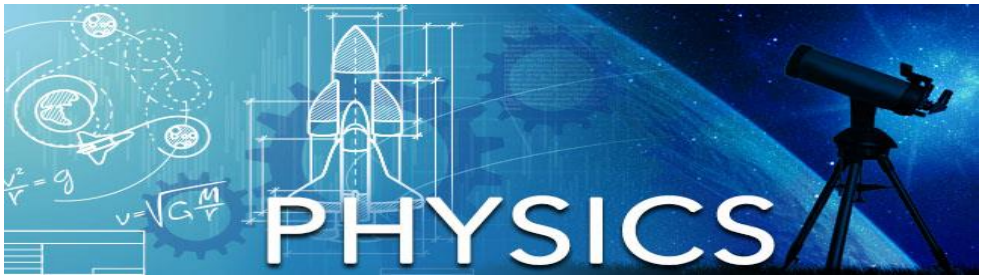
NFC ACADEMY



COURSE OVERVIEW

Physics *(an honor's level course)* is intended to expose students to the design and order in the world that God has created. In preceding years, students should have developed a basic understanding of the macroscopic and microscopic world of forces, motion, waves, light, and electricity. The physics course will expand upon that prior knowledge and further develop both. The curriculum will also seek to teach the symbolic and mathematical world of formulas and symbols used in physics. The major concepts covered are kinematics, forces and motion, work and energy, sound and light waves, electricity and magnetism, and nuclear physics.

Students at this level should show development in their ability and understanding of scientific inquiry. The units contain experiments and projects that seek to develop a deeper conceptual meaning for the student and actively engage the student. The continued exposure of science concepts and scientific inquiry will serve to improve the student's skill and understanding.

Physics should be preceded by Algebra I and II and Geometry.

OBJECTIVES

- **KINEMATICS:** Students will learn to use scalars and vectors to visualize and calculate concepts of motion.
- **DYNAMICS:** Students will articulate Newton's and Kepler's laws of motion.
- **WORK AND ENERGY:** Students will demonstrate an understanding of how energy is transferred and changed from one form to another.
- **INTRODUCTION TO WAVES:** Students will describe wave characteristics such as amplitude, velocity, wavelength, and frequency.
- **LIGHT:** Students will describe phenomena that characterize light as a wave and phenomena that characterize it as a particle.
- **STATIC ELECTRICITY:** Students will understand that all electric charges produce an electric field around them
- **ELECTRIC CURRENTS:** Students will apply and solve problems using Ohm's Law and Watt's Law for both series and parallel circuits.
- **MAGNETISM:** Students will describe the relationship between magnetism and electricity.
- **ATOMIC AND NUCLEAR PHYSICS:** Students will acquire a general understanding of atomic theory, including fusion and fission.

CURRICULUM CONTENT & SKILL FOCUS

UNIT 1: KINEMATICS

- Explain how the use of models, graphs, diagrams, and equations helps to analyze relationships and to understand physical concepts in physics
- Differentiate between scalars and vectors and distinguish between displacement and distance
- Differentiate between speed and velocity
- Solve problems concerning average and instantaneous speed and velocity
- Determine the relationship between acceleration and velocity
- Resolve vectors into components and apply the kinematic equations to solve problems involving projectile motion

UNIT 2: DYNAMICS

- Articulate Newton's first and second laws of motion and calculate the distance an object will travel when acted upon with force, and the acceleration, velocity, and momentum of an object
- Draw and interpret free body diagrams for objects
- Use the Inverse Square law to calculate force, velocity, and displacement
- Explain that in centripetal acceleration and centripetal force, the vector is directed toward the center of the circular motion
- State Newton's Third Law and that the total momentum of a system is conserved
- Understand Kepler's first and second law conceptually and apply Kepler's third law mathematically

