Southern York County School District Instructional Plan

Name:	**Dates: September-October**
Course/Subject: Honors Physics	**Unit 1: Motion in 1- Dimension**

Stage 1 – Desired Results

PA Standard(s)/Assessment Anchors Addressed:

S11.C.3.1.3: Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).

S11.A.1.1.2: Analyze and explain the accuracy of scientific facts, principles, theories, and laws.

S11.A.1.1.3: Evaluate the appropriateness of research questions (e.g., testable vs. not-testable).

S11.A.1.3.1: Use appropriate quantitative data to describe or interpret change in systems (e.g. biological indices, electrical circuit data, automobile diagnostic systems data).

S11.A.2.1.5: Communicate results of investigations using multiple representations.

S11.A.3.2.1: Compare the accuracy of predictions represented in a model to actual observations and behavior.

S11.A.2.1.3: Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.

S11.A.2.1.4: Critique the results and conclusions of scientific inquiry for consistency and logic.

S11.A.3.1.2: Analyze and predict the effect of making a change in one part of a system on the system as a whole.

Understanding(s): ***Students will understand . . .*** 1. Scientists can solve a problem or gain understanding about the physical universe using inquiry.	**Essential Question(s):** ▪ How do scientists use data collected through inquiry to explain motion?
Learning Objectives: ***Students will know . . .*** ▪ What makes an estimate "meaningful." ▪ The difference between independent and dependent variables. ▪ That energy affects a system ▪ That acceleration is the change in an object's motion. ▪ The difference between mass and weight. ▪ That air resistance affects the motion of objects. ▪ That the speed of an object can be calculated using a graph of position vs. time. ▪ Calculate speed, distance, or time given two of the three quantities. ▪ Calculate distance traveled, instantaneous velocity, and acceleration.	***Students will be able to:*** ▪ Use the scientific method to develop solutions to problems posed in lab experiments. ▪ Express measurements in metric and English units in order to compare measurements taken in the lab with familiar examples. ▪ Construct graphs from data gathered in labs and describe the motion of the object based on those graphs. ▪ Describe the motion of an object in free-fall. ▪ Use data to construct a speed vs. time graph and use that graph to predict acceleration and distance traveled.

Name:	**Dates: October-December**
Course/Subject: Honors Physics	**Unit 2: Force and Motion in 1 and 2 - Dimensions.**

Stage 1 – Desired Results	
PA Standard(s)/Assessment Anchors Addressed: **Standard - 3.2.10.B1:** Analyze the relationships among the net forces acting on a body, the mass of the body, and the resulting acceleration using Newton's Second Law of Motion. Use Newton's Third Law to explain forces as interactions between bodies. **Standard - 3.2.P.B6:** PATTERNS SCALE MODELS CONSTANCY/CHANGE. Use Newton's laws of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **S11.A.3.2.1:** Compare the accuracy of predictions represented in a model to actual observations and behavior. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.C.3.1.3:** Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).	
Understanding(s): ***Students will understand . . .*** 1. Scientists can solve a problem or gain understanding about the physical universe using inquiry.	**Essential Question(s):** ▪ How do scientists use data gathered through inquiry to show the relationship between force and motion?
Learning Objectives: ***Students will know . . .*** ▪ That force is needed to change an object's motion. ▪ That Newton's first law qualitatively describes the relationship between net force and acceleration. ▪ That Newton's second law quantitatively describes the relationship between net force and acceleration. ▪ That Newton's third law describes the interaction forces between two objects. ▪ That inertia and mass are related. ▪ The relationship between force, mass, and acceleration. ▪ When an object is in equilibrium. ▪ That springs exert forces. ▪ The difference between sliding and static friction. ▪ The causes of friction. ▪ Reasons to increase or decrease friction. ▪ The difference between mass and weight. ▪ The difference between a vector and a scalar quantity. ▪ Find resultant vectors given component vectors. ▪ Convert between rectangular and polar coordinates ▪ Determine the distance a projectile will travel based on the initial velocity and angle of fire. ▪ Use free-body diagrams to find unknown forces. ▪ Analyze friction on angled surfaces.	***Students will be able to:*** ▪ Determine the force on an object based on data taken on the mass and acceleration. ▪ Graph weight in Newton's versus mass in kilograms. ▪ Graph force of friction versus the mass of a car and speed versus friction based on data taken for position vs. time. ▪ Recognize Hooke's Law from graph of force vs. stretch/compression. ▪ Use free-body diagrams to find unknown forces. ▪ How to analyze forces, velocity, and acceleration when there are components in both the x and y directions.

