

PISD Curriculum – Vertical Alignment of Science TEKS

High School – Chemistry

1	For at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. investigations.
1A Tested	Demonstrate safe practices during field and laboratory investigations. Including --- Describe safety rules, such as heating safety, acid/base safety, and broken glass --- Interpret and read chemical and safety labels --- Identify and explain purpose of lab equipment such as beakers, graduated cylinders, thermometers, pH paper/litmus paper, triple beam/electronic balance, and burets
1B Not Tested	Make wise choices in the use and conservation of resources and the disposal or recycling of materials. Such as --- Disposal of chemicals and nuclear waste
2	Uses scientific methods during fields & laboratory investigations.
2A Tested	Plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology. Including --- Identify control variable, independent variable, and dependent variable --- Apply the scientific method to various hypotheses --- Be able to choose the appropriate lab equipment/technology to use in their experiment --- Be able to design an experiment given a problem
2B Tested	Collect data and make measurements with precision. Including --- Use lab equipment such as graduated cylinders, burets, and balances to make measurements --- Identify the precision/accuracy of different lab equipment such as beakers vs. graduated cylinders --- Understand significant figures in relation to precision of a measurement --- Identify the number of significant figures in a number --- Describe the SI base units --- Apply the rules of significant figures in calculations (PAP)
2C Tested	Organize, analyze, evaluate, make inferences, and predict trends from data. Including --- Convert units using dimensional analysis --- Draw line graphs --- Analyze graphs --- Extrapolate and interpolate graphs
2D Tested	Communicate valid conclusions. Such as --- Lab reports, presentations, written or oral projects, etc.

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3	Uses critical thinking and scientific problem solving to make informed decisions.
3A Tested	Analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information. Such as --- Dalton’s atomic theory, --- Rutherford’s Gold Foil experiment --- Bohr’s Model, --- Mendeleev’s periodic table, --- Schrodinger’s Quantum Mechanical Model (PAP)
3B Tested	Make responsible choices in selecting everyday products and services using scientific information. Such as --- Using current research findings to make informed decisions
3C Not Tested	Evaluate the impact of research on scientific thought, society, and the environment. Such as --- nuclear chemistry and its applications --- development of atom and the periodic table --- environmental impact of pollutants like CFC, sulfur dioxide, etc.
3D Not Tested	Describe connection between chemistry and future careers. Such as --- Medical profession, research, engineering, food chemists, forensics, pharmaceuticals, etc.
3E Not Tested	Research and describe the history of chemistry and contributions of scientists. Such as --- Mendeleev, Dalton, Rutherford, Bohr, Currie, Moseley, Boyle, Charles, Gay-Lussac

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4	The student knows the characteristics of matter.
4A Tested	Differentiate between physical and chemical properties of matter. Including --- Color --- Reactivity --- Texture --- Malleability --- Ductility --- Density --- Solubility --- Conductivity
4B Tested	Analyze examples of solids, liquids, and gases to determine their characteristics. Including --- Compressibility --- Structure and arrangement of particles --- Motion of particles --- Shape --- Volume --- Apply the energy of particles to motion, shape, and volume of solids, liquids, and gases --- Use energy differences to explain the physical properties of solids, liquids, and gases --- Use energy changes to explain phase changes --- Compare densities between three phases and relate it to floating, sinking, or suspension
4C Tested	Investigate and identify properties of mixtures and pure substances. Including --- Describe difference in properties of mixtures vs. samples of pure substances --- Determine if a sample is an element, compound, or mixture using techniques such as <ul style="list-style-type: none"> • Filtration • Distillation • Chromatography • Crystallization • Magnetism
4D Tested	Describe the physical and chemical characteristics of an element using the periodic table and make inferences about its chemical behavior. Including --- Describe <ul style="list-style-type: none"> • Rows (periods) • Columns (groups/families) • s, p, d, and f blocks • Periodic trends (electronegativity) • Atomic radius • Reactivity • Electron configuration • Properties and location of metals, nonmetals, and metalloids • Representative elements (group names and properties) • Location of transition metals • Ionization energy(PAP) • Ionic radius (PAP) --- Use the periodic table to determine <ul style="list-style-type: none"> • Oxidation numbers • Type of bonding

