

PHYSICS, SEMESTER B

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:

- ❖ Compare the major areas of focus within physics, from electromagnetism to cosmology, including the topics each area explores.
- ❖ Apply laws and principles in physics to the analysis of everyday phenomena, such as heat transfer between liquids and the workings of electrical circuits.
- ❖ 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>	33	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	70	100%

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

UNIT 1: CHEMICAL PHYSICS

In this unit, you will analyze phenomena at the intersection of physics and chemistry, such as buoyancy and movement in water.

Lesson and Duration	Activities	Objectives
Chemistry for Physics 2 hours, 55 minutes	<i>Overview: Chemistry for Physics</i> <i>Study: Atomic Structure and the Periodic Table</i> <i>Mastery Test: Atomic Structure and the Periodic Table</i> <i>Study: Chemical Bonds</i> <i>Mastery Test: Chemical Bonds</i> <i>Journal: Elements in Daily Life</i>	- Recognize the history of the development of atomic theory and the structure of an atom. - Analyze the periodic table to find the atomic number and atomic mass number of an element and the number of electrons, protons, and neutrons in an atom or ion. - Distinguish between atoms and molecules. - Distinguish among ionic, covalent, and metallic bonding. - Analyze the periodic table to determine whether an element is a metal, nonmetal, or metalloid. - Summarize how the atomic structure of metals leads to the conductive properties of metals.
Introduction to States of Matter 3 hours, 45 minutes	<i>Overview: Introduction to States of Matter</i> <i>Study: Movement in Matter</i> <i>Mastery Test: Movement in Matter</i> <i>Study: Fluid Dynamics and Buoyancy</i> <i>Mastery Test: Fluid Dynamics and Buoyancy</i> <i>Practice: Chemical Physics</i>	- Define the various states of matter in terms of kinetic molecular theory. - Relate temperature and pressure at the molecular level of matter. - Differentiate among internal, kinetic, and potential energies. - Determine the relationship between the temperature and molecular velocity of a gas.

Lesson and Duration	Activities	Objectives
		- Define and apply Archimedes', Bernoulli's, and Pascal's principles. - Recognize the unique properties of water.
Doing Science: Chemical Physics 3 hours	<i>Overview: Doing Science: Chemical Physics</i> <i>Study: The People of Science</i> <i>Mastery Test: The People of Science</i> <i>Lab: Fluids</i> <i>Discussion: Fluids Lab</i>	- Complete the lab titled "Chemical Physics." - Discuss lab results with your peers online.
Wrap-Up: Chemical Physics 2 hours, 30 minutes	<i>Review: Chemical Physics</i> <i>Posttest: Chemical Physics</i> <i>Teacher-Graded Posttest: Chemical 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: THERMODYNAMICS

In this unit, you will apply the laws of thermodynamics and other principles to the analysis of heat flow, phase changes, and other energy changes.

Lesson and Duration	Activities	Objectives
Laws of Thermodynamics 3 hours, 20 minutes	<i>Overview: Laws of Thermodynamics</i> <i>Study: Potential Energy in Chemical Reactions</i>	- Compare exothermic and endothermic reactions. - Create a potential energy diagram for a chemical reaction. - Define and apply the first law of thermodynamics.

Lesson and Duration	Activities	Objectives
	<i>Mastery Test: Potential Energy in Chemical Reactions</i> <i>Study: First Law of Thermodynamics</i> <i>Mastery Test: First Law of Thermodynamics</i> <i>Study: Second Law of Thermodynamics</i> <i>Mastery Test: Second Law of Thermodynamics</i>	- Differentiate between open, closed, and isolated systems. - Calculate the heat, work, and internal energy of a thermodynamic system. - Define entropy. - Identify what affects the efficiency of a heat engine.
Energy Change 4 hours, 25 minutes	<i>Overview: Energy Change</i> <i>Study: Heat Flow</i> <i>Mastery Test: Heat Flow</i> <i>Study: Heating, Cooling, and Phase Changes</i> <i>Mastery Test: Heating, Cooling, and Phase Changes</i> <i>Practice: Thermodynamics</i> <i>Journal: Endothermic and Exothermic Reactions</i>	- Compare methods of heat flow. - Identify the connections between specific heat capacity and molecular properties. - Solve problems using specific heat capacity and latent heat values. - Determine the final temperature when two objects at different temperatures are in contact. - Interpret heating and cooling curves.
Doing Science: Thermodynamics 3 hours	<i>Overview: Doing Science: Thermodynamics</i> <i>Study: Scientific Models</i> <i>Mastery Test: Scientific Models</i> <i>Lab: Thermodynamics</i> <i>Discussion: Thermodynamics Lab</i>	- Complete the lab titled "Thermodynamics." - Discuss lab results with your peers online.

