



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.

Physical Science

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		Understand motion in terms of speed, velocity, acceleration, and momentum	Forces and Motion	2.01	Measure and mathematically/graphically analyze motion: <ul style="list-style-type: none"> • Frame of reference (All motion is relative—there is no motionless frame.) 	The following bullets from objective 2.01 are addressed in clarifying objective Psc.1.1.2. <ul style="list-style-type: none"> • Uniform motion • Acceleration
	PSc.1.1.1	Explain motion in terms of frame of reference, distance, and displacement.				

2009 Essential Standards			2004 NC SCOS			
Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
		Text of Clarifying objective				
	PSc.1.1.2	Compare speed, velocity, acceleration, and momentum using investigations, graphing, scalar quantities, and vector quantities.		2.01	Measure and mathematically/graphically analyze motion: <ul style="list-style-type: none"> • Uniform motion • Acceleration 	The following bullet from objective 2.01 is addressed in clarifying objective Psc.1.1.1 <ul style="list-style-type: none"> • Frame of reference (All motion is relative—there is no motionless frame.) <i>*The principal of momentum was not addressed directly in the 2004 NCSCOS.</i>
Forces and Motion	Understand the relationship between forces and motion.		Forces and Motion	2.01	Measure and mathematically/graphically analyze motion: <ul style="list-style-type: none"> • Acceleration 	Other bullets from objective 2.01 are addressed in Essential Standard 1.1 <ul style="list-style-type: none"> • Frame of reference (All motion is relative—there is no motionless frame.) • Uniform motion <i>* Freefall motion was addressed as an example of acceleration in the 2004 NCSCOS.</i>
	PSc.1.2.1	Explain how gravitational force affects the weight of an object and the velocity of an object in freefall.				
	PSc.1.2.2	Classify frictional forces into one of four types: static, sliding, rolling, and fluid.				<i>*Friction as a force was addressed through objective 2.02 and the understanding of unbalanced force.</i>
	PSc.1.2.3	Explain Newton’s three laws of motion.	Forces and Motion	2.02	Investigate and analyze forces as interactions that can change motion: <ul style="list-style-type: none"> • In the absence of a force, an object in motion will remain in motion or an object at rest will remain at rest until acted upon by an unbalanced force. • Change in motion of an object (acceleration) is directly proportional to the unbalanced outside force and inversely proportional to the mass. • Whenever one object exerts a force on another, an equal and opposite force is exerted by the second on the first. 	

2009 Essential Standards			2004 NC SCOS			Comments	
Strand	Objective	Essential Standard	Goal	Objective	Text of objective		
Matter: Properties and Change		Understand types, properties, and structure of matter.	Structure and	5.03	Identify substances through the investigation of physical properties:		
	PSc.2.1.1	Classify matter as homogeneous or heterogeneous; pure substance or mixture; element or compound; metals, nonmetals, or metalloids; solution, colloid, or suspension.			Regularity in		6.01
	PSc.2.1.2	Explain the phases of matter and the physical changes that matter undergoes.	Structure and	5.03	Identify substances through the investigation of physical properties:		
					Regularity in Chemistry		6.05
	PSc.2.1.3	Compare general physical and chemical properties of various types of matter.	Structure and	5.03	Identify substances through the investigation of physical properties:		Other bullets in objective 6.05 are addressed as indicated in parentheses:
					Regularity in Chemistry		

- Polarity (PSc.2.2.6)
- pH scale (PSc.2.2.6)
- Electrical conductivity (Psc.2.1.3)

