Strand 1 – Thinking and Practice – SCIENTIFIC METHOD

Essential Question: How do we find out about everything in the universe?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand I THINKING & PRACTICE Process of Investigation **SCIENTIFIC METHOD** **Standard I:** Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically. **Benchmark I:** Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results	1. Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions. 2. Design and conduct scientific investigations that include: • testable hypotheses • controls and variables • methods to collect, analyze, and interpret data • results that address hypotheses being investigated • predictions based on results • re-evaluation of hypotheses and additional experimentation as necessary • error analysis. 3. Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, microscopes). 4. Convey results of investigations using scientific concepts, methodologies, and expressions, including: • scientific language and symbols • diagrams, charts, and other data displays • mathematical expressions and processes (e.g., mean, median, slope, proportionality) • clear, logical, and concise communication • reasoned arguments. 5. Understand how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom).	**Write a procedure for a lab. Do lab using correct safety practices** **Write a procedure for an investigation, perform the lab and write up results.** **Collect data from lab using probes and computers** **Complete data table, display data in graph, determine slope and equation of line.** **Describe how Rutherford and Thomson experiments provide explanation for atom**		H(46-53, 66, 70, 751-759) P (21-23) H(46-63, 792) P (21-23, 65-68, 428-429) H(54-63, 792) P (74-79) H(46-53, 225, 377, 380, 458) Density lab P (25, 51-42, 63-72, 80-87, 253-259, 260-267, 268-270, 271-273) demo pg 262, 264 H(52,53, 68, 69) P (23, 101-102, 104-108, 127-130)

Strand 1 - Thinking and Practice – SCIENTIFIC THINKING

Essential Question: How do we find out about things and agree on an answer?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand 1 THINKING & PRACTICE Process of Investigation **SCIENTIFIC THINKING** **Standard I:** Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically. **Benchmark II:** Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	1. Understand how scientific processes produce valid, reliable results, including: • consistency of explanations with data and observations • openness to peer review • full disclosure and examination of assumptions • testability of hypotheses • repeatability of experiments and reproducibility of results. 2. Use scientific reasoning and valid logic to recognize: • faulty logic • cause and effect • the difference between observation & unsubstantiated inferences and conclusions • potential bias. 3. Understand how new data and observations can result in new scientific knowledge. 4. Critically analyze an accepted explanation by reviewing current scientific knowledge. 5. Examine investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe). 6. 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.	Be able to recognize data that is unreliable Answer questions and point out faulty logic Read and discuss current research in science		H(46-53, 68-70) P(22-25) H(46-53, 68-70) P(127-129, 552-555, 22-23) H(46-53, 68-70, 90-91, 115, 117, 148, 214, 249, 368 P(22-23) P(128-132, 141-145)

Strand 1 – Thinking and Practice – MATH SKILLS

Essential Question: What skills and tools do we need to find out about our universe?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand 1 THINKING & PRACTICE Process of Investigation **MATH SKILLS** **Standard I:** Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically. **Benchmark III:** Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.	1. Create multiple displays of data to analyze and explain the relationships in scientific investigations. 2. Use mathematical models to describe, explain, and predict natural phenomena. 3. Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling). 4. Identify and apply measurement techniques and consider possible effects of measurement errors. 5. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis).	Display data in lab Predict stoichiometry amounts in reaction Predict results from changes in conditions for gases Use simulations to demonstrate relationships between variables in gas laws Show the accuracy of an answer using significant figures Use math to solve problems using dimensional analysis: conversions, stoichiometry, and molarity		H(46-53, 377) P(R74-R77) H(53, 267-271, 282, 377, 641) P(89-9P(89-94, 111-112,139-140, 290-292, 297-303, 305-308, 372-375, 418-425, 426-429, 432-436, 456, 476-477, 491-496, 509-510, 511-513, 530-532, 556-559, 596-601, 804-806, 809, 90, 369, 3.1, 14.9, 14.10, 14.11) H(56-63, 154, 186, 220, 256, 298, 334, 412, 450, 492, 526, 638, 674) P(9) H(18, 54-63, 225, 577) P(65-68) H(13, 14, 54-63, 100-103, 225-233, 307-311, 317, 322, 324, 327) P(63-72, 80-87)

