Archdiocese of Philadelphia
Secondary School System
Physics Standards

The Catholic school community strives to make its faith commitment a complement to academic excellence by developing a curriculum that leads all students to Christ as it prepares them for a successful life in the twenty-first century. It is a curriculum that recognizes the sanctity of each human life while affirming the dignity of each person as a unique creation of God. It is a curriculum that is intended to offer all students the opportunity to study the world at many levels of complexity, through a variety of courses.

Schools of the Archdiocese of Philadelphia shall teach, challenge, and support every student to realize his/her maximum potential and to acquire the knowledge and skill to achieve the general standards in physics.

General Standards

- Introduction
- Motion and Kinematics
- Forces and Newton's Laws
- Energy and Conservation
- Electricity and Magnetism
- Waves
- Modern Physics

Standards Terminology Glossary

- General - Goals
- Content - What a student should know
- Competency - What a student should be able to do
- Assessment - How well a student should be able to perform
- Rubric - Scoring tool to evaluate the level of student performance

1. Introduction

Content Standard

1.1. Experiences, Observations and Order

Competency Standard

1.1.1. Cites examples of experiences in the physical world
1.1.2. Distinguishes between objective and subjective observations
1.1.3. Recognizes situations in which order exists
1.1.4. Works with others in scientific inquiry to observe, hypothesize and analyze

Content Standard

1.2. Inquiry

Competency Standard

1.2.1. Demonstrates inquiry into natural phenomena

Content Standard

1.3. Logic

Competency Standard

1.3.1. Understands the difference between fact and opinion
1.3.2. Distinguishes cause and effect
1.3.3. Recognizes the difference between correlation and causality
1.3.4. Makes scientific predictions

Content Standard

1.4. Gathering and Analyzing Data

Competency Standard

1.4.1. Designs and/or completes experiments to test a hypothesis
1.4.2. Performs measurements to gather data
1.4.3. Measures with precision and accuracy
1.4.4. Determines the reasonableness of data
1.4.5. Analyzes results from measurements
1.4.6. Uses multiple representation to explain results concisely
1.4.7. Graphs data and shows mathematical relationships

2. Motion and Kinematics

Content Standard

2.1. Time and Position

Competency Standard

2.1.1. Recognizes changes in time
2.1.2. Distinguishes time from changes in time
2.1.3. Gives examples of perceived changes in time as thought to be relative
2.1.4. Identifies a frame of reference and position of objects with respect to a reference point
2.1.5. Differentiates between distance and displacement
2.1.6. Generates and analyzes position vs. time graphs

Content Standard

2.2. Velocity

Competency Standard

2.2.1. Defines velocity and identifies it graphically
2.2.2. Distinguishes between speed and velocity
2.2.3. Differentiates between average and instantaneous velocities
2.2.4. Analyzes velocity vs. time graphs
2.2.5. Demonstrates an understanding of phenomena at relativistic speeds
2.2.6. Understands simultaneity
2.2.7. Generates time dilation and length contraction

Content Standard

2.3. Acceleration

Competency Standard

2.3.1. Defines acceleration
2.3.2. Demonstrates an understanding of acceleration in two dimensions
2.3.3. Identifies uniform motion around a curve
2.3.4. Understands and uses mathematical equations

3. Forces and Newton's Laws

Content Standard

3.1. Classification of Forces

Competency Standard

3.1.1. Understands Contact and Non-Contact forces
3.1.2. Recognizes the difference between force and pressure
3.1.3. Classifies Fundamental Forces
3.1.4. Differentiates between Internal and External Forces
3.1.5. Creates and uses Free-Body diagrams

Content Standard

3.2. Force and Momentum

Competency Standard

3.2.1. Demonstrates an understanding of force, momentum and time
3.2.2. Differentiates between weight and mass
3.2.3. Understands friction

Content Standard

3.3. Resistance to Change in Velocity

Competency Standard

3.3.1. Gives examples and understands Inertia

Content Standard

3.4. Interactions

Competency Standard

3.4.1. Demonstrates an Understanding of Newton's Third Law

Content Standard

3.5. Gravitation

Competency Standard

3.5.1. Understands and uses the Law of Universal Gravitation
3.5.2. Analyzes and understands the concept of fields

Content Standard

3.6. Forces Causing Two Dimensional Motion

Competency Standard

3.6.1. Understands projectile motion
3.6.2. Describes and calculates Centripetal force
3.6.3. Understands Rotational equilibrium