UNIT 3: WORK AND ENERGY

- Solve problems involving work, kinetic and potential energy, and the concept of conservation of energy
- Solve problems using power equations, involving efficiency and related ratios, such as IMA and AMA
- Understand the advantages and disadvantages of using a simple machine
- Solve problems involving specific heat and calorimetry
- State the First and Second Laws of Thermodynamics
- Review the concepts of kinetic and potential energy, power, and efficiency and solve problems concerning all these ideas

UNIT 4: INTRODUCTION TO WAVES

- Describe wave characteristics such as amplitude, velocity, wavelength and frequency
- Describe wave characteristics such as reflection, refraction, diffraction and interference
- Describe sound wave characteristics such as beats, resonance, the Doppler Effect and shock waves
- Solve problems concerning beats, the Doppler Effect and the speed of sound

UNIT 5: LIGHT

- Evaluate the impact of technology on the advance of scientific research
- Describe properties of light such as reflection, refraction, polarization, dispersion and scattering
- Use ray diagrams to demonstrate the path of reflected light from a mirror
- Use ray diagrams to demonstrate the path of light through a lens
- Explain the significance of the Young Two Slit experiment, the photoelectric effect, and the Taylor experiment to the definition of light

UNIT 7: STATIC ELECTRICITY

- Describe the historical development of the understanding of electric charge as originating in the atom
- Use Coulomb's Law to solve problems
- Differentiate between a conductor and an insulator
- Understand that all electric charges produce an electric field around them
- Realize when a change moves through an electric field, energy is expended, and work is done
- Solve problems concerning potential energy, capacitance, and work

UNIT 8: ELECTRIC CURRENTS

- Realize that if a current carrying wire is coiled into a loop so that it forms a structure called a solenoid, that its magnetic field will be shaped similar to that of a bar magnet
- Use the right-hand rules to determine the direction of force on a moving charge in a magnetic field
- Determine, using Lenz's law, how to determine the direction of the induced current in a loop of wire experiencing a change in flux
- Realize that the direction of the electron beam in a CRT is determined by the interplay of two magnetic fields that are perpendicular to each other which, in turn, control where the beam will hit the screen to produce an image

UNIT 9: MAGNETISM

- Realize that if a current carrying wire is coiled into a loop so that it forms a structure called a solenoid, that its magnetic field will be shaped similar to that of a bar magnet
- Use the right-hand rules to determine the direction of force on a moving charge in a magnetic field
- Determine, using Lenz's law, how to determine the direction of the induced current in a loop of wire experiencing a change in flux
- Realize that the direction of the electron beam in a CRT is determined by the interplay of two magnetic fields that are perpendicular to each other which, in turn, control where the beam will hit the screen to produce an image

UNIT 10: ATOMIC AND NUCLEAR PHYSICS

- Use the photoelectric and Planck's equation to solve problems
- Explain the difference between the production and appearance of continuous, emission and adsorption spectra
- Understand that energy is emitted from the atom in the form of electromagnetic radiation when an electron moves from a higher to lower energy level
- Understand that the conversion of mass to binding energy in the nucleus was predicted in Einstein's equation, $E = mc^2$
- Understand that electrostatic repulsive forces are longer ranged, but not as strong as nuclear attractive forces between protons
- Understand the basic structure of a fission nuclear power plant

ADDITIONAL RESOURCES

All of the activities in this course can be completed with online resources. Physics lab experiments are done online with our virtual lab partners. Physics also includes extra alternate assignments, experiment/projects and tests for use in enhancing instruction or addressing individual needs as determined by the instructor.

Students in any honors course should expect to complete more extensive research and writing for the successful completion of the course in addition to the basic course program for the course. Science honor's course would require additional labs in addition to the research and writing component of an honor's course.

GRADING INFORMATION

GRADING COMPONENTS *(Honor's Courses)*

Lessons	30%	
Quizzes	25%	
Projects	15%	*(includes science labs)*
Tests	30%	

GRADING SCALE

100-90	A
89-80	B
79-70	C
69-60	D
Below 60	F