AVENTA LEARNING

Alignment Document
State of Indiana and Aventa Learning Chemistry

Chemistry
2005-2007 Benchmark Blueprint

Standards	Benchmarks	Unit Name	Course Topic Description
C.1 Students begin to conceptualize the general structure of the atom and the roles played by the main parts of the atom in determining the properties of materials. They investigate, through such methods as laboratory work, the nature of chemical changes and the role of energy in those changes.	**C.1.1** Differentiate between pure substances and mixtures based on physical properties such as density, melting point, boiling point, and solubility.	Chemistry Fundamentals Chemistry Fundamentals	Physical Change Classification of Matter
	C.1.2 Determine the properties and quantities of matter such as mass, volume, temperature, density, melting point, boiling point, conductivity, solubility, color, numbers of moles, and pH (calculate pH from the hydrogen-ion concentration), and designate these properties as either extensive or intensive.	The Scientific Method The Scientific Method The Scientific Method Water, Solutions Water, Solutions Water, Solutions Solids, Liquids, Gases	Qualitative Versus Quantitative Accuracy and Precision Lab: Density and Measurement Properties of Solutions The Solution Process Measuring Acidity-pH Properties of Gases
	C.1.3 Recognize indicators of chemical changes such as temperature change, the production of a gas, the production of a precipitate, or a color change.	Chemistry Fundamentals	Chemical Change
	C.1.4 Describe solutions in terms of their degree of saturation.	Water, Solutions	The Solution Process

	C.1.5 Describe solutions in appropriate concentration units (be able to calculate these units) such as molarity, percent by mass or volume, parts per million (ppm), or parts per billion (ppb).		
	C.1.6 Predict formulas of stable ionic compounds based on charge balance of stable ions.	Ionic Compounds	Ionic and Covalent Compounds
	C.1.7 Use appropriate nomenclature when naming compounds.	Ionic Compounds	Ionic and Covalent Compounds
	C.1.8 Use formulas and laboratory investigations to classify substances as metal or nonmetal, ionic or molecular, acid or base, and organic or inorganic.	Water, Solutions	Lab: Acids and Bases
	C.1.9 Describe chemical reactions with balanced chemical equations.	Chemical Reactions	What is a Chemical Reaction
	C.1.10 Recognize and classify reactions of various types such as oxidation-reduction.	Chemical Reactions	Types of Chemical Reactions
	C.1.11 Predict products of simple reaction types including acid/base, electron transfer, and precipitation.	Chemical Reactions	Types of Chemical Reactions
	C.1.12 Demonstrate the principle of conservation of mass through laboratory investigations.	Chemical Reactions	Lab: Stoichiometry
	C.1.13 Use the principle of conservation of mass to make calculations related to chemical reactions. Calculate the masses of reactants and products in a chemical reaction from the mass of one of the reactants or products and the relevant atomic masses.	Chemical Reactions	What is a Chemical Reaction
	C.1.14 Use Avogadro's law to make mass-volume calculations for simple chemical reactions.	Solids, Liquids, Gases	Understanding Gas Laws

	C.1.15 Given a chemical equation, calculate the mass, gas volume, and/or number of moles needed to produce a given gas volume, mass, and/or number of moles of product.	Solids, Liquids, Gases	Understanding Gas Laws
	C.1.16 Calculate the percent composition by mass of a compound or mixture when given the formula.	Mole/Chemical Comp	The Mole and Chemical Composition
	C.1.17 Perform calculations that demonstrate an understanding of the relationship between molarity, volume, and number of moles of a solute in a solution.	Solids, Liquids, Gases	Understanding Gas Laws
	C.1.18 Prepare a specified volume of a solution of given molarity.		
	C.1.19 Use titration data to calculate the concentration of an unknown solution.		
	C.1.20 Predict how a reaction rate will be quantitatively affected by changes of concentration.	Reaction Rates	Kinetics
	C.1.21 Predict how changes in temperature, surface area, and the use of catalysts will qualitatively affect the rate of a reaction.	Reaction Rates	Kinetics
	C.1.22 Use oxidation states to recognize electron transfer reactions and identify the substance(s) losing and gaining electrons in an electron transfer reaction.		
	C.1.23 Write a rate law for a chemical equation using experimental data.		
	C.1.24 Recognize and describe nuclear changes.	Nuclear Chemistry Nuclear Chemistry	Nuclear Chemistry Nuclear Reactions
	C.1.25 Recognize the importance of chemical processes in industrial and laboratory settings, e.g., electroplating, electrolysis, the operation of voltaic cells, and such important applications as the refining of aluminum.		

