

## CURRICULUM GUIDE

**NAME OF COURSE:** PHYSICS

**COURSE NUMBER:** SCI 403

**WRITTEN / REVISED:** September 2011

**LEVEL OF COURSE:** COLLEGE PREP B

**NUMBER OF CREDITS:** SIX (6)

**PREREQUISITES:** NONE

**GRADE LEVELS OFFERED TO:** 11-12

### **COURSE DESCRIPTION:**

Material for this course is presented experientially.. It is supplemented by video and computer media. Both formal and informal experiments will be conducted. Students will also work on projects individually and in groups. Active participation and co-operation are essential for successful completion of this course. Additional assignments from other sources will be required.. The course will incorporate mathematics, history, chemistry, physics and social sciences. We will integrate mathematics as a tool for problem solving in science, and as a means of expressing and/or modeling scientific theories. All students will apply their understanding of natural laws as they apply to motion, forces, and energy transformations. All students will develop problem-solving, decision-making and inquiry skills, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.

### **COURSE OBJECTIVES:**

When this Physics course has been completed successfully, students should be able to:

1. Contribute to the general intellectual development of their fellow students.
2. Be a problem solver, developing analytic skills.
3. Be given opportunity to reason, to learn to express their thoughts clearly, and to be able to follow the development of ideas presented, whether orally or written.
4. Analyze results and to distinguish between the essential and peripheral.
5. Sharpen the students' skills as observers and experimenters.
6. Develop the student's aesthetic sense and understanding of the basic laws of physics.

### **EACH UNIT IS BASED ON THE FOLLOWING GOAL:**

The student will gain an understanding of and apply the concepts indicated in the behavioral objectives via problem solving experiments and completing scenario challenges.

### **CORE CONTENT STANDARDS ADDRESSED:**

**5.1 - Scientific Practices**

**5.2 - Physical Science**

## **SPECIFIC BEHAVIORAL OBJECTIVES/PROFICIENCIES AND TIME LINES:**

### **Unit # 1 - Linear, Projectile, and Circular Motion**

**Time = 30 days**

**Objectives:** The students will be able to:

1. Calculate average speed, velocity, and acceleration
2. Understand the concept of free-fall.
3. Apply the equations of motion to solve problems.
4. Plot position vs. time, velocity vs. time, and acceleration vs. time graphs.
5. Understand the effects of air resistance and the concept of terminal velocity.
6. Determine the horizontal range of a projectile.
7. Understand the concept of projectile motion.
8. Explain the details of the "Monkey and the Hunter" problem.
9. Describe and calculate centripetal and centrifugal forces.
10. Explain simulated gravity.
11. Connect gravitation and projectiles with circular motion.

**Assignments:**

1. Homework questions and problems from text.
2. Teacher generated assignments.

**Recommended Lab Experiences:**

1. Impact Speed: Activity # 14 -- CPLM
2. Average Speed: Activity # 2 -- CPLM
3. Graphing Speed: Activity # 3 -- CPLM
4. Incline Plane: Experiment # 4 -- CPLM
5. Projectile Motion: Experiment # 7 -- CPLM
6. Centripetal Force: Lab # 17 -- Practical Physics Labs
7. Bicycle Acceleration: Lab # 3 -- Practical Physics Labs
8. Graphing Motion: Experiment #35 -- PS+C
9. Velocity: Experiment #36-- PS+C
10. Its Race Day: Experiment #37-- PS+C

**Evaluation:**

1. Quiz on measurements and analysis.
2. Lab write-up.
3. Homework problems.

### **Unit # 2 - Newton's Laws of Motion**

**Time = 30 days**

**Objectives:** Students will be able to:

1. Understand concept of inertia.
2. Differentiate between weight and mass
3. Understand the concept of force
4. Understand net forces and equilibrium
5. Understand that force causes acceleration
6. Apply Newton's second law of motion
7. Understand the concept of friction
8. Describe freefall and air resistance
9. State and apply Newton's third law of motion
10. Understand the concept of universal gravitation
11. Describe the concept of weightlessness
12. Describe black holes.