Lesson and Duration	Activities	Objectives
Wrap-Up: Thermodynamics 2 hours, 30 minutes	<i>Review: Thermodynamics</i> <i>Posttest: Thermodynamics</i> <i>Teacher-Graded Posttest: Thermodynamics</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: ELECTRICITY AND MAGNETISM

In this unit, you will create a circuit by applying basic principles of electricity and magnetism.

Lesson and Duration	Activities	Objectives
Electricity 2 hours, 15 minutes	<i>Overview: Electricity</i> <i>Study: Electrostatics</i> <i>Mastery Test: Electrostatics</i> <i>Study: Electrical Potential and Capacitance</i> <i>Mastery Test: Electrical Potential and Capacitance</i>	- Determine the force between two electric charges. - Calculate an electric field. - Relate electric potential energy to the positions of two charges. - Recognize energy conversions in systems involving electric potential energy. - Perform calculations involving electric potential energy, capacitance, and potential difference.
Electrical Circuits 4 hours	<i>Overview: Electrical Circuits</i> <i>Study: Current and Resistance</i> <i>Mastery Test: Current and Resistance</i> <i>Study: Series Circuits</i> <i>Mastery Test: Series Circuits</i>	- Solve problems using Ohm's law. - Calculate the energy dissipation in a resistor. - Summarize the relationships among current, voltage, resistance, and power. - Create diagrams of series, parallel, and combined circuits.

Lesson and Duration	Activities	Objectives
	<i>Study: Parallel and Combined Circuits</i> <i>Mastery Test: Parallel and Combined Circuits</i> <i>Journal: Circuits in Your Home</i>	- Determine the current, resistance, or voltage in a series or parallel circuit. - Differentiate among complete, open, and short circuits.
Magnetism and Electromagnetism 3 hours, 45 minutes	<i>Overview: Magnetism and Electromagnetism</i> <i>Study: Magnetism</i> <i>Mastery Test: Magnetism</i> <i>Study: Electromagnetism</i> <i>Mastery Test: Electromagnetism</i> <i>Practice: Electricity and Magnetism</i>	- Identify the properties of magnetic fields. - Map the magnetic field of a permanent magnet. - Summarize how magnetic fields can produce electric fields and how electric fields can produce magnetic fields. - Examine the properties of electromagnetic waves. - Recognize how generators, motors, and transformers rely on electric and magnetic fields.
Doing Science: Electricity and Magnetism 3 hours	<i>Overview: Doing Science: Electricity and Magnetism</i> <i>Study: Testing Scientific Solutions</i> <i>Mastery Test: Testing Scientific Solutions</i> <i>Lab: Circuit Building</i> <i>Discussion: Circuit Building</i>	- Complete the lab titled "Electricity and Magnetism." - Discuss your lab results with your peers online.
Wrap-Up: Electricity and Magnetism 2 hours, 30 minutes	<i>Review: Electricity and Magnetism</i> <i>Posttest: Electricity and Magnetism</i> <i>Teacher-Graded Posttest: Electricity and Magnetism</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 4: WAVES

In this unit, you will analyze both sound waves and light waves, evaluating the effects of lenses, mirrors, and other equipment used in optics.