	C.1.26 Describe physical changes and properties of matter through sketches and descriptions of the involved materials.		
	C.1.27 Describe chemical changes and reactions using sketches and descriptions of the reactants and products.		
	C.1.28 Explain that chemical bonds between atoms in molecules, such as H2, CH4, NH3, C2H4, N2, Cl2, and many large biological molecules are covalent.	Ionic Compounds	Ionic and Covalent Compounds
	C.1.29 Describe dynamic equilibrium.		
	C.1.30 Perform calculations that demonstrate an understanding of the gas laws. Apply the gas laws to relations between pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.	Solids, Liquids, Gases	Understanding The Gas Laws
	C.1.31 Use kinetic molecular theory to explain changes in gas volumes, pressure, and temperature (Solve problems using pV=nRT).	Solids, Liquids, Gases Solids, Liquids, Gases	Properties of Gases Understanding the Gas Laws
	C.1.32 Describe the possible subatomic particles within an atom or ion.	Atoms/PeriodTable	Atom
	C.1.33 Use an element's location in the Periodic Table to determine its number of valence electrons, and predict what stable ion or ions an element is likely to form in reacting with other specified elements.	Atoms/PeriodTable Atoms/PeriodTable	Group Names Trends in the Periodic Table
	C.1.34 Use the Periodic Table to compare attractions that atoms have for their electrons and explain periodic properties, such as atomic size, based on these attractions.	Atoms/PeriodTable	Trends in the Periodic Table
	C.1.35 Infer and explain physical properties of substances, such as melting points, boiling points, and solubility, based on the strength of molecular attractions.	Solids, Liquids, Gases	Changes of State

	C.1.36 Describe the nature of ionic, covalent, and hydrogen bonds and give examples of how they contribute to the formation of various types of compounds.	Ionic Compounds	Ionic and Covalent Compounds
	C.1.37 Describe that spectral lines are the result of transitions of electrons between energy levels and that these lines correspond to photons with a frequency related to the energy spacing between levels by using Planck's relationship (E=hv).		
	C.1.38 Distinguish between the concepts of temperature and heat.	Thermodynamics	Thermodynamics
	C.1.39 Solve problems involving heat flow and temperature changes, using known values of specific heat and latent heat of phase change.	Thermodynamics	Conservation of Energy-Calorimetry
	C.1.40 Classify chemical reactions and/or phase changes as exothermic or endothermic.	Thermodynamics	Thermodynamics
	C.1.41 Describe the role of light, heat, and electrical energies in physical, chemical, and nuclear changes.		
	C.1.42 Describe that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions. The change in mass (calculated by $E=mc^2$) is small but significant in nuclear reactions.	Nuclear Chemistry	Nuclear Chemistry
	C.1.43 Calculate the amount of radioactive substance remaining after an integral number of half-lives have passed.	Nuclear Chemistry	Fission and Fusion
	C.1.44 Convert between formulas and names of common organic compounds.		
	C.1.45 Recognize common functional groups and polymers when given chemical formulas and names.		

C.2 Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, students understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.	**C.2.1** Explain that Antoine Lavoisier invented a whole new field of science based on a theory of materials, physical laws, and quantitative methods, with the conservation of matter at its core. Recognize that he persuaded a generation of scientists that his approach accounted for the experimental results better than other chemical systems.		
	C.2.2 Describe how Lavoisier's system for naming substances and describing their reactions contributed to the rapid growth of chemistry by enabling scientists everywhere to share their findings about chemical reactions with one another without ambiguity.		
	C.2.3 Explain that John Dalton's modernization of the ancient Greek ideas of element, atom, compound, and molecule strengthened the new chemistry by providing physical explanations for reactions that could be expressed in quantitative terms.	Atoms/PeriodTable	Atom
	C.2.4 Explain how Frederich Wohler's synthesis of the simple organic compound urea from inorganic substances made it clear that living organisms carry out chemical processes not fundamentally different from inorganic chemical processes. Describe how this discovery led to the development of the huge field of organic chemistry, the industries based on it, and eventually to the field of biochemistry.		
	C.2.5 Explain how Arrhenius' discovery of the nature of ionic solutions contributed to the understanding of a broad class of chemical reactions.	Water, Solutions	Properties of Acids and Bases

	C.2.6 Explain that the application of the laws of quantum mechanics to chemistry by Linus Pauling and others made possible an understanding of chemical reactions on the atomic level.	Atoms/PeriodTable	Quantum Theory
	C.2.7 Describe how the discovery of the structure of DNA by James D. Watson and Francis Crick made it possible to interpret the genetic code on the basis of a sequence of "letters".		