**Effective Date: 2008-2009 School Year**

# Hamburg Area School District

**Name of Course:** **Chemistry SB**
**Department:** **Science**

**Grade Level:** **11**
**Instructional Time:** **180 DAYS**
**Length of Course:** **1 YEAR**
**Period Per Cycle:** **6**
**Length of Period:** **45**

**Texts and Resources:**

**Internet**
**Handbook of Chemistry and Physics**
**Laptops**
**Virtual ChemLab (CDRom or Online)**
**Text: *Chemistry*, Prentice Hall 2008**
**Promethean Board**

**Assessments:**

**Exams**
**Quests**
**Quizzes**
**Research Papers**
**Lab Reports and Activities**
**Projects**
**Discussions**
**Current Events**
**Guided Inquiry**

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Introduction to Chemistry and Safety** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| Safety | • Students will become familiar and practice general safety procedures in the classroom and laboratory. | |
| What is chemistry? | • Identify the five traditional areas of study in chemistry.<br>• Relate pure chemistry to applied chemistry | S.11.A.1.2.1 |
| Why should I study chemistry? | • Identify the main areas of chemistry research.<br>• Describe some current focuses of chemistry research, i.e. medicine, materials, energy, agriculture, and technology.<br>• Distinguish between macroscopic and microscopic views.<br>• Explore the impact of scientific knowledge and discoveries on personal and community health.<br>• Recognize how science influences human population growth<br>• Investigate how science can be used to solve environmental problems.<br>• Investigate advances in science and technology that have important and long-lasting effects on science and society.<br>• Recognize how science and technology are necessary but not sufficient for solving local, national, and global issues. | S.11.A.1.2.1<br>S.11.A.1.2.2<br>S.11.A.1.3.4<br>S.11.A.2.2.2 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Introduction to Chemistry and Safety** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How do scientists attempt to answer questions related to observations about the natural world? | • Analyze the role science plays in everyday life and compare different careers in science.<br>• Describe how Lavoisier changed chemistry.<br>• Identify and apply the steps of the scientific method.<br>• Recognize that scientific knowledge comes from empirical standards; logical arguments, and skepticism, and changes as new evidence becomes available.<br>• Explain why collaboration and communication are important in science. | S.11.A.1.1.3<br>S.11.A.1.1.5<br>S.11.A.1.2.1<br>S.11.A.2.1.3<br>S.11.A.2.1.4<br>S.11.A.2.1.5 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Problem Solving in Chemistry** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is a general approach to solving a problem? | • Develop and implement a plan in order to solve a problem.<br>• Students will design and conduct different kinds of scientific investigations for a wide variety of reasons.<br>• Students will communicate and defend the designs, procedures, observations, and results of scientific investigations.<br>• Students will review and analyze scientific investigations and explanations of other investigations including peers.<br>• Recognize that science uses direct and indirect observation during scientific investigation.<br>• Distinguish between testable and non-testable questions.<br>• Distinguish between scientific facts, theories and laws. | S.11.A.1.1.1<br>S.11.A.1.1.2<br>S.11.A.1.1.3<br>S.11.A.1.1.5<br>S.11.A.2.1.1.<br>S.11.A.2.1.2<br>S.11.A.2.1.4<br>S.11.A.2.1.5 |
| What are the steps to solving numeric problems? | • Apply the three steps (analyze, calculate and evaluate) to solve numeric word problems.<br>• Students will apply mathematical models to science and technology | S.11.A.2.1.3<br>S.11.A.3.2.2 |
| What are the two steps to solving conceptual problems? | • Apply the process of analysis and solve to explain conceptual problems, i.e. interpreting diagrams and concept maps. | S.11.A.1.1.4<br>S.11.A.3.1.1<br>S.11.A.3.2.2<br>S.11.A.3.2.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Classification of Matter** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How can properties used to describe matter be classified? | • Identify properties of matter as extensive or intensive.<br>• Define physical properties and list several common physical properties of substances.<br>• Differentiate among the three states of matter.<br>• Sketch or create models of the three states of matter on a molecular level and compare the amount of kinetic energy related to each state of matter.<br>• Describe a physical change in a substance. | S.11.B.1.1.1<br>S.11.C.1.1.2<br>S.11.C.1.1.3 |
| How can mixtures be classified? | • Categorize a sample of matter as a substance or a mixture.<br>• Distinguish between homogeneous and heterogeneous samples of matter.<br>• Describe two ways that components of mixtures can be separated. | S.11.C.1.1.2 |
| How are elements and compounds different? | • Explain the difference between an element and a compound.<br>• Distinguish between a substance and a mixture.<br>• Identify the chemical symbols of common elements, and name common elements given their symbols. | S.11.C.1.1.1<br>S.11.C.1.1.2 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Classification of Matter** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is a chemical change? | • Describe what happens during a chemical change.<br>• Identify four clues that a chemical change has taken place, and recognize that the composition of matter has changed in each.<br>• Students will write a word equation indicating a chemical reaction they relate to everyday life: i.e. commercial use for yeast, transportation, etc. | S.11.A.1.3.1<br>S.11.A.1.3.2<br>S.11.C.2.1.2<br>S.11.C.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Measurement and Uncertainty** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What technological skills will be used? | • Students will identify and safely use a variety of laboratory tools, basic equipment, materials, and techniques to solve problems and answer questions.<br>• Students will apply accurate measurement knowledge to solve everyday problems.<br>• Students will apply basic computer operations and concepts such as touch keyboarding skills and techniques at acceptable speed and accuracy.<br>• Students will demonstrate basic word processing and spreadsheet skills. | S.11.A.2.2.1<br>S.11.A.2.2.2 |
