Board Approved
September 2010

Wilson Area School District
Planned Course Guide

Title of planned course: Physics

Subject Area: Science

Grade Level: 11-12

Course Description: Physics is the study of matter and energy, which includes mechanics, energy, vibrations, light, electricity, magnetism, and atomic structure. CP Physics is designed for the student who plans to continue his or her education in a two- or four-year college or university. Critical thinking skills and problem-solving are emphasized, and students are expected have mastered algebra and geometry.

Time/Credit for this Course: 7 periods each week
1 Full Year / 1.2 Credit

Curriculum Writing Committee: Ed Insel, Sandra Tozzoli, Minh-Dan Tran

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Wilson Area School District
Planned Course Materials

Course Title: Physics

Textbook: Glencoe's "Physics: Principles and Problems"
Holt
1999

Supplemental Books:

Teacher Resources: Teacher's Wrap-Around Edition of textbook

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Curriculum Map

August: Fundamentals Review

September Kinematics

October: Kinematics / Dynamics

November: Dynamics

December: Momentum and Impulse

January: Energy and Work

February: Energy and Work

March: Vibrations and Waves

April: Electricity and Magnetism

May: Electricity and Magnetism

June: Electricity and Magnetism / Special Topics (Relativity, etc.)

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Curriculum Scope & Sequence

Planned Course: Physics

Unit: Kinematics

Time frame: 5-6 weeks

State Standards:

- 3.1.12.A* Apply concepts of systems, subsystems, feedback, and control to solve complex technical problems.
- 3.1.12.B* Apply concepts of models as a method to predict and understand science and technology.
- 3.1.12.C* Assess and apply patterns in science and technology.
- 3.1.12.D* Analyze scale as a way of relating concepts and ideas to one another by some measure.
- 3.1.12.E* Evaluate change in nature, physical systems, and man-made systems.
- 3.2.12.A* Evaluate the nature of scientific and technical knowledge.
- 3.2.12.B* Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.2.12.C* Apply the elements of scientific inquiry to solve multi-step problems.
- 3.2.12.D* Analyze and use the technological design process to solve problems.
- 3.4.12.C Apply the principles of motion and force.
- 3.7.12.A* Apply advanced tools, materials, and techniques to answer complex questions.
- 3.7.12.B* Evaluate appropriate instruments and apparatus to accurately measure materials and processes.
- 3.4.10.C Distinguish among the principles of force and motion.

* These standards are supported in each of the units and for brevity are not re-listed.

Anchor(s) or adopted anchor: S11.A.1.1, S11.A.1.2, S11.A.1.3, S11.A.2.1, S11.A.2.2, S11.A.3.1, S11.A.3.2, S11.A.3.3, S11.C.3.1

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

- Measure and quantify (in magnitude and direction) the position, velocity, and acceleration of an object using appropriate tools and units, in a reference frame.
- Represent and analyze the motion of a projectile as two different motions, a vertical motion with constant acceleration and a horizontal motion with constant speed.
- Recognize vectors as quantities that: rely on both direction and magnitude; combine with other velocity and acceleration vectors according to specific mathematical rules; describe the motion of objects at every scale from the motion of subatomic particles to the motion of entire galaxies; and allow the formulation of Physical Laws independent of a particular coordinate system.
- Classify position, velocity, acceleration, and their rotational analogues as examples of vectors.

Core Activities: Instructor-led discussions, computer-aided labs, small-group problem solving

Extensions:

- Current events
- Study Island
- Independent explorations

Remediation:

- Study Island
- Online tutorials

Instructional Methods:

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

Materials & Resources:

- Textbook
- Computers
- Internet
- Lab equipment
- Worksheets

Assessments:

- Tests / Quizzes
- Lab reports
- Problem sets
- In-class Q&A

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Curriculum Scope & Sequence

Planned Course: Physics

Unit Dynamics

Time frame: 5-6 weeks

State Standards:

- 3.4.12.C Apply the principles of motion and force.
- 3.4.10.C Distinguish among the principles of force and motion.

Anchor(s) or adopted anchor: S11.C.3.1

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

- Relate the four fundamental forces of nature to the different scales at which they dominate.
- Distinguish contact forces (e.g., push/pull, friction) from field forces (e.g., gravitational, electrostatic, or magnetic fields).
- Compute the force between two masses using Newton's Law of Universal Gravitation and two electrically charged objects using Coulomb's Law.
- Apply Newton's Laws of Motion to empirically describe the motion of objects in terms of force interactions, mass, and acceleration in a non-accelerating, non-relativistic reference frame.
- Use free body diagrams to represent and analyze the forces acting on an object.
- Classify force as a vector and determine the single net force produced when multiple forces act upon an object.
- Recognize that a rotating reference frame can give the appearance of an object constrained to travel in a circular path which gives a centripetal acceleration directed from the object toward the center of the rotating reference frame.
- Determine an object's moment of inertia, the rotational analogue of mass for translational motion, by its mass distribution around the axis of rotation.
- Define and calculate torque, the rotational analogue of force for translational motion, as the vector product of an applied force and the distance between the application and an object's axis of rotation that results in the rotation of object.
- Explain that an object in equilibrium has vector sums of forces and torques both equal to zero.

