NORTH CAROLINA STANDARD COURSE OF STUDY
K-12 Science, Chemistry

The North Carolina 2023 K-12 Science Standards are intended to foster conceptual understanding and help develop scientifically literate students. The standards provide foundational knowledge and practices within each grade band and course. The standards are organized within 11 strands which articulate vertical alignment. As students progress from one grade to the next, the depth of knowledge and level of sophistication increases.

Engaging in science encourages students' curiosity, interests, and prepares them for the broadest range of postsecondary opportunities, be it college, career, or military service. The 2023 K-12 Science Standards are designed to allow students to become active participants in science - building their understanding of the natural world through observations and investigations.

The scientific method provides a common framework for introducing the traditional experimental design and hypothesis-testing process. The methodologies or approaches utilized by scientists can vary depending on the nature of their research questions and available tools. Steps that all scientists follow when conducting scientific investigations usually involve asking questions, the collection and analysis of relevant data, the use of logical reasoning, opportunities to communicate and collaborate with others, and the development of explanations.

The Science and Engineering Practices (SEP) are embedded in the standards to support a greater emphasis on how students develop science knowledge and the durable skills within the NC Portrait of a Graduate. While one practice is identified in each objective, teachers should utilize other practices to support students' progress towards mastering the standards.

The North Carolina Science Standards maintain the respect for local control of each Public School Unit (PSU). These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a PSU or school. The K-12 Science Standard Course of Study has been developed to serve as the framework for a well-planned science curriculum which provides opportunities for investigations, experimentation, and technological design.

Chemistry	
Strand: Matter and its Interactions	
Standard	**Objectives**
PS.Chm.1 Analyze the structure of atoms and isotopes.	PS.Chm.1.1 Use models to explain how the scientific understanding of atomic structure has evolved.
	PS.Chm.1.2 Use models to compare nuclear reactions including alpha decay, beta decay and gamma decay; nuclear fusion and nuclear fission.
	PS.Chm.1.3 Use models to explain how electrons are distributed in atoms.
Standard	**Objectives**
PS.Chm.2 Understand the physical and chemical properties of atoms based on their position in the Periodic Table.	PS.Chm.2.1 Use the Periodic Table as a model to predict the relative properties of elements based on the pattern of valence electrons in the outermost energy levels of atoms.
	PS.Chm.2.2 Construct an explanation to infer the atomic size, reactivity, electronegativity, and ionization energy of an element based on its position in the Periodic Table.
Standard	**Objectives**
PS.Chm.3 Understand the bonding that occurs in simple compounds in terms of bond type, strength, and properties.	PS.Chm.3.1 Analyze and interpret data to explain the mechanisms and properties of the two main types of intramolecular (ionic and covalent) bonds.
	PS.Chm.3.2 Construct an explanation to summarize the influences intermolecular forces have on the properties of chemical compounds.
	PS.Chm.3.3 Use models to predict chemical names and formulas including ionic (binary & ternary), acidic, and binary covalent compounds.

Standard	Objectives
PS.Chm.4 Analyze chemical reactions in terms of quantities, product formation, and energy.	PS.Chm.4.1 Use models to explain the exothermic or endothermic nature of chemical changes.
	PS.Chm.4.2 Carry out investigations to predict the outcome of simple chemical reactions that obey the Law of Conservation of Mass.
	PS.Chm.4.3 Use mathematics and computational thinking to analyze quantitatively the composition of a substance (empirical formula, molecular formula, percent composition, and mole conversions).
	PS.Chm.4.4 Use mathematics and computational thinking to apply the mole concept in the stoichiometric relationships inherent in chemical reactions.
Standard	**Objectives**
PS.Chm.5 Understand the factors affecting rate of reaction and chemical equilibrium.	PS.Chm.5.1 Carry out investigations to explain the effects of temperature, surface area, stirring, the concentration of reactants, and the presence of catalysts on the rate of chemical reactions according to Collision Theory.
	PS.Chm.5.2 Analyze and interpret data to predict how stressors on a reaction (concentration, temperature, pressure) would shift equilibrium.
Standard	**Objectives**
PS.Chm.6 Understand solutions and the solution process.	PS.Chm.6.1 Carry out investigations to summarize the factors that affect the formation and properties of solutions.
	PS.Chm.6.2 Use models to explain the quantitative nature of a solution (molarity, dilution, titration).
	PS.Chm.6.3 Carry out investigations to compare properties and behaviors (qualitative and quantitative) of acids and bases.

Strand: Energy	
Standard	**Objectives**
PS.Chm.7 Understand the relationship among pressure, temperature, volume, and phase.	PS.Chm.7.1 Use models to explain how changes in energy affect the arrangement and movement of the particles in solids, liquids, and gases, as well as the relative strengths of their intermolecular forces.
	PS.Chm.7.2 Use mathematics and computational thinking to execute simple calorimetric calculations based on the Law of Conservation of Energy.
	PS.Chm.7.3 Use mathematics and computational thinking to explain the relationships among pressure, temperature, volume, and quantity of gas, both qualitatively and quantitatively.