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5	The student knows that energy transformations occur during physical or chemical changes in matter.
5A Tested	<p>Identify changes in matter, determine the nature of the change, and examine the forms of energy involved. Including</p> <p>--- Analyze changes in state, Including</p> <ul style="list-style-type: none"> • Freezing • Melting • Condensation • Evaporation • Sublimation • Deposition <p>--- Identify the changes in state with regard to the change in heat energy. --- Describe and interpret phase change diagrams. --- Describe the critical temperature and pressure for substances including water. --- Understand the law of conservation of energy in relation to physical changes in matter. --- Define and identify normal boiling point and freezing point of water and other substances on the phase diagram (PAP)</p>
5B Not Tested	<p>Identify and measure energy transformations and exchanges involved in chemical reactions. Including</p> <p>--- Analyze indicators of a chemical reaction</p> <ul style="list-style-type: none"> • Energy change such as heat, light, and temperature • Production of gas • Precipitate • Color change
5C Tested	<p>Measure the effects of the gain or loss of heat energy on the properties of solids, liquids, and gases. Including</p> <p>--- Explain the energy that are associated with phase changes and the specific heat of substances --- Calculate heat transfer using calorimetry (Pre-AP)</p>

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6	<p>The student knows that atomic structure is determined by nuclear composition, allowable electron cloud, and subatomic particles.</p>
6A Not Tested	<p>Describe the existence and properties of subatomic particles. Including</p> <ul style="list-style-type: none"> --- Summarize the historic development of atomic theory --- Describe particles, properties, and location of subatomic particles <ul style="list-style-type: none"> • Protons • Neutrons • Electrons --- Identify in atoms and common ions <ul style="list-style-type: none"> • Mass number • Atomic number • Charge • Number of protons • Neutrons • Electrons --- Differentiate among an element's <ul style="list-style-type: none"> • Atomic mass (1/12 of mass of carbon-12) • Mass number --- Describe and apply the law of definite composition and multiple proportions --- Describe electromagnetic spectrum and wave and particle properties including frequency, wavelength, and energy --- Calculations using wavelength, frequency, and energy (Pre-AP) --- Describe the electron orbitals and properties such as <ul style="list-style-type: none"> • Shape (s & p) • Number of electrons • Sublevels (orientations) • Quantum numbers (PAP) --- Write electron configurations and abbreviated (noble gas) configurations --- Draw orbital diagrams of atoms (and ions PAP) using <ul style="list-style-type: none"> • Aufbau Principle • Pauli Exclusion Principle • Hund's Rule • Periodic table
6B Not Tested	<p>Analyze stable and unstable isotopes of an element to determine the relationship between the isotope's stability and its application. Including</p> <ul style="list-style-type: none"> --- Use hyphen notation and nuclear symbol (superscript mass number and subscript atomic number with charge on the right as a superscript) --- Calculate an element's average atomic mass --- Determine the stability of an isotope by using the band of stability
6C Not Tested	<p>Summarize the historical development of the periodic table to understand the concept of periodicity. Including</p> <ul style="list-style-type: none"> --- Summarize the periodic tables of Mendeleev and Mosley and compare to modern periodic table --- Explain the periodic table with respect to atomic number and observed patterns

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7	The student knows the variables that influence the behavior of gases.
7A Not Tested	Describe interrelationships of gases contained within a closed system. Including --- Temperature (Celsius vs Kelvin) --- Particle number (Avogadro’s number) --- Pressure (Pressure unit conversions) --- Volume --- Gas law constant --- Discuss the Kinetic Molecular Theory of Gases with regard to the nature of gases and varying conditions --- Explain the importance of and use STP when applying the gas laws --- Explain important gas laws and use them in calculations: <ul style="list-style-type: none"> • Charles’s law • Gay-Lussac's Law • Boyle’s law • The combined gas law • Dalton’s law of partial pressures, • Avogadro’s Law • Graham’s Law of Diffusion (PAP) --- Graph relationships expressed by the gas laws
7B Not Tested	Illustrate the data obtained from investigations with gases in a closed system and determine if the data are consistent with the Universal Gas Law. Including <ul style="list-style-type: none"> --- Describe what is meant by an “ideal” gas --- Use and manipulate the ideal gas equation, $PV = nRT$ --- Describe conditions a real gas approaches ideal gas behavior. --- Calculate the molar mass of a substance using DRT/P and identify the substance (PAP)

