



## North Carolina Essential Standards

### Physics

The North Carolina Science Essential Standards maintain the respect for local control of each Local Education Authority (LEA) to design the specific curricular and instructional strategies that best deliver the content to their students. Nonetheless, engaging students in inquiry-based instruction is a critical way of developing conceptual understanding of the science content that is vital for success in the twenty-first century. The process of scientific inquiry, experimentation and technological design should not be taught nor tested in isolation of the core concepts drawn from physical science, earth science and life science. A seamless integration of science content, scientific inquiry, experimentation and technological design will reinforce in students the notion that “what” is known is inextricably tied to “how” it is known. A well-planned science curriculum provides opportunities for inquiry, experimentation and technological design. Teachers, when teaching science, should provide opportunities for students to engage in “hands-on/minds-on” activities that are exemplars of scientific inquiry, experimentation and technological design.

#### Science as Inquiry

Traditional laboratory experiences provide opportunities to demonstrate how science is constant, historic, probabilistic, and replicable. Although there are no fixed steps that all scientists follow, scientific investigations usually involve collections of relevant evidence, the use of logical reasoning, the application of imagination to devise hypotheses, and explanations to make sense of collected evidence. Student engagement in scientific investigation provides background for understanding the nature of scientific inquiry. In addition, the science process skills necessary for inquiry are acquired through active experience. The process skills support development of reasoning and problem-solving ability and are the core of scientific methodologies.

### Forces and Motion

	Essential Standard	Clarifying Objectives	
<b>Phy.1.1</b>	<b>Analyze the motion of objects.</b>	Phy.1.1.1	Analyze motion graphically and numerically using vectors, graphs and calculations.
		Phy.1.1.2	Analyze motion in one dimension using time, distance, displacement, velocity, and acceleration.
		Phy.1.1.3	Analyze motion in two dimensions using angle of trajectory, time, distance, displacement, velocity, and acceleration.
<b>Phy.1.2</b>	<b>Analyze systems of forces and their interaction with matter.</b>	Phy.1.2.1	Analyze forces and systems of forces graphically and numerically using vectors, graphs and calculations.
		Phy.1.2.2	Analyze systems of forces in one dimension and two dimensions using free body diagrams.
		Phy.1.2.3	Explain forces using Newton’s laws of motion as well as the universal law of gravitation.
		Phy.1.2.4	Explain the effects of forces (including weight, normal, tension and friction) on objects.
		Phy.1.2.5	Analyze basic forces related to rotation in a circular path (centripetal force).

	Essential Standard	Clarifying Objectives	
<b>Phy.1.3</b>	<b>Analyze the motion of objects based on the principles of conservation of momentum, conservation of energy and impulse.</b>	Phy.1.3.1	Analyze the motion of objects involved in completely elastic and completely inelastic collisions by using the principles of conservation of momentum and conservation of energy.
		Phy.1.3.2	Analyze the motion of objects based on the relationship between momentum and impulse.

### Energy: Conservation and Transfer

	Essential Standard	Clarifying Objectives	
<b>Phy.2.1</b>	<b>Understand the concepts of work, energy, and power, as well as the relationship among them.</b>	Phy.2.1.1	Interpret data on work and energy presented graphically and numerically.
		Phy.2.1.2	Compare the concepts of potential and kinetic energy and conservation of total mechanical energy in the description of the motion of objects.
		Phy.2.1.3	Explain the relationship among work, power and energy.
<b>Phy.2.2</b>	<b>Analyze the behavior of waves.</b>	Phy.2.2.1	Analyze how energy is transmitted through waves, using the fundamental characteristics of waves: wavelength, period, frequency, amplitude, and wave velocity.
		Phy.2.2.2	Analyze wave behaviors in terms of transmission, reflection, refraction and interference.
		Phy.2.2.3	Compare mechanical and electromagnetic waves in terms of wave characteristics and behavior (specifically sound and light).
<b>Phy.2.3</b>	<b>Analyze the nature of moving charges and electric circuits.</b>	Phy.2.3.1	Explain Ohm's law in relation to electric circuits.
		Phy.2.3.2	Differentiate the behavior of moving charges in conductors and insulators.
		Phy.2.3.3	Compare the general characteristics of AC and DC systems without calculations.
		Phy.2.3.4	Analyze electric systems in terms of their energy and power.
		Phy.2.3.5	Analyze systems with multiple potential differences and resistors connected in series and parallel circuits, both conceptually and mathematically, in terms of voltage, current and resistance.

## Interactions of Energy and Matter

	Essential Standard	Clarifying Objectives	
<b>Phy.3.1</b>	<b>Explain charges and electrostatic systems.</b>	Phy.3.1.1	Explain qualitatively the fundamental properties of the interactions of charged objects.
		Phy.3.1.2	Explain the geometries and magnitudes of electric fields.
		Phy.3.1.3	Explain how Coulomb's law relates to the electrostatic interactions among charged objects.
		Phy.3.1.4	Explain the mechanisms for producing electrostatic charges, including charging by friction, conduction, and induction.
		Phy.3.1.5	Explain how differences in electrostatic potentials relate to the potential energy of charged objects.
<b>Phy.3.2</b>	<b>Explain the concept of magnetism.</b>	Phy.3.2.1	Explain the relationship between magnetic domains and magnetism.
		Phy.3.2.2	Explain how electric currents produce various magnetic fields.
		Phy.3.2.3	Explain how transformers and power distributions are applications of electromagnetism.