COURSE: **Academic Physics**	GRADE(S): **11/12**
UNIT 1: Introductory Skills and Concepts Skills and techniques vital for academic proficiency are presented, reviewed, and practiced.	**TIME FRAME: 7 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

1. The student will be able to utilize a variety of methods that scientists use when investigating scientific phenomena.
2. The student will be able to identify the qualities of a good scientific hypothesis.
3. The student will be able to distinguish between a hypothesis, fact, theory, and law.
4. The student will be able to describe circumstances under which a hypothesis or law must be changed or abandoned.
5. The student will be able to discuss the need for quantifiable measurements of observations and its impact on everyday life.
6. The student will be able to manipulate several apparatus to measure physical quantities.
7. The student will be able to differentiate between accuracy and precision.
8. The student will be able to compute percent error between an experimental value and some known quantity.
9. The student will be able to distinguish between SI and other measurement units.
10. The student will be able to convert a variety of values from SI to other measurement systems.
11. The student will be able to write scientific quantities in scientific notation using the metric prefixes.
12. The student will be able to identify the dependent and independent variable in a set of data.
13. The student will be able to plot a linear set of data and calculate the slope and y-intercept.
14. The student will be able to recognize and distinguish different variable relationships,

	such as linear and quadratic. 15. The student will be able to plot a set of data and create a graph on a computer using the program Microsoft Excel. 16. The student will be able to model mathematical techniques used to solve problems throughout the course. 17. The student will be able to use algebraic principles to solve equations for unknown variables. 18. The student will be able to manipulate mathematical values using scientific notation. 19. The student will be able to use basic geometric and trigonometric properties to assist in solving problems.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Fortune Fish Activity
2. Chapter Concept Worksheets

Laboratory Experiments:

1. Circumference Lab
2. Juice Bottle Lab
3. Measurement Lab

RESOURCES:

1. Web sites:

A. Physics Classroom Online: http://www.physicsclassroom.com/
B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

2. Various textbooks:

A. *"Physics"*, by James Walker
B. *"Conceptual Physics"*, by Paul Hewitt.
C. *Physics for Computers"*, by Vernier Scientific Company.

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments/Reports
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest
3. "A Taller Paper Tower" Tech Prep Application
4. "The Role of Chance" Re-teaching Activity

ENRICHMENT:

1. Least Squares
2. Web Quest
3. Concept Map
4. "Thinking Creatively" Enrichment Activity
5. "Straightening Curves" Enrichment Activity
6. "Scientific Study" Critical Thinking Activity
7. "Direct and Indirect Measurements" Critical Thinking

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 2. Newtonian Mechanics **Section 1: Graphical Analysis of Motion** – Motion of classroom objects using position, velocity, and acceleration vs. time graphs will be analyzed.	**TIME FRAME: 7 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.7.12 C-D
3.8.12 C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section 1: Graphical Analysis of Motion.

1. The student will be able to recognize a motion graph.
2. The student will be able to define the kinematic quantities of displacement, velocity, and acceleration.
3. The student will be able to distinguish position vs. time, velocity vs. time, and acceleration vs. time graphs.
4. The student will be able to confer physical meaning to the slope of a particular motion graph.
5. The student will be able to identify proper SI units of measurement for position, velocity, and acceleration.
6. The student will be able to identify and use a proper coordinate system as a frame of reference.
7. The student will be able to determine the average velocity over a time interval from a position vs. time graph by finding the slope of the line between two points on the curve.
8. The student will be able to determine the instantaneous velocity at a specific time by finding the slope of the tangent line to the position vs. time curve at a single point.
9. The student will be able to determine the average acceleration using the equation $a = \Delta v / \Delta t$.
10. The student will be able to create a detailed sketch of velocity vs. time from the position vs. time graph.
11. The student will be able to determine the average acceleration over a time interval from a velocity vs. time graph by finding the slope of the line between two points on the curve.

