Physics 1B

Course Description

The science of physics deals with the nature of motion, force, energy, matter, heat, light, sound, and electricity. In Physics 1B, students use the laws of physics to explain the events that occur in the world around them. In this course, they investigate wave motion, sound, light, reflection and refraction, color, magnetism, electricity, and nuclear physics.

Each lesson begins with a challenging thought question. Students then learn the physics principles necessary to answering the question. Skills in scientific inquiry, reading, and writing are incorporated throughout the course as students complete labs and writing assignments. Students are engaged by interactive simulations and Fun With Physics segments. Within each unit, students visit websites to explore physics topics such as the properties of sound and light, optical illusions, Doppler and photo-electric effects, uranium and breeder reactors, quantum mechanics, and the laws of physics.

Overview

Unit 1 – Waves
- Lesson 1: Wave Motion
- Lesson 2: Sound

Unit 2 – Light
- Lesson 1: Properties of Light
- Lesson 2: Reflection and Refraction
- Lesson 3: Color, Diffraction, Interference

Unit 3 – Electricity
- Lesson 1: Electrostatics
- Lesson 2: Electric Circuits

Unit 4 – Magnetism, Electricity, and Nuclear Physics
- Lesson 1: Relationship of Magnetism and Electricity
- Lesson 2: The Atom Unraveled

Objectives

Students completing this course will be able to demonstrate the following skills:

- Increase their knowledge of the physical world by gaining a foundation in the major concepts of physics, not just isolated facts and formulas.
- Examine the historical and cultural factors that have led to the current versions of physical laws.
- Test new ideas by making observations, collecting evidence, searching for patterns, and proposing hypotheses to explain the observed relationships.
- Use mathematics as a tool for explaining relationships observed in nature.
- Define wavelength, frequency, and amplitude as they pertain to waves.
- Distinguish among mechanical, electromagnetic, longitudinal, and transverse waves.
- Describe constructive and destructive interference and give examples of each.
- Describe the Doppler effect and give everyday examples of the effect.

- Calculate harmonics in closed and open tubes.
- Apply the inverse square law to illumination.
- Locate visible light in the electromagnetic spectrum.
- Use the Law of Reflection to predict the path of reflected light, given the direction of light striking a reflective surface.
- Use Snell's Law in solving refraction problems.
- Explain how a prism separates white light into colors.
- Calculate the size and location of images produced by lenses and mirrors.
- Describe what factors determine whether a material will reflect or transmit light of particular colors.
- Describe the quantum model of the atom.
- Relate the energy of a photon to its frequency.
- Provide evidence for the particle nature of light.
- Explain the view that all matter has wave properties.
- Explain the application of the Uncertainty Principle in making measurements in the subatomic world.
- Explain how an object becomes either positively or negatively charged from the point of view of electron transfer.
- Define the coulomb and apply Coulomb's Law to solving problems.
- Distinguish between direct and alternating current.
- Compare and contrast series and parallel circuits.
- Use Ohm's Law to solve circuit problems.
- Describe a transformer and how it works.
- Provide evidence for the wave nature of the electron.
- Distinguish among the three types of rays emitted by radioactive nuclei and compare their penetrating powers.
- Interpret the symbols used to label isotopes of an element.
- Weigh the relative risk of radiation exposure.
- Describe a chain reaction involving uranium.
- Demonstrate mass conversion to energy using Einstein's equation $E = mc^2$.
- Weigh the costs and benefits of energy produced by fusion and fission reactions.
- Explore the application of physics to everyday life.

Activities and Assessments

- **13 Laboratory Exercises and 4 Virtual Labs –** Within the course, there are thirteen laboratory exercises that allow students to interact with the physical concepts they are learning by working with materials they may have at home. In the four virtual labs, students interact with the concepts via graphics and animations. The teacher grades these lab activities and provides feedback.

- **4 Writing Assignments –** In addition to the written portions of laboratory activities, students demonstrate their understanding of the concepts in this course by completing four writing assignments. The teacher grades these assignments and provides feedback.

- **4 Unit Evaluations and 1 Final Exam –** In addition to numerous self-check activities throughout the course, there is a self-check quiz at the end of each of the nine lessons. There is also an evaluation at the end of each of the four units. At the conclusion of the course, students are given one opportunity to complete a comprehensive final exam. All of these assessments are computer-graded and provide students with instant feedback on their work.