Course Description: Physical Science…CP1

This college preparatory course is designed to serve as a solid foundation for the study of the Physical Sciences. Topics to be investigated are phases of matter, force and motion, work, simple machines, conservation and transformation of energy, heat, waves, sound, light, electricity and magnetism.

The role of the student in this course is to develop inquiry and problem solving skills within the context of scientific investigation. Students will apply what they learn to everyday situations by conducting investigations and formulating and testing their own hypotheses.

Assessment of a student's progress is based upon daily assignments, laboratory reports, homework, quizzes, tests, projects and class participation. This course is a prerequisite to subsequent college preparatory courses.

Prerequisite: a "C" or better in grade 8 Science and be enrolled in Algebra 1 in grade 8; or recommendation of the Science Department Chairperson.

Major Course Objectives

When students have completed Physical Science, they will have an understanding of:

1. Motion and Forces

a. Vector and scalar quantities: correct usage and application
b. Adding and subtracting vectors
c. Graphically representing vectors
d. Velocity, speed and acceleration of a moving object
e. How to create and interpret graphs of moving objects
f. Mass and inertia: solve problems involving mass and inertia
g. Newton's First Law of Motion
h. Newton's Second Law of Motion
i. Free body diagrams; ability to draw, interpret and calculate net force
j. Static and kinetic friction
k. Newton's Third Law of Motion
l. Newton's Law of Universal Gravitation
m. The System of International Units for Motion

2. Conservation of Energy and Momentum

a. Law of Conservation of Energy
b. Energy Transformation
c. Mechanical Energy Calculations
d. Relationship among energy, work and power
e. Law of Conservation of Momentum
f. SI units for energy, work, power and momentum

3. Heat and Heat Transfer

a. Movement of heat
b. Specific heat and heat capacity
c. Temperature change in a substance
d. Phases of matter

4. Waves

a. Wave motion
b. Properties of waves
c. Transverse and Longitudinal waves
d. Mechanical and electromagnetic waves

e. Reflection and refraction of waves
f. Polarization, wave interaction and the doppler effect
g. Constructive and destructive interference
h. Wave mediums
i. Standing waves

5. Electromagnetism
a. Static charge
b. Coulomb's Law
c. Electric forces and fields
d. Current, voltage and resistance
e. Kirchoff's and Ohm's Law
f. Circuits

6. Electromagnetic Radiation
a. Electromagnetic spectrum
b. Applications of the spectrum
c. Properties of electromagnetic waves
d. Visible light

7. Laboratory
a. The scientific method
b. Qualitative and quantitative data
c. Theory and law

Relationship to the Massachusetts Curriculum Framework

1. Motion and Forces
a. Distinguish between vector quantities and scalar quantities.
b. Illustrate how to represent vectors graphically and be able to add them graphically.
c. Distinguish between and be able to solve problems involving, velocity, speed and constant acceleratiion.
d. Create and interpret graphs of motion(position vs. time, speed vs. time, velocity vs. time, constant acceleratiion vs. time).
e. Explain the relationship between mass and inertia.
f. Interpret and apply Newton's First Law of Motion.
g. Interpret and apply Newton's Second Law of Motion to show how an object's motion will change only when a net force is applied.
h. Use a free body force diagram to show forces acting on an object and determine the net force on the object.
i. Interpret and apply Newton's Third Law of Motion.
j. Understand conceptually Newton's Law of Universal Gravitation.
k. Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration, and time, and explain how they are measured.

2. Conservation of Energy and Momentum
a. Interpret and provide examples that illustrate the Law of Conservation of Energy.
b. Provide examples of how energy can be transformed from kinetic to potential and vice versa.
c. Apply quantatively the Law of Conservation of Mechanical Energy to simple systems.
d. Describe the relationship among energy, work, and power both conceptually and quantitatively.
e. Interpret the Law of Conservation of Momentum and provide examples that illustrate it. Calculate the momentum of an object.

f. Identify appropriate standard international units of measurement for energy, work, power and momentum.

3. Heat and Heat Transfer

a. Relate thermal energy to molecular motion.
b. Differentiate between specific heat and heat capacity.
c. Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.
d. Recognize that matter exists in four phases and explain what happens during a phase change.