	12. The student will be able to determine the instantaneous acceleration at a specific time by finding the slope of the tangent line to the velocity vs. time curve at a single point. 13. The student will be able to create a detailed sketch of acceleration vs. time from the velocity vs. time graph. 14. The student will be able to determine the object's displacement over a time interval utilizing the area under the velocity vs. time curve.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Chapter Concept Worksheets

Laboratory Experiments:

1. Constant Velocity vs. Uniform Acceleration Lab (Trolley on a String)

RESOURCES:

1. Web sites:
   - A. Physics Classroom Online - http://www.physicsclassroom.com/
   - B. Paul Hewitt's Conceptual Physics - http://www.cpsurf.com/
   - C. Batesville, Indiana HS Physics - http://www.batesville.k12.in.us/physics/index.html
   - D. Glenbrook South HS Physics - http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   - E. HyperPhysics - http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
   - F. James Walker's website through Prentice Hall - http://wps.prenhall.com/esm_walker_physics_2

2. Various textbooks:
   - A. *"Physics"*, by James Walker
   - B. *"Conceptual Physics"*, by Paul Hewitt.
   - C. *"Physics for Computers"*, by Vernier Scientific Company.

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Positions Along a Roller Coaster Activity
2. Web Quest
3. Concept Map

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 2: Newtonian Mechanics. **Section 2: One Dimensional Kinematics** – Linear motion problems will be solved using the kinematic equations of motion with constant acceleration.	**TIME FRAME: 8 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (2nd bulleted item)
3.4.12 C (3rd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section 2: One Dimensional Kinematics.

1. The student will be able to identify and distinguish between different motion problem types, such as single and multiple interval, and simultaneous motion.
2. The student will be able to read motion problems and extract given values from the text.
3. The student will be able to make a diagram complete with an appropriate coordinate system and given values for kinematics variables described in the text of the problem.
4. The student will be able to substitute given values into kinematic equations and algebraically solve kinematic equations for unknown variables.
5. The student will be able to describe the motion of an object in free fall and state the average value for the acceleration due to gravity in proper SI units.
6. The student will be able to describe the motion of an object thrown straight upward until it hits the ground, given that air resistance is negligible.
7. The student will be able to determine the speed and the distance fallen at any time after an object is dropped from rest, given that air resistance is negligible.
8. The student will be able to describe how air resistance affects the motion of falling objects and when the effects of air resistance can not be ignored.

	9. The student will be able to distinguish between, and identify the directions of, the velocity and the acceleration, at various instants in time, of an object which is experiencing vertical motion.

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 2: Newtonian Mechanics. **Section 3: Vector Algebra** – Techniques for mathematically manipulating and applying quantities having both magnitude and direction will be discussed and analyzed.	**TIME FRAME: 8 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 C (3rd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section 3: Vector Algebra.

1. The student will be able to distinguish between those quantities that are directional in nature (vector) from those that are not (scalar).
2. The student will be able to show that math operations with vector quantities must be performed with special notations and procedures that are different from those of scalar math.
3. The student will be able to determine information from a vector diagram using a ruler, protractor and scale provided.
4. The student will be able to express vector quantities in polar, analytic, and graphical forms.
5. The student will be able to add a set of vector quantities given in polar form using graphical drawing methods and return an answer for the vector sum in polar form.
6. The student will be able to use sine and cosine functions to convert a vector quantity from polar form to analytic form.
7. The student will be able to use the Pythagorean Theorem to calculate the magnitude of a vector quantity in analytic form.
8. The student will be able to use the tangent function to calculate the direction angle of a two dimensional vector in analytic form.
9. The student will be able to add vector quantities in analytic form and return the vector sum in both analytic and polar forms.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Treasure Hunt

2. Chapter Concept Worksheets

Laboratory Experiments:

1. Force Table

RESOURCES:

