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

# Hamburg Area School District

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

**Grade Level:** **11**
**Instructional Time:** **180 DAYS**
**Length of Course:** **1 YEAR**
**Period Per Cycle:** **7**
**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**
**Scheduled lab time**

**Assessments:**

**Exams**
**Quests**
**Quizzes**
**Research Papers**
**Lab Reports and Activities**
**Projects**

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Safety and technology** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

| Essential Content/ Essential Questions | Performance Objectives | Standards/Anchors |
|---|---|---|
| Safety | • Students will become familiar with general laboratory safety rules. | 3.2.12.A |
| What Technological skills will be used? | • Students will 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.<br>• Students will identify legal restrictions in the use of software and the output data. | S11A.2.2.1<br>S11A.2.2.2 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Problem Solving - Thinking Like a Scientist** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| How do the science concepts learned in class relate to my life? | • Explain and apply scientific concepts to societal issues using case studies e.g., environmental, health and energy).<br>• Discuss scientific and technological advancements in terms of cause and effect.<br>• Describe and evaluate the impact that financial considerations have had on specific scientific applications and decisions. e.g., Challenger Shuttle Disaster | S11A.1.2.1<br>S11A.1.2.2 |
| What process is used by scientists to solve problems | • Recognize that science uses both direct and indirect observation means to study the world and the universe.<br>• Examine the problem and consider the necessary information<br>• Generate questions that can be answered through scientific investigation.<br>• Propose and analyze a solution.<br>• Implement the solution.<br>• Evaluate the solution, test redesign, and improve as necessary.<br>• Communicate the process and present the solution.<br>• Recognize that the application of the scientific process of problem solving often leads to recognition of new problems. | S11A.1.1.3<br>S11A.1.1.5<br>S11A.1.2.1<br>S11A.2.1.3<br>S11A.2.1.4<br>S11A.2.1.5 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Math Skills for Chemistry** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| How do I use scientific notation in chemistry? | • Convert between scientific notation and standard notation. | S11A.2.1.3<br>S11A.2.1.5 |
| What does "uncertainty in measurement" mean? | • Identify the number of significant figures in a measured quantity, and in calculated results.<br>• Distinguish between the accuracy, precision, and error of a measurement. | S11A.2.1.3<br>S11A.2.2.1 |
| How do I convert between units of mass, length and volume measurements? | • Compare and contrast different measurement systems and select the best measurement system for a specific situation.<br>• Distinguish between the mass and weight of an object.<br>• List the basic SI units and the common metric prefixes and their meanings.<br>• Apply appropriate measurement scales when collecting data.<br>• Explain the need to estimate measurements within error of various instruments<br>• Students will apply various forms of dimensional analysis | S11A.2.1.3<br>S11A.2.1.5<br>S11A.2.2.1<br>S11A.3.1.3 |
| How do I convert from one temperature scale to another? | • Concert between Centigrade, Fahrenheit, and Kelvin | S11A.2.1.5<br>S11A.2.2.1 |
| What is density? | • Define density and specific gravity<br>• Calculate the density of various objects<br>• Identify that floating objects are less dense than the medium they are floating in.<br>• Describe how density varies with temp. | S11A.2.1.3<br>S11A.2.2.1<br>S11A.3.1.2<br>S11A.3.1.3 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Matter and Change** **Time Line: Yearly course**
**Text: *Chemistry,* Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| What are the unique properties of water? | • Describe why water has abnormal boiling and freezing points for molecules of similar molecular weight<br>• Describe why water is often referred to as the universal solvent<br>• Explain why ice expands when it freezes<br>• Explain why the colors of a dye separate in paper chromatography | S11C.1.1.2 |
| What is meant by the term solubility? | • Define the terms: insoluble, unsaturated, saturated, and supersaturated. | S11C.1.1.2 |
| What factors affect solubility? | • Use solubility curves to describe the effect of temperature on solubility.<br>• Use the concept of polarity to account for water's ability to dissolve many ionic solids.<br>• Describe the effect of temperature and external pressure on the solubility of gaseous substances. | S11C.1.1.2 |

