

# Chemistry Side-by-Side



2021 Knowledge and Skill Statement/Student Expectation	2021 Text	2017 Knowledge and Skill Statement/Student Expectation	2017 Text	Notes from TEA Staff
SCIENCE.CHEM.1	Scientific <a href="#">and engineering</a> practices. The student, for at least 40% of instructional time, <a href="#">asks questions, identifies problems, and plans and</a> safely conducts <a href="#">classroom</a> , laboratory, and field investigations <a href="#">to answer questions, explain phenomena, or design solutions using appropriate tools and models</a> . The student is expected to:	C.1	Scientific <a href="#">processes</a> . The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, <a href="#">environmentally appropriate, and ethical practices</a> . The student is expected to:	
		C.2	Scientific <a href="#">processes</a> . The student uses scientific practices <a href="#">and equipment during</a> laboratory and field investigations. The student is expected to:	
SCIENCE.CHEM.1.A	<a href="#">ask questions and define problems based on observations or information from text, phenomena, models, or investigations;</a>			
SCIENCE.CHEM.1.B	<a href="#">apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;</a>			
SCIENCE.CHEM.1.C	<a href="#">use appropriate</a> safety <a href="#">equipment and</a> practices during laboratory, <a href="#">classroom</a> , and field investigations <a href="#">as outlined in Texas Education Agency-approved safety standards;</a>	C.1.A	<del>demonstrate</del> safe practices during laboratory and field investigations, <a href="#">including the appropriate use of safety showers, eyewash fountains, safety goggles or chemical splash goggles, as appropriate, and fire extinguishers;</a>	
SCIENCE.CHEM.1.D	<a href="#">use appropriate tools such as</a> Safety Data Sheets (SDS), <a href="#">scientific or</a> graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes;	C.2.E	<del>plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology, including</del> graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes;	
		C.1.B	<del>know specific hazards of chemical substances such as flammability, corrosiveness, and radioactivity as summarized on the</del> Safety Data Sheets (SDS); and	
SCIENCE.CHEM.1.E	collect <a href="#">quantitative</a> data <a href="#">using the International System of Units (SI) and qualitative data as evidence;</a>	C.2.F	collect data <a href="#">and make measurements with accuracy and precision;</a>	
SCIENCE.CHEM.1.F	<a href="#">organize quantitative and qualitative data using oral or written lab reports, labeled drawings, particle diagrams, charts, tables, graphs, journals, summaries, or technology-based reports;</a>			
SCIENCE.CHEM.1.G	<a href="#">develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and</a>			
SCIENCE.CHEM.1.H	distinguish between scientific hypotheses, theories, <a href="#">and laws</a> .	C.2.B	<del>know that</del> scientific hypotheses <a href="#">are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;</a>	
		C.2.C	<del>know that</del> scientific theories <a href="#">are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed;</a>	
		C.2.D	distinguish between scientific hypotheses and scientific theories;	
		<del>C.1.C</del>	<del>demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.</del>	Use and conservation of resources is covered in elementary and middle school science.

		<del>C.2.A</del>	<del>know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;</del>	
SCIENCE.CHEM.2	<u>Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:</u>			
SCIENCE.CHEM.2.A	<u>identify advantages and limitations of models such as their size, scale, properties, and materials;</u>			
SCIENCE.CHEM.2.B	analyze data <u>by identifying significant statistical features, patterns, sources of error, and limitations;</u>	C.2.H	<del>organize, analyze, evaluate, make inferences, and predict trends from data; and</del>	
SCIENCE.CHEM.2.C	<u>use mathematical calculations to assess quantitative relationships in data;</u> and	C.2.G	<del>express and manipulate chemical quantities using scientific conventions and mathematical procedures, including dimensional analysis, scientific notation, and significant figures;</del>	
SCIENCE.CHEM.2.D	<u>evaluate experimental and engineering designs.</u>			
SCIENCE.CHEM.3	<u>Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:</u>	<del>C.3</del>	<del>Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:</del>	
SCIENCE.CHEM.3.A	<u>develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;</u>	C.3.C	<del>draw inferences based on data related to promotional materials for products and services;</del>	
SCIENCE.CHEM.3.B	communicate <u>explanations and solutions individually and collaboratively in a variety of settings and formats;</u> and	C.2.I	<del>communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphs, journals, summaries, oral reports, and technology-based reports.</del>	Students are now being asked to communicate not only as scientists but also as engineers.
