Board Approved
September 2010

Wilson Area School District
Planned Course Guide

Title of planned course: Applied Physics 1

Subject Area: Science

Grade Level: 9-12

Course Description: This Physics course is designed to provide basic principles of Physics through the use of technology and applications. Mechanics and various physical processes are taught through a conceptual approach to physics. Students will perform independent/group investigations leading to discovery of physical principals. This course is strongly recommended for students planning technical careers. (Course requirements include: Tests, quizzes, notebook, laboratory experiments and reports, homework, worksheets and group projects.)

Time/Credit for this Course: One Academic Year / 1.0 Credit

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Wilson Area School District
Planned Course Materials

Course Title: Applied Physics 1

Textbook: Physics in Context: An Integrated Approach
Cord Communications
2001
http://www.learningincontext.com/PiC-Web/index.html

Supplemental Books:

- *Physics Principles and Problems*, Glencoe McGraw-Hill; 1999
- *Physics in Context Lab Manual*, Cord Communications; 2001
- *Physical Science Concepts in Action*, Pearson Educatiion; 2006

Teacher Resources:

- http://teachertube.com
- http://streamingdiscoveryeducation.com
- http://phet.colorado.edu/simulations/
- Computer-based labs

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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:

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Curriculum Scope & Sequence

Planned Course: Applied Physics 1

Unit: Kinematics

Time frame: 5-6 weeks

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

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: Students will complete/participate in the following:

- PowerPoint presentation
- Velocity, Acceleration, projectile motion, vector, and rotational motion worksheets
- Vector Lab, The Moving Man Computer Lab, Race Car Velocity/Acceleration lab

Extensions:

- Study Island
- Critical Thinking Worksheets
- Concepts in Action: Navigation at Sea
- Catapult K-Nex Lab Project

Remediation:

- Study Island
- Teacher directed after school
- Reinforcement worksheets
- Practice online

Instructional Methods:

- Standard and Inquiry based labs
- On-line labs
- Student demonstrations
- On-line video clips
- Cooperative learning groups
- PowerPoint presentations

Materials & Resources:

- PowerPoint
- Worksheets
- Computer Lab
- Video Clips
- Lab Manual
- K-Nex
- Portable Physics Lab
- Racecars

Assessments:

- Test
- Quizzes
- Lab write ups
- Catapult Competition
- In class participation
- Worksheets

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Curriculum Scope & Sequence

Planned Course: Applied Physics 1

Unit: Dynamics

Time frame: 5-6 weeks

State Standards: 3.4.12.C, 3.4.10.C

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 the object.
- Explain that an object in equilibrium has vector sums of forces and torques both equal to zero.

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

- PowerPoint presentation
- Force, Newton's Laws, Torque and vector worksheets
- Video Clips
- Force Lab
- Pendulum Lab

- Coefficient of Friction Lab
- Investigating Acceleration Due to Gravity Lab
- Forces in 1 Dimension computer Lab

Extensions:

- Crash Test Dummies Investigations
- Sky Diving and Terminal Speed
- Amusement Park Rides History Presentations
- Investigating a Balloon Jet Competition

Remediation:

- Study Island
- Teacher directed after school
- Reinforcement worksheets
- Practice online

Instructional Methods:

- Standard and Inquiry based labs
- On-line labs
- Student demonstrations
- On-line video clips
- Cooperative learning groups
- PowerPoint presentations

Materials & Resources:

- PowerPoint
- Worksheets
- Labs
- Portable Physics Lab and accessories
- Computer Lab

Assessments:

- Test
- Quizzes
- Lab write ups
- Jet Lab Competition
- In class participation
- Worksheets
- Amusement Park Presentations

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Curriculum Scope & Sequence

Planned Course: Applied Physics 1

Unit: Momentum and Impulse

Time frame: 3 weeks

State Standards: 3.4.12.C, 3.4.10.C

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: Students will complete/participate in the following:

- PowerPoint Presentation
- Momentum and Impulse Worksheets
- On-line Momentum Computer Lab
- Momentum Car Lab

Extensions:

- History of Bumper Cars
- Impulse as it relates to sports

Remediation:

- Study Island
- Teacher directed after school
- Reinforcement worksheets
- Practice online

