

Wyoming Department of Education Required Virtual Education Course Syllabus

Sheridan County School District # 1

Program Name	Sheridan County School District #1 Virtual School	Content Area	SC
Course ID	AC03106	Grade Level	11 - 12
Course Name	AP Chemistry	# of Credits	1
SCED Code	03106	Curriculum Type	Acellus

COURSE DESCRIPTION

The AP Chemistry course gives students a college-level foundation on which to build more advanced course work in chemistry. Students expand their understanding of chemistry through inquiry-based investigations, as they delve deeper into the following topics: atomic structure, intermolecular forces and bonding, chemical reactions, kinetics, thermodynamics, and equilibrium. This course has been audited and approved by the College Board. Acellus AP Chemistry is A-G Approved through the University of California.

WYOMING CONTENT AND PERFORMANCE STANDARDS

STANDARD #	BENCHMARK (Standard/Indicator) Use the Standards and Benchmarks as Spreadsheets
HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2	Construct 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, and revise, as needed.
HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the macroscopic scale to infer the strength of electrical forces between particles.
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-5	Apply scientific principles and use evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6	Evaluate the design of a chemical system by changing conditions to produce increased amounts of products at equilibrium, and refine the design, as needed.
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS1-8	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.

SCOPE AND SEQUENCE

UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES/STUDENT CENTERED GOALS
Unit 1 - Introduction to Chemistry and Units of Measurement		In this unit students are introduced to chemistry and units of measure. They learn about why we study chemistry, the scientific method, states of matter (solid, liquid, gas), elements, compounds, mixtures, separation methods for mixtures, physical versus chemical changes, physical versus chemical properties, SI Units and Prefixes, SI Unit - Temperature – Conversion, SI Unit - Volume Derived Unit, SI Unit - Density Derived Unit, and the importance of a lab notebook. They also experience a virtual lab on thin layer chromatography.

Unit 2 - Uncertainty in Data		In this unit students study uncertainty in data. They learn about measured and exact numbers, significant figures and rounding, significant figures - add and subtract, significant figures - multiply and divide, data analysis - precision and accuracy, scientific notation, scientific notation - add and subtract, scientific notation - multiply and divide, dimensional analysis - unit conversion, and dimensional analysis - units raised to a power.
Unit 3 - Atomic Theory	HS-PS1-7	In this unit students study atomic theory. They learn about the law of conservation of mass, the law of definite proportions, the law of multiple proportions, and early theory and John Dalton's atomic theory.
Unit 4 - Atomic Structures		In this unit students study uncertainty in data. They learn about measured and exact numbers, significant figures and rounding, significant figures - add and subtract, significant figures - multiply and divide, data analysis - precision and accuracy, scientific notation, scientific notation - add and subtract, scientific notation - multiply and divide, dimensional analysis - unit conversion, and dimensional analysis - units raised to a power.
Unit 5 - Chemical Formulas and Models - Ionic Compounds	HS-PS1-1; HS-PS1-2; HS-PS1-3	In this unit students study chemical formulas and models - ionic compounds. They learn about types of chemical bonds, types of chemical formulas and molecular models, and elements and compounds - atomic view. They also learn about properties of ionic compounds, formulas of ionic compounds, names of ions, metals with a single charge state, metals with multiple charge states, polyatomic ions, and naming hydrates. They also experience a virtual lab on analysis of calcium in hard water.
Unit 6 - Covalent Molecular Compounds	HS-PS1-1; HS-PS1-2	In this unit students learn about the names of binary molecular compounds, naming acids, calculating formula mass and molar mass, moles to particles, moles to mass, and mole ratios of compounds. They also learn about percent composition calculations, empirical formula calculations, molecular formula calculations, and combustion analysis - empirical formula. They also experience a virtual lab on determining the formula of a hydrate.
Unit 7 - Chemical Equations and Stoichiometry	HS-PS1-1; HS-PS1-2	In this unit students learn about chemical reactions - balancing chemical equations, and chemical reactions and how much?, They also learn about mole to mole, mole to mass or mass to mole, mass to mass, limiting reactants, percent yield, They also experience a virtual lab on mole ratios in chemical reactions.

