

## **PETERS TOWNSHIP SCHOOL DISTRICT**

### **CORE BODY OF KNOWLEDGE (CBK)**

#### **PHYSICS HONORS**

#### **GRADES 10, 11, 12**

For each of the sections that follow, students may be required to understand, apply, analyze, evaluate or create the particular concepts being taught.

#### **COURSE DESCRIPTION**

Physics Honors is a first year algebra-based physics course for juniors, seniors and select sophomore students in which the student is expected to be enrolled in pre-calculus. This course is designed for the college bound student planning a career in science, medicine or engineering or any highly motivated student with a desire to learn about the physical world. A working knowledge of trigonometry is expected. This course is conducted at an accelerated pace and the student will be expected to develop and apply problem solving skills in both the lecture and laboratory portions of the course

Physics will be presented as a unified body of knowledge in which the student will become familiar with observable facts about the physical universe. The student is expected to make connection with the subject matter across topics and disciplines in an interactive, often technological environment. Mathematics will be utilized to enable the student to quantify these observable phenomena. A graphing calculator is required for this course.

This course meets six periods per week with one class meeting being a double period primarily used for laboratory. Class periods for teaching days are occupied with interactive lectures, demonstrations, discussions, problem solving sessions and additional hands-on and laboratory investigations. This is a very student-centered/hands on course.

Topics of study for this course include the nature of physics, measurement and techniques of data analysis; motion in one and two dimensions; vectors, forces and Newton's Laws; work, power and energy; linear momentum; rotational motion; oscillatory motion, waves and sound; static and current electricity; magnetism and optics. Applications of the principles and concepts studied to the real world will be stressed throughout the course.

#### **STUDY SKILLS**

- Students will be given assignments for each chapter with problems/theory questions that are representative to those on the chapter exam.
- Students will apply content in the laboratory setting.
- Time during class will be utilized to practice more complex example problems that are representative to those on the chapter exam.

- Students are encouraged to work in study groups to prepare for exams so that they can self-reflect on their true level of understanding of the course material.

## **MAJOR UNIT THEMES**

### **1. INTRODUCTION TO PHYSICS**

- Recognize that physics is the fundamental science
- Develop strategies for utilizing the scientific methodology
- Distinguish between science and. technology

### **2. MEASUREMENT AND PROBLEM SOLVING**

- Systems of measurement with an emphasis on metric units
- Utilize proper measurement tools and techniques
- Develop and utilize proper Techniques for error analysis
- Develop and utilize proper techniques for graphical analysis

### **3. MOTION IN ONE DIMENSION**

- Describe motion in terms of position, velocity and acceleration
- Create and analyze motion diagrams and position vs. time, velocity vs. time and acceleration vs. time graphs
- Solve problems of motion using the equations of uniformly accelerated motion
- Analyze motion in free fall

### **4. VECTORS AND MOTION IN TWO DIMENSIONS**

- Distinguish between vector vs. scalar quantities
- Use graphical methods of vector analysis
- Use Trigonometric methods of vector analysis
- Develop and utilize the equations of two dimensional motion
- Develop strategies to analyze and solve problems of projectile motion
- Successfully complete the fountain project PBL

### **5. FORCES AND NEWTON'S LAWS OF MOTION**

- Characterize the nature of forces
- Describe Newton's Three Laws of Motion
- Describe the nature of friction and develop strategies for solving problems of friction
- Apply Newton's Second Law to a wide variety of physical situations
- Solve problems involving the Law of Universal Gravitation
- Develop descriptions and solve problems of uniform and non-uniform circular motion
- Identify and describe Kepler's Laws of Motion

- Use the Law of Universal Gravitation and circular motion to solve problems of satellite motion

## **6. WORK, ENERGY AND POWER**

- Develop descriptions for and solve problems of work and power
- Identify and describe forms of energy and their transformations
- Develop relationships and solve problems using the work – kinetic energy theorem
- Use the Law of Conservation of Mechanical Energy

## **7. LINEAR MOMENTUM AND COLLISIONS**

- Describe linear momentum and explain the impulse-momentum relationship
- Develop strategies for analyzing collisions in one and two dimensions
- Use the Law of Conservation of Linear Momentum

## **8. ROTATIONAL MOTION**

- Determine the factors that affect torque and solve problems of torque
- Develop and utilize the expressions for rotational kinematics and dynamics
- Describe rolling motion
- Explain the concept of angular momentum and use the Law of Conservation of Angular Momentum to analyze various physical situations

## **9. HARMONIC MOTION**

- Develop descriptions of Simple harmonic motion
- Develop strategies to analyze mass-spring systems
- Develop strategies to analyze simple pendulums
- Characterize damped and driven oscillations

## **10. WAVES AND SOUND**

- Distinguish between transverse and longitudinal waves
- Distinguish between mechanical and electromagnetic waves
- Describe wave properties, characteristics and behaviors
- Describe the nature, properties, characteristics and behaviors of sound waves
- Distinguish between measurement and perception of intensity, frequency and harmonic content
- Solve problems of wave motion
- Develop strategies for solving problems of the Doppler effect

## **11. ELECTROSTATICS**

- Characterize the nature of charge
- Distinguish between conductors, insulators and superconductors
- Use Coulomb's Law to solve problems of electrostatics
- Describe electric fields
- Distinguish between electric potential energy and electric potential difference
- Explain the use of capacitors

## **12. DC CIRCUITS**

- AC vs. DC circuits
- Utilize Ohm's Law to describe both
- Distinguish between series and parallel circuits
- Calculate electrical power and explain its effects on circuits
- Compare and contrast motors and generators

## **13. INTRODUCTION TO MAGNETISM**

- Describe the nature of the magnetic force and the magnetic field
- Describe the nature and sources of the magnetic field

## **14. THE NATURE OF LIGHT**

- Describe the nature of light
- Investigate mirrors and reflection
- Investigate lenses and refraction

## **MATERIALS (and Supplemental materials used in course)**

- Physics, 8<sup>th</sup> Edition, Advanced High School Edition; Cutnell and Johnson; John Wiley and Sons; 2009
- Selected videos from the "Mechanical Universe" series
- Selected videos from the "Bill Nye" video series
- [phet.colorado.edu](http://phet.colorado.edu) – This site is used for simulation activities
- [physicsclassroom.com](http://physicsclassroom.com) – This site contains tutorials, multimedia, problems, etc and is used as a resource site.