

Chemistry Syllabus

Textbook: Chemistry, Wilbraham, Antony, Staley, Dennis D. , Matta, Michael S., Waterman, Edward L., Pearson Prentice Hall, 2005

Unit One: Introductory Concepts: (Chapters 1-3)

| Chpt | Objective | Labs/Activites | Demos |
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| | Lab Safety/Equipment | Lab Tour, MSDS, Lab Drawer Stations | Acid/base in egg white, socks, contacts, shaving cream, Flaming Ramp |
| 1.1 | Identify reasons to study chemistry. Intro | Bunsen Burner Lab Part I Assign Graphing Part II, Brass Penny Lab | Alchemy Read in "Short History" Giant Bunsen Burner, Cardboard |
| 1.3 | Demonstrate in practical situations how the terms experiment, hypothesis, theory, and law fit into the scientific method. | Sci. Method Whiteboard Presentations | |
| 2.1 | Name and characterize the three states of matter. For a substance that can exist in all three phases, describe and make a drawing that shows the arrangement and relative spacing of the particles in each of the phases. For a simple compound, present a drawing that shows the number of particles in the system does not change as a result of a phase change. Draw a picture of the particles of a element or compound as a solid, liquid and gas. P3.p1 Properties of solids, liquids, and gases are explained by a model of matter that is composed of tiny particles in motion. P4.p1 Changes of state are explained by a model of matter composed of tiny particles that are in motion. When substances undergo changes of state, neither atoms nor molecules themselves are changed in structure. Mass is conserved when substances undergo changes of state. <i>(Prerequisite)</i> | Model with students as atoms | CH2 Atomic Structure PPT http://www.learner.org/resources/series61.html?pop=yes&volid=254355&pid=795# |
| 2.2 2.3 | Classify a sample of matter as a substance or a mixture (and classify mixtures as homogeneous or heterogeneous?). State the difference between an element and a compound. Classify substances as elements or compounds. | Element, Compound, Mixture Activities | http://chemmovies.unl.edu/ChemAnime/ATTHED/ATTHED.html |

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| | <p>P3.p2 Elements are a class of substances composed of a single kind of atom. Compounds are composed of two or more different elements chemically combined. Mixtures are composed of two or more different elements and or compounds physically combined. Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample. (<i>Prerequisite</i>)</p> <p>Identifying and Using Performance Expectations</p> <p>Distinguish between an element, compound or mixture based on drawings or formulas. Identify a pure substance (element or compound) based on unique chemical and physical properties. Separate mixtures based on the differences in physical properties of the individual components. Recognize that the properties of a compound differ from those of its individual elements.</p> <p>C3.R1 Describe a method of separating a mixture</p> <p>C3.R2 Determine whether a substance is an element, compound, or a mixture</p> | | |
| 2.3 | Write the symbols of common elements, and, given their symbols, write their names. | Assign as homework, periodic quizzes | |
| 2.4 | State the law of conservation of matter and energy. Mass is conserved when substances undergo chemical change. The total mass of the interacting substances (reactants) is the same as the total mass of the substances produced (products). | MOM demo for matter ? | |
| 2.4 | Classify changes in matter as physical, chemical, or nuclear. C4.2 Chemical Changes Chemical changes can occur when two substances, elements, or compounds interact and produce one or more different substances, whose physical and chemical properties are different from the interacting substances. When substances undergo chemical change, the number of atoms in the reactants is the same as the number of atoms in the products C4.2C Draw pictures to distinguish the (relationships between?) atoms in physical and chemical changes. | | |
| 3.1 | Convert measurements to scientific notation. | Intro when needed with stoich | |
| 3.1 | Distinguish between the accuracy and precision of a measurement. Solve problems dealing with error and deviation. | Intro with “density” and “% sugar (%composition) in gum” labs. Then incorporate throughout all labs when | Measurement PPT? http://www.learner.org/resources/series61.h |

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| | Use rules for significant figures in calculations. | applicable | tml?pop=yes&vodid=254355&pid=795# Measurement |
| 3.2 | List and define the common metric prefixes. | Intro with density lab, practice throughout all labs/problems | |
| 3.2 | Convert between Celsius and Kelvin temperature scales. | Will be done with Gas Laws | |
| 3.3 | Construct conversion factors from equivalent measurements. Use conversion factors in factor-label problem solving. Use dimensional analysis to solve multi-step problems. | Intro when needed with stoich | |
| 3.4 | Calculate the density of an object. | Measurement challenge | Golf ball float, diet vs. reg. soda |