SCIENCE.CHEM.3.C	<u>engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.</u>	<del>C.3.B</del>	<del>communicate and apply scientific information extracted from various sources such as current events, published journal articles, and marketing materials;</del>	
SCIENCE.CHEM.4	<u>Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:</u>			
SCIENCE.CHEM.4.A	analyze, evaluate, and critique scientific explanations <u>and solutions</u> by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	C.3.A	analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	
SCIENCE.CHEM.4.B	<u>relate</u> the impact of <u>past and current</u> research on scientific thought and society, <u>including research methodology, cost-benefit analysis,</u> and contributions of <u>diverse</u> scientists <u>as related to the content;</u> and	C.3.D	<del>evaluate</del> the impact of research on scientific thought, society, <del>and the environment;</del>	
		C.3.F	<del>describe the history of chemistry</del> and contributions of scientists.	
SCIENCE.CHEM.4.C	<u>research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM</u> careers.	C.3.E	<del>describe the connection between chemistry and future</del> careers; and	
SCIENCE.CHEM.5	Science concepts. The student understands the development of the Periodic Table and applies its predictive power. The student is expected to:	C.5	Science concepts. The student understands the <u>historical</u> development of the Periodic Table and can apply its predictive power. The student is expected to:	
SCIENCE.CHEM.5.A	explain the development of the Periodic Table <u>over time using evidence such as</u> chemical and physical properties;	C.5.A	explain the use of chemical and physical properties in the <u>historical</u> development of the Periodic Table;	

SCIENCE.CHEM.5.B	<u>predict</u> the properties of <u>elements in</u> chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, <u>based on valence electrons patterns</u> , using the Periodic Table; and	C.5.B	<del>identify and explain</del> the properties of chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, using the Periodic Table; and	
SCIENCE.CHEM.5.C	<u>analyze and</u> interpret <u>elemental data</u> , including atomic radius, <u>atomic mass</u> , electronegativity, ionization energy, <u>and reactivity to identify</u> periodic trends.	C.5.C	interpret periodic trends, including atomic radius, electronegativity, and ionization energy, <u>using the</u> Periodic Table.	
		<del>C.4</del>	<del>Science concepts. The student knows the characteristics of matter and can analyze the relationships between chemical and physical changes and properties. The student is expected to:</del>	The concept of physical properties was covered in Grades 3-8. Chemical changes are covered in Grades 6-8.
		<del>C.4.A</del>	<del>differentiate between physical and chemical changes and properties;</del>	The concept of physical properties was covered in Grades 3-8. Chemical changes are covered in Grades 6-8.
		<del>C.4.B</del>	<del>identify extensive properties such as mass and volume and intensive properties such as density and melting point;</del>	Extensive and Intensive properties have been deleted from Chemistry.
		<del>C.4.C</del>	<del>compare solids, liquids, and gases in terms of compressibility, structure, shape, and volume; and</del>	The properties of solids, liquids, and gasses are covered in Grades 3-8.
		<del>C.4.D</del>	<del>classify matter as pure substances or mixtures through investigation of their properties.</del>	Pure substances versus mixtures are covered in Grades 6-8.
