
Coal City Unit District #1
Physics
Science Curriculum

SC.P:1 Students will analyze data in order to describe the kinematic motion of macroscopic objects including the forces that cause the object's motion. (NGSS HS-PS2-1)

- SC.P:1-1 Distinguish between position, displacement, distance, average speed, average velocity, instantaneous velocity, and acceleration.
- SC.P:1-2 Identify examples of constant acceleration, constant velocity, and constant speed.
- SC.P:1-3 Describe what happens to the displacement, velocity, acceleration, and forces acting on an object in free fall.
- SC.P:1-4 Perform calculations involving displacement, acceleration, velocity, and average speed.
- SC.P:1-5 Differentiate between vector and scalar quantities and give examples of each.
- SC.P:1-6 Solve problems involving vectors using trigonometry, Pythagorean Theorem, and/or graphically.
- SC.P:1-7 Analyze data or graphs to describe the motion of an object.
- SC.P:1-8 Determine the net force on a system given data from experiments or various types of graphs.
- SC.P:1-9 Predict the effects of friction on an object's motion using the concepts of Net force and Newton's 2nd law.
- SC.P:1-10 Compare and contrast mass and weight
- SC.P:1-11 Predict the effects on the motion of an object when the net force, mass or acceleration is changed.
- SC.P:1-12 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.P:1-13 Calculate the net force, mass, or acceleration using Newton's 2nd law.
- SC.P:1-14 Draw force diagrams and use diagrams to determine if an object is accelerating, it's F_{net} , and/or unknown forces on the object.

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

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

SC.P: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.P:4 Students will demonstrate knowledge of gravitational interactions and universal gravitation. (NGSS HS-PS2-4, NGSS HS-ESS1-4)

- SC.P:4-1 Describe the relationship between Force, mass and distance.
- SC.P:4-2 Perform calculations using the Law of Gravitation.
- SC.P:4-3 Predict the Force if distance and/or mass is changed.
- SC.P:4-4 Predict effects of an elevator or other accelerating object on your weight.
- SC.P:4-5 State Kepler's Laws of orbital motions.
- SC.P:4-6 Calculate the period of an orbiting object based off of its distance from the sun.

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

SC.P:6 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.P:6-1 Define current, electrical power and energy.
- SC.P:6-2 Apply Ohm's Law to determine resistance, current or voltage given the other two.
- SC.P:6-3 Explain how the makeup of wires in a circuit can affect the circuit.
- SC.P:6-4 Apply rules of series and parallel circuits to analyze systems of resistors.
- SC.P:6-5 Calculate unknown variables using power equations. (e.g. power, resistance, current, energy, voltage)
- SC.P:6-6 Justify the use of series, parallel, or complex circuits in different applications.
- SC.P:6-7 Draw a schematic of a circuit given voltage, resistor, or current requirements.

SC.P:7 **Students will demonstrate knowledge of energy and energy transfers in a system. (NGSS HS-PS3-1, NGSS HS-PS3-2, NGSS HS-PS3-3)**

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

SC.P:8 **Students will design, perform, and analyze scientific investigations in order to answer a question.**

- SC.P:8-1 Write a question answerable by a scientific process.
- SC.P:8-2 Write a hypothesis with a prediction and thoughtful reason for the prediction.
- SC.P:8-3 Design and carry out a controlled scientific investigation.
- SC.P:8-4 Analyze trends from experimental data in graph or table form.
- SC.P:8-5 Draw conclusions from experimental data.
- SC.P:8-6 Write a scientific explanation to communicate experimental results.