Unit 8 - Chemical Reactions	HS-PS1-1; HS-PS1-2; HS-PS1-3	In this unit students learn about reactions in water, precipitation reactions, acids and bases - neutralization reactions, gas-evolution reactions, oxidation-reduction reactions, and combustion reactions. They also experience a virtual lab on redox titration.
Unit 9 - Gases	HS-PS1-1; HS-PS1-2	In this unit, students study gases. In relation to gases, they learn about pressure units, Boyle's Law, Charles's Law, Avogadro's Law, Gay-Lussac's Law, Combined Gas Law, and Ideal Gas Law. In relation to the Ideal Gas Law, they learn about molar mass and density. Also in relation to gases, they experience a virtual lab on determining the molar volume of a gas, and learn about Dalton's Law of Partial Pressures. stoichiometry - volume-volume, stoichiometry - volume-mass, kinetic molecular theory, behavior, and the atmosphere. In relation to real gases, they learn about the effect of particle volume, the effect of intermolecular forces, and Van der Waals Equation. Finally, they experience a virtual lab on how to determine molar volume of volatile liquid.
Unit 10 - Thermochemistry	HS-PS1-3	In this unit, students learn about energy - definitions and units, the first law of thermodynamics, heat, work, constant volume calorimetry, enthalpy, and exothermic and endothermic reactions. They also learn about constant pressure calorimetry, Hess's Law, standard heats of formation, calculating enthalpy change for a reaction, and energy use and environmental consequences.
Unit 11 - Quantum Mechanical Model of the Atom	HS-PS1-3	In this unit students learn about the wave nature of light, electromagnetic spectrum/light - particle nature, atomic spectroscopy and the Bohr Model, wave nature of matter, quantum mechanics model for atom, atomic spectroscopy, atomic orbital shapes, electronic configuration of atoms, valence electrons, electronic configuration and periodicity, periodic trends - atomic size/electronegativity, electronic configuration of ions, and electronic configuration of ions – radii. In relation to periodic trends, they learn about ionization energy, electron affinity, and metallic character.
Unit 12 - Chemical Bonds - Ionic Bonds	HS-PS1-1; HS-PS1-2; HS-PS1-4	In this unit students learn about types of bonds and formation, lewis dot structure for atoms, and ionic bonds and electron transfer. In relation to trends in lattice energy, they learn about ion size and charge, and they also learn about the properties of ionic bonding.

Unit 13 - Chemical Bonds - Covalent Bonds	HS-PS1-1; HS-PS1-2; HS-PS1-4	In this unit students learn about covalent bond and single covalent bond, multiple covalent bond, electronegativity, polarity, and percent ionic character. In relation to the Lewis Structure, students learn about covalent compound, polyatomic ions, resonance, formal charge, and exceptions. They also learn about bond energy, bond length, and bonding in metals.
Unit 14 - Molecular Shapes and VSEPR	HS-PS1-4	In this unit, students learn about VSEPR, VSEPR - effect of lone pairs, molecular shapes of large molecules, and molecular shapes and polarity. In relation to hybridization, they learn about sp ³ , sp ² , sp, sp ³ d, and sp ³ d ² . They also learn about molecular orbital theory - period 1 elements and molecular orbital theory - period 2 elements.
Unit 15 - Liquids, Solids and Intermolecular Forces		In this unit students learn about solids, liquids, and gases - comparison, intermolecular forces determine state of matter, liquids, solids, and vaporization and vapor pressure. They also learn about Clausius-Clapeyron Equation-heat of vaporization, Clausius-Clapeyron Equation - vapor pressure, as well as critical point, sublimation and fusion, phase diagrams, crystalline solids, and crystalline solids - types.
Unit 16 - Solutions		In this unit students learn about homogeneous mixture, solution formation, solvation - ionic and molecular compounds, and solubility. Regarding concentration they learn about percent by mass, percent by volume, molarity, dilution of molar solutions, molality, mole fraction, and mole percent. They also learn about vapor pressure - Raoult's law, and ideal and non-ideal solutions. Regarding colligative properties, they learn about boiling point elevation, freezing point depression, osmosis, and van't Hoff factor. They also learn about heterogeneous mixture - colloids, and experience a virtual lab on analysis of alum.
Unit 17 - Kinetics	HS-PS1-5	In this unit students learn about reaction rates, rate laws, integrated rate law, reaction half-life, temperature effects on reaction rates, Arrhenius plots, collision model, reaction mechanisms, rate determining steps, and catalysis. They also experience a virtual lab on kinetics of crystal violet.
Unit 18 - Equilibrium	HS-PS1-6	In this unit students learn about dynamic equilibrium, equilibrium constant expressions, equilibrium constant values, constant expression and chemical equations, equilibrium constant expression - pressure, heterogeneous equilibria - solids and liquids, equilibrium constant - calculations, reaction quotient, and equilibrium concentration calculations. They also learn about concentration calculations - initial values, pressure calculations - initial values, concentration calculations - approximations, Le Chatelier's Principle - concentration change, pressure or volume change, and Le Chatelier's Principle - temperature. In addition, they experience a virtual lab on determining the equilibrium constant.

