College Physical Science

Curriculum

Vineland Public Schools
Vineland, NJ
2004

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COLLEGE PHYSICAL SCIENCE PURPOSE AND GOALS

This course is designed to give the student an overview of the major concepts, theories, and mathematical laws governing physical and life sciences. This course will attempt to reveal the inter-relationship that exists between science, technology and society through the past, present and future. Students will gain the necessary knowledge and understanding of science information and terminology to become scientifically and technologically literate.

The main content areas of focus are: Earth and Life Sciences, Chemistry and Physics. A strong emphasis will be placed on matter, waves, energy, motion, forces, and environmental topics. Infused into each topic are the principles of the scientific method and laboratory safety. Students will improve their skills in mathematics and science while adding new critical thinking, life and work skills. They will be introduced to a variety of science related careers.

Discussion, debate and research will enable students to hypothesize, interpret, infer, inquire and predict. Projects, simulations and laboratory experiments will reinforce lecture and discussion while presenting opportunities for gathering data. Students will acquire hands-on and hands-off experiences with computers and a variety of scientific equipment.

Goals:

1) The students will be exposed to a variety of learning environments that are conducive to our multi-cultural society. Students will also understand how a multicultural society is responsible for major discoveries in the advancement of science and technology, while assessing impact on our environment.
2) The students will increase their self-esteem and confidence in their ability to investigate and apply inquiry, while developing the self-management skills necessary to make this possible.
3) The students will learn to value the environment and become aware of the application of the variety of sciences involved with environmental study, while investigating careers and possible future developments.
4) The students will understand and use chemistry and physics vocabulary in scientific activities.
5) Students will use computers, calculators, and related technology to enhance their educational opportunities throughout the course.
6) Students will use their conceptual and applied knowledge of environmental issues (matter, energy, conservation).
7) Students will be able to recognize, describe, and predict patterns and relationships from presented data and information.
8) Students will be able to collect, organize, and interpret information to make meaning interpretations in an applied activity.
9) Students will be able to develop and test arguments based on data and their own observations. They will be able to present their ideas as written conclusions in lab activities, and/or orally in a debate forum.
10) Students will comply with all rules governing lab and classroom safety including the wearing of goggles and aprons, the use of fire extinguishers, showers, fume hoods,

fire drill/bomb threat procedures. The students will be able to effectively apply safety principles.

11) Students will be able to use the basic science strategies of hypothesis and theory formulations, and modeling to analyze, evaluate, and possibly solve problems.
12) Students will gain an understanding of the organization of the periodic table as a tool for predicting properties.
13) Students will be able to develop career planning and workplace readiness skills.
14) Students will gain an understanding of Newton's laws, energy transformations and motion.
15) Students will gain an understanding of the basic structure of the Earth and the Universe.
16) Students will investigate how human activities affect and influence the environment and natural phenomena.

New Jersey Core Curriculum Content Science Standards

5.1 (Scientific Processes) All students will develop problem- solving, decision-making and inquiry skills, reflected by formulating usable questions and hypothesis, planning, experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions and communicating results.

5.2 (Science and Society) All students will develop an understanding of how people of various cultures have contributed to the advancement of science and technology and how major discoveries and events have advanced science and technology.

5.3 (Mathematical Applications) All students will integrate mathematics as a tool for problem solving in science, and as a means of expressing and/or modeling scientific theories.

5.4 (Nature and Process of Technology) All students will understand the interrelationships between science and technology and develop a conceptual understanding of the nature and process of technology.

5.5 (Characteristics of Life) All students will gain an understanding of the structure, characteristics, and basic needs of organisms and will investigate the diversity of life.

5.6 (Chemistry) All students will gain an understanding of the structure and behavior of matter.

5.7 (Physics) All Students will gain an understanding of natural laws as they apply to motion, forces, and energy.

5.8 (Earth Science) All students will gain an understanding f the structure, dynamics and geophysical systems of the Earth.

5.9 (Astronomy and Space Science) All students will gain an understanding of the origin, evolution and structure of the universe.