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**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Matter and Change** **Time Line: Yearly course**
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|---|---|---|
| How is matter classified? | • Distinguish between chemical and physical properties and between chemical and physical changes.<br>• Classify samples of matter in terms of elements, compounds, or mixtures<br>• Interpret and create models that represent elements, compounds, and mixtures at the particulate level.<br>• Differentiate between the three states of matter (solid, liquid, gas). | S11C.1.1.2<br>S11C.1.1.3 |
| What is a mixture? | • Distinguish among different types of mixtures:<br>a) homogeneous (solutions)<br>b) heterogeneous (suspensions)<br>c) colloids<br>• demonstrate knowledge of appropriate separation techniques. | S11C.1.1.2 |
| What happens during a chemical change? | • Identify three clues that a chemical change has taken place, and recognize that the composition of matter has changed in each.<br>• Apply the Law of Conservation of Mass to Chemical reactions. | S11A.1.3.1<br>S11C.2.1.2<br>S11C.2.1.3 |
| What are Chemical symbols? | • Recognize, explain, and distinguish among common element symbols on the periodic table. | S11A.3.3.1 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

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

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|---|---|---|
| What is an atom and how has atomic theory changed over time? | • Describe Democritus' ideas about atoms.<br>• Explain how Dalton improved earlier atomic ideas. | S11A.1.1.2 |
| What are the subatomic particles? | • Recognize and distinguish characteristics of protons. neutrons, and electrons.<br>• Describe the properties of the electron as seen in cathode rays.<br>• Describe the structure of atoms according to the J.J. Thompson's Plum Pudding model.<br>• Describe how the nucleus was discovered.<br>• Describe the structure of atoms according to the Rutherford model.<br>• Recognize how models, systems, technologies and theories have changed over time (atomic theory). | S11A.3.2.1<br>S11A.3.2.2<br>S11A.3.2.3<br>S11C.1.1.1<br>S11A.1.1.1<br>S11A.1.1.2<br>S11A.1.1.3<br>S11A.1.1.4<br>S11A.1.1.5 |
| What are isotopes? | • Distinguish between isotopes based on their total neutrons and/or mass numbers<br>• Calculate the mass number, atomic number, number of neutrons, and number of protons in a given isotope.<br>• Recognize that the elemental mass number listed on the periodic table is an isotopic average.. | S11A.3.2.3<br>S11C.1.1.1 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

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

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|---|---|---|
| What is the current understanding of modern atomic structure? | • Distinguish between the valid parts of the Bohr model of the atom, and those no longer accurate.<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.<br>• Identify which regions of the periodic table contain different suborbitals (s, p, d, and f). | S11A.3.2.1<br>S11A.3.2.2<br>S11A.3.2.3<br>S11A.3.3.3 |
| Where are electrons and how are they arranged in atoms? | • Describe how to write the electron configuration of the atom.<br>• Develop the electron configuration for several elements by applying the Aufbau principle, the Pauli exclusion principle, and Hunds' rule as needed.<br>• Explain why the actual configuration for some elements differ from those predicted by the Aufbau principle. | S11A3.2.3<br>S11A.3.3.1<br>S11A.3.3.2<br>S11A.3.3.3<br>S11B.1.1.1 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

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

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| What are the important parts of the periodic table? | • Classify selected elements as metals, nonmetals, or metalloids based on observations of chemical and physical properties.<br>• Describe the properties of metals and nonmetals<br>• Identify elements by their atomic numbers and atomic masses<br>• Locate periods and groups (families) of elements. | S11A.3.3.1<br>S11C.1.1.4 |
| How are elements organized in a periodic table? | • Compare early and modern periodic tables.<br>• Explain that elements are currently arranged by increasing atomic number. | S11A.3.3.1 |
| Why is Mendeleev given credit for developing the periodic table? | • Recognize that he published his work (based on increasing mass number) first<br>• Recognize that he predicted the properties of two elements that were undiscovered at the time. | S11C.1.1.4 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: The Periodic Table** **Time Line: Yearly course**
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|---|---|---|
| Are there repeating patterns on the periodic table? | • Explain how an elements chemical and physical properties are associated with the number and arrangement of electrons in its atoms<br>• Predict examine and describe recurring patterns (atomic radius, ionization energy, and electronegitivity) that form the basis of chemical periodicity.<br>• Predict physical and chemical properties of an element based on position on the periodic table.<br>• Classify elements based on electron configuration. | S11A.2.1.3<br>S11A.3.3.1<br>S11C.1.1.2<br>S11C.1.1.4 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

