

2019 Minnesota Academic Standards in Science

9th Grade-12th Grade Chemistry		
Strand	Code	Benchmark
Exploring Phenomena or Engineering Problems	9C.1.1.1.1	Ask questions about the impact of greenhouse gases on the Earth's climate, by analyzing their molecular structure and responses during energy absorption
	9C.1.2.1.1	Plan and conduct an investigation to gather evidence to compare the structure of substances and infer the strength of electrical forces between particles.
	9C.1.2.1.2	Plan and conduct an investigation of acid-base reactions to test ideas about the concentrations of the hydronium ion in an aqueous solution (pH).
Looking at data and empirical evidence to understand phenomena or solve problems	9C.2.1.1.1	Analyze patterns in air or water quality data to make claims about the causes and severity of a problem and the necessity to remediate or to recommend a treatment process.
	9C.2.2.1.1	Develop a data simulation, based on observations and experimental data of how the pressure, volume, temperature, and mass of a gas are related to each other, to predict the effect on a system of changing one of those variables
	9C.2.2.1.2	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
Developing possible explanations of phenomena or designing solutions to engineering problems	9C.3.1.1.1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of valence electrons.

	9C.3.1.1.2	Develop a model based on evidence to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
	9C.3.1.1.3	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
	9C.3.2.1.1	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
	9C.3.2.1.2	Apply scientific principles and evidence to provide an explanation about the effects of changing the surface area, agitation, temperature, and concentration of the reacting particles on the rate at which the reaction occurs.
	9C.3.2.1.3	Construct an explanation for the phenomenon of solution creation and identify from patterns how the properties of the resulting solution depend on the interactions between solute and solvent or on concentrations of solutes.
	9C.3.2.2.1	Evaluate the design and function of products and processes involving organic compounds to meet desired needs in relationship to the molecular structures and in particular, the functional groups involved.
Communicating reasons, arguments and ideas to others	9C.4.2.1.1	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
	9C.4.2.1.2	Review text and online sources to develop a series of questions regarding the chemistry, utility, and safety of nuclear fission.
	9C.4.2.2.1	Communicate and evaluate claims by various stakeholders, including Minnesota American Indian Tribes and communities and other cultures, about the environmental impacts of various chemical processes on natural resources.