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**Coal City Unit District #1**  
**Honors Physics**  
**Science Curriculum**

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- SC.HP:1**      **Students will analyze data in order to describe the kinematic motion of macroscopic objects including the forces that cause the object's motion in 1 or 2 dimensions. (NGSS HS-PS2-1)**
- SC.HP:1-1      Distinguish between position, displacement, distance, average speed, average velocity, instantaneous velocity, and acceleration.
  - SC.HP:1-2      Analyze data or graphs to describe the motion of an object.
  - SC.HP:1-3      Identify examples of constant acceleration and constant velocity.
  - SC.HP:1-4      Describe what happens to the displacement, velocity, acceleration, and forces acting on an object in free fall.
  - SC.HP:1-5      Perform calculations involving displacement, acceleration, velocity, and average speed.
  - SC.HP:1-6      Differentiate between vector and scalar quantities and give examples of each.
  - SC.HP:1-7      Solve problems involving vectors using trigonometry, Pythagorean Theorem, and/or graphically.
  - SC.HP:1-8      Determine the net force on a system given data from experiments or various types of graphs
  - SC.HP:1-9      Describe Newton's 2nd law using graphs or text.
  - SC.HP:1-10     Predict the effects of friction on an object's motion using the concepts of Net force and Newton's 2<sup>nd</sup> law.
  - SC.HP:1-11     Compare and Contrast mass and weight
  - SC.HP:1-12     Predict the effects on the motion of an object when the net force, mass or acceleration is changed.
  - SC.HP:1-13     Identify action/reaction forces and/or predict the direction and/or magnitude of a reaction force and/or the resulting motion of objects when a given action force is applied.
  - SC.HP:1-14     Calculate the  $F_{\text{net}}$ , mass, or acceleration using Newton's 2<sup>nd</sup> law.
  - SC.HP:1-15     Draw force diagrams and use diagrams to determine if an object is accelerating, it's  $F_{\text{net}}$ , and/or unknown forces on the object.

**SC.HP:2 Students will use data and mathematical calculations to show that momentum is conserved. (NGSS HS-PS2-2)**

- SC.HP:2-1 Define momentum, impulse, and how they are related.
- SC.HP:2-2 Differentiate between elastic and inelastic collisions.
- SC.HP:2-3 Calculate the momentum or the change in momentum of a system.
- SC.HP:2-4 Predict the effects of an impulse on the motion or momentum of a system.
- SC.HP:2-5 Apply the law of conservation of momentum to both elastic and inelastic collisions in order to solve for unknowns.
- SC.HP:2-6 Evaluate situations and safety devices in order to reduce the amount of force on objects during a collision.

**SC.HP:3 Students will define a problem and then develop, test, and modify solutions to solve the problem. (NGSS HS-ETS1-2)**

- SC.HP:3-1 Define a problem that needs to be solved.
- SC.HP:3-2 Identify criteria and constraints that need to be followed while finding a solution to the problem.
- SC.HP:3-3 Develop possible solutions.
- SC.HP:3-4 Evaluate possible solutions to determine the best one.
- SC.HP:3-5 Write a rationale for the chosen solution based off research or preliminary data.
- SC.HP:3-6 Design and carry out a procedure to test the solution.
- SC.HP:3-7 Modify solution to improve results.
- SC.HP:3-8 Write a rationale for the chosen modifications.

**SC.HP:4 Students will demonstrate knowledge of the basic concepts of static electricity by using Coulomb's law and other models to predict interactions between charged objects. (NGSS HS-PS2-4, NGSS HS-PS3-5)**

- SC.HP:4-1 Describe the nature of charge.
- SC.HP:4-2 Draw electric fields around systems of interacting charges.
- SC.HP:4-3 Explain how a change in energy of an object in an electric field is related to the change in energy of the field.
- SC.HP:4-4 State and apply the Law of Electrostatics.
- SC.HP:4-5 Describe the different ways to charge an object: charging by conduction, friction and induction.
- SC.HP:4-6 Predict the electric forces between point charges, distances between the charges, or the magnitude of the charges using Coulomb's Law.
- SC.HP:4-7 Recognize examples of electric conductors and/or insulators.
- SC.HP:4-8 Relate how charges act in electric conductors and insulators to the properties of each.

**SC.HP:5 Students will draw and analyze simple and complex circuits in order to solve for necessary information as well as determine where these circuits might be useful. (NGSS HS-PS2-5)**

- SC.HP:5-1 Define current, electrical power and energy.
- SC.HP:5-2 Apply Ohm's Law to determine resistance, current or voltage given the other two and in terms of the physical character of the wire.
- SC.HP:5-3 Apply rules of series and parallel circuits to analyze systems of resistors.
- SC.HP:5-4 Justify the use of series, parallel, or complex circuits in different applications.
- SC.HP:5-5 Calculate unknown variables using power equations. (e.g. power, resistance, current, energy, voltage)
- SC.HP:5-6 Use simplification or Kirchoff's rules to solve complex circuits.
- SC.HP:5-7 Draw a schematic of a circuit given voltage, resistor, or current requirements.

**SC.HP:6 Students will demonstrate knowledge of energy and energy transfers in a system by proving that energy is conserved in a closed system. (NGSS HS-PS3-1, NGSS HS-PS3-2, NGSS HS-PS3-3)**

- SC.HP:6-1 Define work, power, kinetic, gravitational potential, and elastic potential energy.
- SC.HP:6-2 Develop equations for kinetic, gravitational potential, and elastic potential energy.
- SC.HP:6-3 Perform calculations involving power, work, efficiency, gravitational potential, elastic potential, and kinetic energy.
- SC.HP:6-4 Apply the Law of Conservation of Energy to solve for an unknown.
- SC.HP:6-5 Perform calculations and make predictions involving Hooke's law or Force vs displacement data.
- SC.HP:6-6 Illustrate energy transformations in a system
- SC.HP:6-7 Calculate the efficiency of a machine that converts one form of energy to another based off of input and output energy.
- SC.HP:6-8 Explain why a machine is less than 100% efficient.

**SC.HP:7 Students will design, perform, and analyze scientific investigations in order to answer a question.**

- SC.HP:7-1 Write a question answerable by a scientific process.
- SC.HP:7-2 Write a hypothesis with a prediction and thoughtful reason for the prediction.
- SC.HP:7-3 Design and carry out a controlled scientific investigation.
- SC.HP:7-4 Analyze trends from experimental data in graph or table form.
- SC.HP:7-5 Draw conclusions from experimental data.
- SC.HP:7-6 Write a scientific explanation to communicate experimental results.