Board Approved
October 2016

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 AP Central.

Time/Credit for this Course: Full year / 1.2 credits

Curriculum Writer: John Harvey

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Wilson Area School District
Planned Course Materials

Course Title: AP Physics 2

Textbook: N/A

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.

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Curriculum Map

August / September: Review of Physics 1: Students will review the major themes of AP Physics I. Major themes that will be addressed will be motion, forces, and energy. This unit will also address the major procedures in experimental design and analysis.

September: Fluids: Students will examine and design procedures to predict the behaviors of fluids.

October / November: Thermal Physics: Students will examine and design procedures to investigate the concepts of temperature and internal energy. Students will use molecular motion to define and explain temperature and internal energy. The gas laws and the laws of thermodynamics will be applied to explain how heat can be used to perform work. The second half of this unit will place an emphasis on the law of conservation of energy. As this course is developed, it might be advised to break into two units due to amount of content

November: Electrostatics and Electric Potential: Students will examine the concept of electric charge and the forces and energies associated with electric charges.

December: Current Electricity: Students will examine and design procedures to investigate current electricity. In particular, they will 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. They will also examine, the behavior of electric circuits consisting of varying power sources, resistors, and/or capacitors.

January: Magnetism and Electromagnetism: Students will examine and design procedures to investigate magnetism and electromagnetism. They will use the ideas of magnetism to explain the theory behind ferromagnetism. They will also look at how magnetic forces act upon charges and currents that are moving in magnetic fields. Through demonstration and experimentation, they will gain an understanding of the fact that electric currents can create their own magnetic fields.

January / February: Light and Optics: Students will examine and design procedures to investigate light and optics.

March: Atomic/Nuclear and Modern Physics: Students will examine and design procedures to investigate concepts in modern and atomic physics.

April / May: AP Exam Review: Students will review content and participate in mock question sets in preparation for the AP Exam in early May.

May / June: Small group projects

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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 answer questions with mastery in the following content areas:

- Mathematical review
- Vector and scalar quantities and mathematics
- Conservation laws (mass, energy, charge, and momentum)
- Developing 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

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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 answer questions with mastery in the following content areas:

- Mass density
- Pressure (dependence on depth, gauge vs. absolute)
- Pascal's Principle
- Archimedes' Principle
- Fluid dynamics (equation of continuity, Bernoulli's Principle, viscous flow)

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

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Curriculum Scope and Sequence

Planned Course: AP Physics 2

Unit: Thermal Physics

Time Frame: 5 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 answer questions with mastery in the following content areas:

- Temperature and temperature scales
- Thermal expansion (linear and volumetric)
- Molecular mass and the mole
- Kinetic molecular theory and the gas laws
- Heat, work, and internal energy (including PV diagrams)
- Heat and change (specific heat, latent heat and calorimetry)
- Methods of heat transfer (conduction, convection, and radiation)
- 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

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Curriculum Scope and Sequence

Planned Course: AP Physics 2

Unit: Electrostatics and Electric Potential

Time Frame: 4 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 answer questions with mastery in the following content areas:

- Conductors and insulators
- Methods of charging (friction, conduction, and induction)
- Electric force and Coulomb's law
- Electric fields and field lines
- Electric potential energy and the electric potential
- Capacitance and capacitors (geometry, factors affecting capacitance)

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: 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 answer questions with mastery in the following content areas:

- Resistance and Resistivity
- Ohm's Law
- Kirchoff's Rules and Electric Circuits
- Electric Power
- 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
- Internet
- 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 answer questions with mastery in the following content areas:

- Magnetic fields and forces (force on moving charges and path of charge)
- Current in fields (force and torque)
- Magnetic fields produced by currents
- Ampere's Law
- Motional EMF and magnetic flux
- Faraday's and Lenz's Laws
- Inductance (Mutual and Self-Inductance)
- 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
- Internet
- Lab equipment

Assessments:

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

Curriculum Scope and Sequence

Planned Course: AP Physics 2

Unit: Light and Optics

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 answer questions with mastery in the following content areas:

- Electromagnetic spectrum, ray optics, polarization, and dispersion
- Reflection (plane mirrors, spherical mirrors, and mirror equations)
- Refraction (index of refraction, Snell's Law, and total internal reflection)
- Lenses (image formation, thin-lenses, and systems of lenses)
- Optical devices (human eye, telescope, microscope, and lens aberrations)
- 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
- Internet
- Lab equipment

Assessments:

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

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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 answer questions with mastery in the following content areas:

- Wave-particle duality (photoelectric effect, Compton effect, blackbody radiation, de Broglie wavelength)
- Nature of the atom (Rutherford scattering, models of the hydrogen atom)
- Nuclear physics (nuclear force, binding energy, mass defect)
- Radioactivity (reactions and energy)
- Nuclear reactions (fission, fusion, and reactors)
- 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