

Science - Chemistry

Idaho Department of Education Content Standards	Objective	Sub Objectives	Task Analysis	Essential Vocabulary
Cognitive level codes: • B: Memorize • C: Perform procedures • D: Demonstrate understanding • E: Conjecture, generalize, prove • F: Solve non-routine problems, make connections	Bloom's Equivalent • B = Knowledge • C = Comprehension • D = Comprehension • E = Application and Analysis • F = Synthesis			
Standard 1: Nature of Science				
Goal 1.1: Understand Systems, Order, and Organization	11-12.C.1.1.1 Use the periodic table to predict physical and chemical properties.		<ul style="list-style-type: none"> Predict reactivity, density, electronegativity, and other trends of the periodic table. 	mass • volume • chemical/physical change and property • electronegativity • metal • nonmetal • noble gas
Goal 1.2: Understand Concepts and Processes of Evidence, Models, and Explanations	11-12.C.1.2.1 Describe the historical development of the periodic table.		<ul style="list-style-type: none"> Explain Mendeleev's and Mosely's contribution to the development of the periodic table. 	atomic number • atomic mass
	11-12.C.1.2.2 Create and interpret graphs of data.		<ul style="list-style-type: none"> Collect data to create graphs. Distinguish between different graphs. Interpret graphs. 	independent variable • dependent variable • x-axis • y-axis • line graph • bar graph • pie graphs
	11-12.C.1.2.3 Explain and interpret the key concepts of the kinetic molecular theory.		<ul style="list-style-type: none"> Predict particle activity associated with temperature change. 	kinetic energy • temperature • heat energy • kinetic theory
	11-12.C.1.2.4 Distinguish the common theories defining acids and bases.		<ul style="list-style-type: none"> Compare and contrast the different theories of acids and bases (e.g. Arrhenius Acids and Bases, Lewis Acids and Bases, Bronsted-Lowry Acids and Bases). Classify compounds as acids or bases using the different theories. 	Electrons • Protons • H ⁺ • OH ⁻ • Arrhenius Acids and Bases • Lewis Acids and Bases • Bronsted-Lowry Acids and Bases
Goal 1.3: Understand Constancy, Change, and Measurement	11-12.C.1.3.1 Identify, compare and contrast physical and chemical properties and changes and appropriate computations.		<ul style="list-style-type: none"> Explain physical properties of certain substances. Explain chemical properties of certain substances. Distinguish between a chemical and physical change. Compare and contrast chemical and physical changes. 	physical change • chemical change • physical property • chemical property

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	11-12.C.1.3.2 Perform computations using scientific notation, the metric system and dimensional analysis.		<ul style="list-style-type: none"> • Identify a number in scientific notation. • Convert between standard and scientific notation by hand and with a calculator. • Perform mathematical operations using scientific notation. • Measure and record using the metric system. Convert measurements within the metric system. • Define dimensional analysis. • Convert units using dimensional analysis. • Defend the usefulness of dimensional analysis. 	exponent • milli • centi • deci • kilo • conversion factors • dimensional analysis • scientific notation • SI units of measurement
	11-12.C.1.3.3 Compute measurement uncertainty to include precision, accuracy and the rules for significant digits.		<ul style="list-style-type: none"> • Define precision • Define accuracy • Recognize precise and accurate measurements • Compare and contrast precision and accuracy. • Recognize significant digits in a number. • Express measurements using the correct number of significant digits. • Use correct significant digits in calculations. 	precision • accuracy • significant digits
	11-12.C.1.3.4 Perform calculations related to the conversion of grams to moles to particles, atoms, molecules and volume.		<ul style="list-style-type: none"> • Define moles. • Explain the usefulness of moles. • Calculate molar mass. • Memorize Avogadro's number. • Determine the number of atoms, molecules, or particles in a certain number of moles. • Calculate the number of atoms in a certain number of grams in a specific substance and vice versa. • Know the standard molar volume. • Calculate between moles and liters using the standard molar volume. 	Avogadro's number • mole • formula unit • atom • molecule • average atomic mass • dimensional analysis • molar mass • standard molar volume
	11-12.C.1.3.5 Analyze and solve reaction stoichiometry problems.		<ul style="list-style-type: none"> • Balance an equation. • Understand mole ratios of molecules in a chemical equation. • Convert moles to grams and grams to moles. • Solve stoichiometry problems 	stoichiometry • chemical reaction • chemical equation • reactant • product • mole • gram • coefficient • subscript
	11-12.C.1.3.6 Express concentrations of solutions in various ways including molarity.		<ul style="list-style-type: none"> • Define molarity. • Calculate molarity values of solutions. 	solution • solute • solvent • molarity

