



This document is designed to help North Carolina educators teach the Essential Standards (Standard Course of Study). NCDPI staff are continually updating and improving these tools to better serve teachers.

Physics

2009-to-2004 Standards Crosswalk

This document is a general comparison of the current 2004 Science Standard Course of Study and the new 2009 Science Essential Standards. It provides initial insight into sameness and difference between these two sets of standards. This document is not intended to answer all questions about the nuance of the new standards versus the old - in fact, we imagine you will develop questions as you do a close reading of the new standards. Please send the science section of NC DPI any thoughts, feedback, questions and ideas about additional resources that would help you start preparing to teach the Essential Standards. Email Beverly Vance at bvance@dpi.state.nc.us.

Important Note: The current 2004 SCOS will continue to be the operational standards in the 2010-11 and 2011-12 school years as resource materials are developed to support the new Science Essential Standards, professional development is conducted and assessments are designed to align to the new Science Essential Standards. We expect the new Essential Standards to be taught and assessed in schools for the first time in the 2012-13 school year. That said, we are providing Essential Standards resources now and over the next two-years so that schools and teachers can get a head start on internalizing and planning to teach the new standards.

2009 Essential Standards			2004 NC SCOS			Comments
Strand	Objective	Essential Standard	Goal	Objective	Text of objective	
Forces and Motion		Analyze the motion of objects.	Linear Motion	2.01	Analyze velocity as a rate of change of position: <ul style="list-style-type: none"> Average velocity Instantaneous velocity 	
	Phy.1.1.1	Analyze motion graphically and numerically using vectors, graphs and calculations.		2.02	Compare and contrast as scalar and vector quantities: <ul style="list-style-type: none"> Speed and velocity Distance and displacement 	
				2.03	Analyze acceleration as rate of change in velocity.	

2009 Essential Standards		2004 NC SCOS		Comments	
Strand	Objective	Goal	Objective		
	<p>Essential Standard</p> <p>Text of Clarifying objective</p>		Text of objective		
			<p>2.04</p> <p>Using graphical and mathematical tools, design and conduct investigations of linear motion and the relationship among:</p> <ul style="list-style-type: none"> • Position • Average velocity • Instantaneous velocity • Acceleration • Time 		
	Phy.1.1.2		<p>2.04</p> <p>Using graphical and mathematical tools, design and conduct investigations of linear motion and the relationship among:</p> <ul style="list-style-type: none"> • Position • Average velocity • Instantaneous velocity • Acceleration • Time 		
	Analyze motion in one dimension using time, distance, and displacement, velocity, and acceleration.				
	Phy.1.1.3	Two Dimensional Motion Including Circular Motion	3.01	Analyze and evaluate projectile motion in a defined frame of reference.	
	Analyze motion in two dimensions using angle of trajectory, time, distance, displacement, velocity, and acceleration.		3.02	Design and conduct investigations of two-dimensional motion of objects.	
			3.03	Analyze and evaluate independence of the vector components of projectile motion.	
			3.04	Evaluate, measure, and analyze circular motion.	
			3.06	Investigate, evaluate and analyze the relationship among:	
			<ul style="list-style-type: none"> • Centripetal acceleration • Velocity • Radius 	<p>The following bullets from objective 3.06 are addressed in clarifying objective Phy.1.2.5</p> <ul style="list-style-type: none"> • Centripetal force • Mass 	

2009 Essential Standards			2004 NC SCOS			Comments
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	Text of Clarifying objective					
Forces and Motion	Analyze systems of forces and their interaction with matter.		Forces and Newton's Laws of Motion	4.02	Assess, measure and calculate the conditions required to maintain a body in a state of static equilibrium.	
	Phy.1.2.1	Analyze forces and systems of forces graphically and numerically using vectors, graphs, and calculations.		4.05	Assess the independence of the vector components of forces.	
		4.06		Investigate, measure and analyze the nature and magnitude of frictional forces.		
		4.07		Assess and calculate the nature and magnitude of gravitational forces (Newton's Law of Universal Gravitation).		
	Phy.1.2.2	Analyze systems of forces in one dimension and two dimensions using free body diagrams.		4.05	Assess the independence of the vector components of forces.	
	Phy.1.2.3	Explain forces using Newton's laws of motion as well as the universal law of gravitation.		4.01	Determine that an object will continue in its state of motion unless acted upon by a net outside force (Newton's First Law of Motion, The Law of Inertia).	
				4.03	Assess, measure and calculate the relationship among the force acting on a body, the mass of the body, and the nature of the acceleration produced (Newton's Second Law of Motion).	
				4.04	Analyze and mathematically describe forces as interactions between bodies (Newton's Third Law of Motion).	
				4.07	Assess and calculate the nature and magnitude of gravitational forces (Newton's Law of Universal Gravitation)	

