Jemez Valley Public Schools
CHEMISTRY • CONTENT MAP

Quadrant I	Quadrant II	Quadrant III	Quadrant IV
Strand I: Scientific Thinking and Practice **Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.**			
Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions. Design and conduct scientific investigations that include: testable hypotheses, controls and variables, results that address hypotheses being investigated, predictions based on results, and error analysis. Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., balances, microscopes). Convey results of investigations using scientific concepts, methodologies, and expressions, including: scientific language and symbols, charts, and other data displays, clear, logical, and concise communication with reasoned arguments Understand how scientific processes produce valid, reliable results, including: consistency of explanations with data and observations, testability of hypotheses, repeatability of experiments and reproducibility of results. Create multiple displays of data to analyze and explain the relationships in scientific investigations. Identify and apply measurement techniques and consider possible effects of measurement errors. Design and conduct scientific investigations that include: methods to collect, analyze, and interpret data, re-evaluation of hypotheses and additional experimentation as necessary. Understand how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom). Use scientific reasoning and valid logic to recognize: faulty logic, cause and effect, the difference between observation and unsubstantiated inferences and conclusions and potential bias.	Convey results of investigations using scientific concepts, methodologies, and expressions, including: mathematical expressions and processes (e.g., mean, median, slope, proportionality). Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators). Use mathematical models to describe, explain, and predict natural phenomena.	Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling). Understand how scientific processes produce valid, reliable results, including: openness to peer review, full disclosure and examination of assumptions.	Critically analyze an accepted explanation by reviewing current scientific knowledge. Examine investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe). Examine the scientific processes and logic used in investigations of past events (e.g., using data from crime scenes, fossils), investigations that can be planned in advance but are only done once (e.g., expensive or time-consuming experiments such as medical clinical trials), and investigations of phenomena that can be repeated easily and frequently.

Understand how new data and observations can result in new scientific knowledge. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis).			
Quadrant I	**Quadrant II**	**Quadrant III**	**Quadrant IV**
Strand II: Content of Science **Standard I: (Physical Science) Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.**			
Classify matter in a variety of ways (e.g., element, compound, mixture; solid, liquid, gas; acidic, basic, neutral). Know how to use properties to separate mixtures into pure substances (e.g., distillation, chromatography, solubility). Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point). Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion. Explain how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature.	Understand that matter is made of atoms and that atoms are made of subatomic particles. Understand atomic structure, including; (a) most space occupied by electrons, (b) nucleus made of protons and neutrons, (c) isotopes of an element, (d) masses of proton and neutron 2000 times greater than mass of electron, and (e) atom held together by proton-electron electrical forces. Know that there are four fundamental forces in nature: gravitation, electromagnetism, weak nuclear force, and strong nuclear force. Understand that electromagnetic waves carry energy that can be transferred when they interact with matter. Describe the characteristics of electromagnetic waves (e.g., visible light, radio, microwave, X-ray, ultraviolet, gamma) and other waves (e.g., sound, seismic waves, water waves), including; (a) origin and potential hazards of various forms of electromagnetic radiation, and (b) energy of electromagnetic waves carried in discrete energy packets (photons) whose energy is inversely proportional to wavelength.	Know that each kind of atom or molecule can gain or lose energy only in discrete amounts. Explain how wavelengths of electromagnetic radiation can be used to identify atoms, molecules, and the composition of stars. Describe trends in properties (e.g., ionization energy or reactivity as a function of location on the periodic table, boiling point of organic liquids as a function of molecular weight). Make predictions about elements using the periodic table (e.g., number of valence electrons, metallic character, reactivity, conductivity, type of bond between elements). Explain how electrons determine the properties of substances by; (a) interactions between atoms through transferring or sharing valence electrons, (b) ionic and covalent bonds the ability of carbon to form a diverse array of organic structures. Understand how the type and arrangement of atoms and their bonds determine macroscopic properties (e.g., boiling point, electrical conductivity, hardness of minerals).	Know that chemical reactions involve the rearrangement of atoms, and that they occur on many timescales (e.g., picoseconds to millennia). Understand types of chemical reactions (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic. Know how to express chemical reactions with balanced equations that show (a) conservation of mass, and (b)products of common reactions. Describe how the rate of chemical reactions depends on many factors that include temperature, concentration, and the presence of catalysts. Understand the relationship between force and pressure, and how the pressure of a volume of gas depends on the temperature and the amount of gas. Explain how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions. Understand the concept of equilibrium (i.e., thermal, mechanical, and chemical).
Quadrant I	**Quadrant II**	**Quadrant III**	**Quadrant IV**
Strand III: Content of Science **Standard I: (Life Science) Understand the properties, structures, and processes of living things and the interdependence of living things and their environments..**			
	Understand the scale and contents of the universe, including (a)range of structures from atoms through astronomical objects to the universe, and (b) objects in the universe such as planets, stars, galaxies, and nebulae		

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Strand IV: Science and Society **Understand how scientific discoveries, inventions, practices, and knowledge influence, and are influenced by, individuals and societies.**			
Describe how scientific knowledge helps decision makers with local, national, and global challenges (e.g., Waste Isolation Pilot Project [WIPP], mining, drought, population growth, alternative energy, climate change). Know that societal factors can promote or constrain scientific discovery (e.g., government funding, laws and regulations about human cloning and genetically modified organisms, gender and ethnic bias, AIDS research, alternative-energy research). Understand that scientists have characteristics in common with other individuals (e.g., employment and career needs, curiosity, desire to perform public service, greed, preconceptions and biases, temptation to be unethical, core values including honesty and openness). Describe major historical changes in scientific perspectives (e.g., atomic theory, germs, cosmology, relativity, plate tectonics, evolution) and the experimental observations that triggered them.	Evaluate the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, genetic engineering) including both desired and undesired effects, and including some historical examples (e.g., the wheel, the plow, the printing press, the lightning rod) Analyze the impact of digital technologies on the availability, creation, and dissemination of information.	Understand the scientific foundations of common technologies (e.g., kitchen appliances, radio, television, aircraft, rockets, computers, medical X-rays, selective breeding, fertilizers and pesticides, agricultural equipment). Understand how advances in technology enable further advances in science (e.g., microscopes and cellular structure; telescopes and understanding of the universe).	Identify how science has produced knowledge that is relevant to individual health and material prosperity. Know how science enables technology but also constrains it, and recognize the difference between real technology and science fiction (e.g., rockets vs. antigravity machines; nuclear reactors vs. perpetual-motion machines; medical X-rays vs. Star-Trek tricorders) Know that science plays a role in many different kinds of careers and activities (e.g., public service, volunteers, public office holders, researchers, teachers, doctors, nurses, technicians, farmers, ranchers).