1. Web sites:

A. Physics Classroom Online: http://www.physicsclassroom.com/

B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/

C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html

D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html

E. HyperPhysics : http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

F. James Walker's website through Prentice Hall : http://wps.prenhall.com/esm_walker_physics_2

2. Various textbooks:

A. *"Physics"*, by James Walker

B. *"Conceptual Physics"*, by Paul Hewitt.

C. *"Physics for Computers"*, by Vernier Scientific Company.

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Pennsylvania Road Map Experiment

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 2: Newtonian Mechanics. **Section 4: Newton's Laws of Motion** – Newton's Laws of Motion are examined and applied to static and dynamic systems having only constant forces acting.	**TIME FRAME: 11 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (2nd bulleted item)
3.4.12 C (4th bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section 4: Newton's Laws of Motion.

1. The student will be able to define inertia, using Newton's 1st Law of Motion.
2. The student will be able to distinguish between mass and weight.
3. The student will be able to calculate weight in Newtons from mass in kilograms.
4. The student will be able to solve dynamics problems by using a free-body diagram to label the different forces that act on masses.
5. The student will be able to solve dynamics problems by choosing and applying an appropriate coordinate system.
6. The student will be able to solve dynamics problems by writing equations of motion for masses from the free-body diagram using Newton's 2nd Law of Motion.
7. The student will be able to solve dynamics problems by calculating acceleration expressions or values from the equation of motion derived using Newton's 2nd Law of Motion.
8. The student will be able to solve statics problems by choosing and applying an appropriate coordinate system.
9. The student will be able to solve statics problems by writing equations of equilibrium for masses from the free-body diagram using Newton's 2nd Law of Motion.
10. The student will be able to solve statics problems by solving for missing/unknown variables using the equation(s) of equilibrium.
11. The student will be able to define a force pair in a Newton's 3rd Law situation.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Mystery Mass.
2. Discovery Lab.
3. Demonstration – Inertia Demos (cloth on table, embroidery hoop)
4. Chapter Concept Worksheets.

Laboratory Experiments:

1. Inertia Balance
2. Static Equilibrium
3. Atwood's Machine
4. Balloon Rocket

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics : http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
   F. James Walker's website through Prentice Hall : http://wps.prenhall.com/esm_walker_physics_2

2. Various textbooks:
   A. *"Physics* by", James Walker
   B. *"Conceptual Physics",* by Paul Hewitt.
   C. *"Physics for Computers",* by Vernier Scientific Company.

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 2: Newtonian Mechanics. **Section 5: Work and Energy** – Theories of work and energy are examined and applied to systems having constant as well as variable forces acting; in addition, the law of conservation of energy is discussed.	TIME FRAME: **10 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A
3.4.12 C (2nd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section 5: Work and Energy.

1. The student will be able to differentiate between the three types of mechanical energy, which are kinetic energy, gravitational potential energy, and elastic potential energy.
2. The student will be able to use appropriate equations to compute kinetic energy (E_K), gravitational potential energy (E_{pg}), and elastic potential energy (E_{pe}).
3. The student will be able to compute the work done by a constant force parallel or anti-parallel to the direction of motion of the object.
4. The student will be able to complete an energy table for a dynamic system involving hills, springs, and a moving mass.
5. The student will be able to apply the law of conservation of energy to systems free of non-conservative forces.
6. The student will be able to make corrections in the total energy of a dynamic system when non-conservative forces are present.

OPTIONAL Objectives for Advanced classes:

1. The student will be able to calculate the work done by a constant force at an angle to the direction of motion using the dot product definition of work.
2. The student will be able to calculate the angle between a constant force vector and displacement vector using the dot product definition of work.