Key Terms: Homogeneous mixture, Mass, Mixture, Phase, Reactant, Solid, Substance, Vapor, Fluid, Accuracy, Celsius temperature scale, Gram, SI units, Kelvin temperature scale, Meter, Precision, Temperature, Weight, Dimensional analysis, Factor-label, Compound, Distillation, Distillate, Filtration, Filtrate, Gas, Heterogeneous mixture, Hypothesis, Liquid, Matter, Observation, Physical change, Product, Reactant, Scientific law, Solution, Theory, Absolute zero, Density, Liter, Metric system, Significant figure or digit, Volume, Conversion factor

Unit Two: Atomic Structure (Chapters 4-6)

| Chpt | Objective | Labs/Activities | Demos |
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| 4.1 | Summarize Dalton's atomic theory | Combine 4.1-4.2, 5.1? | Dalton bio in "Short History" Video Segment 3 of 18 from the Full Video Greatest Discoveries with Bill Nye: Chemistry http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795# The Atom |
| 4.2 | Describe the contributions that Thomson and Rutherford made to the development of atomic theory. | Atomic Target Practice "mini lab" | Cathode Ray Demo |

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| | | | Video Segment 12 of 18 from the Full Video Greatest Discoveries with Bill Nye: Chemistry |
| 4.2 | <p>Distinguish between protons, electrons, and neutrons in terms of their relative masses, charges, and position in the atom.</p> <p>C3.8 Atomic Structure Electrons, protons, and neutrons are parts of the atom and have measurable properties including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.</p> <p>C3.8A Identify the location, relative mass and charge for electrons, protons and neutrons.</p> <p>C3.8B Describe the atom as mostly empty space with an extremely small, dense nucleus consisting of the protons and neutrons and an electron cloud surrounding the nucleus.</p> <p>C3.8C Recognize that protons repel each other and that there needs to be a strong force present to keep the nucleus intact.</p> <p>C3.r8 Develop your own analogy for describing the location of the electron. Do not include sub-nuclear particles such as quarks in the discussion.</p> | | |
| 4.3 | <p>Use the atomic number and mass number of an element to find the number of protons, electrons, and neutrons.</p> <p>C3.10A List the number of protons, neutrons and electrons for any given ion or isotope. There are three isotopes for hydrogen, explain that these are all hydrogen, yet different in mass.</p> | | |
| 4.3 | Define an atomic mass unit. | | |
| 4.3 | <p>Use the concept of isotopes to explain why the atomic masses of elements are not whole numbers.</p> <p>C3.10 Neutral Atoms, Ions, and Isotopes A neutral atom of any element will contain the same number of protons and electrons. Ions are charged particles with an unequal number of protons and electrons. Isotopes are atoms of the same element with different numbers of neutrons and essentially the same chemical and physical properties.</p> <p>C3.10B Recognize that an element always contains the same number of</p> | | |

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| | <p>protons.</p> <p>C3.10e Write the symbol for an isotope, ${}_Z^AX$, where Z is the atomic number, A is the mass number and X is the symbol for the element</p> <p>Limit the calculations to elements with no more than three isotopes.</p> | | |
| 4.3 | <p>Calculate the average atomic mass of an element from isotope data.</p> <p>C3.10x Average Atomic Mass The atomic mass listed on the periodic table is an average mass for all the different isotopes that exist, taking into account the percent and mass of each different isotope.</p> <p>Identifying and Using Performance Expectation: C3.10c Calculate the average atomic mass of an element given the percent abundance and mass of the individual isotopes. C3.10d Predict which isotope will have the greatest abundance given the possible isotopes for an element, along with the average atomic mass in the periodic table.</p> | Centium Lab | |
| 5.1 | <p>Explain how Bohr's model of the atom differed from its predecessors.</p> | | <p>C H5 Electron Configuration PPT</p> <p>http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795#</p> |
| 5.1 | <p>Compare the quantum mechanical model of the atom with previous models.</p> <p>C3.8i Describe the fact that the electron location cannot be exactly determined at any given time.</p> | | <p>Irradiated Salt , Tonic Water Mints (take home?)</p> <p>Quantum Theory Movie from "Mechanical Universe" (Learner.org)</p> |
| 5.1 | <p>Describe the general shape of s, p, and d orbitals.</p> | Map your personal orbital | |
| 5.2 | <p>Use the Aufbau principle, the Pauli exclusion principle, and Hund's rule to write the electron configurations of the elements. (no names to be memorized)</p> <p>C3.8x Electron Configuration Electrons are arranged in main energy levels with sublevels that specify particular shapes and geometry. Orbitals represent a region of space in where an electron may be found with a high level of probability. Each defined orbital can hold two electrons, each with a specific</p> | | <p>Electron orbital filling: Http://intro.chem.okstate.edu</p> <p>http://chemmovies.unl.edu/ChemAnime/LONDOND/LONDOND.html</p> |