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	11-12.C.1.3.7 Interpret how the presence of solute particles affect the properties of a solution and be able to do calculations involving colligative properties.		<ul style="list-style-type: none"> • Define colligative properties. • Use calculations to solve boiling point elevation and freezing point depression. 	colligative properties • molality • boiling point elevation • freezing point depression
	11-12.C.1.3.8 Analyze quantitative relationships involved in acid/base chemistry including pH.		<ul style="list-style-type: none"> • Memorize the pH scale • Determine whether a solution is acidic or basic based on the pH scale, Predict the pH of a variety of substances • Calculate the pH from [H+] and [OH-]. 	pH scale • hydronium ion • hydroxide ion • acid • base
Goal 1.4: Understand the Theory that Evolution is a Process that Relates to the Gradual Changes in the Universe and of Equilibrium as a Physical State	No objectives in Chemistry.			
Goal 1.5: Understand Concepts of Form and Function	No objectives in Chemistry.			
Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills	11-12.C.1.6.1 Demonstrate an understanding of the scientific method.		<ul style="list-style-type: none"> • Memorize the steps of the scientific method. • Validate the usefulness of the scientific method. • Analyze how certain experiments follow the scientific method. 	hypothesis • theory • observation • control • data • experiment • conclusion • variable
	11-12.C.1.6.2 Select and use appropriate scientific equipment, materials and techniques.		<ul style="list-style-type: none"> • Recognize the basic laboratory equipment/materials • Demonstrate proper usage of laboratory equipment/materials. • Select the appropriate equipment/materials to use to perform specific tasks. 	balance • beaker • graduated cylinder • metric ruler • thermometer • pipette • Bunsen burner • hot plate • test tube
Goal 1.7: Understand That Interpersonal Relationships Are Important in Scientific Endeavors	11-12.C.1.7.1 Explain how a series of historically related and documented experiments led to the current model and structure of the atom.		<ul style="list-style-type: none"> • Describe the major contributions of specific scientists to the atomic theory. 	Democritus • Dalton • Thomson • Rutherford • Bohr • proton • neutron • nucleus • electron • energy levels
Goal 1.8: Understand Technical Communication	11-12.C.1.8.1 Correctly write symbols, formulas and names for common elements, ions and compounds.		<ul style="list-style-type: none"> • Find elements on the periodic table. • Recognize the symbols for common elements. • Recognize the symbol for an ion. • Construct formulas for compounds. 	periodic table • chemical symbol • element • compound • ion • polyatomic ion • cation • anion
	11-12.C.1.8.2 Communicate scientific investigations and information clearly.		<ul style="list-style-type: none"> • Recognize and read a formal lab report. • Compose a lab report. • Evaluate a lab report. 	Data • observation • material • conclusion