	3. The student will be able to calculate the work done by a variable force using area under the curve definition of work and a plot of force vs. displacement. 4. The student will be able to calculate the work done by a variable force using the integral calculus definition of work.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Pendulum of Death
2. Lifting vs. Pulling demos
3. Chapter Concept Worksheets

Laboratory Experiments:

1. Spring Constant Lab
2. Stairwell Power Lab.

RESOURCES:

1. Web sites:
   - A. Physics Classroom Online: http://www.physicsclassroom.com/
   - B. Paul Hewitt's Conceptual Physics - http://www.cpsurf.com/
   - C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   - D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   - E. HyperPhysics : http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
   - F. James Walker's website through Prentice Hall : http://wps.prenhall.com/esm_walker_physics_2

2. Various textbooks**:**
   - A. *"Physics"*, by James Walker
   - B. *"Conceptual Physics"*, by Paul Hewitt
   - C. *"Physics for Computers"*, by Vernier Scientific Company

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 2: Mechanics. **Section 6: Impulse and Momentum** – Impulse and momentum theories are applied to interactions between masses; in addition, the law of conservation of momentum is discussed.	**TIME FRAME: 11 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section 6: Impulse and Momentum.

1. The student will be able to distinguish between impulse and momentum.
2. The student will be able to state impulse-momentum theorem and the mathematical relationship between impulse and momentum.
3. The student will be able to calculate impulse and changes in momentum using appropriate equations.
4. The student will be able to distinguish between elastic and inelastic collisions.
5. The student will be able to calculate the final speeds of two masses involved in a perfectly elastic collision.
6. The student will be able to calculate the initial momentum of a system and show that it is equal to the final momentum of the system.
7. The student will be able to calculate the initial kinetic energy of a system and show that it is equal to the final kinetic energy of the system.
8. The student will be able to calculate the final speed if a pair of masses involved in a perfectly inelastic collision.
9. The student will be able to show that there is no change in momentum for masses involved in a perfectly inelastic collision.
10. The student will be able to calculate the change in kinetic energy for masses involved in a perfectly inelastic collision.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Chapter Concept Worksheets

Laboratory Experiments:

1. Collision Lab (2D collisions)
2. Rocket Car Lab
3. Conservation of Energy and Conservation of Momentum Lab
4. Egg Drop Lab

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics : http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
   F. James Walker's website through Prentice Hall : http://wps.prenhall.com/esm_walker_physics_2

2. Various textbooks:
   A. *"Physics"*, by James Walker
   B. *"Conceptual Physics"*, by Paul Hewitt
   C. *"Physics for Computers"*, by Vernier Scientific Company

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map

COURSE: **Academic Physics**	GRADE(S): **11/12**
UNIT 3 A (Optional): Electricity and Magnetism. **Section A-1: Electrostatics** – Electrical properties of matter and electrostatic phenomena will be investigated and explored.	**TIME FRAME: 5 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (2nd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section A-1: Electrostatics.

1. The student will be able to discover that electricity is a group of related phenomena dealing with the separation and movement of charges, which is called a charge imbalance.
2. The student will be able to recall that all objects are made of charges, which can be positive, negative, or neutral.
3. The student will be able to recognize that charged objects exert electric forces, which can be attractive or repulsive, depending on the charge.
4. The student will be able to identify the three properties of electric charge.
5. The student will be able to describe the characteristics of and differences between conductors, insulators, semi-conductors, and super-conductors.
6. The student will be able to recall and explain the methods of charging.
7. The student will be able to describe how to charge a neutral conductor via conduction and induction.
8. The student will be able to describe how to charge an insulator via charge-polarization phenomena.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Van de Graaff generator
2. Chapter Concept Worksheet.
3. Electrophorus

Laboratory Experiments:

1. Electrostatics Lab

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

2. Various textbooks:
   A. *"Physics"*, by James Walker
   B. *"Conceptual Physics"*, by Paul Hewitt.
   C. *"Physics for Computers"*, by Vernier Scientific Company.

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map
3. "The Capacitor" – Enrichment Activity

COURSE: Academic Physics	GRADE(S): 11 and 12
UNIT 3 A (Optional): Electricity and Magnetism. **Section A-2: Electric Fields and Electric Potential** – Field theory will be introduced as a basis for unifying energy concepts with electrical phenomena. These ideas will be used as a springboard into electric circuit theory.	**TIME FRAME: 3 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (2nd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section A-2: Electric Fields and Electric Potential.