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| | <p>spin orientation.</p> <p>C3.9b Write electron configurations for the first four rows using the periodic table.</p> <p>C3.8e Write the complete electron configuration of elements in the first four rows of the periodic table.</p> <p>C3.8f Write kernel structures for main group elements.</p> <p>C3.8g Predict oxidation states and bonding capacity for main group elements using their electron structure.</p> <p>C3.8h Describe the shape and orientation of s and p orbitals.</p> <p>C3.8D Give the number of electrons and protons present if the fluoride ion has a -1 charge. Identify in a series of atoms and ions the ones that have the same electron configuration.</p> <p>Complete electron configuration limited to the first four periods.</p> <p>Kernel structures for main group elements.</p> | | |
| 5.2 | <p>Describes the significance of the four quantum numbers and be able to assign quantum numbers to specific electrons in atoms.</p> <p>The specific assignment of an electron to an orbital is determined by a set of 4 quantum numbers. Each element, and therefore each position in the periodic table, is defined by a unique set of quantum numbers. Assignment of quantum numbers not required.</p> | Optional – make it fun! | |
| 5.3 | <p>Describe the relationship and work problems involving wavelength, frequency, and energy of light.</p> <p>C1.4a Describe energy changes in flame tests of common elements in terms of the (characteristic) electron transitions.</p> <p>C1.4d Compare various wavelengths of light (visible and nonvisible) in terms of frequency and relative energy.</p> <p>Technical Vocabulary: Electromagnetic spectrum, photon, wavelength, frequency and wave speed.</p> <p>Boundaries and Clarification: Student should relate color, wavelength and frequency for visible light. Students should compare relative energy of radiowaves, microwaves, infrared, ultraviolet, x-rays, and gamma rays.</p> | Flame Test Lab | <p>Planetarium Show?</p> <p>Glowing Pickle (may fit in better later)</p> <p>Physics2000 applets</p> |
| 5.3 | <p>Explain the origin of the atomic emission spectrum of an element.</p> <p>C1.4x Electron Movement For each element the arrangement of electrons surrounding the nucleus is unique. These electrons are found in different energy levels and can only move</p> | Spectroscope Lab | <p>http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795# The Atom</p> |

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| | <p>from a lower energy level (closer to nucleus) to a higher energy level (further from nucleus) by absorbing energy in discrete packets. The energy content of the packets is directly proportional to the frequency of the radiation. These electron transitions will produce unique absorption spectra for each element. When the electron returns from an excited (high energy state) to a lower energy state energy is emitted in only certain wavelengths of light, producing an emission spectra.</p> <p>Identifying and Using Performance Expectations: C1.4b Contrast the mechanism of energy changes and the appearance of absorption and emission spectra. C1.4c Explain why an atom can absorb only certain wavelengths of light. Student should be able to use Bohr model diagrams of main energy level transitions for absorption and emission spectra . Qualitative use of photoelectric effect required.</p> | | |
| 5.3 | Elucidate wave-particle duality of matter. | | |
| 6.1 | <p>Explain the origin of the periodic table.</p> <p>C3.R5 Discuss the historical development of the periodic table</p> | | <p>CH6 Periodic Table PPT</p> <p>Mendeleev bio in “Short History”</p> |
| 6.1 | <p>Distinguish between a period and a group in the periodic table.</p> <p>C3.9 Periodic Table In the Periodic Table, elements are arranged in order of increasing number of protons (called the atomic number). Vertical groups in the periodic table (families) have similar physical and chemical properties due to the same outer electron structures.</p> <p>Identifying and Using Performance Expectation: C3.9A Identify elements with similar chemical and physical properties using the periodic table. C3.R3 Explain why isotopes of an element should have the same physical and chemical properties and why this is important.</p> | | <p>http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795# The Periodic Table</p> |
| 6.1 | <p>State the periodic law.</p> <p>C3.r9 Discuss the importance of the periodic law and the reason why Mendeleev is given credit for the periodic table.</p> | | |
| 6.2 | <p>Identify an element as an alkali metal, alkaline earth metal, halogen, or noble gas.</p> <p>C3.9c Identify metals, non-metals and metalloids using the periodic table.</p> | Need to find a good “Family” lab | Li, Na, K demo Ca, Mg demo |
| 6.2 | <p>Recognize the demarcation of the periodic table into a s block, p block, d block, and f block.</p> <p>C3.9x Electron Energy Levels</p> | | |

