutes	<i>Review: Dynamics</i> <i>Posttest: Dynamics</i> <i>Teacher-Graded Posttest: Dynamics</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 5: MOMENTUM AND GRAVITATION

In this unit, you will predict the movements of the planets and analyze other phenomena by drawing upon knowledge of momentum and harmonic motion.

Lesson and Duration	Activities	Objectives
Momentum 2 hours, 15 minutes	<i>Overview: Momentum</i> <i>Study: Momentum</i> <i>Mastery Test: Momentum</i> <i>Study: Conservation of Momentum</i> <i>Mastery Test: Conservation of Momentum</i>	- Differentiate among force, energy, and momentum. - Calculate the momentum of a mechanical system.

Lesson and Duration	Activities	Objectives
Harmonic Motion 1 hour, 50 minutes	<i>Overview: Harmonic Motion</i> <i>Study: Harmonic Motion</i> <i>Mastery Test: Harmonic Motion</i> <i>Journal: Rhythm in Your Life</i>	- Apply the law of conservation of energy to situations involving harmonic motion. - Perform calculations involving Hooke's law.
Planetary Physics 2 hours, 40 minutes	<i>Overview: Planetary Physics</i> <i>Study: Orbits</i> <i>Mastery Test: Orbits</i> <i>Practice: Momentum and Gravitation</i>	- Recognize the motion of satellites. - Summarize planetary motion. - Perform calculations involving the gravitational force between two objects.
Doing Science: Momentum and Gravitation 3 hours	<i>Overview: Doing Science: Momentum and Gravitation</i> <i>Study: Evaluating Scientific Conclusions</i> <i>Mastery Test: Evaluating Scientific Conclusions</i> <i>Lab: Simple Harmonic Motion</i> <i>Discussion: Simple Harmonic Motion Lab</i>	- Complete the lab titled "Physics Around the Universe." - Discuss lab results with your peers online.
Wrap-Up: Momentum and Gravitation 2 hours, 30 minutes	<i>Review: Momentum and Gravitation</i> <i>Posttest: Momentum and Gravitation</i> <i>Teacher-Graded Posttest: Momentum and Gravitation</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

SEMESTER WRAP-UP

Lesson and Duration	Activities	Objectives
Semester Wrap-Up 3 hours	<i>Review: Semester Review</i> <i>End-of-Semester Test: Semester Exam</i> <i>Teacher-Graded End-of-Semester Test: Semester Exam</i>	- Review key ideas presented in the semester. - Demonstrate mastery of concepts and skills from the semester by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the semester by completing a teacher-scored assessment.