



GREAT NECK PUBLIC SCHOOLS

"Where Discovery Leads to Greatness"

#DiscoverGreatness

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Course Profile: Chemistry Honors

<u>Department</u>	Science		
<u>Course Name</u>	Honors Chemistry		
<u>Course Length</u>	1 year		
<u>High School Credits</u>	1 unit		
<u>Description</u>	An enriched and more quantitatively oriented course emphasizing the same areas as Regents Chemistry. Mathematical rigor is maintained throughout the course. The course is designed for students who wish to pursue careers in science as well as for those students who wish an intellectual challenge. All students will be expected to take the Chemistry Regents examination in June. Class daily plus lab alternate days.		
<u>Target/eligible students</u>	Students from grades 10 and 11		
<u>State Learning Standards Link(s)</u>	http://www.nysed.gov/common/nysed/files/programs/curriculum-instruction/hs-science-learning-standards.pdf		
<u>Primary texts and materials</u>	Wilbraham, A.C. et al. (2008). Chemistry (New York ed, Chapters 1-25). Pearson Prentice Hall		
<u>Scope/Sequence</u>			
<u>Unit 1: Matter</u>	HS-PS1-1 HS-PS1-3 HS-PS1-4 HS-PS1-7	- Types of matter include elements, compounds and mixtures. - Chemical and physical properties of matter - Allotropes as elements of the same kind but with different properties PS1.A Structure and Properties of Matter The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3),(secondary to HS-PS2-6) - pg. 54 PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56	pg. 54 pg. 56
<u>Unit 2: Formulas and Equations</u>	HS-PS1-1 HS-PS1-2 HS-PS1-7	- Framework of a chemical equation - Five basic types of chemical reactions - Naming of covalent and ionic compounds - Formula Laws - Percent Composition PS1.A Structure and Properties of Matter	pg. 54 pg. 56

		The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.(HS-PS1-3),(secondary toHS-PS2-6) - pg. 54 PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56	
<u>Unit 3: The Atom</u>	HS-PS1-1 HS-PS1-3 HS-PS1-4 HS-PS1-7 HS-ESS-1	- History of the atom in terms of model representation - Subatomic particles and isotopes - Quantum mechanical model - Electron configurations (ground state) - Excitation and emission spectra PS1.A Structure and Properties of Matter Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) - pg. 54 PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56 PS4.B Electromagnetic Radiation Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary HS-ESS1-2) - pg. 73 PS4.A Wave Properties The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) - pg. 62	pg. 54 pg. 56 pg. 62 pg. 73
<u>Unit 4: The Periodic Table</u>	HS-PS1-1 HS-PS1-2 HS-PS1-3	- History of the Periodic Table and its current design, Periodic Law - Chemical and physical properties of Groups 1, 2, 3-12, 17 and 18 - Periodic Trends (metallic character, electronegativity, radius, ionization energy) PS1.A Structure and Properties of Matter The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The	pg. 54 pg. 56

		repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1) - pg. 54 PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56	
<u>Unit 5: Moles & Stoichiometry</u>	HS-PS1-4 HS-PS1-7	• The mole by definition • Use of dimensional analysis to make mole conversions • Limiting Reactant • Percent Yield PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56 PS3.B Conservation of Energy and Energy Transfer Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) - pg. 60	pg. 56 pg. 60
<u>Unit 6: Chemical Bonding</u>	HS-PS1-1 HS-PS1-2 HS-PS1-3 HS-PS1-4 HS-PS2-6	• Bonding as a means to attain a Noble Gas configuration • Covalent bonding, ionic bonding, metallic bonding • Lewis dot diagrams • Types of solids • Intermolecular forces and their effect on melting/boiling points and state of matter. • Hybrid orbitals • Polarity of bond and molecules • Shapes of molecules and Lewis structures PS1.A Structure and Properties of Matter A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4) - pg. 56 PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56 PS2.B Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces	pg. 54 pg. 56 pg. 60

		between material objects. (secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6) - pg. 54 PS3.B Conservation of Energy and Energy Transfer Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution (HS-PS3-4) - pg. 60	
<u>Unit 7: Gases</u>	HS-PS1-3 HS-PS1-9	• Kinetic Molecular Theory • Ideal vs Real Gas • Gas Laws (Avogadro, Boyle, Charles, Gay Lussac, Combined, Ideal, Dalton,) PS1.A Structure and Properties of Matter The concept of an ideal gas is a model to explain the behavior of gases. A real gas is most like an ideal gas when the real gas is at low pressure and high temperature. (HS-PS1-9) - pg. 54 PS2.B Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6) - pg. 54 PS3.B Conservation of Energy and Energy Transfer Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) - pg. 60	pg. 54 pg. 60
<u>Unit 8: Energy</u>	HS-PS3-1 HS-PS3-2 HS-PS3-4	• Endothermic vs Exothermic • States of matter • Heating and cooling curves • Enthalpy and Hess' Law PS3.A Definitions of Energy Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) - pg. 60 PS3.B Conservation of Energy and Energy Transfer Energy exists in many forms, and when these forms change, energy is conserved. (HS-PS3-1), (HS-PS3-3), (HS-PS3-4) - pg. 60 & 61	pg. 60 pg. 61