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| | The rows in the periodic table represent the main electron energy levels of the atom. Within each main energy level are sublevels that represent an orbital shape and orientation. | | |
| 6.3 | Describe variations within a group and a period of atomic radii, ionization energy, electron affinity, and electronegativity. C3.9d Predict general trends in atomic radius and first ionization energy of the elements using the periodic table. | Plotting Trends with straws “lab” | |
| 6.3 | Explain how the shielding effect influences periodic trends. | | |

Key Terms: Atom, Atomic number, Cathode ray, Isotope, Amplitude, Emission Spectrum, Electromagnetic radiation, Electron cloud, Excited state, Heisenberg uncertainty , Principle, Quanta, Lewis dot formula, Alkali metal, Electron affinity, Period, Halogen, Transition metal, p block elements, f block elements, s block elements, d block elements, Orbital, Angular momentum quantum number, Magnetic quantum number, Principal , quantum number, Spin quantum number, Atomic mass, Cathode, Anode, Mass number, Nucleus, Absorption spectrum, Electron configuration, Frequency, Hertz, Pauli exclusion principle, Spectrum, Orbital notation, Alkaline earth metal, Electronegativity, Group, Inner transition metal, Quantum numbers, Deuterium, Atomic mass unit , Dalton, amu, Carbon-12-exactly-12 scale, Electron, Neutron, Proton, Energy level, Ground state, Hund’s rule, Photon, Wavelength, Periodic law, Covalent atomic radius, Ionization , energy, Family, Noble gas, Representative elements, Tritium, Planck's constant,

Inquiry, Reflecting, and Technology Performances

C3.r6 Design an activity that will allow you to identify the type of solid based on simple laboratory tests such as melting point, conductivity, solubility.

C3.r7 Predict the number of atoms in a sample with the exact atomic mass listed in the periodic table.

Unit Three: Chemical Bonding and Nomenclature (Chapters 7-9)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
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| 7.1 | Use the periodic table to find the number of valence electrons in an atom. | | |
| 7.1 | Draw the electron dot formulas of the representative elements | | |
| 7.1 | State the octet rule. | | |
| 7.1 | Describe the formation of a cation or an anion. C3.R4 Explain why ions have different chemical properties than their neutral atoms and why this is important | Exp10:electron configuration of atoms and ions | Paramagnetic Ions Demo |
| 7.2 | Give the characteristics of an ionic bond. C4.5 Chemical Bonds | Petri dish ionic compound naming activity | Include nomenclature (Ch9) throughout bonding unit (Ch7-8) |

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| | An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules are called chemical bonds. | “Now its your turn” Lab | http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795# Chemical Bonds |
| 7.2 | Explain the electrical conductivity of a melted and aqueous solution of ionic compounds. | | |
| 7.3 | Use the theory of metallic bonds to explain the physical properties of metals. | | |
| 8.1 | Identify the characteristics of molecular and ionic compounds. C4.5x Classifying Chemical Bonds Chemical bonds can be classified as ionic, covalent and metallic. The properties of a compound will depend on the types of bonds holding the atoms together. | | Bonding Quiz Video.wmv |
| 8.2 | Describe the formation of a covalent bond between two nonmetallic elements. | | |
| 8.2 | Describe double and triple covalent bonds. | | |
| 8.2 | Draw electron dot formulas for simple covalent molecules. C4.5c Draw Lewis structures for simple compounds. Lewis structures for covalent compounds limited to 4 atoms. | | |
| 8.2 | Define resonance and draw resonance structures of compounds. | | |
| 8.3 | Use VSEPR theory to describe the shapes of simple covalently bonded molecules. | 3D Models of Covalent Compounds Activity | |
| 8.3 | Describes the shapes of simple molecules using orbital hybridization. | | |
| 8.4 | Use electronegativity values to determine whether a bond is non polar covalent, polar covalent, or ionic. | | |
| 8.4 | Show the relationship between polar covalent bonds and polar | | |

