Course Description
In **Honors Chemistry** students will communicate and collaborate while performing chemical investigations that complement the various theories/laws embodied in this discipline. Concepts and principles discussed and illustrated through differentiated instruction include scientific measurement, dimensional analysis, properties of matter, the periodic table of the elements, atomic structure, chemical bonding, chemical names and formulas, chemical reactions, chemical quantities, stoichiometry, oxidation and reduction, solutions, and gas laws. The honors course stresses critical thinking and problem-solving skills. The global impact of chemistry upon our society and the world economy and other associated issues will be discussed to complement the curriculum. This course will prepare students for taking the MCAS Chemistry exam. For grade 10-11 students who have successfully completed Honors Biology and are concurrently taking Algebra 2.
Three Core Ideas of Chemistry
The major focus of chemistry is on **matter and its interactions**. Students develop both molecular and sub-atomic models of matter and learn to rely on the periodic table as a powerful model for predicting a wide variety of properties of elements and compounds. Students develop greater capacity for building multi-step linear causal explanations by using a combination of the periodic table model and Coulomb's law to predict and explain qualitative comparisons of bond energies. They also consider spatial arrangements of ions in crystal structures and covalent bonds in molecules, and the relative favorability of energy changes required to rearrange components. Students reason about timescales in the context of a collision theory model, and consider how altering external conditions, chemical concentrations, and ways of introducing reactants to a system can be manipulated to control chemical processes. Students refine their understanding of conservation of matter by making quantitative predictions of theoretical yields if reactions are driven to completion using stoichiometric molar proportions and molar mass calculations. They also practice using two major models of reaction processes, the Bronsted-Lowry acid-base reaction model and the oxidation-reduction reaction model, to explain reaction patterns observed in many common phenomena in the natural world. Standards for **motion and stability: forces and interactions** help students explain structure-property relationships in terms of forces and interactions, and to consider the energetic stabilities of structures as a driving force in predicting a variety of observable response properties. Water's role as a common solvent is a central example in using molecular-level intermolecular bonding structure arguments to explain the relative solubilities of different ionic compounds. Intermolecular bonding is also explored in rationalizing why some classes of substances are better than others for specific practical uses, and designing molecular level structural specifications of substances that could have desired properties. Students also build on the basic particle model of matter studied in middle school to add quantitative predictions of externally controllable or measurable properties of gases. Standards about **energy** help students demonstrate understanding of energy transfer and dissipation of energy in chemical systems. Students rationalize observations of endothermic and exothermic changes in terms of energy required to break and form chemical bonds when structural rearrangements occur in chemical processes.

Subject: Chemistry

Units	Topics and Standards	Activities May Include
Matter Fundamentals 2 weeks HS-PS1-1.	Use the periodic table as a model to predict the relative properties of main group elements	▪ Distillation of Dr. Pepper (separation of a mixture) ▪ Paper Chromatography: Separating Ink ▪ Smoking Rock Lab ▪ Chemical vs. Physical Properties lab
Early Atomic Theory (The Nuclear Atom) 3 weeks HS-PS1-1. HS-PS1-3.	▪ Nuclear Model – Rutherford ▪ Planetary Model – Bohr ▪ Atoms are made of a nucleus consisting of protons and neutrons. The nucleus is surrounded by electrons. ▪ Atomic mass ▪ Atomic and Mass numbers	▪ Graphic Oragnizers ▪ Periodic Table
Numbers in Chemistry 3 weeks	▪ Measurement ▪ Significant numbers ▪ Dimensional analysis	▪ Mass Lab ▪ Conversion Activity
Light Energy and the Quantum Atom (Electrons in atoms) Orbitals 3.5 weeks	HS-PS1-2. Use the periodic table model to predict and design simple reactions that result in two main classes of binary compounds, ionic and molecular	▪ Flame Test Lab/Demonstration ▪ Atomic Emission Spectrum Tube Demonstration
Periodic Trends (Coulomb's Law) 3.5 weeks	HS-PS1-1. Use the periodic table as a model to predict the relative properties of main group elements, including ionization energy and relative sizes of atoms and ions, based on the patterns of electrons in the outermost energy level of each element	▪ Reactivity of metals lab
Bonding, Ionic, Metallic and Covalent 3.5 weeks	HS-PS1-1. Use the periodic table as a model to predict the relative properties of main group elements	▪ Bonding Activity ▪ Build Molecular Models

Units	Topics and Standards	Activities May Include
Chemical Nomenclature 3 weeks	HS-PS1-2. Use the periodic table model to predict and design simple reactions that result in two main classes of binary compounds, ionic and molecular	▪ Periodic Table ▪ Folders
Chemical Quantities (Stoichiometry: the Mole, Limiting Reactants) 4 weeks	HS-PS1-7. Use mathematical representations and provide experimental evidence to support the claim that atoms, and therefore mass, are conserved during a chemical reaction	▪ Iron Nail Lab ▪ Copper and Silver Nitrate Lab
Chemical Reactions: Equation balancing, Redox, Acid/Base and pH 3.5 weeks	HS-PS1-9(MA). Relate the strength of an aqueous acidic or basic solution to the extent of an acid or base reacting with water as measured by the hydronium ion concentration (pH) of the solution HS-PS1-10(MA). Use an oxidation-reduction reaction model to predict products of reactions given the reactants, and to communicate the reaction models using a representation that shows electron transfer (redox)	▪ Quantitative titration of vinegar. ▪ Titration of Pixie Stix (Citric Acid)
Gas Laws 2.5 weeks	HS-PS2-8(MA). Use kinetic molecular theory to compare the strengths of electrostatic forces and the prevalence of interactions that occur between molecules in solids, liquids, and gases	▪ Virtual Lab
Thermochemistry 2.5 weeks	HS-PS3-4b. Provide evidence from informational text or available data to illustrate that the transfer of energy during a chemical reaction in a closed system involves changes in energy dispersal (entropy change) and heat content (enthalpy change) while assuming the overall energy in the system is conserved	▪ Lab: Measuring Heat of Vaporization of Ice ▪ Lab: Determining Specific Heat Capacity of a Metal
Nuclear Chemistry 2 weeks	▪ Nuclear Fission ▪ Splitting/subdivision of nuclei into two nuclei of roughly even mass ▪ Nuclear Fusion ▪ Joining of two or more nuclei together	▪ Video

Textbook
▪ ***Chemistry***, by Wilbraham, Staley, Matta, and Waterman; published by Prentice Hall, 2008