2009 Essential Standards			2004 NC SCOS			
Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
		Text of Clarifying objective				
				6.05	Investigate and analyze the properties and composition of solutions: <ul style="list-style-type: none"> Electrical Conductivity 	This is the only bullet that addresses this clarifying objective. Other bullets in objective 6.05 are addressed as indicated in parentheses: <ul style="list-style-type: none"> Solubility curves (PSc.2.1.2) Concentration (PSc.2.1.2) Polarity (PSc.2.2.6) pH scale (PSc.2.2.6)
	PSc.2.1.4	Interpret the data presented in the Bohr model diagrams and dot diagrams for atoms and ions of elements 1-18.	Structure and Properties of Matter	5.01	Develop an understanding of how scientific processes have led to the current atomic theory. <ul style="list-style-type: none"> Dalton's Atomic Theory J. J. Thomson's Model of the Atom Rutherford's Gold Foil Experiment Bohr's Planetary Model 	* <i>While there is value in students understanding the historical development of atomic theory, the focus is understanding the relationship between structure and properties of matter. Electron cloud model has been omitted from the 2009 Clarifying Objectives.</i>
				5.02	Examine the nature of atomic structure: <ul style="list-style-type: none"> Protons Neutrons Electrons Atomic Mass Atomic Number Isotopes 	
Matter: Properties and	Understand chemical bonding and chemical interactions.		Regularities in Chemistry	6.01	Analyze the periodic trends in physical and chemical properties of elements. <ul style="list-style-type: none"> Groups (families) Periods 	
	PSc.2.2.1	Infer valence electrons, oxidation number, and reactivity of an element based on its location in the Periodic Table.		6.02	Investigate and analyze the formation and nomenclature of simple inorganic compounds. <ul style="list-style-type: none"> Ionic bonds (including oxidation numbers) 	

2009 Essential Standards			2004 NC SCOS		
Strand	Objective	Essential Standard	Goal	Objective	Comments
		Text of Clarifying objective		Objective	
				<ul style="list-style-type: none"> • Covalent bonds • Metallic bonds 	
	PSc.2.2.2	Infer type of chemical bond that occurs, whether covalent, ionic, or metallic, in a given substance.	6.01	Analyze the periodic trends in physical and chemical properties of elements. <ul style="list-style-type: none"> • Groups (families) • Periods 	
			6.02	Investigate and analyze the formation and nomenclature of simple inorganic compounds. <ul style="list-style-type: none"> • Ionic bonds (including oxidation numbers) • Covalent bonds • Metallic bonds 	
	PSc.2.2.3	Predict chemical formulas and names for simple compounds based on knowledge of bond formation and naming conventions.	6.02	Investigate and analyze the formation and nomenclature of simple inorganic compounds. <ul style="list-style-type: none"> • Ionic bonds (including oxidation numbers) • Covalent bonds • Metallic bonds 	<i>*The list of polyatomic ions has been shortened removing chlorate, permanganate, and chromate.</i>
	PSc.2.2.4	Exemplify the law of conservation of mass by balancing chemical equations.	6.03	Identify the reactants and products of chemical reactions and balance simple equations of various types. <ul style="list-style-type: none"> • Single replacement • Double replacement • Decomposition • Synthesis 	
	PSc.2.2.5	Classify types of reactions such as synthesis, decomposition, single replacement, or double replacement.	6.03	Identify the reactants and products of chemical reactions and balance simple equations of various types. <ul style="list-style-type: none"> • Single replacement • Double replacement • Decomposition • Synthesis 	

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	PSc.2.2.6	Summarize the characteristics and interactions of acids or bases.		6.05	Investigate and analyze the properties and composition of solutions: <ul style="list-style-type: none"> • Concentration • Polarity • pH scale • Electrical Conductivity (partial) 	The remaining bullet in objective 6.05 is addressed as indicated in parentheses: <ul style="list-style-type: none"> • Solubility curves (PSc.2.1.2)
Matter: Properties and Change	Understand the role of the nucleus in radiation and radioactivity.		Regularities in Chemistry	6.06	Describe and explain radioactivity and its practical application as an alternative energy source: <ul style="list-style-type: none"> • Alpha, beta, and gamma decay • Fission • Fusion • Nuclear waste 	<i>*Practical application as an alternative energy source has been removed as an objective. However, the use of practical applications are encouraged as an instructional strategy.</i>
	PSc.2.3.1	Compare nuclear reactions including alpha decay, beta decay, and gamma decay; nuclear fusion and nuclear fission.				
	PSc.2.3.2	Exemplify the radioactive decay of unstable nuclei using the concept of half-life.				
Energy: Conservation and Transfer	Understand types of energy, conservation of energy and energy transfer.		Energy and its Conservation	3.01	Investigate and analyze storage of energy: <ul style="list-style-type: none"> • Thermal energy 	The remaining bullets in objective 3.01 is addressed in clarifying objective PSc.3.1.2 <ul style="list-style-type: none"> • Kinetic energy • Potential energies: gravitational, chemical, electrical, elastic, nuclear
	PSc.3.1.1	Explain thermal energy and its transfer.				