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective			
	Phy.1.2.4	Explain the effects of forces (including weight, normal, tension and friction) on objects.		4.06	Investigate, measure and analyze the nature and magnitude of frictional forces.			
				4.07	Assess and calculate the nature and magnitude of gravitational forces (Newton's Law of Universal Gravitation)			
	Phy.1.2.5	Analyze basic forces related to rotation in a circular path (centripetal force).	Two Dimensional Motion Including Circular Motion	3.05	Analyze and evaluate the nature of centripetal forces.			
				3.06	Investigate, evaluate and analyze the relationship among: <ul style="list-style-type: none"> • Centripetal force • Centripetal acceleration • Mass • Velocity • Radius 			
Forces and Motion	Analyze the motion of objects based on the principles of conservation of momentum, conservation of energy and impulse.		Impulse and Momentum	5.04	Analyze one-dimensional interactions between objects and recognize that the total momentum is conserved in both collision and recoil situations.			
	Phy.1.3.1	Analyze the motion of objects 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.					5.01	Assess the vector nature of momentum and its relation to the mass and velocity of an object.
							5.02	Compare and contrast impulse and momentum.
		5.03	Analyze the factors required to produce a change in momentum.					

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
		Text of Clarifying objective				
				5.05	Assess real world applications of the impulse and momentum. Including but not limited to, sports and transportation.	
Energy: Conservation and Transfer	Understand the concepts of work, energy, and power, as well as the relationship among them.		Energy as the Ability to Cause Change	6.01	Investigate and analyze energy storage and transfer mechanisms: <ul style="list-style-type: none"> Gravitational potential energy Elastic potential energy Kinetic energy 	The remaining bullet, <ul style="list-style-type: none"> Thermal energy is addressed in objective Phy.2.1.2.
	Phy.2.1.1	Interpret data on work and energy presented graphically and numerically.		6.03	Analyze, evaluate and measure the transfer of energy by a force. <ul style="list-style-type: none"> Work 	The remaining bullet, <ul style="list-style-type: none"> Power is addressed in clarifying objective Phy.2.1.3.
				6.04	Design and conduct investigations of : <ul style="list-style-type: none"> Mechanical energy 	The remaining bullet, <ul style="list-style-type: none"> Power is addressed in clarifying objective Phy.2.1.3.
				6.01	Investigate and analyze energy storage and transfer mechanisms: <ul style="list-style-type: none"> Gravitational potential energy Elastic potential energy Thermal energy Kinetic energy 	
	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.		6.02	Analyze, evaluate and apply the principle of conservation of energy.	
	Phy.2.1.3	Explain the relationship among work, power and energy.		6.03	Analyze, evaluate and measure the transfer of energy by a force. <ul style="list-style-type: none"> Work Power 	
				6.04	Design and conduct investigations of : <ul style="list-style-type: none"> Mechanical energy Power 	