**Assignments:**

1. Read chapters 4,5,6 and selected sections of chapters 12 and 13
2. Homework questions and problems from text.
3. Teacher generated assignments

**Recommended Lab Experiences:**

1. Inertia: Activity # 8 -- Conceptual Physics Lab Manual (CPLM)
2. Inertia: Activity # 9 -- CPLM
3. Force and Acceleration: Activity # 11 -- CPLM
4. Force and Acceleration: Experiment # 13 -- CPLM
5. Action and Reaction: Activity # 16 -- CPLM
6. Hooke's Law: Experiment # 17 -- CPLM
7. Action and Reaction: Experiment # 18 -- CPLM
8. Acceleration Due to Gravity: Experiment #40 -- Physical Science and Computers (PS+C)
9. Newton's Second Law: Experiment #39-- PS+C

**Evaluation:**

1. Quiz on measurements, analysis, application, and problem solving.
2. Lab write-up.
3. Homework problems.

**Unit # 3- Momentum, Energy and Simple Machines****Time = 30 days****Objectives:** Students will be able to:

1. Develop the concept of momentum and impulse.
2. Show the relationship between momentum and impulse.
3. Understand and apply the law of conservation of momentum.
4. Differentiate between inelastic and elastic collisions.
5. Understand the relationship between work and energy.
6. Differentiate between potential and kinetic energy.
7. Calculate, work, power and energy.
8. Describe the law of conservation of energy
9. List and describe simple machines.
10. Demonstrate the usage of simple machines

**Assignments:**

1. Read chapter 7 and chapter 8.
2. Homework questions and problems from text.
3. Teacher generated assignments.

**Recommended Lab Experiences:**

1. Incline Plane Energy: Activity # 21 -- CPLM
2. Human Horse Power: Lab # 6 -- Practical Physics Labs
3. Conservation of Energy: Lab # 7 -- Practical Physics Labs
4. Collision in One Dimension: Teacher Generated
5. Conservation of Energy: Teacher Generated
6. Pulleys: Lab 10.1 -- Merrill Physics Lab Manual
7. Levers: Teacher Generated
8. Momentum: A Crash Course: Experiment #38 PS+C
9. Egg Drop Competition-- Teacher Generated
10. King of The Hill Competition -- Teacher Generated

11. Hot Wheels Test Track -- Teacher Generated

**Evaluation:**

1. Quiz on measurements, analysis, application, and problem solving.
2. Lab write-up.
3. Homework problems.

**Unit # 4 - Waves and Sound**

**Time = 15 days**

**Objectives:** Students will be able to:

1. Understand the behavior of waves.
2. Describe the action of a simple pendulum.
3. Differentiate between transverse and longitudinal waves.
4. Describe wave interference.
5. Recognize the phenomenon of the Doppler Effect.
6. Understand how a shock wave is formed.
7. Calculate the speed of sound in air.
8. Understand the relationship between frequency and pitch.
9. Explain how sonar is used to measure distances.
10. Determine the natural frequency.
11. Describe the phenomenon of resonance.

**Assignments:**

1. Read chapter 25 and chapter 26.
2. Homework questions and problems from text.
3. Teacher generated assignments.

**Recommended Lab Experiences:**

1. Waves on a Spring: Teacher Generated
2. Resonance Tubes :Teacher Generated
3. Echolocation Lab : Teacher Generated

**Evaluation:**

1. Quiz on measurements, analysis, applications, and problem solving.
2. Lab write-up.
3. Homework problems.

**Unit # 5 - Color and Light**

**Time = 30 days**

**Objectives:** Students will be able to:

1. Understand the wave nature of light.
2. State the speed of light through various media.
3. Describe the electromagnetic spectrum.
4. Explain how polarization is accomplished.
5. Describe reflected and transmitted color mixing.
6. Explain, "Why is the sky blue?" and other atmospheric phenomena.
7. Understand the significance of atomic spectra.
8. Understand reflection and refraction.
9. Differentiate between diffuse and specular reflection.
10. Determine the index of refraction of various materials.
11. Explain total internal reflection and its application to optical fibers.
12. Describe the images created by converging and diverging lenses.
13. Describe the images created by spherical mirrors.

14. Construct ray tracing diagrams.
15. Explain the design of common optical instruments.
16. Understand the functions of the human eye.