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Standard 2: Physical Science				
Goal 2.1: Understand the Structure and Function of Matter and Molecules and Their Interactions	11-12.C.2.1.1 Explain and understand how electrons are involved in the formation of chemical bonds using the octet rule and Lewis dot diagrams.		<ul style="list-style-type: none"> • Define valence electrons. • Determine the number of valence electrons using the periodic table. • Draw Lewis dot diagrams for various elements. • Explain the octet rule. • Define ionic bonds. • Define covalent bonds. • Demonstrate how covalent bonds form using Lewis dot diagrams. • Demonstrate how ionic bonds form using Lewis dot diagrams. 	Valence electrons • ionic bonding • covalent bonding • octet rule • Lewis dot diagram • energy levels
	11-12.C.2.1.2 Predict the polarity of chemical bonds using electronegativity.		<ul style="list-style-type: none"> • Understand the concept of electronegativity. • Use the trends for electronegativity on the periodic table to predict polarity. 	polarity • electronegativity • chemical bonds
	11-12.C.2.1.3 Predict physical properties of compounds based upon the attractive forces between atoms and molecules.		<ul style="list-style-type: none"> • Use Lewis dot structures to predict attraction between molecules. • Predict intermolecular physical properties (e.g. capillary action, surface tension). 	surface tension • capillary action • polarity • hydrogen bonding • physical properties
	11-12.C.2.1.4 Distinguish and classify all matter into appropriate categories.		<ul style="list-style-type: none"> • Define atom, element, compound, molecule, pure substance, heterogeneous mixture, and homogeneous mixture. • Classify different examples of matter. 	atom • element • compound • molecule • pure substance • heterogeneous mixture • homogeneous mixture
	11-12.C.2.1.5 Explain the relationship and reactions of acids, bases, and salts.		<ul style="list-style-type: none"> • Identify a neutralization reaction. • Predict the products of a neutralization reaction. 	acid • base • salt • neutralization
	11-12.C.2.1.6 Explain the role of dissociation and ionization in producing strong, weak, and nonelectrolytes.		<ul style="list-style-type: none"> • Define strong and weak electrolytes, and nonelectrolytes. • Explain how dissociation and ionization produce electrolytes. 	dissociation • ionization • electrolyte • strong electrolyte • weak electrolyte • nonelectrolyte
Goal 2.2: Understand Concepts of Motion and Forces	11-12.C.2.2.1 Describe the Kinetic Molecular Theory as it applies to phases of matter.		<ul style="list-style-type: none"> • Explain the kinetic molecular theory. • Compare and contrast the molecular arrangement for each state of matter. • Explain how heat changes the molecular arrangement of matter. 	solid • liquid • gas

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Goal 2.3: Understand the Total Energy in the Universe is Constant	11-12.C.2.3.1 Explain and calculate the changes in heat energy that occur during chemical reactions and phase changes.		<ul style="list-style-type: none"> • Read and record temperature and mass measurements. • Calculate the change in heat energy. • Explain the reasons for temperature change of a system 	specific heat capacity • latent heat
	11-12.C.2.3.2 Demonstrate the conservation of matter by balancing chemical equations.		<ul style="list-style-type: none"> • Define the law of conservation of matter. • Use coefficients to balance chemical equations. • Defend how balancing equations is in accordance with the law of conservation of matter. 	conservation of matter • coefficient • chemical formula • reactant • product • subscript
	11-12.C.2.3.3 Differentiate between exothermic and endothermic chemical reactions during chemical or physical changes.		<ul style="list-style-type: none"> • Define exothermic and endothermic reactions. • Identify chemical reactions and phase changes as endothermic and exothermic. 	temperature • endothermic • exothermic • heat energy
Goal 2.4: Understand the Structure of Atoms	11-12.C.2.4.1 Interpret the classic historical experiments that were used to identify the components of an atom and its structure.		<ul style="list-style-type: none"> • Describe the experimental designs and conclusions of specific experiments to the development of the modern theory and model of the atom. • Interpret the data of these experiments to justify the conclusions. 	Thomson's cathode ray tube experiment • Rutherford's gold foil experiment • Bohr's spectroscopy • quantum theory
	11-12.C.2.4.2 Deduce the number of protons, neutrons and electrons for an atom or ion.		<ul style="list-style-type: none"> • Use the atomic number on the periodic table to find the number of protons of an atom or ion. • Use the atomic number and charge to determine the number of electrons for an atom or ion. • Use the atomic number and mass number to determine the number of neutrons in an atom or ion. 	Proton • neutron • electron • atomic number • mass number
	11-12.C.2.4.3 Describe the relationship between the structure of atoms and light absorption and emission.		<ul style="list-style-type: none"> • Explain how the wavelengths of light emitted by an atom provide information about electron energy levels. 	electron • energy levels • wavelength • electromagnetic spectrum • absorption • emission • ground state • excited state
	11-12.C.2.4.4 Determine and illustrate electron arrangements of elements using electron configurations and orbital energy diagrams.		<ul style="list-style-type: none"> • Know that there are seven energy levels where electrons can be found. • List which sublevels (s, p, d, f) are in each energy level. • Show the number of orbitals and maximum number of electrons in each sublevel. • Illustrate the location of electrons of specific atoms using electron configuration and orbital energy diagrams. 	energy levels • sublevels • orbitals • spin • quantum numbers • Pauli Exclusion Principle