Instructional Methods:

- Standard and Inquiry based labs
- On-line labs
- Student demonstrations
- On-line video clips
- Cooperative learning groups
- PowerPoint presentations

Materials & Resources:

- PowerPoint
- Worksheets
- Labs
- Computer Lab
- Momentum cars and track

Assessments:

- Test
- Quizzes
- Lab write ups
- In class participation
- Worksheets

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Curriculum Scope & Sequence

Planned Course: Applied Physics 1

Unit: Energy and Work

Time frame: 6 weeks

State Standards: 3.4.10.B, 3.4.10.C

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 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: Students will complete/participate in the following:

- PowerPoint Presentation
- Energy, Potential and Kinetic Energy, Work and Machine Worksheets
- Determining the Mass on Kinetic Energy Lab
- How Much Horse Power Can You Generate Lab
- Roller Coaster On-line Lab
- Simple/Compound K-Nex Simple Machines Projects
- Inquiry-Based Roller Coaster Marble Lab

Extensions:

- Energy Conservation in the Pole Vault
- How Wind Turbines Work
- Solar Home Project
- Data Analysis Cost of a Washing Machine

Remediation:

- Study Island
- Teacher directed after school
- Reinforcement worksheets
- Practice online

Instructional Methods:

- Standard and Inquiry based labs
- On-line labs
- Student demonstrations
- On-line video clips
- Cooperative learning groups
- PowerPoint presentations

Materials & Resources:

- PowerPoint
- Worksheets
- Labs
- Computer Lab
- K-Nex

Assessments:

- Test
- Quizzes
- Lab write ups
- In class participation
- Worksheets
- Simple/Compound Machine Project
- Solar Home Project

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Curriculum Scope & Sequence

Planned Course: Applied Physics 1

Unit: Vibrations and Waves

Time frame: 3-4 weeks

State Standards: 3.4.10.B

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: Students will complete/participate in the following:

- PowerPoint Presentation
- Wave, frequency, velocity, harmonic motion, electromagnetic spectrum, superposition, interference, reflection and refraction worksheets
- Wave on a String Computer Lab
- Slinky Lab
- Investigating Sound Waves Lab

Extensions:

- Ocean and Lake Waves
- Debate: Are Regulations Needed to Protect Whales from Noise Pollution?
- The Anatomy of the Ear and How Sound is Produced.
- Evaluating Sun Screen Lab

Remediation:

- Study Island
- Teacher directed after school
- Reinforcement worksheets
- Practice online

Instructional Methods:

- Standard and Inquiry based labs
- On-line labs
- Student demonstrations
- On-line video clips
- Cooperative learning groups
- PowerPoint presentations

Materials & Resources:

- PowerPoint
- Worksheets
- Labs
- Computer Lab
- Sun Screen

Assessments:

- Test
- Quizzes
- Lab write ups
- In class participation
- Worksheets
- Noise Debate

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Curriculum Scope & Sequence

Planned Course: Applied Physics 1

Unit: Electricity and Magnetism

Time frame: 5-6 weeks

State Standards: 3.4.12.C, 3.4.10.B

Anchor(s) or adopted anchor: S11.C.2.1, S11.C.2.2, 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: Students will complete/participate in the following:

- PowerPoint Presentation
- Coulomb's Law, Electricity, Electrical Circuits and Electrical Safety Worksheets
- Resistor Lab
- Evaluating Electrical Safety Lab
- Parallel and Series On-line Lab
- Static Electricity and Reading a Multi-Meter On-line Lab

Extensions:

- Electro-Surgical Machines
- EKG Machines
- How It Works Reports: Digital Cameras, Electrical Cars, Solid State Components, Cell Phones, Computers, Lightning

Remediation:

- Study Island
- Teacher directed after school
- Reinforcement worksheets
- Practice online

Instructional Methods:

- Standard and Inquiry based labs
- On-line labs
- Student demonstrations
- On-line video clips
- Cooperative learning groups
- PowerPoint presentations

Materials & Resources:

- PowerPoint
- Worksheets
- Labs
- Computer Lab
- Resistors, Multi-meters

Assessments:

- Test
- Quizzes
- Lab write ups
- In class participation
- Worksheets
- How It Works Report