Lesson and Duration	Activities	Objectives
Introduction to Wave Motion 2 hours, 15 minutes	<i>Overview: Introduction to Wave Motion</i> <i>Study: Introduction to Waves</i> <i>Mastery Test: Introduction to Waves</i> <i>Study: Wave Interactions</i> <i>Mastery Test: Wave Interactions</i>	• Compare different types of waves. • Identify examples of waves in everyday life. • Recognize the properties of waves: period, speed, frequency, wavelength, and amplitude. • Solve problems involving wave speed, frequency, and wavelength. • Determine how waves interact with media and with other waves. • Differentiate between constructive and destructive interference.
Sound and Light 2 hours, 55 minutes	<i>Overview: Sound and Light</i> <i>Study: Sound</i> <i>Mastery Test: Sound</i> <i>Study: Light</i> <i>Mastery Test: Light</i> <i>Journal: Sounds You Hear</i>	• Examine the properties of sound waves. • Define the Doppler effect. • Identify the regions of the electromagnetic spectrum. • Solve problems involving electromagnetic wave speed, frequency, and wavelength.
Optics 3 hours, 45 minutes	<i>Overview: Optics</i> <i>Study: Introduction to Optics</i>	• Interpret and draw ray diagrams. • Create ray diagrams to show how light reflects and refracts.

Lesson and Duration	Activities	Objectives
	<i>Mastery Test: Introduction to Optics</i> <i>Study: Lenses and Mirrors</i> <i>Mastery Test: Lenses and Mirrors</i> <i>Practice: Waves</i>	- Recognize the process of image formation. - Apply lens and mirror equations.
Doing Science: Waves 3 hours	<i>Overview: Doing Science: Waves</i> <i>Study: Applications of Electromagnetic Radiation</i> <i>Mastery Test: Applications of Electromagnetic Radiation</i> <i>Lab: Optics</i> <i>Discussion: Optics Lab</i>	- Complete the lab titled "Waves." - Discuss lab results with your peers online.
Wrap-Up: Waves 2 hours, 30 minutes	<i>Review: Waves</i> <i>Posttest: Waves</i> <i>Teacher-Graded Posttest: Waves</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: MODERN PHYSICS

In this unit, you will compare nuclear physics, quantum physics, and cosmology, examining the essential principles and problems that are the focus of each field.

Lesson and Duration	Activities	Objectives
Nuclear Physics 3 hours, 20 minutes	<i>Overview: Nuclear Physics</i> <i>Study: Nuclear Structure</i> <i>Mastery Test: Nuclear Structure</i> <i>Study: Radioactivity and Half-Life</i> <i>Mastery Test: Radioactivity and Half-Life</i> <i>Study: Fission and Fusion</i> <i>Mastery Test: Fission and Fusion</i>	- Identify how competing forces in a nucleus determine the stability of the nucleus. - Apply Einstein's mass-energy equivalence formula to nuclear reactions. - Differentiate between nuclear and chemical reactions. - Recognize the processes of radioactive decay. - Perform calculations involving half-life. - Differentiate among the levels of danger from various radiation sources. - Compare fission and fusion. - Determine the energy changes involved in fission and fusion reactions.
Quantum Physics 2 hours, 15 minutes	<i>Overview: Quantum Physics</i> <i>Study: Atomic Physics and Quantization</i> <i>Mastery Test: Atomic Physics and Quantization</i> <i>Study: Introduction to Relativity</i> <i>Mastery Test: Introduction to Relativity</i>	- Examine the dual natures of light and matter. - Identify the key experiments that led to the current understanding of the nature of light. - Define the concept of quantization.

Lesson and Duration	Activities	Objectives
Cosmology 3 hours, 20 minutes	<i>Overview: Cosmology</i> <i>Study: Cosmology</i> <i>Mastery Test: Cosmology</i> <i>Journal: What Do You Think about the Big Bang?</i> <i>Practice: Modern Physics</i>	Identify and evaluate the evidence for the big bang theory.
Doing Science: Modern Physics 3 hours	<i>Overview: Doing Science: Modern Physics</i> <i>Study: Evaluating Scientific Claims</i> <i>Mastery Test: Evaluating Scientific Claims</i> <i>Lab: Nuclear Physics</i> <i>Discussion: Nuclear Physics Lab</i>	- Complete the lab titled "Modern Physics." - Discuss lab results with your peers online.
Wrap-Up: Modern Physics 2 hours, 30 minutes	<i>Review: Modern Physics</i> <i>Posttest: Modern Physics</i> <i>Teacher-Graded Posttest: Modern 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.

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>	- Review key ideas presented in the semester. - Demonstrate mastery of concepts and skills from the semester by completing a computer-scored assessment.

Lesson and Duration	Activities	Objectives
	<i>Teacher-Graded End-of-Semester Test: Semester Exam</i>	Demonstrate mastery of concepts and skills from the semester by completing a teacher-scored assessment.