**Assignments:**

1. Read chapters 27, 28, 29, and 30.
2. Homework questions and problems from text.
3. Teacher generated assignments.

**Recommended Lab Experiences:**

1. Refraction : Teacher Generated
2. Reflection : Teacher Generated
3. Lenses : Teacher Generated
4. Ray Diagrams and image Location : Teacher Generated
5. Pinhole Camera : Teacher Generated

**Evaluation:**

1. Quiz on measurements, analysis, applications, and problem solving.
2. Lab write-up.
3. Homework problems.

**Unit # 6- Electricity**

**Time = 30 days**

**Objectives:** Students will be able to:

1. Understand the concept of electrical charge.
2. Understand and apply the law of conservation of electrical charge.
3. Differentiate between conductors and insulators.
4. Describe the differences between charging by conduction and charging by induction.
5. Develop the concept of an electrical field.
6. Understand the relationship between electric potential and potential energy.
7. Understand the significance of electric shielding.
8. Draw electric field lines.
9. Describe the operation of a Van de Graff generator.
10. Use water flow analogy for electric current.
11. Describe sources of voltage.
12. Differentiate between AC and DC.
13. Analyze an electric circuit using Ohm's Law.
14. Differentiate between parallel and series circuits.
15. Calculate electric power.
16. Construct electric circuits from a schematic diagram.
17. Use voltmeters, ohmmeters, ammeters, and multimeters correctly.
18. Understand the operation of a household electric circuit.

**Assignments:**

1. Read chapter 32, 33, 34, and 35.
2. Homework questions and problems from text.
3. Teacher generated assignments.

**Recommended Lab Experiences:**

1. Circuits Lab -- Teacher Generated
2. Electrostatics Lab -- Teacher Generated

**Evaluation:**

1. Quiz on measurements, analysis, applications, and problem solving.
2. Lab write-up.
3. Homework problems.

**Unit # 7 - Magnetism****Time = 15 days****Objectives:** Students will be able to:

1. Diagram a magnetic field.
2. Differentiate between the poles of a magnet.
3. Describe the relationship between electric current and magnetic field.
4. Understand significant applications of magnetic fields.
5. Construct a simple Galvanometer.
6. Describe the operation of an electric motor.
7. Explain that the earth is itself a magnet.
8. Construct an electromagnet.
9. Describe the production of electromagnetic waves.

**Assignments:**

1. Read chapters 36 and 37.
2. Homework questions and problems from text.
3. Teacher generated assignments.

**Recommended Lab Experiences:**

1. Galvanometer Lab: Teacher Generated
2. Simple Motor Lab: Teacher Generated
3. Telegraph Lab: Teacher Generated
4. Energy Transformations in Electric Circuits: Teacher Generated
5. Magnetic Field Mapping: Teacher Generated

**Evaluation:**

1. Quiz on measurement, analysis, application, and problem solving.
2. Lab write-up.
3. Homework Problems.

**MATERIALS/RESOURCES:**

- A. Text: Conceptual Physics, Hewitt -- Prentice Hall, 2006
- B. Laboratory Physics, Murphy and Doyle, Charles E. Merrill Publishing Company.

C. Practical Physics Labs - Goodwin

**EVALUATION:**

**A. STUDENT PROGRESS:**

- |                       |            |
|-----------------------|------------|
| 1. Test and Quizzes   | up to 40 % |
| 2. Laboratory Reports | up to 30 % |
| 3. Homework           | up to 20 % |
| 4. Participation      | up to 10%  |

The mid-term and final examinations are each 10% of the yearly grade.

**B. PERIODIC EVALUATION OF THE PROGRAM:**

The next evaluation of program, text and materials will be in June, 2014

**D. DATE MID-TERM / FINAL REVISED**

1. Mid-term – January 2011
2. Final – June 2011

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectionate or sexual orientation, gender, religion, disability or socioeconomic status.

**SUPPLEMENTARY READINGS AND INSTRUCTORS BIBLIOGRAPHY:**

1. Physics - Douglas C. Giancoli - Prentice Hall - 1985
2. Concepts of Modern Physics - Arthur Beiser - McGraw Hill - 1981
3. Physics - David Halliday and Robert Resnick - Wiley - 1978
4. Six Easy Pieces - Richard P. Feynman - Addison Wesley - 1996
5. College Physics - Sears, Zemansky, and Young - Addison Wesley - 1991
6. College Physics - Franklin Miller and Dietrich Schroer - HBJ - 1987