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8	The student knows how atoms form bonds to acquire a stable arrangement of electrons.
8A Not Tested	Identify characteristics of atoms involved in chemical bonding. Including --- Describe and differentiate between types of bonds including ionic and covalent --- Draw Lewis Dot structures for atoms and compounds --- State the octet rule and explain how it influences chemical reactivity --- Identify and describe double and triple bonds --- Point out common exceptions to octet rule (PAP)
8B Not Tested	Investigate and compare the physical and chemical properties of ionic and covalent compounds. Including --- Describe ionic bonding and properties --- Describe covalent bonding and properties <ul style="list-style-type: none"> • Polar • Nonpolar covalent --- Describe metallic bonding and properties --- Describe the difference between strong and weak electrolytes
8C Not Tested	Compare the arrangement of atoms in molecules, ionic crystals, polymers, and metallic substances. Including --- Solid amorphous structures --- Solid covalent network structures --- Ionic compound structure (crystal lattice) --- Metallic bonding (“sea of electrons”) --- Explain VSEPR theory in relation to shapes including <ul style="list-style-type: none"> • Linear • Bent • Tetrahedral • Trigonal planar • Trigonal pyramidal --- Use geometric shapes to determine molecular polarity
8D Not Tested	Describe the influence of intermolecular forces on the physical and chemical properties of covalent compounds. Including --- Describe and distinguish among the intermolecular forces <ul style="list-style-type: none"> • Dipole forces • Hydrogen bonds • London dispersion forces --- Relate intermolecular forces to boiling point, melting point, surface tension, and the three phase of matter

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9	The student knows the processes, effects, and significance of nuclear fission and nuclear fusion.
9A Not Tested	Compare fission and fusion reactions in terms of the masses of the reactants and products and the amount of energy released in the nuclear reactions. Including --- Describe fusion and fission using nuclear reactions --- Describe alpha, beta, and gamma particles
9B Not Tested	Investigate radioactive elements to determine half-life. Including --- Describe half-life --- Graph half-life --- Calculate half-life (PAP)
9C Tested	Evaluate the commercial use of nuclear energy and medical uses of radioisotopes. Such as --- Applications in medicine --- The effects of radiation exposure
9D Tested	Evaluate environmental issues associated with the storage, containment, and disposal of nuclear wastes. Such as ----Describe radiation detection methods.
10	The student knows common oxidation reduction reactions.
10A Not Tested	Identify oxidation-reduction processes. Including --- Describe and differentiate between oxidation and reduction --- Identify which substances will behave as oxidizing or reducing agents(PAP) --- Balance redox equations (PAP)
10B Not Tested	Demonstrate and document the effects of a corrosion process and evaluate the importance of electroplating metals. Including --- Describe electroplating metals --- Describe the properties of corroded metals

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11	The student knows that balanced chemical equations are used to interpret and describe the interactions of matter.
11A Tested	Identify common elements and compounds using scientific nomenclature. Including --- Use the periodic table to determine oxidation numbers --- Name and write formulas for ionic compounds and polyatomic ions --- Name and write formulas for molecular compounds --- Name and write formulas for binary and oxyacids
11B Not Tested	Demonstrate the use of symbols, formulas, and equations in describing interactions of matter. Such as --- Recognize chemical and nuclear reactions --- Explain evidences of a chemical reaction --- Explain the relationship of chemical equation balancing to the law of conservation of mass --- Describe the symbols used in a chemical equation <ul style="list-style-type: none"> • + • → --- states of matter <ul style="list-style-type: none"> • Solid (s) • Liquid (l) • Gas (g) • Aqueous (aq) --- Write and balance equations when both reactants and products are given --- Translate word equations into chemical formula equations --- Write word equations from formula equations --- Recognize what type of reaction is taking place, given the reactants and products: <ul style="list-style-type: none"> • Synthesis (combination) • Decomposition (analysis) • Single replacement (single displacement) Use the activity series of metals to predict single replacement • Double replacement (double displacement) Use the solubility chart to predict products of double replacement • Combustion --- Predict the products based on reaction type --- Write and balance equations when you must predict the products based on reaction type (PAP)
11C Tested	Explain and balance chemical and nuclear equations using number of atoms, masses, and charge. Including --- Use and apply the Law of Conservation of Mass --- Use stoichiometry of chemical equations to calculate molar conversions --- Calculate <ul style="list-style-type: none"> • Molar Mass • Percent composition • Number of particles using Avogadro’s constant • Mole ratio • Empirical formulas (PAP) • Molecular formulas (PAP) • Limiting reactant (PAP)