| How do measurements relate to science? | • Convert measurements between standard notation and scientific notation.<br>• Differentiate between accuracy, precision and error of a measurement.<br>• Identify the number of significant figures in a measurement and in calculated results. | S.11.A.2.1.3<br>S.11.A.2.1.5<br>S.11.A.2.2.1 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Measurement and Uncertainty** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What metric units are commonly used to measure length, volume, mass, temperature and energy? | • List SI units of measurement and common SI prefixes.<br>• Distinguish between the mass and weight of an object.<br>• Apply different measurement systems, and select the best measurement system for mass, volume, and distance.<br>• Convert between Celsius, Fahrenheit and Kelvin temperature scales. when formulas are provided. | S.11.A.2.1.3<br>S.11.A.2.1.5<br>S.11.A.2.2.1<br>S.11.A.3.1.3 |
| How do I use scientific notation in chemistry? | • Convert between scientific notation and standard notation. | S.11.A.2.1.3<br>S.11.A.2.1.5 |
| Why is dimensional analysis useful? | • Construct conversion factors from equivalent measurements.<br>• Apply the techniques of dimensional analysis to a variety of conversion problems.<br>• Solve problems by breaking solutions into steps. | S.11.A.2.1.5<br>S.11.A.2.2.1 |
| What determines the density of a substance? | • Calculate the density of a material from experimental data.<br>• Describe how density varies with temperature.<br>• Recognize that floating objects are less dense then the medium they are floating in. | S.11.A.2.1.3<br>S.11.A.2.2.1<br>S.11.A.3.1.2 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Atomic Structure** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How did Democritus describe atoms? | • Describe Democritus' ideas about atoms. | S.11.A.1.1.2<br>S.11.A.1.1.3 |
| How did John Dalton describe atoms? | • Explain how Dalton improved earlier atomic ideas.<br>• Understand that special instruments are needed to observe individual atoms. | S.11.A.1.1.2<br>S.11.A.1.1.3 |
| What are subatomic particles? | • Describe the structure of atoms according to J.J. Thompson's Plum Pudding model<br>• Identify three types of subatomic particles.<br>• Describe the structure of atoms according to the Rutherford model. | S.11.A.3.2.1<br>S.11.A.3.2.2<br>S.11.A.3.2.3<br>S.11.C.1.1.1 |
| What makes one element different from another? | • Explain what makes elements and isotopes different from each other.<br>• Calculate the number of neutrons in an atom.<br>• Calculate the atomic mass of an element.<br>• Explain why scientists use the periodic table. | S.11.A.3.2.3<br>S.11.A.3.3.2<br>S.11.C.1.1.1 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Atomic Structure** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How have theories about the structure of the atom changed over time? | • Identify inadequacies in the Rutherford atomic model.<br>• Identify the new assumption in the Bohr model of the atom.<br>• Students will recognize that models and theories have changed over time.<br>• Describe the energies and positions of electrons according to the quantum mechanical model.<br>• Describe how the shapes of orbitals at different sublevels differ. | S.11.A.3.2.1<br>S.11.A.3.2.2<br>S.11.A.3.2.3<br>S.11.A.3.3.3 |
| What are the three rules for writing the electron configurations of elements? | • Apply the Aufbau principle, Pauli exclusion principle, and Hund's Rule to write the electron configuration for several simple elements.<br>• Recognize that the actual electron configuration for some elements differ from those predicted by the Aufbau principle. | S.11.A.3.2.3<br>S.11.A.3.3.1<br>S.11.A.3.3.2<br>S.11.A.3.3.3<br>S.11.B.1.1.1 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: The Periodic Table** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How did chemists begin to organize the known elements? | • Recognize that chemists used the properties of elements to sort them into groups.<br>• Compare early and modern periodic tables. | S.11.A.3.3.1<br>S.11.C.1.1.4 |
| How did Mendeleev organize his periodic table? | • Describe why Mendeleev was given credit for developing the periodic table.<br>• Understand that Mendeleev arranged the elements into groups based on a set of similar repeating properties.<br>• Recognize that Mendeleev arranged the elements in his periodic table in order of increasing atomic mass. | S.11.A.3.3.1<br>S.11.C.1.1.4 |
| How is the modern periodic table organized? | • Recognize in the modern periodic table, elements are arranged in increasing atomic number. | S.11.A.3.3.1<br>S.11.C.1.1.4 |
| What are three broad classes of elements? | • Identify by location on the periodic table if an element is a metal, non-metal, or metalloid.<br>• List the properties of a metal, non-metal, and metalloid. | S.11.A.3.3.1<br>S.11.C.1.1.4 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: The Periodic Table** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What type of information can be displayed on the periodic table? | • Use the periodic table to correlate the number of protons, neutrons, and electrons in an atom.<br>• Compare the number of protons and neutrons in isotopes of the same element.<br>• Identify similarities in chemical behavior of elements within a group.<br>• Recognize that elements can be sorted into groups based on their electron configurations. | S.11.A.3.3.1<br>S.11.C.1.1.2<br>S.11.C.1.1.4 |
| Are their patterns in the periodic table? | • Describe trend among elements for atomic size.<br>• Explain how ions form.<br>• Describe periodic trends for the following properties of ions: ionic charge, ionic radii, ionization energy, and electronegativity. | S.11.A.3.3.1<br>S.11.C.1.1.2<br>S.11.C.1.1.4 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Ionic and Metallic Bonding** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is an ion? | • Determine the number of valence electrons in atoms using the periodic table.<br>• Predict the charge an atom will acquire when it forms an ion by gaining or losing electrons and name the ion.<br>• Explain how the octet rule applies to atoms of metallic and non-metallic elements.<br>• Describe how cations form and anions form.<br>• Define a polyatomic ion and write the names and formulas for the most common polyatomic ions.<br>• Identify mass number, atomic number, and the number of protons, neutrons, and electrons for an atom or ion when given the symbol and charge. | S.11.C.1.1.1<br>S.11.C.1.1.4 |