SCIENCE.CHEM.6	Science concepts. The student understands the development of atomic theory <u>and applies it to real-world phenomena</u> . The student is expected to:	C.6	Science concepts. The student <del>knows and</del> understands the <u>historical</u> development of atomic theory. The student is expected to:	
SCIENCE.CHEM.6.A	<u>construct models using</u> Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, Bohr's nuclear atom, and <u>Heisenberg's Uncertainty Principle to show the</u> development of modern atomic theory <u>over time</u> ;	C.6.A	<del>describe the experimental design and conclusions used in the</del> development of modern atomic theory, <del>including</del> Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, and Bohr's nuclear atom;	
SCIENCE.CHEM.6.B	describe the structure of atoms <u>and ions</u> , including the masses, electrical charges, and locations of protons and neutrons in the nucleus and electrons in the electron cloud;	8.5.A	describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud;	Structure of the atom was moved up from middle school.
SCIENCE.CHEM.6.C	<u>investigate</u> the mathematical relationship between energy, frequency, and wavelength of light using the electromagnetic spectrum <u>and relate it to the quantization of energy in the emission spectrum</u> ;	C.6.B	<del>describe</del> the mathematical relationships between energy, frequency, and wavelength of light using the electromagnetic spectrum;	
SCIENCE.CHEM.6.D	calculate average atomic mass of an element using isotopic composition; and	C.6.C	calculate average atomic mass of an element using isotopic composition; and	
SCIENCE.CHEM.6.E	<u>construct models to</u> express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis dot structures.	C.6.D	express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis <del>valence electron</del> dot structures.	
SCIENCE.CHEM.7	Science concepts. The student knows how atoms form ionic, covalent, and metallic bonds. The student is expected to:	C.7	Science concepts. The student knows how atoms form ionic, covalent, and metallic bonds. The student is expected to:	
SCIENCE.CHEM.7.A	<u>construct an argument to support how periodic trends such as electronegativity can predict bonding between elements</u> ;			
SCIENCE.CHEM.7.B	name and write the chemical formulas for ionic and covalent compounds using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules;	C.7.A	name ionic compounds <del>containing main group or transition metals</del> , covalent compounds, <del>acids, and bases</del> using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules;	Acids and bases were separated into their own Knowledge and Skill statements.
		C.7.B	write the chemical formulas of ionic compounds <del>containing representative elements, transition metals and common polyatomic ions</del> , covalent compounds, and <del>acids and bases</del> ;	
SCIENCE.CHEM.7.C	classify <u>and draw</u> electron dot structures for molecules with linear, <u>bent</u> , trigonal planar, <u>trigonal pyramidal</u> , and tetrahedral <u>molecular</u> geometries as explained by Valence Shell Electron Pair Repulsion (VSEPR) theory; and	C.7.C	<del>construct</del> electron dot <del>formulas to illustrate ionic and covalent bonds</del> ;	
		C.7.E	classify <u>molecular</u> structure for molecules with linear, trigonal planar, and tetrahedral <del>electron pair</del> geometries as explained by Valence Shell Electron Pair Repulsion (VSEPR) theory.	
SCIENCE.CHEM.7.D	<u>analyze the properties of ionic, covalent, and</u> metallic <u>substances in terms of intramolecular and intermolecular forces</u> .	C.7.D	<del>describe</del> metallic <del>bonding and explain</del> metallic <del>properties such as thermal and electrical conductivity, malleability, and ductility</del> ; and	The concept of metallic bonding was expanded to include more types of substances and their properties.