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

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| What is an ion? | • Determine the number of valence electrons in an atom of an element.<br>• Describe how cations and anions form.<br>• List the elements whose atoms tend to gain electrons and those that tend to lose electrons.<br>• Write the symbol and charge for an atom or ion, having been given the number of protons, neutrons, and electron, and perform the reverse operation. | S11C.1.1.1<br>S11C.1.1.4 |
| How do I determine the name and formula of simple ionic compounds? | • Indicate the electrical charge of an ion containing a specific number of protons and electrons<br>• Apply the rules for naming and writing formulas for binary ionic compounds , given the compound's anion and cation name and electrical charge.<br>• Apply the rules for naming and writing formulas for compounds with polyatomic ions. | S11C.1.1.3<br>S11C.1.1.4 |
| What is a metallic bond? | • Describe the arrangement of valence electrons in metal atoms.<br>• Describe how this model of metallic bonding explains the conductivity of metals. | S11C.1.1.2<br>S11C.1.1.3 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Covalent Bonding** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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| What is meant by the term covalent? | • Distinguish molecular compounds from ionic compounds. | S11C.1.1.3 |
| How do I determine the name and formula for molecular compounds? | • Interpret the prefixes in the names of molecular compounds in terms of their chemical formulas.<br>• Apply the rules for naming and writing formulas for binary molecular compounds. | S11C.1.1.3 |
| How do I determine the name and formula for acids and bases? | • Apply the rules for naming acids and bases to determine the chemical formula for common acids and bases. | S11C.1.1.3 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Chemical Names and Formulas** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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| Can I determine the structure of compounds? | • State and apply the octet rule.<br>• Draw Lewis structures to demonstrate how electron dot diagrams are used.<br>• Determine when two atoms are likely to be joined by a double or triple bond.<br>• Identify exceptions to the octet rule. | S11A.3.2.2<br>S11A.3.2.3<br>S11B.1.1.1 |
| Can the properties of matter be linked to its structure? | • Explain the properties of allotropes in terms of the bonding and arrangement of atoms. | S11B.1.1.1 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