<u>Unit 9: Solutions</u>	HS-PS1-2 HS-PS1-3 HS-PS-1-10	• Types of mixtures with focus on identifying homogeneous mixtures/solutions • Concentration (molarity, molality, ppm, % by volume, % by mass) • Henry's Law • Solubility curves • Colligative properties (melting and boiling points, vapor pressure) PS1.A Structure and Properties of Matter Solutions possess characteristic properties that can be described qualitatively and quantitatively. (HS-PS1- 10) - pg. 54 PS2.B Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (secondary to HS-PS1- 1), (secondary to HS-PS1-3),(HS-PS2-6) - pg. 54	pg. 54
<u>Unit 10: Kinetics and Equilibrium</u>	HS-PS1-2 HS-PS1-4 HS-PS1-5 HS-PS1-7 HS-PS-1-9	• The spontaneous reaction • Gibbs Free Energy • Equilibrium Expression/Constant • LeChatelier's Principle • Potential Energy Diagrams • Collision Theory and Rate of Reaction PS1.A Structure and Properties of Matter A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4) - pg. 56 PS1.B Chemical Reactions Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of particles and the rearrangements of particles into new substances, with consequent changes in the sum of all bond energies in the set of substances that are matched by changes in energy. (HS-PS1-4),(HS-PS1-5) - pg. 56 In many situations, a dynamic and condition dependent balance between a reaction and the reverse reaction determines the numbers of all types of particles present. (HSPS1-6) - pg. 56	pg. 56
<u>Unit 11: Acids and Bases</u>	HS-PS1-2 HS-PS1-6 HS-PS1-7 HS-PS-1-10 HS-PS1-11	• Two Definition of Acids/Bases (Arrhenius and Bronsted-Lowry) • Common strong and weak acids and bases • Salts with acidic and basic properties • Determination of pH • Neutralization reactions	pg. 54 pg. 56

		• Titration as a means of determining an unknown concentration • Liquid indicators • Introduction to buffers PS1.A Structure and Properties of Matter The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. - pg. 54 PS1.B Chemical Reactions) Acids and bases play an important role in the daily lives of humans and other organisms (e.g. agricultural applications, environmental impacts (acid rain), animal and plant physiology). (HS-PS1-11) - pg. 56	
<u>Unit 12: Oxidation-Reduction/Electrochemistry</u>	HS-PS1-2 HS-PS1-7 HS-PS1-12	• Definition of oxidation • Assigning oxidation numbers • Identifying and balancing redox reactions • Voltaic/Galvanic cell • Electrolytic cell PS1.A Structure and Properties of Matter The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.(HS-PS1-3),(secondary toHS-PS2-6) - pg. 56 PS1.B Chemical Reactions Oxidation-reduction reactions are the prevailing source of power for many of today's modern conveniences. (HS-PS1-12) - pg. 56 & 57	pg. 56 pg. 57
<u>Unit 13: Organic Chemistry</u>	HS-PS1-2 HS-PS1-3 HS-PS1-7 HS-PS2-6	• Definition of organic compounds • Homologous series (alkanes, alkenes alkynes) • Functional groups and popular organic families • Stereoisomers (emphasis on structural) • Sample of popular organic reactions (Substitution, Addition, Esterification, Saponification, Polymerization, Combustion, Fermentation) PS1.A Structure and Properties of Matter The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.(HS-PS1-3),(secondary toHS-PS2-6) - pg. 54 PS1.B Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1- 7) - pg. 56	pg. 56 pg. 54

<u>Unit 14: Nuclear Chemistry</u>	HS-PS1-8 HS-PS4-4 HS-ESS1- 1 HS-ESS1-5 HS-ESS1- 6	• What does it mean to be radioactive and belt of stability? • Alpha decay, Beta decay, Positron Emission, gamma radiation • Decay series • Transmutation (artificial and natural) • Radioisotopes and practical applications • Fission and fusion PS1.C Nuclear Processes Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1- 8) - pg. 54 Spontaneous radioactive decay follows a characteristic exponential decay law allowing an element's half-life to be used for radiometric dating of rocks and other materials. (secondary to HS-ESS1- 5),(secondary to HS-ESS1-6) - pg. 75 PS3.D Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1) - pg. 73	pg. 54 pg. 73 pg. 75
<u>Additional Notes</u>	Students will be challenged in this class due to multi-step calculations and the use of multiple equations. The order of topics may vary from year to year and school to school.		