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| | <p>molecules.</p> <p>C3.4x Molecular Polarity The forces between molecules depend on the net polarity of the molecule as determined by shape of the molecule and the polarity of the bonds. Identifying and Using Performance Expectation: C3.4a Explain why at room temperature different compounds can exist in different phases. C3.4b Identify if a molecule is polar or nonpolar given a structural formula for the compound. Boundaries and Clarification: Structural formulas will be provided showing shapes of molecules.</p> | | |
| 8.4. | <p>Name and describe the weak attractive forces that hold molecules together.</p> <p>Identifying and Using Performance Expectation: C3.3f Identify the elements necessary for hydrogen bonding (N, O, F) C3.3g Given the structural formula of a compound, indicate all the intermolecular forces present (dispersion, dipolar, hydrogen bonding).</p> | | <p>http://chemmovies.unl.edu/ChemAnime/DIPOLED/DIPOLED.html</p> <p>http://chemmovies.unl.edu/ChemAnime/LONDOND/LONDOND.html</p> <p>http://www.geocities.com/le_chatelier_uk/h-bond.html song</p> |
| 9.1 | <p>Define the terms cation and anion and show how they are related to the terms metal and nonmetal.</p> | | |
| 9.1 | <p>Use the periodic table to determine the charge on an ion.</p> | | |
| 9.1 | <p>Learn the common polyatomic ions and their names. Include common polyatomic ions (CO_3^{2-}, SO_4^{2-}, NO_3^-, PO_4^{3-}, NH_4^+)</p> | | |
| 9.2- 9.3 | <p>Write the chemical formula of a compound, when given the name of the compound and vice versa.</p> <p>C3.2x Nomenclature All compounds have unique names that are determined systematically. Identifying and Using Performance Expectations C3.2a Given the formula, name simple binary compounds. C3.2b Given the name, write the formulas of simple binary compounds. C3.2c Given the formula for a simple hydrocarbon draw and name the isomers. Naming binary ionic compounds using the IUPAC conventions, no traditional</p> | | |

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| | names. Binary molecular compounds, such as CO ₂ , CO, SO ₂ Organic names limited to 10 carbon or less hydrocarbons | | |
| 9.4 | Name an acid when given the formula and vice versa. Binary acids and the acids of the polyatomic ions. | | |
| 9.5 | Differentiate between ionic compounds and molecular compounds, and between formula units and molecules. C3.3e , Predict whether the forces of attraction in a solid are primarily metallic, covalent, network covalent, or ionic based upon the elements' location on the periodic table. C4.5A Predict if the bonding between two atoms of different elements will be primarily ionic or covalent. C4.4B Predict the formula for binary compounds of main group elements. | | |

Key Terms: Lewis dot structure, Octet rule, Oxidation number, Dispersion interaction, or force, Hydrogen bond, London force, Nonpolar covalent bond, Polar covalent bond, Single covalent bond, Lone pair, Linear molecule, Trigonal bipyramid (TBP), Ionic bond, Halide ion, Valence, Anion, Bond dissociation energy, Dipole, Double covalent bond, Molecular orbital, Electronegativity, Polar molecule, Structural formula, van der Waals force, VSEPR, Trigonal planar, Octahedral, δ charge, Electron dot structure, Metallic bond, Valence electron, Cation, Bonding orbital, Polar, Hybridization, Network solid, Resonance, Tetrahedral angle, Trigonal pyramid, Dipole moment, Solution, Solvent, Solute, Miscible, Immiscible, Acid, Anion, Binary compound, Base, Cation, Formula unit, Nonmetal, Molecular compound, Group, Ion, Periodic Table, Polyatomic ion, Ionic compound, Transition metal, Representative element, Law of definite proportions, Metalloid, Law of multiple proportions

Technical vocabulary:

Lewis structures, octet rule, polarity, bond geometry, bond angles and central atom.

Unit Four: Basic Stoichiometry (Chapters 10-12)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
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| 10.1 | Identify the mole as the SI unit that measures the "amount of substance." The mole concept is essential in chemical calculations Calculations to include: mass/mass, moles/mole, mass/volume, limiting reagent C3.6x Moles | | http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795# The Mole |

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| | The mole is the standard unit for counting atomic and molecular particles in terms of common mass units. | | |
| 10.1 | Define a mole as Avogadro's number of representative particles of a substance. | | |
| 10.1 | Calculate the number of moles in a given number of representative particles of any substance. | | |
| 10.1 | Distinguish between the terms gram atomic mass, gram molecular mass, gram formula mass, and molar mass. | | |
| 10.1 | Calculate the mass of one mole of any substance. | | |
| 10.2 | Calculate the mass of a given number of moles of a substance. | | |
| 10.2 | Calculate the number of moles in a given mass of a substance. C3.6a Calculate the number of moles of any compound or element given the mass of the substance. C3.6b Calculate the number of particles of any compound or element, given the mass of the substance. C4.2g Calculate the number of atoms present in a given mass of element. | | |
| 10.2 | Use the molar volume of a mole of gas (STP) to work mole-volume problems. | | Holy Molee: 2-02 Gas Vol at STP |
| 10.3 | Calculate the percentage composition of a substance from its chemical formula or experimental data. | | |
| 10.3 | Distinguish between an empirical and a molecular formula. | | |
| 10.3 | Derive empirical and molecular formulas from appropriate experimental data. | | |
| 11.1 | Identify the reactants and products in a chemical equation. C4.2B Distinguish between chemical and physical changes in terms of the properties of the reactants and products. | | |
| 11.1 | Write a balanced chemical equation when given the names or formulas of all the reactants and products in a chemical reaction. | | |