Core Activities: Instructor-led discussions, computer-aided labs, small-group problem solving

Extensions:

- Current events
- Study Island
- Independent explorations

Remediation:

- Study Island
- Online tutorials

Instructional Methods:

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

Materials & Resources:

- Textbook
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Assessments:

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Curriculum Scope & Sequence

Planned Course: Physics

Unit: Momentum and Impulse

Time frame: 3 weeks

State Standards:

- 3.4.12.C Apply the principles of motion and force.
- 3.4.10.C Distinguish among the principles of force and motion.

Anchor(s) or adopted anchor: S11.C.3.1

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

- Represent and quantify the position and velocity of an object or interacting objects in terms of linear momentum.
- Represent and quantify rotational inertia and angular velocity of an object in terms of angular momentum.
- Recognize that in a closed system, the total linear and angular momenta are conserved and use this fact when solving motion problems.

Core Activities: Instructor-led discussions, computer-aided labs, small-group problem solving, group project

Extensions:

- Current events
- Study Island
- Independent explorations

Remediation:

- Study Island
- Online tutorials

Instructional Methods:

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

Materials & Resources:

- Textbook
- Computers
- Internet
- Lab equipment
- Worksheets

Assessments:

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Curriculum Scope & Sequence

Planned Course: Physics

Unit: Energy and Work

Time frame: 6 weeks

State Standards:

- 3.4.10.B Analyze energy sources and transfers of heat.
- 3.4.10.C Distinguish among the principles of force and motion.

Anchor(s) or adopted anchor: S11.C.2.1

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

- Represent and quantify the position and velocity of an object or interacting objects in terms of kinetic energy and potential energy.
- Relate rotational kinetic energy, the rotational analogue of translational kinetic energy, to rotational inertia and angular velocity.
- Calculate the total work performed by objects in a closed system by calculating the change in energy.
- Identify elements of simple machines in compound machines.
- Calculate the mechanical advantage of moving an object using a simple machine.
- Apply the knowledge that the total amount of energy in a closed system is conserved to explain common systems (e.g., refrigeration system, rocket propulsion, heat pump).
- Describe different human-made systems and how they use renewable and nonrenewable natural resources (e.g., energy, transportation, distribution, management, and processing).
- Explain the environental impacts of energy use by various economic sectors (e.g., mining, logging, transportation) on environmental systems.
- Explain the practical use of alternative sources of energy (i.e., wind, solar, and biomass) to address environmental problems (e.g. air quality, erosion, resource depletion).
- Give examples of renewable energy resources (e.g. wind, solar, biomass) and nonrenewable resources (e.g., coal, oil, natural gas) and expain the environmental and economic advantages ond disadvantages of their use.

Core Activities: Instructor-led discussions, computer-aided labs, small-group problem solving, group project

Extensions:

- Current events
- Study Island
- Independent explorations

Remediation:

- Study Island
- Online tutorials

Instructional Methods:

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

Materials & Resources:

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Assessments:

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Curriculum Scope & Sequence

Planned Course: Physics

Unit: Vibrations and Waves

Time frame: 3-4 weeks

State Standards

- 3.4.10.B Analyze energy sources and transfers of heat.

Anchor(s) or adopted anchor: S11.C.2.1, S11.C.2.2

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

- Describe how waves transfer energy to distant objects that absorb or reflect the traveling waves.
- Diagram and quantify how potential energy, kinetic energy, displacement, velocity, acceleration, and the restoring force vary during simple harmonic motion.
- Measure the period, frequency, wavelength, and amplitude of a simple harmonic oscillator.
- Compare and contrast different types of waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, x-rays, microwaves) as it relates to their properties, energy levels, and motion.
- Describe the phenomena of wave superposition, interference, reflection, refraction, and resonance.

Core Activities: Instructor-led discussions, computer-aided labs, small-group problem solving

Extensions:

- Current events
- Study Island
- Independent explorations

Remediation:

- Study Island
- Online tutorials

Instructional Methods:

- Direct instruction
- Demonstrations
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Materials & Resources:

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Curriculum Scope & Sequence

Planned Course: Physics

Unit: Electricity and Magnetism

Time frame: 5-6 weeks

State Standards

- 3.4.12.C Apply the principles of motion and force.
- 3.4.10.B Analyze energy sources and transfers of heat.

Anchor(s) or adopted anchor: S11.C.3.1

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

- Compute the force between two electrically charged objects at a distance using Coulomb's Law.
- Describe electricity and magnetism as two aspects of a singe electromagnetic force and relate electricity and magnetism to the movement of charges.
- Explain how Ohm's Law relates resistance, current, and electromotive forces.
- Recognize that inductance is the electrical analog for inertial mass and capacitance is the electrical analog for a returning force.

Core Activities: Instructor-led discussions, computer-aided labs, small-group problem solving

Extensions:

- Current events
- Study Island
- Independent explorations

Remediation:

- Study Island
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