SCIENCE.CHEM.8	<u>Science concepts. The student understands how matter is accounted for in chemical substances. The student is expected to:</u>	<del>C.8</del>	<del>Science concepts. The student can quantify the changes that occur during chemical reactions. The student is expected to:</del>	
SCIENCE.CHEM.8.A	define mole and <u>apply</u> the concept of <u>molar mass to convert between moles and grams</u> ;	C.8.A	define and <del>use</del> the concept of a mole;	
SCIENCE.CHEM.8.B	calculate the number of atoms or molecules in a sample of material using Avogadro's number;	C.8.B	calculate the number of atoms or molecules in a sample of material using Avogadro's number;	
SCIENCE.CHEM.8.C	calculate percent composition of compounds; and	C.8.C	calculate percent composition of compounds;	
SCIENCE.CHEM.8.D	differentiate between empirical and molecular formulas.	C.8.D	differentiate between empirical and molecular formulas;	
SCIENCE.CHEM.9	Science concepts. The student <u>understands how matter is accounted for in</u> chemical reactions. The student is expected to:	C.8	Science concepts. The student <del>can quantify the changes that occur during</del> chemical reactions. The student is expected to:	
SCIENCE.CHEM.9.A	<u>interpret</u> , write, and balance chemical equations, <u>including synthesis, decomposition, single replacement, double replacement, and combustion reactions</u> using the law of conservation of mass;	C.8.E	write and balance chemical equations using the law of conservation of mass;	
SCIENCE.CHEM.9.B	differentiate among acid-base reactions, precipitation reactions, and oxidation-reduction reactions;	C.8.F	differentiate among <del>double replacement reactions, including</del> acid-base reactions and precipitation reactions, and oxidation-reduction reactions <del>such as synthesis, decomposition, single replacement, and combustion reactions</del> ;	
SCIENCE.CHEM.9.C	perform stoichiometric calculations, including determination of mass relationships, gas volume relationships, and percent yield; and	C.8.G	perform stoichiometric calculations, including determination of mass and gas volume relationships <del>between reactants and products</del> and percent yield; and	
SCIENCE.CHEM.9.D	describe the concept of limiting reactants in a balanced chemical equation.	C.8.H	describe the concept of limiting reactants in a balanced chemical equation.	
SCIENCE.CHEM.10	Science concepts. The student understands the principles of the kinetic molecular theory and ideal gas behavior. The student is expected to:	C.9	Science concepts. The student understands the principles of ideal gas behavior, kinetic molecular theory, <del>and the conditions that influence the behavior of gases</del> . The student is expected to:	
SCIENCE.CHEM.10.A	describe the postulates of the kinetic molecular theory;	C.9.B	describe the postulates of kinetic molecular theory.	
SCIENCE.CHEM.10.B	describe and calculate the relationships <u>among</u> volume, pressure, number of moles, and temperature for an ideal gas; and	C.9.A	describe and calculate the relations <del>between</del> volume, pressure, number of moles, and temperature for an ideal gas <del>as described by Boyle's law, Charles' law, Avogadro's law, Dalton's law of partial pressure, and the ideal gas law</del> ; and	
SCIENCE.CHEM.10.C	<u>define and apply</u> Dalton's law of partial pressure.			
SCIENCE.CHEM.11	Science concepts. The student understands and can apply the factors that influence the behavior of solutions. The student is expected to:	C.10	Science concepts. The student understands and can apply the factors that influence the behavior of solutions. The student is expected to:	
SCIENCE.CHEM.11.A	describe the unique role of water in solutions in terms of polarity;	C.10.A	describe the unique role of water in solutions in terms of polarity;	
SCIENCE.CHEM.11.B	distinguish among types of solutions, including electrolytes and nonelectrolytes and unsaturated, saturated, and supersaturated solutions;	C.10.E	distinguish among types of solutions such as electrolytes and nonelectrolytes; unsaturated, saturated, and supersaturated solutions; <del>and strong and weak acids and bases</del> ;	The types of solutions and acids and bases were split into two separate Student Expectations, C.11.B and C.12.C.