5.10 (Environmental Studies) All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

College Physical Science: Student Objectives

The first set of numbers following the objective corresponds to the New Jersey Core Curriculum Content Standards for ninth to twelfth grades. The second set of numbers corresponds to the Cross-Content Workplace Readiness Standards (WPRS)

1) Describe the relationship between science and technology. 5.4.A1; WPRS 1
2) Explain the roles of models and mathematics n scientific theories and laws. 5.3.C1; WPRS 2
3) Understand how to use critical thinking skills to solve problems. 5.1.A1; WPRS 3
4) Describe the steps of the scientific method. 5.1.A1; WPRS 3
5) Explain the objective of a consistent system of units and identify the SI units for length, mass, and time. 5.3.A1; WPRS 3
6) Explain the relationship between matter, atoms and elements. 5.6.A1; WPRS 5
7) Distinguish between elements and compounds. 5.6.A2&3; WPRS 5
8) Classify matter as pure substances or mixtures. 5.6.A6; WPRS 5
9) Use the kinetic theory to describe the properties and structures of the different states of matter. 5.7.A4; WPRS 5
10) Distinguish between chemical and physical properties of matter. 5.7.A4; WPRS 5
11) State the charge, mass and location of each part of an atom according to the modern model of the atom. 5.6.A1; WPRS 5
12) Relate the organization of the Periodic Table to the arrangement of electrons within an atom. 5.6.A5; WPRS 5
13) Explain why some atoms gain or lose electrons to form ions. 5.6.A4; WPRS 5
14) Locate alkai-metals, alkaline-earth metals, transition metals, semiconductors, halogens and noble gases on the Periodic Table. 5.6.A5; WPRS 4
15) Relate the chemical formula of a compound to the relative numbers of atoms or ions present in the compound. 5.6.A7; WPRS 3
16) Differentiate between ionic, covalent and metallic bonds. 5.6.A4; WPRS 3
17) Write chemical formulas for simple ionic compounds. 5.6.A4; WPRS 3
18) Identify the names and structures of groups of simple organic compounds and polymers. 5.6.A7; WPRS 4
19) Recognize signs that a chemical reaction is taking place. 5.6.B1; WPRS 5
20) Distinguish among five general types of chemical reactions. 5.6.B1; WPRS 5
21) Demonstrate how to balance a chemical equation. 5.3.C1; WPRS 3
22) Describe the factors affecting reaction rates. 5.6.B1; WPRS 5
23) Distinguish between homogeneous and heterogeneous mixtures. 5.6.A7; WPRS 4
24) Compare and contrast acids and bases. 5.7.A7; WPRS 5
25) Identify four types of nuclear radiation and their properties. 5.6.A7; WPRS 5
26) Solve problems involving time, distance, velocity, acceleration, and momentum. 5.7.A1; WPRS 3
27) State Newton's three laws of motion and apply them to physical situations. 5.7.A2; WPRS 3
28) Calculate the work done on an object and the rate at which it is done. 5.7.A1; WPRS 2
29) Name and describe the six types of simple machines. 5.7.B3; WPRS 2
30) Define potential energy and kinetic energy. 5.7.B3; WPRS 3
31) Explain the law of conservation of energy. 5.7.B3; WPRS 3

32) Define temperature in terms of the average kinetic energy of atoms or molecules. 5.7.B1; WPRS 3
33) Distinguish between mechanical waves and electromagnetic waves, and transverse and longitudinal waves. 5.7.B3; WPRS 3
34) Differentiate wave behaviors: reflection, refraction, diffraction, constructive interference and destructive interference. 5.7.B1; WPRS 3
35) Recognize what factors affect the speed of sound. 5.7.B1; WPRS 4
36) Describe different parts of the electromagnetic spectrum and their uses in communication, medicine and other areas. 5.7.B4; WPRS 1
37) Explain what factors affect the strength of the electric force. 5.7.B6; WPRS 5
38) Use schematic diagrams to represent circuits. 5.1.B1; WPRS 2
39) Describe how electric currents produce magnetism. 5.7.A7; WPRS 3
40) Explain how radio and television signals are broadcast using electromagnetic waves. 5.7.A4; WPRS 2
41) Describe the basic structure of the universe. 5.9.A1; WPRS 4
42) Identify Earth's different geologic layers. 5.8.D1; WPRS 4
43) Distinguish between Primary and Secondary and surface waves in earthquakes. 5.8.C1; WPRS 3
44) Describe how the oxygen-carbon dioxide cycle works and expain its importance to living organisms. 5.8.A1; WPRS 4
45) Describe various severe weather situations, including thunderstorms, tornadoes, and hurricanes. 5.8.A1; WPRS 4
46) Explain the structure of an ecosystem and ways natural forces and human interactions can change that ecosystem. 5.10.B1; WPRS 3
47) Describe the advantages and disadvantages of several energy sources. 5.10.B2; WPRS 3
48) Describe types of pollution in air, in water, and on land. 5.10. B1; WPRS 4
49) Describe contributions made by various inventors to the science community and to society. 5.2.B1
50) Explain how technological advancements have improved our ways of researching the world around us. 5.2.B2

College Physical Science Learning Activities

A. Introduction to Safety
1) Video: Accident at Jefferson High
2) Demonstration: Locations and proper use of safety equipment
3) Parental Inclusion: Safety Contract