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| | <p>C4.2x Balancing Equations A balanced chemical equation will allow one to predict the amount of product formed.</p> <p>C4.2A Balance simple chemical equations applying the conservation of matter. Limited to equations that can be balanced by “trial and error” method. Formula writing not required.</p> | | |
| 11.2 | Classify a reaction as combination, decomposition, single-replacement, double replacement (metathetical), or combustion. | | |
| 11.2 | Predict the products of simple combination and decomposition reactions. | | |
| 12.1 | Interpret a balanced chemical equation in terms of interacting moles, representative particles, masses, and volumes of gases (STP). | | |
| 12.2 | <p>Perform stoichiometric calculations with balanced equations using moles, mass, representative particles, and volumes of gases (STP).</p> <p>C4.2d Calculate the mass of a particular compound formed from the masses of starting materials.</p> <p>C4.2f Predict volumes of product gases using initial volumes of gases at the same temperature and pressure.</p> | | |
| 12.3 | <p>Determine the limiting reagent in a chemical system</p> <p>C4.2e Identify the limiting reagent when given masses (of) more than one reactant.</p> | | |
| 12.3 | Knowing the limiting reagent in a reaction, calculate the maximum amount of product(s) produced and the amount of any unreacted excess reagent. | | |

Technical Vocabulary:

limiting reactant, excess reactant, Avogadro's #, %

Key Terms: Avogadro's number, Empirical formula, Gram atomic mass or weight, Gram formula mass or weight, Molar mass, Molar volume, Mole, Percent composition, Representative particle, STP, Activity series of elements, Balanced equation, Catalyst, Chemical equation, Coefficient, Combination reaction, Synthesis reaction, Combustion reaction, Decomposition reaction, Double replacement reaction, Net ionic equation, Single replacement reaction, Metathetical reaction, Exothermic reaction, Endothermic reaction, Excess reagent, Limiting reagent, Percent yield, Stoichiometry, Theoretical yield

Unit Five: The Kinetic Molecular Theory (Chapters 13-14)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
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| 13.1 | State and explain the major points of the kinetic molecular theory C3.3C Recognize that solids have a more ordered, regular arrangement of their particles than liquids and that liquids are more ordered than gases. . | | |
| 13.1 | Use the kinetic molecular theory to explain the motion, pressure, and temperature of a gas. | | |
| 13.1 | Relate temperature to the average kinetic energy of the particles in a substance C3.3A Recognize that substances that are solid at room temperature have stronger attractive forces than liquids at room temperature, which have stronger attractive forces than gases at room temperature. C4.4x Changes of State All changes of state require energy. Changes in state that require energy involve breaking forces holding the particles together. The amount of energy will depend on the type of forces C4.4e Explain why freezing is an exothermic change of state. C4.4f Compare the melting point of covalent compounds based on the strength of IMF's (intermolecular forces) | | |
| 13.1 | Use the kinetic molecular theory to explain phenomena such as diffusion, compressibility, or pressure of gases. | | |
| 13.1 | Explain the significance of absolute zero, giving its value in degrees Celsius and Kelvin. | | |

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| 13.2 | Explain the meaning of dynamic equilibrium in phase changes. | | |
| 13.2 | Describe what happens on a particle level at the melting point and boiling point of a substance. C3.3B Compare the relative strengths of forces between molecules based on the MP and BP of the substances. | | |
| 13.3 | Relate the physical properties of solids to their type. Solids can be classified as metallic, ionic, covalent or network covalent. These different types of solids have different properties that depend on the particles and forces found in the solid. C3.3h Explain properties of various solids such as malleability, conductivity and melting point in terms of the solid's structure and bonding Chemical bonds and intermolecular forces for melting metallic, ionic, molecular, and network covalent solids Limit to common binary salts and covalent compounds, network covalent limited to diamonds, silicates, metals limited to elements (not alloys). C3.3D Compare the strength of the forces of attraction between the molecules of the two elements knowing that Chlorine is a gas at room temperature and iodine is a solid. C4.5d Compare the relative melting point, electrical and thermal conductivity, and hardness for ionic, metallic, and covalent compounds. C4.5e Relate the melting point, hardness, electrical and thermal conductivity, of a substance to its structure | | |
| 13.4 | Identify the basic regions shown in a phase diagram. Locate each of the following on the diagram: normal boiling point, normal freezing point, triple point, critical point. | | |
| 14.1. | Convert between units of pressure--kPa, atm, and torr. | | |
| 14.1. | State the values of standard temperature and pressure. | | |
| 14.2. | State and explain the significance of Avogadro's hypothesis | | |
| 14.2 | Use the gas laws to solve problems involving volume, temperature, pressure, and moles. C3.5x Ideal Gas Law The forces in gases are explained by the ideal gas law. (See Energy unit for KMT and related) Identifying and Using Performance Expectation: C3.5a Provide macroscopic examples, atomic and molecular explanations, and | | |