1. The student will be able to define and be able to measure an electric field.
2. The student will be able to diagram electric field lines for different charged conductor arrangements.
3. The student will be able to define electric potential difference.
4. The student will be able to describe the applications of field and potential theory as they apply to an oscilloscope.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Demonstration – Oscilloscope and speaker
2. Chapter Concept Worksheets

Laboratory Experiments:

1. Mapping Electric Fields

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest
3. "Shielding & Electric Field" – Reteaching

ENRICHMENT:

1. Web Quest.
2. Concept Map.

2. Various textbooks: A. *"Physics"*, by James Walker B. *"Conceptual Physics"*, by Paul Hewitt. C. *"Physics for Computers"*, by Vernier Scientific Company.	

COURSE: Academic Physics	GRADE(S): 11 and 12
UNIT 3 A (Optional): Electricity and Magnetism. **Section A-3: Electric Current & Electric Circuits** – Electric circuits are introduced as a basis for transporting electrical energy and for doing work in an electrical device, such as a light bulb or heater. Common misconceptions about electricity and electrical circuits are discussed and dispelled.	**TIME FRAME: 10 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (2nd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section A-3: Electric Current & Electric Circuits.

1. The student will be able to differentiate between electric current, voltage, and electrical resistance.
2. The student will be able to calculate the current through and voltage drop across devices within various circuit types using Ohm's Law.
3. The student will be able to identify situations in which electric shock is a possibility.
4. The student will be able to construct circuits which perform a variety of functions.
5. The student will be able to use a multi-meter to diagnose electrical circuitry.
6. The student will be able to determine the value of resistors using the resistor color code chart.
7. The student will be able to differentiate between alternating and direct current phenomena.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Fruit Battery
2. Chapter Concept Worksheets
3. Equivalent Resistance

Laboratory Experiments:

1. Resistor Lab
2. Basic Circuit Lab

RESOURCES:

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web sites: A. Physics Classroom Online: http://www.physicsclassroom.com/ B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/ C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html 2. Various textbooks: A. *"Physics"*, by James Walker B. *"Conceptual Physics"*, by Paul Hewitt. C. *"Physics for Computerss"*, by Vernier Scientific Company.	1. Web Quest 2. Concept Map 3. "A Simple Meter" Enrichment Activity

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 3 A (Optional): Electricity and Magnetism. **Section A-4: Magnetism** – The nature of magnetism is explored through the use of common bar magnets, electrical motors, and their applications.	**TIME FRAME: 10 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (2nd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section A-4: Magnetism.

1. The student will be able to compare and contrast magnetic poles and electric charges.
2. The student will be able to relate the motion of electrons within a material to the ability of the material to become a magnet.
3. The student will be able to describe what happens to the magnetic domains of iron in the presence of a strong magnet.
4. The student will be able to describe the magnetic field produced by a current carrying wire, single loop of wire, and a wire loop of multiple turns.
5. The student will be able to describe how a magnetic field exerts a force on a charged particle in the field.
6. The student will be able to construct a simple motor and describe its operation.
7. The student will be able to suggest possible causes for earth's magnetic field.
8. The student will be able to explain the principles of electromagnetic induction governing the operation of common devices, such as automotive ignition systems and electric guitars.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Demonstration - Induction coil and moving magnet
2. Motor Timing
3. Speedometer
4. Chapter Concept Worksheets

Laboratory Experiments:

1. Simple Motor Lab
2. Electromagnet Lab
3. Generator Lab

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics - http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

2. Various textbooks:
   A. *"Physics"*, by James Walker
   B. *"Conceptual Physics"*, by Paul Hewitt
   C. *"Physics for Computers* by Vernier Scientific Company

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map
3. Induction of Current

COURSE: Academic Physics	GRADE(S): 11 and 12
UNIT 3 B (Optional): Engineering Physics. **Section B-1: Projectile Motion** – A unifying concept in physics, two dimensional projectile motion delves into the mechanics behind the flight paths of common flying objects.	**TIME FRAME: 10 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 C (3rd bulleted item)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section B-1: Projectiles.