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		Text of Clarifying objective				
Energy: Conservation and	PSc.3.1.2	Explain the law of conservation of energy in a mechanical system in terms of kinetic energy, potential energy and heat.	Energy and its Conservation	3.01	Investigate and analyze storage of energy: <ul style="list-style-type: none"> • Kinetic energy • Potential energy: gravitational, chemical, electrical, elastic, nuclear • Thermal energy 	
				3.03	Investigate and analyze transfer of energy by heating: <ul style="list-style-type: none"> • It is impossible to build a machine that does nothing but convert thermal energy into useful work. 	The remaining bullets in objective 3.03 are addressed in clarifying objective PSc.3.1.1 <ul style="list-style-type: none"> • Thermal energy flows from a higher to a lower temperature. • Energy will not spontaneously flow from a lower temperature to a higher temperature.
		PSc.3.1.3		Explain work in terms of the relationship among the force applied to an object, the resulting displacement of the object, and the energy transferred to an object.	3.02	Investigate and analyze transfer of energy by work. <ul style="list-style-type: none"> • Force • Distance
	PSc.3.1.4	Explain the relationship among work, power, and simple machines both qualitatively and quantitatively.		3.02	Investigate and analyze transfer of energy by work. <ul style="list-style-type: none"> • Force • Distance 	* <i>Mechanical advantage and efficiency of simple machines have been added to the 2009 Clarifying Objectives.</i>
		Understand the nature of waves.				
	PSc.3.2.1	Explain the relationships among wave frequency, wave period, wave velocity, amplitude, and wavelength through calculation and investigation.		3.04	Investigate and analyze the transfer of energy by waves: <ul style="list-style-type: none"> • General characteristics of waves: amplitude, frequency, period, wavelength, and velocity of propagation 	Comparing and classifying wave types are addressed in clarifying objective PSc.3.2.2 and PSc.3.2.3 <ul style="list-style-type: none"> • Mechanical waves • Sound waves • Electromagnetic waves (radiation)

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	PSc.3.2.2	Compare waves (mechanical, electromagnetic, and surface) using their characteristics.		3.04	Investigate and analyze the transfer of energy by waves: <ul style="list-style-type: none"> • General characteristics of waves: amplitude, frequency, period, wavelength, and velocity of propagation • Mechanical waves • Sound waves • Electromagnetic waves (radiation) 	*Surface waves have been added to the 2009 Clarifying Objectives.
	PSc.3.2.3	Classify waves as transverse or compressional (longitudinal).		3.04	Investigate and analyze the transfer of energy by waves: <ul style="list-style-type: none"> • General characteristics of waves: amplitude, frequency, period, wavelength, and velocity of propagation • Mechanical waves • Sound waves • Electromagnetic waves (radiation) 	
	PSc.3.2.4	Illustrate the wave interactions of reflection, refraction, diffraction, and interference.				
Energy: Conservation and Transfer	Understand electricity and magnetism and their relationship.		Electricity and Magnetism	4.01	Investigate and analyze the nature of static electricity and the conservation of electrical charge: <ul style="list-style-type: none"> • Positive and negative charges • Opposite charges attract, and like charges repel. • Analyze the electrical charging of objects due to the transfer of charge 	
	PSc.3.3.1	Summarize static and current electricity.				
PSc.3.3.2	Explain simple series and parallel DC circuits in terms of Ohm's law.		4.02	Investigate and analyze direct current electrical circuits: <ul style="list-style-type: none"> • Ohm's law • Series circuits • Parallel circuits 		

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
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	PSc.3.3.3	Explain how current is affected by changes in composition, length, temperature, and diameter of wire.				<i>*New topic- not specifically addressed in 2004 NSCOS</i>
	PSc.3.3.4	Explain magnetism in terms of domains, interactions of poles, and magnetic fields.	Electricity and Magnetism	4.03	Investigate and analyze magnetism and the practical applications of the characteristics of magnets. <ul style="list-style-type: none"> • Permanent magnets • Electromagnetism • Movement of electrical charges 	
	PSc.3.3.5	Explain the practical application of magnetism.		4.03	Investigate and analyze magnetism and the practical applications of the characteristics of magnets. <ul style="list-style-type: none"> • Permanent magnets • Electromagnetism • Movement of electrical charges 	Includes motors, generators, and transformers.

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

Objective 6.04 not addressed