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| | <p>mathematical representations (graphs and equations) for the pressure-volume relationship in gases.</p> <p>C3.5b Provide macroscopic examples, atomic and molecular explanations, and mathematical representations (graphs and equations) for the pressure-temperature relationship in gases.</p> <p>C3.5c Provide macroscopic examples, atomic and molecular explanations, and mathematical representations (graphs and equations) for the temperature-volume relationship in gases.</p> <p>Boundaries and Clarification: Limit to explicit binary (PV, PT, VT) relationships.</p> | | |
| 14.3 | State and use the ideal gas law. | | |
| 14.3 | Explain why real gases deviate from the gas laws. | | |
| 14.4 | State and use Dalton's law of partial pressures. | | |
| 14.4 | State and use Graham's law of diffusion. | | |

Key Terms: Solid, Liquid, Gas, Kinetic molecular theory, Pressure, torr, Kilopascal , (kPa), Atmosphere, Kinetic energy, Kelvin temperature, Evaporation, Dynamic , equilibrium, Equilibrium vapor pressure, Relative humidity, Le Chatelier's principle, Sublimation, Boiling, Normal boiling point, Phase diagram, Triple point, Critical point, Van der Waals forces, Dispersion interaction, London forces, Crystal, Amorphous solid, Glass, Super cooled liquid, Ionic solid, Molecular solid, Metallic solid, Covalent network , solid, Allotrope, Pressure, Boyle's Law, Charles' Law, Guy Lussac's Law, Dalton's Law of Partial Pressures, Graham's Law, Avogadro's principle, Diffusion , Effusion, Barometer, Dipole-dipole attraction, Hydrogen Bonding, Ideal gas, Ideal gas law

Unit Six: Properties of Solutions (Chapters 15-16)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
|-------------|--|-----------------------|---|
| 15.1 | Describe the hydrogen bonding that occurs in water based on the structure of the polar water molecule. | | |
| 15.1 | Use the concept of hydrogen bonding to explain the following properties of water: high surface tension, low vapor pressure, high specific heat, high heat of vaporization, and high boiling point. | | http://www.learner.org/resources/series61.html?pop=yes&volid=254355&pid=795# Water |

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| | <p>C3.3i Explain why NaF has a melting point of 995°C while water has a melting point of 0°C.</p> <p>C4.4d Explain why both the melting point and boiling points for water are significantly higher than other small molecules of comparable mass (e.g., ammonia and methane).</p> | | |
| 15.2 | Define the terms solution, aqueous solution, solute, and solvent and give an example of each. | | |
| 15.2 | Use the rule that "like dissolves like" to predict the solubility of one substance in another. | | |
| 15.2 | Calculate the percent of water in a given hydrate. | | |
| 15.3 | Give the characteristics of colloids and suspensions that distinguish them from solutions. | | |
| 16.1 | Explain the difference between saturated, unsaturated, and supersaturated solutions. | | |
| 16.1 | Use Henry's law to describe gas solubility. | | |
| 16.2 | Define and work problems involving the molarity and molality of a solution. | | |
| 16.2 | Describe how to prepare dilute solutions from concentrated solutions or solids. | | |
| 16.3 | <p>Explain on a particle basis how the addition of a solute to a pure solvent causes an elevation of the boiling point and a depression of the freezing point of the resultant solution.</p> <p>The physical properties of a solution are determined by the concentration of solute.</p> | | |
| 16.4 | <p>Calculate the freezing point depression and the boiling point elevation of various solutions.</p> <p>C3.7a Investigate the difference in the boiling point or freezing point of pure water and a salt solution</p> <p>C3.7b Compare the density of pure water to that of a sugar solution.</p> | | |

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Key Terms: Aqueous, Browning motion, Colloid, Deliquescent, Efflorescent, Electrolyte, Emulsion, Hygroscopic, Non-electrolyte, Solute, Solvation, Solvent, Strong, Weak, Surface tension, Surfactant, Suspension, Water of hydration, Water of Crystallization, Suspension, Tyndall effect, Boiling point, Normal boiling point, Colligative property, Concentrated, Dilute, Saturated, Unsaturated, Supersaturated, Henry's law, Immiscible, Miscible, Molality (m), Molarity (M), [], Mole fraction, Mass percent

Technical Vocabulary:

Molarity, solute, solvent, solution, saturation, supersaturation.

