# Wilson Area School District
# Planned Course Guide

**Title of Planned Course:** AP Physics 2

**Subject Area:** Science

**Grade Level:** 12

**Course Description:** Advanced Placement Physics 2 is an introductory college level algebra-based physics course. The course will place an emphasis on scientific practices such as identifying and explaining relationships, developing experimental procedures including data analysis, applying mathematical procedures, and connecting physical concepts presented throughout the course. The material presented in the course will be centered around six “Big Ideas” (Objects vs. Systems, Fields, Forces, System Changes, Conservation Laws, and Waves) and seven “Science Practices” (Models, Mathematics, Scientific Questioning, Data Collection, Data Analysis and Evaluation, Theories, and Cross-Curricular Understanding) identified by the College Board.

**Time/Credit for this Course:** One Full Academic Year / 1.2 credits

**Curriculum Writer:** Jarrod Gibson

# Wilson Area School District
# Planned Course Materials

**Course Title:** AP Physics 2

**Supplemental Books:** *College Physics: A Strategic Approach*
Knight, Jones & Field

**Teacher Resources:**

- Various websites
  - Learnerator.com
  - Phet.com
  - AP Central
- Sguides from 5 Steps to a 5
- Barron's.
- AP Classroom Website

# Curriculum Map

**August / September:** Review
- Review the major themes of AP Physics, motion, forces, and energy
- Major procedures in experimental design and analysis

**September:** Fluids
- Examine and design procedures to predict the behaviors of fluids

**October:** Thermal Physics
- Examine and design procedures to investigate the concepts of temperature and internal energy
- Use molecular motion to define and explain temperature and internal energy
- Apply gas laws and the laws of thermodynamics to explain how heat can be used to perform work
- Law of conservation of energy

**November:** Electrostatics and Electric Potential
- Examine the concept of electric charge and the forces and energies associated with electric charges

**December:** Current Electricity
- Examine and design procedures to investigate current electricity
- Examine the factors affecting the amount of current that flows through an electrical conductor as governed by Ohm's law and the electrical power equations
- Examine the behavior of electric circuits consisting of varying power sources, resistors, and/or capacitors

**January:** Magnetism and Electromagnetism
- Examine and design procedures to investigate magnetism and electromagnetism
- Ideas of magnetism to explain the theory behind ferromagnetism
- How magnetic forces act upon charges and currents that are moving in magnetic fields
- Through demonstration and experimentation gain an understanding of the fact that electric currents can create their own magnetic fields

**January / February:** Light and Optics
- Examine and design procedures to investigate light and optics

**March:** Atomic/Nuclear and Modern Physics
- Examine and design procedures to investigate concepts in modern and atomic physics

**April / May:** AP Exam Review
- Review content and participate in mock question sets in preparation for the AP Exam in early May.

**May / June:** Small group projects/ Other Post AP Work

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** AP Physics 1 Review

**Time Frame:** 2 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:
- Use mathematical concepts learned in AP Physics 1
- Describe vector and scalar quantities and mathematics
- Explain conservation laws (mass, energy, charge, and momentum)
- Develop scientific procedures, data collection and evaluation, graphical analysis

**Core Activities:** Students will complete/participate in the following:
- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**
- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**
- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**
- Computers
- Internet
- Lab equipment

**Assessments:**
- TIPERs
- Lab reports
- Problem sets
- In-class Q & A

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Fluid Statics and Dynamics

**Time Frame:** 2 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:
- Describe mass density
- Explain pressure (dependence on depth, gauge vs. absolute)
- Use Pascal's Principle
- Describe Archimedes' Principle
- Solve fluid dynamic (equation of continuity, Bernoulli's Principle, viscous flow) problems

**Core Activities:** Students will complete/participate in the following:
- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**
- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**
- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**
- Computers
- Internet
- Lab equipment

**Assessments:**
- TIPERs
- Lab reports
- Problem sets
- In-class Q & A

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Thermal Physics

**Time Frame:** 3 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe temperature and temperature scales
- Explain thermal expansion (linear and volumetric)
- Relate molecular mass and the mole
- Use kinetic molecular theory and the gas laws
- Solve heat, work, and internal energy (including PV diagrams) problems
- Describe heat and change (specific heat, latent heat and calorimetry)
- Explain methods of heat transfer (conduction, convection, and radiation)
- Explain engines and efficiency