| What is an ionic compound? | • Explain the electrical charge of an ionic compound (neutral).<br>• Recognize that most ionic compounds have the following properties:<br>1. Most are crystalline solids at room temperature.<br>2. They generally have high melting points.<br>3. They can conduct an electrical current when dissolved in water. | S.11.C.1.1.2 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Ionic and Metallic Bonding** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How do I name and write formulas for ionic compounds. | • Apply the crisscross method for naming and writing formulas for simple binary ionic compounds, given the anion and cation names and electrical charges (level 1) or given a periodic table (level 2).<br>• Apply the rules for naming and writing formulas for compounds with the most common polyatomic ions.<br>• Compare the physical properties of a compound to the elements that form it.<br>• Compare the chemical properties of a compound to the elements that form it.<br>• Explain that combining elements in different proportions results in the formation of different compounds with different properties. | S.11.C.1.1.3<br>S.11.C.1.1.4 |
| How do metallic bonds form? | • Describe the arrangement of the valence electrons of metal atoms.<br>• Describe the arrangement of atoms in a metal.<br>• Explain the importance of alloys. | S.11.C.1.1.2<br>S.11.C.1.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Molecular Compounds** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What are covalent bonds? | • Classify compounds as ionic and covalent bonding.<br>• Identify the information a molecular formula provides.<br>• State the octet rule, and recognize there are exceptions to the rule.<br>• Predict how many bonds each atom must form to attain a noble-gas configuration.<br>• Draw Lewis Dot Diagrams showing the structure of simple compounds.<br>• Recognize the strength of a covalent bond is related to its bond dissociation energy | S.11.A.3.2.2<br>S.11.A.3.2.3<br>S.11.C.1.1.2<br>S.11.C.1.1.3 |
| Do the properties of compounds relate to the type of bonding? | • Generalize, from investigations, the physical properties (e.g., malleability, conductivity, solubility) of substances with different bond types.<br>• Given a model, describe the shape and resulting polarity of water, ammonia, and methane molecules. | S.11.B.1.1.1<br>S.11.C.1.1.2<br>S.11.C.1.1.4 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Molecular Compounds** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What are polar covalent bonds? | • Recognize how electronegativity values determine the distribution of charge in a polar molecule.<br>• Describe what happens to polar molecules when they are placed between oppositely charged metal plates.<br>• Evaluate the strength of intermolecular attractions compared with the strength of ionic and covalent bonds.<br>• Identify the reason why network solids have high melting points. | S.11.A.1.1.3<br>S.11.C.1.1.2<br>S.11.C.1.1.4 |
| How do I name and write the formula for molecular compounds? | • Write molecular formulas by using the prefixes in the names of molecular compounds to write the appropriate subscripts with the correct element symbols.<br>• When given the molecular formula, determine the name of the molecular compound by using the subscript of each element in the formula. | S.11.C.1.1.3 |
| What are the two laws that describe how compounds form? | • Define the Law of Definite Proportion<br>• Define the Law of Multiple Proportions<br>• Apply the rules for naming compounds and writing formulas by using a flowchart. | S.11.A.3.1.1<br>S.11.A.1.1.4<br>S.11.C.1.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Acids and Bases** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How do I name and write the formula for acids? | • Apply three rules for naming simple common acids.<br>• Apply the rules in reverse to write formulas of simple acids. | S.11.C.1.1.3 |
| How do I name and write the formula for bases? | • Understand that bases are named in the same way as other ionic compounds. | S.11.C.1.1.3 |
| What are the properties of acids and bases? | • Define the common properties of acids.<br>• Define the common properties of bases. | S.11.C.1.1.2 |
| What theories attempt to explain the behavior of acids and bases? | • Identify acids and bases as defined by Arrhenius.<br>• Identify Acids, bases, conjugate acids, and conjugate bases as defined by Bronsted-Lowry.<br>• Differentiate between , Arrhenius, Bronsted-Lowry, and Lewis definitions of acids and bases.<br>• Recognize that strong acids and bases dissociate completely, forming equal amounts of ions. | S.11.A.1.1.1<br>S.11.A.1.1.2<br>S.11.C.1.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Acids and Bases** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is pH? | • Relate hydrogen ion concentration to pH values and to the terms acidic, basic or neutral.<br>• Using an indicator, measure the pH of common household solutions and standard laboratory solutions, and identify them as acids or bases.<br>• Determine the concentration of an acid or a base using a simple computerized acid-base titration.<br>• Research and report on the uses of acids and bases in industry, agriculture, medicine, mining, manufacturing, or construction.<br>• Evaluate mechanisms by which pollutants modify the pH of various environments (e.g., aquatic, atmospheric, soil). | S.11.A.1.2.1<br>S.11.A.1.3.3<br>S.11.A.2.2.2 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Chemical Quantities** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How is Avogadro's number related to a mole of any substance? | • Recognize that substances are often measured by count, by mass, and by volume.<br>• Define Avogadro's number and relate it to a mole of a substance.<br>• Distinguish between the atomic mass of an element and its molar mass. | S.11.A.1.1.4<br>S.11.A.2.1.3<br>S.11.A.2.1.5 |