Name:	**Dates: January-March**
Course/Subject: Honors Physics	**Unit 3: Energy and Momentum**

Stage 1 – Desired Results

PA Standard(s)/Assessment Anchors Addressed:

Standard 3.2.P.B2: Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum.

Standard 3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

Standard 3.2.10.B6: PATTERNS SCALE MODELS CONSTANCY/CHANGE. Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

Standard 3.2.12.B2: Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.

Standard 3.2.12.B6: CONSTANCY/CHANGE. Compare and contrast motions of objects using forces and conservation laws.

S11.C.2.1.3: Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).

S11.C.3.1.5: Calculate the mechanical advantage for moving an object by using a simple machine.

S11.C.3.1.6: Identify elements of simple machines in compound machines.

S11.A.2.1.5: Communicate results of investigations using multiple representations.

S11.A.3.2.1: Compare the accuracy of predictions represented in a model to actual observations and behavior.

S11.A.2.1.3: Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.

S11.C.3.1.3: Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).

Understanding(s):
Students will understand . . .

1. That physical events involve transferring energy or changing energy from one form to another.

Essential Question(s):

- How is energy transformed and conserved in systems?

Learning Objectives:
Students will know . . .

- That work relates to energy.
- The difference between potential and kinetic energy.
- That simple machines make a task easier.
- That to describe different forms of energy.
- That energy is "lost" in a system.
- That machines can never be 100% efficient.
- The role of energy and power in technology, nature, and living things.
- The relationship between Newton's third law and conservation of momentum.
- The difference between elastic and inelastic collisions.
- That momentum, force, and time are related through "impulse".
- That they can apply the law of conservation of energy to explain the motion of an object acted on by gravity.

Students will be able to:

- Use process skills to make inferences and predictions about the relationship between height and speed.
- Calculate the efficiency of systems of machines.
- Calculate potential and kinetic energy and use data to show that energy is conserved as a system changes with time.
- Use momentum and energy conservation to make predictions about collisions based on data gathered.
- Calculate mechanical advantage and predict the force needed to lift an object using various simple machines.

- Use the Work-Energy theorem to determine the change in energy and motion of an object acted on by a net force.
- Calculate power based on data taken for force, time, height, mass or other variables.

Name:	**Dates: March-June**
Course/Subject: Honors Physics	**Unit 4: Electricity**

Stage 1 – Desired Results

PA Standard(s)/Assessment Anchors Addressed:

Standard 3.2.10.B4: Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.
Standard 3.2.P.B4: Explain how stationary and moving particles result in electricity and magnetism. Develop qualitative and quantitative understanding of current, voltage, resistance, and the connections among them.
Standard 3.2.12.B4. Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.

S11.C.1.1.1: Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).

S11.C.1.1.2: Explain the relationship between the physical properties of a substance and its molecular or atomic structure.

S11.C.2.1.4: Use Ohm's Law to explain relative resistances, currents, and voltage.

S11.C.2.1.3: Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).

S11.A.1.3.1: Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).

S11.A.2.1.5: Communicate results of investigations using multiple representations.

S11.A.3.2.1: Compare the accuracy of predictions represented in a model to actual observations and behavior.

S11.A.2.1.3: Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.

Understanding(s):
Students will understand . . .

1. That physical events involve transferring energy or changing energy from one form to another.

Essential Question(s):

- How does electrical energy transfer to other forms of energy (e.g. light, heat, kinetic)?

Learning Objectives:
Students will know . . .

- That electrical energy is supplied to devices in a circuit.
- The difference between open and closed circuits.
- That the units used to measure current and voltage relate to previous units.
- The function of a battery in a circuit.
- The relationships between current, voltage, and resistance.
- That multiple resistors can be combined in series and parallel circuit to generate an "equivalent resistance."

Students will be able to:

- Measure voltage in a circuit.
- Measure current in a circuit.
- Measure resistance in a circuit.
- Use Ohm's law to predict current, resistance, or voltage based on measured data.
- Use Kirchoff's Laws to determine current and voltage drops for various components in a compound circuit.
- Calculate electric power used by circuits and household appliances in order to determine electric bills.

▪ The difference between conductors and insulators. ▪ That all matter is made of protons, neutrons, and electrons. ▪ That "electric current" is the movement of charged particles. ▪ The major properties of series and parallel circuits. ▪ That a "dimmer switch" works by varying the resistance in a circuit. ▪ That a capacitor causes the current in a circuit to vary with time. ▪ That "electric charge" and "electric fields" causes current to flow through a circuit. ▪ Use Coulomb's Law to calculate the force between charged objects. ▪ Describe the motion of charged particles in an electric field. ▪ Calculate the charge stored in a capacitor as a function of time.	▪ Predict the time-dependent behavior of capacitors based on data taken for circuit resistance and capacitance.