4. Waves

a. Differentiate between wave motion(simple harmonic nonlinear motion) and the motion of objects(nonharmonic)
b. Recognize the measurable properties of waves(e.g. velocity, frequency, wavelength) and explain the relationship among them.
c. Distinguish between transverse and longitudinal waves.
d. Distinguish between mechanical and electomagnetic waves.
e. Interpret and be able to apply the laws of reflection and refraction to all waves.
f. Recognize the effects of polarization, wave interaction, and the Doppler effect.
g. Explain, graph, and interpret graphs of constructive and destructive interference of waves.
h. Explain the relationship between the speed of a wave(e.g., sound) and the medium it travels through.
i. Recognize the characteristics of a standing wave and explain the conditions under which two waves on a string or in a pipe can interfer to produce a standing wave.

5. Electromagnetism

a. Recognize the characteristics of static charge, and explain how a static charge is generated.
b. Interpret and apply Coulomb's Law.
c. Explain the difference in concept between electric forces and electric fields.
d. Develop a quantitative and qualitative understanding of current, voltage, resistance, and the connection between them.
e. Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.
f. Analyze circuits (find the current at any point and the potential difference between any two points in the circuit) using Kirchoff's amd Ohm's Law.

6. Electromagnetic Radiation

a. Describe the electromagnetic spectrum in terms of wavelength and energy, and be able to identify specific regions such as visible light.
b. Explain how the various wavelengths in the electromagnetic spectrum have many useful applications such as radio, television, microwave appliances and cellular telephones.
c. Calculate the frequency and energy of an electromagnetic wave from the wavelength.
d. Recognize and explain the ways in which the direction of visible light can be changed.

Assessment Tools

Success in Physical Science will be assessed by the following methods:

1. Homework will be checked for completeness, accuracy and/or understanding.
2. Writing assignments will be required on a regular basis.
3. Quizzes will assess students understanding of material.
4. Laboratory work will be graded with an emphasis on the use of the scientific method.
5. Tests will consist of matching, multiple choice, true or false and open ended questions.
6. Projects will be graded using a rubric combining content and correct form

Materials and Resources

Cuevas, Physical Science, Boston, Massachusetts; Holt, Rinehart and Winston, 1994. *This is the primary text for this course*.

Cunningham, Herr, Hands- on Physics Activities with Real Life Applications, West Nyack, N.Y. The Center for Applied research in Education

Christianson, Gale E., Isaac Newton and the Scientific Revolution; New York,Oxford University Press, 1996

Goodwin, Physics Can Be Fun, Portland, Maine; J. Weston Walch, 1985

Graff, Rudolf F., Safe and Simple Electrical Experiments, N.Y.; Dover Publications, Inc. 1964

Hewitt, Suchocki, Conceptual Physical Science Explorations, Boston, Massachusetts; Addison Wesley, 2002

Kardos, 75 Easy Physics Demonstrations, Portland, Maine; J. Weston Walch, 1996

Miller, Eric D., Investigations in Science, Fort Collins, CO; Hubbard Scientific/Scott Resources, 1998

Schaffer, Frank, Physical Science for Everyday, Torrance, CA; Frank Schaffer Publication, 1997

Sneider, Cary I., Gould. Alan, Hawthorne, Cheryll, Color Analyzers, Berkeley, CA, GEMS, Lawrence Hall of Science, 1996

Taylor, Poth, Portman, Teaching Physics with Toys, Middleton, Ohio; Terrific Science Press, 1995

Tolman, Marvin N., Hands-on Physical Science, Chicago, Illinois; Parker Publishing Company, 1995

www.glenbrook.k12.il.us/gbssci/phys/class/estatics/u813b.html

RELATIONSHIP TO THE HIGH SCHOOL STUDENT EXPECTATIONS

In accordance with the Massachusetts Curriculum Frameworks, the members of the faculty of Scituate High School offer to every student the opportunity to:

1. Be an effective reader
2. Be an effective writer
3. Be an effective speaker/presenter/performer
4. Be an effective problem solver
5. Be an effective information seeker/organizer
6. Contribute to the community at large