1. The student will be able to employ kinematic equations in 2 dimensions to solve trajectory problems.
2. The student will be able to predict total time of flight, horizontal range, and maximum altitude from initial launch data.
3. The student will be able to select a velocity and launch angle to achieve specific target range and height.
4. The student will be able to relate 2-D kinematics to real life events, such as athletic events involving trajectory.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Medieval Siege Weapons
2. Mouse Trap Catapult
3. Pneumatic Rocket Launching
4. Shoot the Monkey Demo
5. Chapter Concept Worksheets

Laboratory Experiments:

1. On Target Lab
2. Rubber Band Cannon

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest
3. "Analysis of Vectors" Re-teaching

ENRICHMENT:

1. Web Quest
2. Concept Map

D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html **2.** Various textbooks: A. *"Physics"*, by James Walker B. *"Conceptual Physics"*, by Paul Hewitt. C. *"Physics for Computers"*, by Vernier Scientific Company.	

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 3 B (Optional): Engineering Physics. **Section B-2: Rotational Mechanics** – Rotating and revolving systems will be compared and contrasted to linear systems. Techniques to analyze rotating and revolving systems will be utilized to solve a variety of problems.	**TIME FRAME: 10 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 C (2nd, 4th-6th bulleted items)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section B-2: Rotational Mechanics

1. The student will be able to define angular displacement, velocity, acceleration, rotational inertia, centripetal acceleration, and torque.
2. The student will be able to relate rotational motion to linear motion.
3. The student will be able to provide examples of mechanical advantage with gearing and pulleys.
4. The student will be able to relate tangential velocity and acceleration to angular velocity and acceleration.
5. The student will be able to measure angular displacement in radians.
6. The student will be able to calculate the power of rotational assemblies.
7. The student will be able to explain the functionality and necessity of an automotive transmission with respect to power and rotational requirements of a vehicle.
8. The student will be able to postulate how a rotational assembly can provide an artificial gravitational environment in aerospace applications.
9. The student will be able to describe satellite motion and how to attain low-Earth orbit.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Chapter Concept Worksheets
2. Conversation of Angular Momentum
3. Crankshaft Manipulative
4. Trundle Wheel
5. Gyroscopic Forces
6. Center of Mass Demo
7. Magnus Effect
8. Water Bucket Rotation Demo

Laboratory Experiments:

1. Intro Torque Lab
2. Gear & Pulley Lab
3. Centripetal Force Lab

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

2. Various textbooks:
   A. *"Physics"*, by James Walker
   B. *"Conceptual Physics"*, by Paul Hewitt.
   C. *"Physics for Computers"*, by Vernier Scientific Company.

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map
3. "Fundamentals of Rotation" Advanced Concept Activity
4. "Applications of Rotation" Advanced Concept Activity

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 3 B (Optional): Engineering Physics. **Section B-3: Wave Mechanics, Optics, and Light** – Electromagnetic waves present in a variety of ways in everyday life. Concepts and modern theories of wave propagation are investigated.	**TIME FRAME: 15 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 C (1st Bullet)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section B-3: Wave Mechanics, Optics, Light.