B. Introduction to Science
1) Skill Builder Lab: Making Measurements
2) Real World Application: Lab- Ships Ahoy!

C. Matter
1) Inquiry Lab: Making Cornstarch Putty
2) Demonstration: Physical vs. Chemical Changes
3) Real World Application: Chromatography Lab- Separating a Mixture

D. Atoms and the Periodic Table
1) Introductory Activity: Color-coding element groupings on Periodic Table
2) Design your own lab: Flame Test
3) Real world application: Reasons for the varied monetary value of metals

E. The Structure of Matter
1) Inquiry Lab: What properties for polymers have?
2) Skill builder Lab: Comparing two polymers.

F. Chemical Reactions
1) Inquiry Lab: Writing balanced chemical equations.
2) Inquiry Lab: What affects the rates of chemical reactions?
3) Design your own lab: Measuring the rate of a chemical reaction.
4) Real world application: Self- heating meals

G. Solutions, Acids and Bases
1) Inquiry Lab: Determine acids, bases or neither of household products.
2) Inquiry Activity: What are and how does an antacid work?
3) Inquiry Lab: The process of determining pH.
4) Real world application: The effects of acid rain on the environment.

H. Nuclear Changes
1) Skill builder lab: Simulating nuclear decay reactions.
2) Skill builder lab: Calculating half-life.
3) Real World application: Medical radiation exposure.

I. Motion and Forces
1) Inquiry Lab: Building a balloon powered car.
2) Real world application: Video- Roller Coaster Physics
3) Science and the Consumer: Should a car's air bags be disconnected?

J. Work and Energy

1) Inquiry lab: Steam powered boat
2) Design your own lab: Energy in a roller coaster
3) Real world application: The energy in food.

K. Heat and Temperature

1) Inquiry lab: Relationship of temperature and energy
2) Inquiry lab: What color absorbs more radiation?
3) Design your own lab: Investigating conduction of heat
4) Real world application: Buying appliances

L. Waves

1) Inquiry lab: Movement of particles in a medium
2) Design your own lab: Modeling waves
3) Science and the consumer: Shock absorbers, their importance

M. Sound and light

1) Amplify the sound of a tuning fork
2) Skill builder lab: Forming images with lenses
3) Real world application: Sun Protection

N. Electricity

1) Inquiry lab: How materials are classified by resistance?
2) Skill builder lab: Conducting electric circuits
3) Science and the consumer: Which is the best type of battery?
4) Real world application: The danger of electric shock

O. Magnets and Electromagnetism

1) Inquiry lab: The making of an electromagnet
2) Inquiry lab: Demonstrate electromagnetic induction
3) Design your own lab: Making a better electromagnet

P. Communication Technology

1) Inquiry Lab: Red, blue, and green TV phosphors produce other colors
2) Skill building lab: Determining the speed of sound
3) Science and the consumer: TV and newest technologies
4) Real world application: Using a search engine

Q. The Universe

1) Skill builder: Estimating the size and power output of the Sun

R. Planet Earth

1) Inquiry lab: Modeling tectonic plate boundaries with clay
2) Skill builder: Analyzing seismic waves

S. The Atmosphere

1) Design your own lab: Measuring temperature effects
2) Real life application: Calculating the distance to a thunderstorm

T. Using Natural Resources
1) Inquiry Lab: The cleaning of oil spills
2) Skill builder lab: Changing the form of a fuel
3) Science and the consumer: Sun- warmed houses

College Physical Science Assessment

Student Proficiency (satisfactory achievement) in each of the outcomes/objectives listed in this guide shall be determined by student attainment of the 70% district passing standard which pertains to all curricula and populations. Such proficiency shall be measured by a multiplicity of evaluation techniques and instruments, which includes, but is not restricted to the following:

1) Overall Participation
2) Written class work assignments
3) Homework assignments
4) Laboratory experiments
5) Class Discussions
6) Group and/or individual projects
7) Teacher- made quizzes
8) Teacher- made chapter test
9) Teacher-made final exam

Instructional Resources/ Material

1) Textbook: *Science Spectrum, A Physical Approach*. Holt, Rinehart and Winston, 2001
2) Laboratory Experiments. Holt, Rinehart and Winston, 2001
3) Study Guide. Holt, Rinehart, and Winston, 2001
4) Integration Enrichment Resources. Holt, Rinehart, and Winston 2001
5) Holt Science Spectrum Basic Skills Worksheets
6) Holt Science Spectrum Math Skills Worksheets
7) CD-ROM: Holt Physical Science Interactive Tutor