| How is the mole concept used in chemistry? | • Calculate the molar mass of a compound when given simple formulas and a periodic table.<br>• Convert between mass in grams to moles of a substance, and moles to mass by using a flowchart.<br>• Convert number of particles to moles by using a flowchart.<br>• Convert moles to number of particles by using a flowchart. | S.11.A.1.1.4<br>S.11.A.2.1.3 |
| What is percent composition of a compound? | • Recognize that the percent composition of a compound consists of a % by mass value for each element in the compound.<br>• Calculate the percent composition for specified elements when given the formula of the compound. | S.11.A.1.1.3<br>S.11.A.1.1.4<br>S.11.A.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Chemical Quantities** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is the difference between the molecular formula and the empirical formula | • Define and recognize empirical formulas and molecular formulas for a given compound.<br>• Calculate simple molecular formulas when given the percent composition and the molar mass. (NOTE: steps may be provided for Level1)<br>• Calculate simple empirical formulas when given the empirical formula and the mass. (NOTE: Steps may be provided for Level 1). | S.11.A.1.1.4<br>S.11.A.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Chemical Reactions**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How do I know a chemical reaction has taken place? | • Describe evidences of chemical reactions.<br>• Compare the properties of reactants to the properties of products in a chemical reaction. .<br>• Investigate everyday chemical reactions that occur in a student's home (e.g., baking, rusting, bleaching, cleaning). | S.11.A.1.1.3<br>S.11.A.1.2.2<br>S.11.A.1.3.2 |
| What is the Law of Conservation of Matter? | • Use a chemical equation to describe a simple chemical reaction.<br>• Recognize that the number of atoms in a chemical reaction does not change.<br>• Explain how balanced equations apply to both chemistry and everyday situations.<br>• Determine the molar proportions of the reactants and products in a balanced chemical reaction. | S.11.A.1.1.3<br>S.11.A.3.1.1<br>S.11.A.3.2.3 |
| What are the five general types of reactions? | • Recognize the following reaction types: synthesis, decomposition, combustion, single replacement, and double replacement.<br>• Predict products and balance simple chemical equations for chemical reactions.<br>• Using a flowchart, predict the formation of a precipitate in a double replacement reaction. | S.11.A.1.3.2<br>S.11.A.3.2.3<br>S.11.C.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Arithmetic of Equations (Stoichiometry)** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How is a balanced equation like a recipe? | • Calculate the amounts of reactants required or product formed in a non-chemical process.<br>• Explain how balanced equations apply to both chemistry and everyday situations. | S.11.A.2.1.3 |
| How do chemists use balanced chemical equations? | • Interpret balanced chemical equations in terms of moles, representative particles, and mass.<br>• Recognize that chemists use balanced chemical equations as the basis to calculate how mush reactant is needed or product is formed in a reaction. | S.11.A.2.1.3.<br>S.11.A.2.1.5 |
| What quantities are always conserved in chemical reactions? | • Students will recognize that a balanced chemical equation can be interpreted in terms of different quantities including: number of atoms, molecules, moles, mass, volume, and energy.<br>• Paired students will write balanced chemical equations and then exchange their equations with other pairs of students to write quantitative relationships between reactants and products.<br>• Report evidence of energy transformations in a chemical reaction.<br>• After observing or measuring, classify evidence of temperature change in a chemical reaction as endothermic or exothermic. | S.11.A.3.1.1<br>S.11.C.2.1.2<br>S.11.C.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Arithmetic of Equations (Stoichiometry)** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How are mole ratios used in chemical calculations. | • Construct a mole ratio (conversion factor) from balanced chemical equations to convert between moles of reactant and moles of product. | S.11.A.1.1.4<br>S.11.A.2.1.3 |
| What is a Limiting Reagent? | • Given the masses of reactants, predict which reactant will limit the reaction.<br>• Describe how the amount of product in a reaction (chemical or non-chemical) is affected by an insufficient amount of any of the reactants. | S.11.A.1.1.3<br>S.11.A.1.3.1<br>S.11.A.2.1.3<br>S.11.A.3.2.1 |
| What does the percent yield of a reaction measure? | • Calculate theoretical yield, actual yield, and percent yield, given the necessary information. | S.11.A.1.1.4<br>S.11.A.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Kinetic Theory and a Model for Gases, Liquids , and Solids** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What are the three assumptions of the kinetic theory as it applies to gases? | • Recognize particles in a gas are considered to be small hard spheres with an insignificant volume.<br>• Understand that motion of the particles in a gas is rapid, constant, and random.<br>• Recall that all collisions between particles in a gas are perfectly elastic (Note: in an elastic collision, kinetic energy is transferred without loss from one particle to another, and the total kinetic energy remains constant). | S.11.A.1.1.1<br>S.11.A.1.1.2<br>S.11.A.1.1.3<br>S.11.A.1.1.4 |
| How does Kinetic theory explain gas pressure? | • Recognize that gas pressure is the result of simultaneous collisions of billions of rapidly moving particles in a gas with an object.<br>• Understand that if there are no particles, there can not be collisions and therefore, there is no pressure. No pressure is called a vacuum.<br>• Understand the amount of gas, volume, and temperature affect gas pressure. | S.11.A.1.1.2<br>S.11.C.1.1.6 |
| What is the relationship between the temperature in Kelvin and the average kinetic energy of particles. | • Recognize the Kelvin temperature of a substance is directly proportional to the average Kinetic energy of the particles of substance. | S.11.C.1.1.5 |