Strand II Content of Science – PHYSICAL SCIENCE – Forms of Matter

Essential Question: What is the universe made of?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand II: Content of Science **PHYSICAL SCIENCE** **Forms of Matter** **Standard I):** Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy. **Benchmark I:** Understand the properties, underlying structure, and reactions of matter.	**Properties of Matter** 1. Classify matter in a variety of ways (e.g., element, compound, mixture; solid, liquid, gas; acidic, basic, neutral). 2. Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point). 3. Know how to use properties to separate mixtures into pure substances (e.g., distillation, chromatography, solubility). 4. 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). **Structure of Matter** 5. Understand that matter is made of atoms and that atoms are made of subatomic particles. 6. Understand atomic structure, including: • most space occupied by electrons nucleus made of protons and neutrons • isotopes of an element • masses of proton and neutron 2000 times greater than mass of electron • atom held together by proton-electron electrical forces. 7. Explain how electrons determine the properties of substances by: • interactions between atoms through transferring or sharing valence electrons • ionic and covalent bonds • the ability of carbon to form a diverse	**Use elements in formulas to classify acids, bases, compounds. Use properties to classify gases, liquids, & solids, acids, bases, metals, nonmetals, organic & inorganic compounds** **Fill out skeleton periodic table with trends. Graph boiling point vs. molecular weight & describe trend. Describe atomic & subatomic particles** **Determine bonding type that exist in compounds; determine the number of bonds each atom can form; write proper formula for compounds using bond type information**		**H(21-28, 32-33, 378, 384, 530-538, 546** **P (48-51. 395-386, 390-391, 396, 387-593, 600-602, 397, 398)** **P(48-51, 385-386,390-391, 396, 587-593, 600-602, 49, 397, 398** **H(4-19, 27, 397, 478-480, 531, 546-547** **P(39-40, 53, 89-90, 198, 212, 40, 90, 92** **H(27, 228, 458-459** **P(46-47, 472-473, 46, 475)** **H(132-141, 685-686)** **P(155-157, 170-178, 155, 174)** **H(21, &4-76, 78-89, 107-111)** **P(104-108, 105,)** **H(74-78, 96-99, 119, 160, 166-169, 190-198, 647, 649)** **P(107, 106, 112-113)** **P(187-188, 188-193, 194-196, 213-216, 217-225, 230-236, 215, 237-241, 243-244, 398**

	array of organic structures. 8. Make predictions about elements using the periodic table (e.g., number of valence electrons, metallic character, reactivity, conductivity, type of bond between elements). 9. Understand how the type and arrangement of atoms and their bonds determine macroscopic properties (e.g., boiling point, electrical conductivity, hardness of minerals). 10. Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion. 11. Know that some atomic nuclei can change, including: • spontaneous decay • half-life of isotopes • fission • fusion (e.g., the sun) • alpha, beta, and gamma radiation. **Chemical Reactions** 12. Know that chemical reactions involve the rearrangement of atoms, and that they occur on many timescales (e.g., picoseconds to millennia). 13. Understand types of chemical reactions (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic. 14. Know how to express chemical reactions with balanced equations that show: • conservation of mass • products of common reactions. 15. Describe how the rate of chemical reactions depends on many factors that include temperature, concentration, and the presence of catalysts.	**Given an element, make prediction about number of valence e-, reactivity & bond type.** **Describe basic properties of covalent and ionic compound** **Know the differences between solid, liq, & gas because of arrangement of molecules & motion of molecules** **Using alpha, beta & gamma decay describe fission; Describe solar fusion** **Describe how nature of reactants effects speed of reaction** **Identify types of reactions observed in lab** **Show and describe how to balance equations** **Describe on the molecular level, how changing factors of a reaction changes the rate**	**TE138SkB** **TE388SkB** **Types of reaction lab write up** **Effect of temp & concentration on rate Lab**	**H(74-78, 96-99, 119, 160, 166-169, 190-198, 386-392) P(155-160, 164-167, 187-193, 239, 155, 174)** H(118-122, 124-141), Periodic Table Video, Halides Lab, Periodic Table of Mars P(196-199, 201-202, 214, 226, 240-241, 243-244, 242, 202, 240, 243 H(197-198, 385-392, 468-473) Metal or Nonmetal Lab, Chemical bond Lab P(385-386, 390-391, 396, 392-397) H(378-384), Heating curve activity, "Wet" Dry Ice Lab P(799-800, 803-804, 807-808 H(641-657) P(321-328, 342 H(260-262, 814-817) Baggie Reaction Activity