4. Energy and Conservation

Content Standard

4.1. Energy

Competency Standard

4.1.1. Understands Potential and Kinetic Energy

4.1.2. Recognizes and identifies various forms of Energy

Content Standard

4.2. Thermodynamics

Competency Standard

4.2.1. Demonstrates an understanding of the Zeroth Law

4.2.2. Understands qualitatively the First Law

4.2.3. Understands qualitatively the Second Law

4.2.4. Defines Heat

4.2.5. Understands and calculates the Specific Heat of a substance

4.2.6. Demonstrates an understanding of how thermal conductivity influences our perception of hot and cold

4.2.7. Uses thermal energy to explain phase and phase changes

4.2.8. Relates collisions of particles to the Ideal Gas Law

Content Standard

4.3. Redistribution of Energy in Systems

Competency Standard

4.3.1. Explains energy redistribution

4.3.2. Defines and Analyzes systems using conservation law

4.3.3. Examines collisions in systems

4.3.4. Relates the concept of work to the action of forces

4.3.5. Defines and calculates Power

5. Electricity and Magnetism

Content Standard

5.1. Electrostatics

Competency Standard

5.1.1. Describes the electric charge distribution in neutral and charged bodies

5.1.2. Recognizes how electric charges interact with each other

5.1.3. Investigates Coulombs Law

5.1.4. Understands electric fields using gravitational fields as a model

5.1.5. Recognizes for any given point in space, the electric potential is caused by a distribution of charges

Content Standard

5.2. Potential Differences, Current and Resistance

Competency Standard

5.2.1. Identifies simple electrical circuits

5.2.2. Explains the role of wires and resistance in a circuit

5.2.3. Manipulates and analyzes circuit elements in a DC circuit

5.2.4. Understands the basic properties and uses of superconductors

5.2.5. Differentiates between electric power and electrical energy

Content Standard

5.3. Magnetism

Competency Standard

5.3.1. Explains properties of permanent magnets and their interactions

5.3.2. Recognizes the forces associated with magnetic field concepts

5.3.3. Understands electromagnetic induction

5.3.4. Explains the role of oscillating charges in the production of electromagnetic waves

Content Standard

5.4. Solid State Electronics

Competency Standard

5.4.1. Understands the structure of semiconductors

5.4.2. Explains how current is conducted in semiconductors

6. Waves

Content Standard

6.1. Wave Properties

Competency Standard

6.1.1. Understands vibrations and how they travel
6.1.2. Explains how waves transfer energy
6.1.3. Classifies types of waves

Content Standard

6.2. Periodic Waves

Competency Standard

6.2.1. Understands how periodic waves are produced
6.2.2. Explains the characteristics of periodic waves

Content Standard

6.3. Modeling Phenomena as Waves

Competency Standard

6.3.1. Applies the wave model to vibrating physical systems
6.3.2. Models sound, light and similar phenomena as waves

Content Standard

6.4. Wave Behaviors

Competency Standard

6.4.1. Understands that waves incident on a boundary may be reflected
6.4.2. Demonstrates an understanding of refraction
6.4.3. Recognizes and understands interference
6.4.4. Demonstrates an understanding of diffraction
6.4.5. Demonstrates an understanding of polarization

Content Standard

6.5. Simple Harmonic Motion

Competency Standard

6.5.1. Understands simple, forced and damped harmonic motion

Content Standard

6.6. Matter as Waves and Particles

Competency Standard

6.6.1. Evaluates the wave nature of matter
6.6.2. Understands what happens when waves interact with matter
6.6.3. Explains Einstein's Postulates

7. Modern Physics

Content Standard

7.1. Atomic Physics

Competency Standard

7.1.1. Explains the historical development of atomic physics during the 19^{th} and 20^{th} centuries

7.1.2. Understands electrons

7.1.3. Recognizes photons as discrete energy levels

7.1.4. Describes and uses Quantum Numbers

Content Standard

7.2. Chaos and Fractals

Competency Standard

7.2.1. Understands rule-governed systems

7.2.2. Understands the concept of nonlinearity

7.2.3. Identifies systems that are sensitive to initial conditions

7.2.4. Understands fractal patterns as a reflection of chaos

Content Standard

7.3. Cosmology

Competency Standard

7.3.1. Traces the history of Cosmology

7.3.2. Understands and uses astronomical tools

7.3.3. Identifies modern theories of evolution of the universe

Content Standard

7.4. Nuclear Physics

Competency Standard

7.4.1. Understands fission

7.4.2. Understands fusion

7.4.3. Explains radioactivity

7.4.4. Relates the four fundamental forces to each other

Content Standard

7.5. Particle Physics

Competency Standard

7.5.1. Demonstrates an understanding of particle accelerators

7.5.2. Understands the relationships of families, forces and conservation

7.5.3. Identifies quarks and explains the phenomena of baryons and mesons

Content Standard

7.6. Michelson-Morley Experiment

Competency Standard

7.6.1. Understands the operation of the Michelson-Morley interferometer

7.6.2. Explains the implications of the experiment

Content Standard

7.7. Special Relativity

Competency Standard

7.7.1. Demonstrates an understanding of Einstein's postulates

7.7.2. Understands simultaneity

7.7.3. Explains time dilation and length contraction

7.7.4. Understands Mass increase

7.7.5. Identifies c as a speed limit

7.7.6. Understands curved space