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| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What factors determine the physical properties of a liquid? | • Understand that according to kinetic theory, particles of a liquid are attracted to each other, and recognize that this is a key difference between liquids and gases.<br>• Recognize that intermolecular attractions in liquids reduce the amount of space between the molecules in a liquid.<br>• Understand intermolecular attraction is why liquids are more dense than gases.<br>• Understand intermolecular attraction is why liquids and are not able to be compressed. | S.11.A.3.2.2<br>S.11.C.1.1.2<br>S.11.C.1.1.6 |

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| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is the relationship between evaporation and Kinetic energy? | • Recall the conversion of a liquid to a gas is called evaporation.<br>• Understand that during evaporation, only those molecules with a certain minimum kinetic energy can escape from the surface of the liquid. | S.11.C.1.1.6<br>S.11.C.2.1.2 |
| How are the structure and properties of solids related? | • Explain how the orderly, fixed arrangement of atoms explains the properties of solids. | S.11.C.1.1.2 |
| What determines the shape of a crystal? | • Describe how the shape of a crystal reflects the arrangement of the particles within the solid.<br>• Explain how allotropes of an element are different. | S.11.C.1.1.2<br>S.11.A.3.3.1<br>S.11.A.3.3.2 |
| How are changes of state represented on a phase diagram? | • Understand a phase diagram is a graph which gives the conditions of temperature and pressure at which a substance exists as a solid, liquid and gas.<br>• Understand that the conditions of temperature and pressure at which two phases exist in equilibrium are indicated on a phase diagram by a line separating the phases.<br>• Recall the term “triple point” describes the only set of conditions at which all three phases can exist in equilibrium with one another. | S.11.A.1.3.1<br>S.11.A.3.2.3 |