Unit Seven: Acids and Bases (Chapter 19)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
|------|--|----------------|---|
| 19.1 | List the properties of acids and bases. | | http://www.learner.org/resources/series61.html?pop=yes&vodid=254355&pid=795# Acids and Bases |
| 19.1 | Define and give examples of Arrhenius, Bronsted-Lowry, and Lewis acids and bases. | | Chemistry Connections: Acids and Bases Defined. United Learning. 1998. unitedstreaming. 27 July 2006 < http://www.unitedstreaming.com/ > |
| 19.1 | Use the Bronsted-Lowry theory to classify substances as acids or bases; identify conjugate acid-base pairs in reactions. | | |
| 19.2 | Write the equation for the self-ionization of water. | | |
| 19.2 | Calculate the pH of a solution given the {H ⁺ } or {OH ⁻ }, or vice versa. | | Chemistry Connections: Explaining the pH/pOH Scale. United Learning. 1998. unitedstreaming. 27 July 2006 < http://www.unitedstreaming.com/ > |
| 19.3 | Use the extent of ionization to distinguish between strong and | | |

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| | weak acids and bases. List the strong acids. | | |
| 19.4 | Complete and balance a neutralization reaction. | | |
| 19.4 | Perform calculations involving acid-base reactions. | | |
| 19.4 | Explain the steps of a titration. | | Chemistry Connections: Acid-Base Titrations. United Learning. 1998. unitedstreaming. 27 July 2006 < http://www.unitedstreaming.com/ > |
| 19.5 | Describe when a solution of a salt is acidic or basic. | | http://www.geocities.com/le_chatelier_uk/deprotonated.html song |
| 19.5. | Define a buffer, and show with equations how a buffer system works. | | |

Key Terms: Acid, Amphoteric, Bronsted acid/base, Diprotic acid, Hydronium ion (H_3O^+), K_w , Autoprotolysis, Law of mass action, Common ion effect, Indicator, Amphiprotic, Arrhenius acid/base, Base, Monoprotic acid, Neutral solution, Self-ionization, Equilibrium, End point, Neutralization reaction, Standard solution, Alkaline solution, Conjugate acid-base pair, Lewis acid/base, Triprotic acid, Hydroxide ion (OH^-) pH, pOH, Weak acid/base, Equilibrium expression, Equivalence point, Hydrolysis, Titration

Unit Eight: Oxidation-Reduction (Chapter 20)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
|------|---|----------------|-------|
| 20.1 | Properly use the terms oxidation, reduction, reducing agent, oxidizing agent. | | |
| 20.2 | Determine the oxidation number of an atom of any element in a pure substance. | | |
| 20.3 | Balance redox equations. | | |

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Key Terms:

If Time: Thermochemistry and Rates (Chapter 17 and 18)

The student will:

| Chpt | Objective | Labs/Activites | Demos |
|------|--|----------------|-------|
| 17.1 | Classify reactions as exothermic or endothermic. | | |
| 17.1 | Distinguish between heat capacity and specific heat. | | |
| 17.2 | Use a calorimeter to determine the heat of combustion of a substance. | | |
| 17.2 | Define the enthalpy of a substance. | | |
| 17.3 | Interpret and/or draw a potential energy diagram for both exothermic and endothermic reactions correctly labeling the axes, the enthalpy of the reaction, and the activation energy. | | |
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Key Terms: Exothermic, Endothermic, ΔH , Potential energy diagram, Enthalpy, Entropy, ΔH°_f , Heat of reaction, Standard molar heat of formation, Heat of combustion, Thermochemical equation, Free Energy, Heat of solution, System, Surroundings, Universe,

C1.1b Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).

C1.1c Compare qualitatively the energy changes associated with melting various types of solids in terms of the types of forces between the particles in the solid.

Boundaries and Clarification:

Students should be able to compare the amount of energy in the reactants and products using qualitative diagrams showing energy as a function of reaction progress.

Students should be able to make distinctions between types of chemical bonds (covalent, ionic, metallic) and intermolecular forces (dispersion, dipole-dipole, hydrogen bonding) in metallic, ionic, molecular, and covalent network solids when comparing bond energies.

substances are explained by the ways in which the atoms, ions, or molecules of the substances are arranged and the strength of the forces of attraction between the atoms, ions, or molecules.