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

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| What is the usefulness of the mole concept in chemistry? | • Relate Avogadro's number to a mole of a substance.<br>• Calculate the molar mass of a compound, when given its formula and a periodic table.<br>• Convert the mass of a substance to the number of moles of a substance, and moles to mass.<br>• Calculate the molarity of a solution, and prepare a solution of a specified molarity.<br>• Calculate the volume of a quantity of gas at STP. | S11A.1.1.4<br>S11A.2.1.3 |
| What is the percent composition of a particular compound? | • Calculate the percent composition by mass of a specified element in a given compound.<br>• Interpret an empirical formula.<br>• Compare and contrast empirical and molecular formulas. | S11A.1.1.3<br>S11A.1.1.4<br>S11A.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Chemical Reactions** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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| What is meant by "Conservation of Matter"? | • State and apply the Law of Conservation of Matter<br>• Identify the parts of a chemical equation.<br>• Write and explain balanced chemical equations as related to the Law of Conservation of Matter<br>• Construct mole ratios from balanced chemical equations and apply these ratios in mole-mole stoichiometric calculations.<br>• Calculate stoichiometric quantities from balanced chemical equations using units of moles, mass, and volumes of gases at STP. | S11A.1.1.3<br>S11A.1.3.2 |
| Can I predict the products of a chemical reaction? | • Recognize, the following different types of chemical equations: synthesis, acid/base, decomposition, combustion, single replacement, and double replacement.<br>• Predict the products and write the balanced chemical equation for a chemical reaction.<br>• Describe the information found in a net ionic equation.<br>• Predict the formation of a precipitate in a double-replacement reaction. | S11A.1.3.2<br>S11C.2.1.3 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Stoichiometry** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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| What is a limiting reagent? | • Given the masses of reactants, predict which reactant will limit the reaction.<br>• Given the masses of reactants, calculate the mass of the products produced.<br>• Calculate theoretical yield, actual yield, and percent yield, given appropriate information. | S11A.1.1.3<br>S11A.1.3.1<br>S11A.2.1.3<br>S11A.3.2.1 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Thermochemistry** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| What is energy? | • Explain *endothermic* and *exothermic* reactions in terms of total energy involved in bond breaking and bond making.<br>• State, explain, and give examples of "The Law of Conservation of Energy".<br>• Use knowledge of conservation of energy explain common phenomena (e.g., heating and cooling curves, ). | S11A.1.1.3<br>S11A.3.1.3<br>S11A.3.2.3<br>S11C.2.1.2<br>S11C.2.1.3 |
| What is heat capacity? | • Define heat.<br>• Convert among units of heat.<br>• Define specific heat.<br>• Calculate the heat capacity of various objects | S11A.1.3.1<br>S11C.2.1.2 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: States of Matter** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| What does "change of state" mean? | • Describe how solid, liquid, and gas conditions are represented in a phase diagram.<br>• Recognize that each substance has a unique set of properties that includes melting point, boiling point, and triple point. | S11A.3.2.3 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: The Behavior of Gases** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| What are the properties of gases? | • Explain why gases are easier to compress than solids or liquids are.<br>• Describe the assumptions of the kinetic theory as it applies to gases.<br>• Define the relationship between the Kelvin temperature and the average kinetic energy of particles. | S11C.1.1.2<br>S11C.1.1.6 |
| How is the behavior of gases explained by Boyle's Law, Charles' Law, and the Combined Gas law? | • Understand conditions of standard temperature and pressure.<br>• Analyze data that relates temperature, pressure, and volume of a gas.<br>• Predict the effect of changes in pressure and temperature on the volume of a gas.<br>• Apply Boyle's Law, Charles, Law, and the Combined Gas Law to solve problems. | S11A.1.1.1<br>S11A.1.1.3<br>S11A.1.1.4<br>S11A.1.3.1<br>S11A.1.3.2<br>S11A.3.1.2<br>S11C.1.1.5 |
| What did Avogadro discover about gases? | • Recognize that equal volumes of gases at the same temperature and pressure contain equal numbers of molecules.<br>• Relate molar quantities of a gas to its temperature, volume, and pressure. | S11A.1.1.3<br>S11A.1.1.4 |
| How is the behavior of gases explained by Daltons Law of Partial Pressures? | • Recognize that the total pressure of a mixture of gases is equal to the sum of the pressure exerted by each gas separately.<br>• Recognize that Daltons Law is used when collecting gases over water. | S11A.1.1.3<br>S11A.1.1.4 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Behavior of Gases** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| How is the behavior of gases explained by Grahm's Law | • Understand that the word *effusion* refers to the leakage of a gas through a small hole, whereas *diffusion* is the speed of a gas through open space.<br>• Recognize that, at the same temperature and pressure, lighter gas molecules will travel at a higher velocity than heavy gas molecules. | S11A.1.1.3<br>S11A.1.1.4 |
| How is the behavior of gases explained by the Ideal Gas Law? | • State the underlying assumptions behind the Ideal Gas Law<br>• Compare and contrast real and ideal gases.<br>• Define R as a physical constant.<br>• Compute the value of an unknown variable in the equation for the ideal gas law. | S11A.1.1.1<br>S11A.1.1.4<br>S11A.1.3.1<br>S11A.3.2.1 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

**Course Name: Chemistry PS**
**Unit: Acids, Bases, and Salts** **Time Line: Yearly course**
**Text: *Chemistry*, Prentice Hall. 2008** *D. Ottaviani*

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|---|---|---|
| What is the difference between an acid and a base? | • Define the properties of acids and bases.<br>• Describe strong acids/bases and week acids.bases.<br>• Compare and contrast acids and bases as defined by the Arrhenius, Brønsted-Lowrey, and Lewis. | S11A.1.1.1 |
| What is pH? | • Define pH.<br>• Classify a solution as neutral, acidic, or basic, given the hydrogen-ion or hydroxide–ion concentration.<br>• Convert hydrogen-ion concentrations into values of pH and hydroxide-ion concentrations into values of pOH (strong acids and bases only).<br>• Demonstrate how acid-base titration is used to calculate the concentration of an acid or a base.<br>• Explain the concept of equivalence point in neutralization reactions. | S11A.2.2.1<br>S11A.2.2.2 |

**Hamburg Area School District**
**Course Plan**
**(Chemistry PS)**

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

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|---|---|---|
| What is Nuclear radiation? | • Explain how an unstable nucleus releases energy.<br>• Describe the three main types of radiation.<br>• Describe the types of decay a radioisotope undergoes.<br>• Calculate half-life. | S11A.1.1.4<br>S11A.1.1.5<br>S11C.2.1.2 |
| What is the difference between fission and fusion of atomic nuclei? | • Describe what happens in a nuclear chain reaction.<br>• Compare and contrast fission and fusion reactions. | S11A.1.1.1<br>S11A.1.2.1<br>S11A.2.2.2<br>S11A.3.1.1<br>S11C.2.1.2 |