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**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: The Gas Laws** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How are the temperature, volume, and pressure of a gas related? | • Students will create a concept map entitled "Gas Laws" to relate the relationship of pressure, temperature, and volume to the following gas laws:<br>  • Boyle's Law<br>  • Charles Law<br>  • Gay-Lussac's Law<br>  • The Combined Gas Law<br>• Compute the value of an unknown using the combined gas law.<br>  • Level 1 students may be paired to solve math practice problems. | S.11.A.1.3.1<br>S.11.A.3.1.1<br>S.11.A.3.1.2<br>S.11.C.1.1.5 |
| What is the Ideal Gas Law | • Students will compute the value of an unknown variable in the equation for the ideal gas law.<br>  • Level 1 students may be paired to solve math practice problems | C.11.C.1.1.5 |

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**Course Name: Chemistry SB**
**Unit: The Gas Laws** **Time Line: Yearly course**
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| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| Under what conditions are real gases most likely to differ from ideal gases? | • Recognize that real gases do not obey the assumptions of kinetic theory at all conditions, therefore, an ideal gas does not exist.<br>• Students will compare and contrast real and ideal gases.<br>• Students will discuss that at many conditions, real gases behave very much like an ideal gas.<br>• Students will recognize that real gases differ most from an ideal gas at low temperature and high pressure. | S.11.A.1.1.1<br>S.11.A.1.1.4<br>S.11.A.1.3.1<br>S.11.C.1.1.5 |
| What is Dalton's Law of Partial Pressure? | • Students will relate the total pressure of a mixture of gases to the partial pressure of the component gases. | S.11.A.1.1.3<br>S.11.A.1.1.4<br>S.11.C.1.1.5 |
| What is Graham's Law of Effusion? | • Students will recall that during *effusion*, a gas escapes through a tiny hole in its container, whereas *diffusion* refers to the tendency of molecules to move towards areas of lower concentration.<br>• Students will explain how the molar mass of a gas affects the rate at which the gas diffuses and effuses. | S.11.A.1.1.1<br>S.11.A.1.1.5<br>S.11.C.1.1.5 |