				H(275-285, 192, 262, 293-298), Type of Reaction Activity, Determine Activity Series H(263-274, 52, 76-77, 292-298) Cu & $AgNO_3$ Lab H(582-585, 593-595, 722-724, 814-817)

Strand II Content of Science – PHYSICAL SCIENCE – Properties of Matter

Essential Question: How does the universe work?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand II: Content of Science **PHYSICAL SCIENCE Properties of Matter** **Standard I):** Understand the structure and properties of matter, the	**Energy Transformation and Transfer** 1. Identify different forms of energy, including kinetic, gravitational (potential), chemical, thermal, nuclear, and electromagnetic. 2. Explain how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature. 3. Understand that energy can change from one form	Calculate the type & amount of energy change for a phase change & chemical change Describe the differences in movement of atoms between solids, liquids & gases as temp changes Describe how the total energy of reactants equals		H(393-398, 41-42, 192-193, 340-344, 381, 422, 429, 439, 590-595) P(54, 139, 173-174, 226,385-386, 388-389, 813) H(39, 42-45, 339, 381-384), Brownian Motion Demo P(388-389, 504-505) P(505-507, 514-517, 527-529)

characteristics of energy, and the interactions between matter and energy. **Benchmark II**: Understand the transformation and transmission of energy and how energy and matter interact	to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes. 4. Understand how heat can be transferred by conduction, convection, and radiation, and how heat conduction differs in conductors and insulators. 5. Explain how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions. **Interactions of Energy & Matter** 7. Understand that electromagnetic waves carry energy that can be transferred when they interact with matter. 8. 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: • origin and potential hazards of various forms of electromagnetic radiation	the total energy of products _____ Explain changes in matter that involve energy transfer _____ Explain the flow of heat energy between samples of different temp Explain how ionizing radiation differs from non ionizing in terms of effects on nature _____ Describe the electromagnetic spectrum in terms of energy and wavelength	H 337 Start Up Activity Calorimetry problem	_____ H(38-41, 350, 734-738) _____ H(42-45, 337-344) P(13, 505) _____ H(42-45, 337-344) P(505, 507-509) H(92-94, 99) P(138-139, 141-143) _____ H(92-94, 772-775) P(141-143)

	energy of electromagnetic waves carried in discrete energy packets (photons) whose energy is inversely proportional to wavelength. 9. Know that each kind of atom or molecule can gain or lose energy only in discrete amounts.	Explain why each element has its own spectral line	H(776-777) Spectroscopy & flame test lab	P(128-129) H(93-99, 772-775) Spectral Tube Activity

Strand II Content of Science – PHYSICAL SCIENCE Forces of Matter

Essential Question: How and why do the things in the universe move?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand II: Content of Science **PHYSICAL SCIENCE** **Forces of Matter** **Standard I):** Understand the structure and properties of matter, the	**Forces** 4. 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. Motion 10. Describe wave propagation using amplitude, wavelength, frequency, and speed.	Describe the relationship between the variables in the ideal gas law.		**H(423-432, 445-450) Gas Law Computer Simulation , P-V with probe lab, Determine R Demo, Molar Volume Lab** **H(92-93)**

characteristics of energy, and the interactions between matter and energy. **Benchmark III:** Understand the motion of objects and waves, and the forces that cause them				

Strand II Content of Science – LIFE SCIENCE – Life Forms in the Environment

Essential Question: Why do you look like you do?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand II: Content of Science **LIFE SCIENCE** **Life Forms in the Environment** **Standard II (Life Science):** Understand the properties, structures, and processes of	**Genetics** 1. Know how DNA carries all genetic information in the units of heredity called genes, including: • the structure of DNA (e.g., subunits A, G, C, T) • information-preserving replication of DNA • alteration of genes by inserting, deleting, or substituting parts of DNA.			

living things and the interdependence of living things and their environments. **Benchmark II:** Understand the genetic basis for inheritance and the basic concepts of biological evolution.				