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12	The student knows the factors that influence the solubility of solutes in a solvent.
12A Tested	Demonstrate and explain effects of temperature and the nature of solid solutes on the solubility of solids. Including --- Interpret solubility curves for given substances --- Describe and differentiate between <ul style="list-style-type: none"> • Solutions • Colloids • Suspensions
12B Tested	Develop general rules for solubility through investigations with aqueous solutions. Including --- Explain the factors that affect the rate of solubility of a solid in solution <ul style="list-style-type: none"> • Temperature • Surface area • Agitation --- Explain the relation between pressure and solubility of a gas --- Read and interpret a solubility chart --- Write net ionic equations (PAP)
12C Tested	Evaluate the significance of water as a solvent in living organisms and in the environment. Including --- Describe the physical properties of water including density of each phase, use as a solvent, and surface tension --- Describe the significance of intermolecular forces to the behavior of water
13	The student knows relationships among the concentration, electrical conductivity, and colligative properties of a solution.
13A Tested	Compare unsaturated, saturated, and supersaturated solutions. Including --- Differentiate among solutions that are <ul style="list-style-type: none"> • Dilute • Concentrated • Unsaturated • Saturated • Supersaturated --- Calculate dilution problems, given initial or final concentration (PAP) --- Differentiate between molarity (M) and molality (m) and calculate each
13B Tested	Interpret relationships among ionic and covalent compounds, electrical conductivity, and colligative properties of water. Including --- Describe and demonstrate how adding a nonvolatile solute affects colligative properties. <ul style="list-style-type: none"> • Vapor pressure • Freezing point • Boiling point --- see 8B for conductivity
13C Tested	Measure and compare the rates of reaction of a solid reactant in solutions of varying concentration. See 15B

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14	The student knows the properties and behavior of acids and bases.
14A Not Tested	Analyze and measure common household products using a variety of indicators to classify the products as acids or bases. Including --- Differentiate between strong and weak acids and bases in terms of degree of ionization --- Compare the properties of acids, bases, and salts according to <ul style="list-style-type: none"> • Arrhenius • Bronsted Lowry (PAP) • Lewis (PAP) --- Describe and calculate the concentration of solutions in terms of pH and pOH --- Analyze solution pH using indicators
14B Not Tested	Demonstrate the electrical conductivity of acids and bases. Including --- Describe electrical conductivity with reference to presence of ions
14C Not Tested	Identify the characteristics of a neutralization reaction. Including --- Describe reactants and products of neutralization reactions --- Explain how titration is used in a volumetric analysis of acid or base concentrations --- Solve titration problems (PAP)
14D Not Tested	Describe effects of acids and bases on an ecological system. Such as --- Describe the effects of acids and bases on living systems such as acid rain
15	The student knows factors involved in chemical reactions.
15A Tested	Verify the law of conservation of energy by evaluating the energy exchange that occurs as a consequence of a chemical reaction. Including --- Distinguish between an endothermic and an exothermic reaction
15B Not Tested	Relate the rate of a chemical reaction to temperature, concentration, surface area, and presence of a catalyst. Including --- Describe effect of reaction rate, according to: <ul style="list-style-type: none"> • The exposed surface area of the reactants • The concentration of the reactants • Temperature • Catalyst • Agitation/Collision --- Describe the importance of the collision theory to reaction rates --- Describe how catalysts can be used to affect the rate of a reaction (PAP) --- Predict changes in reactions produced by shifts in equilibrium (PAP)

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