**Hamburg Area School District**
**Course Plan**
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**Course Name: Chemistry SB**
**Unit: Solutions** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| What is meant by the term surface tension? | • Students will use analogies to point out the skin-like qualities of water due to high surface tension, a result of the structure of water molecules and hydrogen bonding. | S.11.C.1.1.1<br>S.11.C.1.1.2 |
| What is meant by the term polarity? | • Describe polarity as a partial negative charge on a molecule resulting from electronegativity differences between covalently bonded atoms.<br>• Demonstrate the concept of "like dissolves like" for polar and non-polar solutions<br>• Describe why a detergent molecule will dissolve both oils and also dissolve in water. | S.11.A.1.2.2<br>S.11.C.1.1.1<br>S.11.C.1.1.2 |
| What is the difference between a solute and a solvent? | • Students will recognize the dissolving media is the solvent, and the dissolved particles are the solute.<br>• Students will distinguish between a solution, suspensions and colloids. | S.11.C.1.1.2 |
| What is an electrolyte? | • Students describe an electrolyte as a substance that conducts an electric current when dissolved in solution.<br>• Students will recognize that ionic compounds are electrolytes because they dissociate into ions. | S.11.C.1.1.2 |
| What is a hydrate? | • Demonstrate how the formula for a hydrate is written. | S.11.C.1.1.2 |

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**Chemistry SB**

**Course Name: Chemistry SB**
**Unit: Nuclear Chemistry** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008**

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| How does an unstable nucleus release energy? | • Recognize that radioactive particles and wavelike radiations are products of the decay of an unstable nucleus.<br>• Interpret graphical data relating half-life and age of a radioactive substance.<br>• Describe the mass, energy, and penetrating power of alpha, beta, and gamma radiation.<br>Discuss the effects of nuclear radiation on humans or other organisms. | S.11.A.1.1.4<br>S.11.A.1.1.5<br>S.11.C.2.1.2 |
| What happens in a nuclear chain reaction? | • Describe what happens in a nuclear chain reaction<br>• Explain the role of water in the storage of spent fuel rods.<br>• Distinguish fission reaction from fusion reactions. | S.11.A.1.1.1<br>S.11.A.1.2.1<br>S.11.A.2.2.2<br>S.11.A.3.1.1<br>S.11.C.2.1.2 |