Strand II Content of Science – LIFE SCIENCE Life Forms in the Environment

Essential Question: What are living things in the universe made of?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand II: Content of Science **LIFE SCIENCE Life Forms in the Environment** **Standard II (Life Science):** Understand the properties,	**Structure and Function** 1. Know that cells are made of proteins composed of combinations of amino acids.			

structures, and processes of living things and the interdependence of living things and their environments. **Benchmark III:** Understand the characteristics, structures, and functions of cells.				

Strand II Content of Science – EARTH & SPACE SCIENCE Earth

Essential Question: Why, of all places in the universe, is the Earth the best place to live?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources
Strand II: Content of Science **EARTH & SPACE SCIENCE Earth** **Standard III (Earth and Space Science):**	**Characteristics and Evolution of Earth** 1. Describe the characteristics and the evolution of Earth in terms of the geosphere, the hydrosphere, the atmosphere, and the biosphere. 3. Describe the internal structure of Earth (e.g., core, mantle, crust) and the structure of Earth's plates.			

Understand the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of Earth's systems. **Benchmark II:** Examine the scientific theories of the origin, structure, energy, and evolution of Earth and its atmosphere, and their interconnections.	**Energy in Earth's System** 8. Describe the patterns and relationships in the circulation of air and water driven by the sun's radiant energy, including: • patterns in weather systems related to the transfer of energy • differences between climate and weather • global climate, global warming, and the greenhouse effect • El Niño, La Niña, and other climatic trends. **Geochemical Cycles** 9. Know that Earth's system contains a fixed amount of natural resources that cycle among land, water, the atmosphere, and living things (e.g., carbon and nitrogen cycles, rock cycle, water cycle, ground water, aquifers). 10. Describe the composition and structure of Earth's materials, including: • the major rock types (i.e., sedimentary, igneous, metamorphic) and their formation • natural resources (e.g., minerals,			

	petroleum) and their formation. 11. Explain how layers of the atmosphere (e.g., ozone, ionosphere) change naturally and artificially. 12. Explain how the availability of ground water through aquifers can fluctuate based on multiple factors (i.e., rate of use, rate of replenishment, surface changes, and changes in temperature).			

Strand III Science & Society – DISCOVER / INVENT Scientific Influence

Essential Question: How do we minimize the human footprint on the universe?

Category	Chemistry	End Learning Mastery	Assessment(s)	Resources

Strand III: Science and Society **Discover / Invent Scientific Influence** **Standard I:** Understand how scientific discoveries, inventions, practices, and knowledge influence, and are influenced by, individuals and societies. **Benchmark I:** Examine and analyze how scientific discoveries and their applications affect the world, and explain how societies	**Science and Technology** 1, 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). 3. 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). 4. 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). 7. Describe how human activities have affected ozone in the upper			1, 9, 11 3. 18-19, 23, 88, 109, 147, 168-169, 204-205, 247, 259, 313, 340-341, 376-377, 405, 430-31, 463, 478-479, 518-519, 548, 623, 644, 685, 716-717, 754-755, 791, 814-815 4. 18-19, 43, 88, 109, 142, 168-169, 304-205, 242, 259, 313, 340-341, 376-377, 405, 430-431, 463, 478-479, 518-519, 548, 623, 644, 685, 716-717, 754-755, 791, 814-815

	atmosphere and how it affects health and the environment. 8. Describe uses of radioactivity (e.g., nuclear power, nuclear medicine, radiometric dating). **Science and Society** 9. 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). 10. Describe major historical changes in scientific perspectives (e.g., atomic theory, germs, cosmology, relativity, plate tectonics, evolution) and the experimental observations that triggered them. 11. 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).			

	13. Describe how environmental, economic, and political interests impact resource management and use in New Mexico. 14. Describe New Mexico's role in nuclear science (e.g., Manhattan Project, WIPP, national laboratories). **Science and Individuals** 15. Identify how science has produced knowledge that is relevant to individual health and material prosperity. 16. Understand that reasonable people may disagree about some issues that are of interest to both science and religion (e.g., the origin of life on Earth, the cause of the Big Bang, the future of Earth). 17. Identify important questions that science cannot answer (e.g., questions that are beyond today's science, decisions that science can only help to make, questions that are inherently outside of the realm of science). 18. 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). 19. 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).			