SCIENCE.CHEM.11.C	investigate <u>how</u> solid and gas solubilities are influenced by temperature <u>using solubility curves and how</u> rates of dissolution are influenced by temperature, agitation, and surface area;	C.10.F	investigate <del>factors that</del> influence solid and gas solubilities and rates of dissolution such as temperature, agitation, and surface area;	

SCIENCE.CHEM.11.D	<u>investigate</u> the general rules regarding solubility and <u>predict the solubility of the products of a double replacement reaction</u> ;	C.10.B	<del>apply</del> the general rules regarding solubility <del>through investigations with aqueous solutions</del> ;	
SCIENCE.CHEM.11.E	calculate the concentration of solutions in units of molarity; and	C.10.C	calculate the concentration of solutions in units of molarity;	
SCIENCE.CHEM.11.F	calculate the dilutions of solutions using molarity.	C.10.D	calculate the dilutions of solutions using molarity;	
SCIENCE.CHEM.12	<u>Science concepts. The student understands and applies various rules regarding acids and bases. The student is expected to:</u>			
SCIENCE.CHEM.12.A	<u>name and write the chemical formulas for acids and bases using IUPAC nomenclature rules</u> ;			
SCIENCE.CHEM.12.B	define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions;	C.10.G	define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions <del>and predict products in acid-base reactions that form water</del> ; and	Defining acids and bases and predicting the products of reactions were split into two separate Student Expectations, C.12.B and C.12.D.
SCIENCE.CHEM.12.C	<u>differentiate between</u> strong and weak acids and bases;	C.10.E	<del>distinguish among types of solutions such as electrolytes and nonelectrolytes; unsaturated, saturated, and supersaturated solutions</del> ; and strong and weak acids and bases;	The types of solutions and acids and bases were split into two separate Student Expectations, C.11.B and C.12.C.
SCIENCE.CHEM.12.D	predict products in acid-base reactions that form water; and	C.10.G	<del>define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions and</del> predict products in acid-base reactions that form water; and	Defining acids and bases and predicting the products of reactions were split into two separate Student Expectations, C.12.B and C.12.D.
SCIENCE.CHEM.12.E	define pH and calculate the pH of a solution using the hydrogen ion concentration.	C.10.H	define pH and calculate the pH of a solution using the hydrogen ion concentration.	
SCIENCE.CHEM.13	Science concepts. The student understands the energy changes that occur in chemical reactions. The student is expected to:	C.11	Science concepts. The student understands the energy changes that occur in chemical reactions. The student is expected to:	
SCIENCE.CHEM.13.A	<u>explain everyday examples that illustrate the four laws of thermodynamics</u> ;			
SCIENCE.CHEM.13.B	<u>investigate</u> the process of heat transfer <u>using</u> calorimetry;	C.11.B	<del>describe the law of conservation of energy and</del> the processes of heat transfer <del>in terms of</del> calorimetry;	Conservation of energy is covered in Grades 6-8.
		<del>C.11.D</del>	<del>perform calculations involving heat, mass, temperature change, and specific heat.</del>	
SCIENCE.CHEM.13.C	classify <u>processes</u> as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis; and	C.11.C	classify <del>reactions</del> as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis; and	
		<del>C.11.A</del>	<del>describe energy and its forms, including kinetic, potential, chemical, and thermal energies</del> ;	The concepts of kinetic, potential, chemical, and thermal energy are covered in Grades 6-8.
SCIENCE.CHEM.14	Science concepts. The student understands the basic processes of nuclear chemistry. The student is expected to:	C.12	Science concepts. The student understands the basic processes of nuclear chemistry. The student is expected to:	
SCIENCE.CHEM.14.A	describe the characteristics of alpha, beta, and gamma radioactive decay processes in terms of balanced nuclear equations;	C.12.A	describe the characteristics of alpha, beta, and gamma radioactive decay processes in terms of balanced nuclear equations; and	
SCIENCE.CHEM.14.B	compare fission and fusion reactions; and	C.12.B	compare fission and fusion reactions.	
SCIENCE.CHEM.14.C	<u>give examples of applications of nuclear phenomena such as nuclear stability, radiation therapy, diagnostic imaging, solar cells, and nuclear power.</u>			
KEY	<u>Blue double underline: indicates content new to the grade level</u>		<del>Orange strike through: indicates content was deleted</del>	