**Core Activities:** Students will complete/participate in the following:

- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**

- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**

- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**

- Computers
- Internet
- Lab equipment

**Assessments:**

- TIPERs
- Lab reports
- Problem sets
- In-class Q & A

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Electrostatics and Electric Potential

**Time Frame:** 3 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:
- Differentiate conductors and insulators
- Describe methods of charging (friction, conduction, and induction)
- Solve for electric force and Coulomb's law
- Explain electric fields and field lines
- Describe electric potential energy and the electric potential
- Describe capacitance and capacitors (geometry, factors affecting capacitance) and solve basic problems

**Core Activities:** Students will complete/participate in the following:
- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**
- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**
- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**
- Computers
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**Assessments:**
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# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Current Electricity

**Time Frame:** 2 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:
- Describe resistance and resistivity
- Use Ohm's Law to solve problems
- Use Kirchoff's Rules and Electric Circuits
- Determine electric power
- Describe, diagram, and use RC Circuits

**Core Activities:** Students will complete/participate in the following:
- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**
- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**
- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**
- Computers
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- Lab equipment

**Assessments:**
- TIPERs
- Lab reports
- Problem sets
- In-class Q & A

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Magnetism and Electromagnetism

**Time Frame:** 2 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe and solve for magnetic fields and forces (force on moving charges and path of charge)
- Describe and solve for current in fields (force and torque)
- Calculate magnetic fields produced by currents
- Use Ampere's Law
- Describe motional EMF and magnetic flux
- Calculate using Faraday's and Lenz's Laws
- Explain inductance (Mutual and Self-Inductance)
- Describe and use transformers

**Core Activities:** Students will complete/participate in the following:

- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**

- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**

- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**

- Computers
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**Assessments:**

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- Problem sets
- In-class Q & A

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Light and Optics

**Time Frame:** 2 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:
- Describe electromagnetic spectrum, ray optics, polarization, and dispersion
- Explain and use reflection (plane mirrors, spherical mirrors, and mirror equations)
- Explain and use refraction (index of refraction, Snell's Law, and total internal reflection)
- Explain and use lenses (image formation, thin-lenses, and systems of lenses)
- Describe optical devices (human eye, telescope, microscope, and lens aberrations)
- Describe and solve problems focusing on linear superposition (double-slit experiment, thin-film interference, and interferometer)

**Core Activities:** Students will complete/participate in the following:
- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**
- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**
- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**
- Computers
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**Assessments:**
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- Lab reports
- Problem sets
- In-class Q & A

# Curriculum Scope and Sequence

**Planned Course:** AP Physics 2

**Unit:** Atomic/Nuclear and Modern Physics

**Time Frame:** 3 weeks

**State Standards:** 3.1.12.A, B, C, D, E; 3.2.12.A, B, C. D; 3.4.12.C; 3.7.12.A, B; 3.4.10.C

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe and use wave-particle duality (photoelectric effect, Compton effect, blackbody radiation, de Broglie wavelength)
- Explain the nature of the atom (Rutherford scattering, models of the hydrogen atom)
- Describe nuclear physics (nuclear force, binding energy, mass defect)
- Explain and use radioactivity (reactions and energy)
- Describe nuclear reactions (fission, fusion, and reactors)
- Describe elementary particles and ionizing radiation

**Core Activities:** Students will complete/participate in the following:

- Instructor-led discussions
- Individual conceptual assignments (TIPERs)
- Higher-order thinking questions
- Inquiry labs

**Extensions:**

- Research opportunities
- Advanced questions

**Remediation:** Small group reinforcement

**Instructional Methods:**

- Direct instruction
- Demonstrations
- Lab activities
- Inquiry-based learning

**Materials & Resources:**

- Computers
- Internet
- Lab equipment

**Assessments:**

- TIPERs
- Lab reports
- Problem sets
- In-class Q & A