SCIENCE DEPARTMENT **PHYSICAL SCIENCE (CP): COURSE #463**

The Department's Educational Philosophy

We believe that students should be exposed to the process of scientific inquiry so they can acquire and interpret scientific knowledge, and begin to realize the wider applicability of scientific problem-solving methods. By making the laboratory the focal point of learning, we seek to foster students' appreciation for the experience of doing science.

Guiding Principles

- Students must be able to collect and analyze data and formulate hypotheses.
- Inductive and deductive problem-solving skills are central to science education.
- An effective program in science addresses the limitations of data and conclusions.
- Students should be able to use or design a strategy for testing scientific concepts.
- A comprehensive science program will emphasize the delicate checks and balances in man's abiotic and biotic environments and the stresses upon these ecosystems, which could affect the destiny of the world.
- Science is integrally related to mathematics.
- An effective science program builds students' ability to communicate accurately and precisely.
- An effective science program stresses both cooperative and independent learning.

PHYSICAL SCIENCE (CP): COURSE #463

Course Frequency: Full-year course, six times per six-day cycle
Credits Offered: Five
Prerequisites: Biology

Background to the Curriculum

The College Preparatory Physical Science course includes individualized instruction along with more traditional courses of chemistry and physics. The main text is Conceptual Physical Science: Explorations by Hewitt. The course is designed to meet the needs of the diversity of students as they attack the major theoretical concepts and ideas of physics and chemistry through problem solving, classroom dialog, and laboratory work. There is a strong emphasis on the experimental foundations of physics and chemistry. In addition, the course is intended to maximize the use of technology.

Core Topics/Questions/Concepts/Skills

Mechanics – Newton's 1st, 2nd, and 3rd Laws, Momentum, Gravity, Projectile and Satellite Motion
Work and Energy
Electricity and Magnetism
Waves – Sound, Light, Color, Reflection and Refraction, Properties of Light
Atoms
Periodic Table
Radioactivity and Nuclear Chemistry
Elements, Mixtures, and Compounds
Chemical Bonding and Naming Compounds
Solutions – Solids, Liquids and Gases
Acids, Bases, and Salts
Oxidation and Reduction
Organic Compounds (optional)

Course-End Learning Objectives

Students will:

Mechanics

1) Distinguish between, and solve problems involving position, velocity, and acceleration.
2) Create and interpret graphs of motion.
3) Add and subtract vectors.
4) Solve and interpret a variety of word problems involving motion.
5) State, explain and give examples of Newton's Three Laws of Motion.
6) Compare and contrast mass and weight.
7) Understand friction and its effects on the motion of an object.
8) Solve and interpret a variety of word problems involving motion.
9) Explain the concept of conservation of momentum.
10) Compare and contrast elastic collisions with inelastic collisions.

Work and Energy

1) Explain and apply the Law of Conservation of Energy.
2) Distinguish between kinetic and potential energy and power.
3) Explain how simple machines work in terms of energy and principles.

Universal Gravitation

1) Explain and apply Newton's Law of Universal Gravitation

Electricity and Magnetism

1) Explain and differentiate the three main ways of charging an object: by friction, induction, and conduction.
2) Construct and interpret sketches of electric field lines.
3) Explain and apply Coulomb's Law in a variety of situations.
4) Differentiate between electric potential and electric potential energy and between electric force and electric field.

5) Explain the relationship between charge, current, resistance, voltage, and power.
6) Explain "Ohm's Law" and describe why some things obey and others do not.
7) Qualitatively and mathematically analyze a circuit of resistors.
8) Explain and differentiate between magnetism and electric charge.

Atoms

1) Interpret Dalton's atomic theory in terms of the Laws of Conservation of Mass, Constant Composition, and Multiple Proportions.
2) Identify the major components of the nuclear atom (protons, neutrons, and electrons

Periodic Table

1) Explain the relationship of an element's position on the periodic table to its atomic number and mass.
2) Use the periodic table to identify metals, nonmetals, metalloids, families (groups), periods, valence electrons, and reactivity with other elements in the table.

Radioactivity and Nuclear Chemistry

1) Understand the types of radioactivity (alpha, beta, gamma) and compare their properties.
2) Explain the parts of the atom and their importance in nuclear reactions.
3) Write balanced nuclear reactions.
4) Explain the concept of half-life of a radioactive element and apply it to simple calculations for dating objects.
5) Compare and contrast nuclear fission and fusion.

Elements, Mixtures and Compounds

1) Identify and explain some of the physical properties that are used to classify matter; e.g., density, melting point, and boiling point.
2) Distinguish between chemical and physical changes.
3) Explain the differences between mixtures and pure substances.
4) Describe the three states of matter (solid, liquid, and gas) in terms of energy, particle motion, and phase transitions.

Chemical Bonding, Naming Compounds, Chemical Reactions

1) Explain how atoms combine to form compounds through ionic and covalent bonding.
2) Draw Lewis dot structures for simple molecules.
3) Name and write the chemical formula for simple ionic and molecular compounds.
4) Balance chemical equations by applying the law of conservation of mass.

Solutions- Solids, Liquids and Gases

1) Describe the process by which solutes dissolve solvents.
2) Identify factors that affect the rate of dissolving (i.e. temperature, concentration, and mixing).
3) Use a solubility curve to determine saturation values at different temperatures.
4) Explain the differences in rate of dissolving, solubility, and solutions with solids, liquids, and gases.

Acids, Bases, and Salts

1) Describe the difference between acids, bases, and salts.
2) Compare and contrast the nature, behavior, concentration and strength of acids and bases.
3) Calculate pH or pOH of aqueous solutions using the hydronium or hydroxide ion concentration.
4) Describe how a buffer works.

Oxidation and Reduction

1) Describe oxidation and reduction reactions and give some everyday examples, such as fuel burning and corrosion.

Organic Compounds

1) Explain the difference between inorganic and organic compounds.
2) Name and write simple organic chemical names and formulas.

Assessment

- Tests: Mostly open-ended application of content questions, with some problem solving and objective items such as multiple choice, matching or fill-in-the blank.
- Quizzes: Problem solving and open-ending questions.
- Laboratory Activities: Data analysis and application of theory are major points of emphasis.

Materials and Resources

Student text and teacher resources

Hewitt, Paul G. et al. Conceptual Physical Science: Explorations (2007), Addison Wesley.

Labs and Activities: Teacher generated using a variety of sources including:

Hewitt, Paul G., et al. Conceptual Physical Science: Explorations (2007), Addison Wesley.

Laboratory Activities Manual: Physical Science (2000), McGraw Hill, Glencoe.

Lemay, Eugene, et al. Laboratory Manual: Chemistry: Connections to Our Changing World, 2nd Edition (2000), Prentice Hall Publishing.

Robinson, Paul. Laboratory Manual: Conceptual Physics (1999), Scott Foresman Addison Wesley.

Wagner, Maxine. Laboratory Manual: Chemistry: The Study of Matter, 3rd Edition (1989), Prentice Hall Publishing.

Tetenbaum, Zelda. Physical Science Activities (1984), D.C. Heath and Company.

Tzimopoulos, Nicholas, et al. Laboratory Experiments: Modern Chemistry (1990), Holt, Rinehart and Winston, Inc.