

TAMALPAIS UNION HIGH SCHOOL DISTRICT
Larkspur, California

COURSE OF STUDY

PHYSICS

I. INTRODUCTION

Since science is one of the major factors influencing the development of societies, all citizens should know something of its method of operation and of its content. Physics is an important part of science, therefore students should know the kinds of problems physics deals with and how it does this.

The need for the course was established by tradition. Colleges have found it to be excellent preparation for their students.

This introductory course is designed both for college bound students (not only physical science majors) and also for non-college bound students who want to know more of their physical surroundings.

II. EXPECTATIONS

A. Objectives

1. To develop scientific attitudes and the habit of using the scientific method in daily living.
2. To develop an interest and appreciation for the physical factors of our environment.
3. To develop an understanding of the application of basic laws of physics in a problem solving framework.

B. Means

1. Content and Concepts

a. Motion

- 1) Describing motion -- kinematics
 - a) Measurement of distance and time
 - b) Calculation of average speed
 - c) Use of equation relating speed, distance and time
 - d) Use of distance vs. change in time graphs

Physics

- e) Use of slope at a point and slope between points on distance vs. time graph
 - f) concepts of average and instantaneous speed
 - g) Concept of acceleration
 - h) Use of equation relating acceleration, change in speed, and time
 - i) Freely falling bodies
 - i) Aristotelian theory of motion
 - ii) Galileo's theory of motion
 - iii) Use of change of speed vs. change in time graphs
 - iv) Derivation and use of equations relating initial speed, acceleration and time from speed vs. time graphs
 - v) Relationships between initial speed, average speed, final speed, acceleration, distance and time
- 2) Describing the causes of motion -- dynamics
- a) Concept of force
 - b) Concept of vectors
 - c) Use of Newton's First Law of Motion
 - d) Use of Newton's Second Law of Motion
 - e) Concept of mass and weight
 - f) Use of Newton's Third Law of Motion
 - g) Projectile motion
 - i) concept of component motion
 - ii) Use of component motions to describe projectile motion in the horizontal and vertical directions
 - h) Description of motion from different frames of reference
 - i) Circular motion
 - Concepts of frequency, period, centripetal acceleration and centripetal force
- 3) Conservation of mass and momentum
- a) Application of conservation laws in open and closed systems
 - i) In one- and two-dimensional collisions
 - ii) In elastic and inelastic collisions
 - iii) In relation to Newton's Laws of Motion
 - b) Energy and Its Conservation
 - i) Concepts of work, kinetic energy, potential energy
 - ii) Heat energy and the steam engine
 - a.) James Watt and the industrial revolution

Physics

- b.) Joule's experiments relating work, energy, heat and power
- iii) Energy in biological systems
- iv) The First Law of Thermodynamics
- c) Kinetic Theory of Gases
 - i) Development of a model
 - ii) Speed and size of particles
 - iii) Effect of temperature and pressure
 - iv) The Second Law of Thermodynamics
Entropy and "Maxwell's" demon
- d) Waves
 - i) Characteristics
 - a.) Transverse, longitudinal, torsional
 - b.) Amplitude, period, wave length, frequency, generation, speed, propagation
 - c.) Polarization
 - d.) Superposition principle
 - ii) Two source interference patterns
 - a.) Constructive and destructive interference
 - b.) Nodal and antinodal lines
 - c.) Deriving wave length from interference patterns
 - iii) Standing waves
 - a.) Bounded and unbounded
 - iv) Wave fronts and Huygen's Principle
 - a.) Resonance
 - b.) Reflection, refraction and diffraction
 - v) Sound, acoustics, harmonics
- e) Light and Electromagnetism
 - i) Characteristics
 - a.) Constant speed, reflection, refraction, diffraction, polarization
 - b.) Particle and wave models, Young's experiment
 - c.) Color
Theories of perception and explanation of some common phenomena
 - ii) Concepts of electric, gravitational and magnetic fields
 - iii) Concept of charge
 - a.) Definition and types
 - b.) Units of measurement
 - c.) Conservation law
 - d.) Basic unit of charge, Millikan's experiment
 - iv) Study of currents
 - a.) Use of Ohm's Law
 - b.) Concept of electric potential difference

Physics

- c.) Concept of magnetic fields caused by moving charge
- d.) Interactions of magnetic fields
- v) Electromagnetic induction
 - a.) Electric motors and generators
 - b.) Electric energy, its practical application and social implications
- vi) Electromagnetic radiation
 - a.) Propagation
 - b.) Historic development of the concept
 - c.) Maxwell's Principles
- f) Models of the Atom
 - i) Historic development of atomic structure
 - a.) The periodic table of the elements
 - b.) Electrical nature of matter
 - c.) Some significant experiments -- J.J. Thomson (cathode rays), Millikan (oil drop), Hertz (photo electric effect), Rutherford (scattering), Frank-Hertz (quantized x-ray absorption)
 - d.) Basis for the modern concept of atomic structure
 - ii) The Rutherford-Bohr model of the atom
 - a.) Spectra of gases
 - b.) Nuclear charge and size
 - c.) The Bohr theory
 - i.) Consequences of
 - ii.) Based on the hydrogen atom spectra
 - iii.) Inadequacies
 - iv.) Stationary states
- g) Radioactivity
 - i) Discovery
 - ii) Characteristics of alpha, beta and gamma rays
 - iii) Transformations, decay series and half-life
- h) Structure of the Atomic Nucleus
 - i) Proton -- electron hypothesis
 - ii) Proton -- neutron theory
 - iii) Neutrino and antineutrino
 - iv) Particle accelerators
 - v) Nuclear reactions, fission, fusion
- i) Some topics from Modern Physical Theories
 - i) Relativity
 - ii) Particle behavior of radiation)
 - iii) Wave properties of particles

Physics

- iv) A mathematical model of the atom
- v) The uncertainty principle (Heisenberg)
- iv) Probability interpretations

2. Skills

a. The following skills are developed:

- 1) Planning experimental procedures
- 2) Critical thinking
 - a) Making accurate observations and measurements
 - b) Recording data systematically
 - c) Interpreting data and drawing conclusions
 - d) Analytical reading of scientific material -- separating fact from opinion
- 3) Clearly communicating scientific concepts (written and oral)
- 4) Evaluating accuracy of work
- 5) Determining sources of error
- 6) Applying principles to practical problems both within and outside the scope of experience of the student -- the problem solving approach

3. Major Activities

The student is exposed to lectures, lab activities, problem solving sessions, demonstrations, audio-visual material, supplementary material and reading assignments.

C. Evaluation

Students are evaluated by tests, quizzes, lab reports, problem sets, and teacher observation of student performance.

Physics

III. GENERAL INFORMATION

This course fulfills the University of California "e" requirement, the University of California "f" requirement, and one year of the district's science requirement.

Physics prepares students well for college and also satisfies the needs of other highly motivated students who want to know more about their physical surroundings.

It is recommended that students have either successfully completed or be concurrently enrolled in advanced algebra.