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Energy: Conservation and Transfer	Analyze the behavior of waves.		Wave Motion and the Wave Nature of Sound and Light	7.01	Analyze, investigate and evaluate the relationship among the characteristics of waves: <ul style="list-style-type: none"> • Wavelength • Frequency • Period • Amplitude 	
	Phy.2.2.1	Analyze how energy is transmitted through waves, using the fundamental characteristics of waves: wavelength, period, frequency, amplitude, and wave velocity.			7.05	
	Phy.2.2.2	Analyze wave behaviors in terms of transmission, reflection, refraction and interference.		7.02	Describe the behavior of waves in various media.	
				7.03	Analyze the behavior of waves at boundaries between media: <ul style="list-style-type: none"> • Reflection, including the Law of Reflection • Refraction, including Snell's Law 	
				7.04	Analyze the relationship between the phenomena of interference and the principle of superposition.	
Phy.2.2.3	Compare mechanical and electromagnetic waves in terms of wave characteristics and behavior (specifically sound and light).				While identified in the 2004 Content Description for Objective 7.01, it has been explicitly stated as a clarifying objective in the 2009 revision.	
Energy: Conservation	Analyze the nature of moving charges and electric circuits.		Static Electricity and	8.02	Analyze and measure the relationship among potential difference, current, and resistance in a direct current circuit.	
	Phy.2.3.1	Explain Ohm's law in relation to electric circuits.				

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	Phy.2.3.2	Differentiate the behavior of moving charges in conductors and insulators.				Foundational understanding of how charges move through materials is key to conceptual development of Ohm’s law.
	Phy.2.3.3	Compare the general characteristics of AC and DC systems without calculations.				New topic—while an in-depth study of AC systems is not needed, students need to be aware of their prevalence and why.
	Phy.2.3.4	Analyze electric systems in terms of their energy and power.	Static Electricity and Direct Current Electrical	8.04	Analyze and measure the nature of power in an electrical circuit.	
	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.		8.03	Analyze and measure the relationship among current, voltage, and resistance in circuits. <ul style="list-style-type: none"> • Series • Parallel • Series-parallel combinations 	<i>*Multiple potential differences (voltage sources) has been added to the 2009 Clarifying Objective.</i>
Interactions of Energy and Matter	Understand charges and electrostatic systems.		Static Electricity and Direct Current Electrical Circuits	8.01	Analyze the nature of electrical charges. <ul style="list-style-type: none"> • Investigate the electrical charging of objects due to transfer of charge • Investigate the conservation of electric charge 	These are the only bullets in objective 8.01 that address this clarifying objective. The remaining bullet applies to Phy.3.1.3. <ul style="list-style-type: none"> • Analyze the relationship among force, charge and distance summarized in Coulomb’s law.
	Phy.3.1.1	Explain qualitatively the fundamental properties of the interactions of charged objects.			Analyze the nature of electrical charges. <ul style="list-style-type: none"> • Investigate the electrical charging of objects due to transfer of charge • Investigate the conservation of electric charge 	See comments for clarifying objective Phy.3.1.1.
	Phy.3.1.2	Explain the geometries and magnitudes of electric fields.		8.01	Analyze the nature of electrical charges. <ul style="list-style-type: none"> • Investigate the electrical charging of objects due to transfer of charge • Investigate the conservation of electric charge 	

2009 Essential Standards			2004 NC SCOS			
Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
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	Phy.3.1.3	Explain how Coulomb’s law relates to the electrostatic interactions among charged objects.		8.01	Analyze the nature of electrical charges. <ul style="list-style-type: none"> Analyze the relationship among force, charge and distance summarized by Coulomb’s law 	The remaining bullets in objective 8.01 are addressed in clarifying objectives Phy.3.1.1, Phy.3.1.2, and Phy.3.1.4 <ul style="list-style-type: none"> Investigate the electrical charging of objects due to transfer of charge Investigate the conservation of electric charge
	Phy.3.1.4	Explain the mechanisms for producing electrostatic charges including charging by friction, conduction, and induction.		8.01	Analyze the nature of electrical charges. <ul style="list-style-type: none"> Investigate the electrical charging of objects due to transfer of charge Investigate the conservation of electric charge 	See comments for clarifying objective Phy.3.1.1
	Phy.3.1.5	Explain how differences in electrostatic potentials relate to the potential energy of charged objects.				New topic—The focus is on conceptual development of electric potential energy.
Interactions of Energy and Matter	Explain the concept of magnetism.					New topic—Conceptual understanding of magnetism and models of magnetic fields are critical to students’ understanding of the interrelationship between electricity and magnetism.
	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.					

Goal 1 in 2004 SCOS, “develop abilities necessary to do and understand scientific inquiry,” should be integrated in classroom instructional unit design.