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Goal 2.5: Understand Chemical Reactions	11-12.C.2.5.1 Illustrate the Law of Conservation of Mass and the Law of Definite Proportions.		<ul style="list-style-type: none"> • Define the Law of Conservation of Mass and the Law of Definite Proportions. • Perform an activity using a chemical equation and examine if the equation follows the Law of Conservation of Mass and the Law of Definite Proportions. 	mass • reactants • products • proportion
	11-12.C.2.5.2 Classify, write and balance chemical equations for common types of chemical reactions and predict the products.		<ul style="list-style-type: none"> • Label the parts of a chemical equation. • Translate word equations into chemical equations and vice versa. • Balance chemical equations by counting the total number of each type of atom for both reactants and products, then inserting coefficients. • Recognize the different types of chemical reactions. • Predict the products from various reactants for the different types of chemical reactions. 	reactant • product • chemical reaction • coefficient • synthesis • decomposition • single displacement/replacement • double displacement/replacement • combustion • diatomic elements • polyatomic ions
	11-12.C.2.5.3 Describe the factors that influence the rates of chemical reactions.		<ul style="list-style-type: none"> • Discuss the factors that influence the rates of chemical reactions. 	reaction rates • surface area • stirring • concentration • states of matter • energy • catalyst

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Standard 3: Biology				
Goal 3.1: Understand the Theory of Biological Evolution	No goals or objectives in Chemistry.			
Goal 3.2: Understand the Relationship between Matter and Energy in Living Systems	No goals or objectives in Chemistry.			
Goal 3.3: Understand the Cell is the Basis of Form and Function for All Living Things	No goals or objectives in Chemistry.			
Standard 4: Earth and Space Systems				
Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems	No goals or objectives in Chemistry.			
Goal 4.2: Understand Geo-chemical Cycles and Energy in the Earth System	No goals or objectives in Chemistry.			
Standard 5: Personal and Social Perspectives; Technology				
Goal 5.1: Understand Common Environmental Quality Issues, Both Natural and Human Induced	11-12.C.5.1.1 Demonstrate the ability to work safely and effectively in a chemistry laboratory.		<ul style="list-style-type: none"> • List the safety rules. • Discuss the importance of safety rules. • Identify the location of safety equipment. • Explain how and when to use the safety equipment. • Demonstrate how to work safely in the laboratory. 	goggles • gloves • apron • fume hood • fire extinguisher • safety shower • eye wash station
Goal 5.2: Understand the Relationship between Science and Technology	11-12.C.5.2.1 Assess the role of chemistry in enabling technological advances.		<ul style="list-style-type: none"> • List technology that was developed by chemists. • State career fields that use chemistry. • Explore the role of chemistry in the development of specific technology. 	
Goal 5.3: Understand the Importance of Natural Resources and the Need to Manage and Conserve Them	11-12.C.5.3.1 Evaluate the role of chemistry in energy and environmental issues.		<ul style="list-style-type: none"> • List various forms of energy production. • Relate how chemistry is involved in energy production. • Evaluate how energy production affects the environment. • Discuss how chemistry can be used to help or harm the environment. 	