1. The student will be able to identify and describe the basic characteristics and properties of waves, including amplitude, wavelength, frequency, and wave speed.
2. The student will be able to classify wave interference phenomena.
3. The student will be able to apply wave physics to explain real world situations, such as the basic operation of Radar systems and stealth technology.
4. The student will be able to analyze and describe the characteristics of sound waves.
5. The student will be able to apply the properties of sound to musical instruments.
6. The student will be able to describe the properties of electromagnetic waves.
7. The student will be able to describe the relationship among light, radio waves, microwaves, and X-rays using the electromagnetic spectrum.
8. The student will be able to identify how the human eye perceives light and color.
9. The student will be able to interpret the different analytical models of light described in modern physics.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Phone on a String
2. Physics of Music
3. Chapter Concept Worksheets

Laboratory Experiments:

1. Basic Optics Lab
2. Single/Double Slit Lab

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

2. Various textbooks:
   A. *"Physics"*, by James Walker
   B. *"Conceptual Physics"*, by Paul Hewitt
   C. *"Physics for Computers"*, by Vernier Scientific Company

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest
3. "Making a Straw Oboe" Re-teaching

ENRICHMENT:

1. Web Quest
2. Concept Map
3. "Earthquake Wave Velocities" Enrichment
4. "A Model of Sound Waves" Enrichment
5. "The Telescope" Enrichment

COURSE: **Academic Physics**	GRADE(S): **11 and 12**
UNIT 3 B (Optional): Engineering Physics. **Section B-4: Strength of Materials** – Mechanical constructs, i.e. buildings, cars, etc. are inherent in everyday life. Properties of materials used to construct these structures are introduced and applied to a variety of issues.	**TIME FRAME: 10 days**

NATIONAL STANDARDS:

SCIENCE THEMES:

- Systems and Interactions
- Models
- Patterns of Change
- Stability (Constancy)
- Energy
- Scale

PROCESS SKILLS:

- Observing
- Classifying
- Measuring
- Analyzing and Interpreting Data
- Formulating Hypotheses
- Predicting
- Experimenting/Testing
- Variable Recognition
- Control

STATE STANDARDS:

The following PA state standards apply to this section:

3.2.12 A-D
3.4.12 A (8th Bullet), C (2nd Bullet)
3.7.12 A-E
3.8.12 A-C

For a more thorough listing of each individual standard, please look at the end of this curriculum form.

UNIT OBJECTIVES:

Section B-4: Strength of Materials.

1. The student will be able to define stress, strain, Poisson's ratio, area moment of inertia, and the modulus of elasticity.
2. The student will be able to apply Hooke's Law to solve elementary mechanics of materials problems.
3. The student will be able to cite specific examples of mechanical material selection based on stress or strain predictions.
4. The student will be able to distinguish between the different types of materials based on their mechanical properties.
5. The student will be able to construct an object with composite materials and discuss the advantages therein.
6. The student will be able to analyze problems involving linearly elastic deformation.
7. The students will be able to design and construct a mechanical object based on their knowledge of its required mechanical properties.
8. The student will be introduced to the concept of finite element analysis modeling and its current use in industry.
9. The student will be able to describe the techniques used in experimental stress analysis.

ACTIVITIES/LABORATORY EXPERIMENTS:

Activities:

1. Four-Point Bending
2. Materials Selection
3. Scaling Laws
4. Chapter Concept Worksheets

Laboratory Experiments:

1. Composite Material Lab
2. Modulus of Elasticity Lab

RESOURCES:

1. Web sites:
   A. Physics Classroom Online: http://www.physicsclassroom.com/
   B. Paul Hewitt's Conceptual Physics: http://www.cpsurf.com/
   C. Batesville, Indiana HS Physics: http://www.batesville.k12.in.us/physics/index.html
   D. Glenbrook South HS Physics: http://www.glenbrook.k12.il.us/gbssci/phys/phys.html
   E. HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html

2. Various textbooks:
   A. *"Physics"*, by James Walker
   B. *"Conceptual Physics"*, by Paul Hewitt
   C. *"Physics for Computers"*, by Vernier Scientific Company

ASSESSMENTS:

1. Chapter Exams
2. Quizzes
3. Laboratory Experiments
4. Homework
5. Classwork
6. Notebook/ATB Checks

REMEDIATION:

1. Cooperative Learning Groups
2. Web Quest

ENRICHMENT:

1. Web Quest
2. Concept Map