Unit 19 - Acids and Bases - Part 1		<p>In this unit students learn about properties of acids and bases, Arrhenius Model, Bronsted-lowry Model, Lewis Model, strength of acids, weak acid ionization constants, strength of bases, and weak base ionization constants. They also learn about hydrogen ions and ion product constant, pH and pOH, pH and H⁺ calculations, pOH and OH⁻ calculations, pH and pOH calculations, pH and pOH of strong acids and bases.</p>
Unit 20 - Acids and Bases - Part 2		<p>In this unit students learn about Ka for weak acids - known concentrations, Ka for weak acids - unknown concentrations, Ka for weak acids - quadratic equation, Ka calculations for weak acids - pH, percent ionization of weak acids, mixtures of acids - strong and weak, and mixtures of acids - weak and weak. They also learn about cations as weak acids, basic, acidic, and neutral salt solutions, polyprotic acids - dilute strong acid, polyprotic acids - weak acid calculations, and acid rain, and experience a virtual lab on acid base titration.</p>
Unit 21 - Aqueous Ionic Equilibrium		<p>In this unit students learn about buffers, pH buffer calculations (acid and conjugate base), Henderson-Hasselbalch Equation, pH calculations with addition of acid or base, pH buffer calculations (base and conjugate acid), buffer capacity and range, titration - strong acid/strong base, and titration - weak acid/strong base. They also learn about K_{sp}, molar solubility, relative solubility, common ion effect on solubility, pH effect on solubility, precipitation reactions, selective precipitation, effect of complex ion equilibria on solubility, and solubility of amphoteric metal hydroxides. In addition, they experience a virtual lab on determining Ka of a weak acid.</p>
Unit 22 - Thermodynamics		<p>In this unit students learn about spontaneous and nonspontaneous reactions, entropy and second law of thermodynamics, entropy and changes of state, entropy and change to the surroundings. They also learn about Gibbs free energy, standard molar entropies, calculations of standard entropy changes, calculations of free energy change - $\Delta G = \Delta H - T\Delta S$, free energies of formation, free energy change - stepwise reactions, and free energy change - nonstandard conditions. In addition, they experience a virtual lab on energy content of fuels.</p>

Unit 23 - Electrochemistry		In this unit students learn about oxidation-reduction - acidic solution, oxidation-reduction - basic solution, voltaic/galvanic cells, electrochemical cell notation, and standard reduction potentials, and experience a virtual lab on electrochemistry. They also learn about how to predict direction of redox reactions, how to predict metal dissolution in acid, Gibbs Free Energy and standard cell potential, standard cell potential and equilibrium constant, standard cell potential and nonstandard conditions, concentration cells, electrolytic cells, products of electrolysis, and stoichiometry of electrolysis. The also experience a virtual lab on lead storage batteries.
Unit 24 - Nuclear Chemistry And Radioactivity	HS-PS1-8	In this unit students learn about discovery and types of radioactivity, writing nuclear equations, predicting radioactive decay, and half-lives. They also learn about radio-carbon dating, fission and fusion, harmful radiation, and applications of radioactivity.
Unit 25 - Organic Molecules		In this unit students learn about organic molecules – properties. Regarding hydrocarbons, they learn about alkanes, drawing structures, alkanes - straight-chain alkanes, alkanes - branched-chain alkanes, alkanes - cyclic alkanes, alkanes - structures from names, alkenes, alkenes - nomenclature, cycloalkenes - nomenclature, alkynes, alkynes - nomenclature, aromatic, isomers, and substituted hydrocarbons - functional groups. They also learn about halocarbons, alcohols, ethers, amines, aldehydes, ketones, carboxylic acid, carboxylic acid - ester, carboxylic acid - amide, substitution reactions, elimination reactions, addition reactions, oxidation-reduction reactions, and polymers.