**CHEMISTRY 14A Revised August 2017**

**DESCRIPTION:** This course provides a strong chemistry foundation. We review physical and chemical principles. We then go on to atomic structure based on quantum mechanics, and study atomic properties, trends in the periodic table, and chemical bonding in molecules and coordination compounds with an emphasis on structure and shape. The course concludes with the structure and properties of inorganic, organic, and biological acids, bases, and salts. Throughout the course biological and environmental examples are used to illustrate the central role chemistry plays in the world around us. Emphasis is placed on developing problem solving skills and collaborative interaction and learning.

**SYLLABUS**

**Review of Physical and Chemical Principles**

SI units; unit conversions (e.g., Kelvin, Celsius and Fahrenheit); scientific notation; dimensional analysis; significant figures; accuracy versus precision; solutions; molarity and dilution calculations; determining mass percentage composition, and empirical and molecular formulas; conservation of mass and balancing chemical equations; limiting reactant calculations; determining real and theoretical yields in chemical reactions

**The Quantum World**

wave and photon properties of light; Einstein equation; photoelectric effect; Bohr frequency condition; atomic and molecular spectra (electronic transitions); wave and particle properties of electrons, protons, etc.; DeBroglie equation; Heisenberg’s indeterminacy equation; wave functions and s-, p-, and d-orbitals; quantum numbers; H-atom; many-electron atoms; electron configurations of atoms and ions; atomic radius, ionic radius, ionization energy, electron affinity and their trends in the periodic table

**Chemical Bonds**

ionic and covalent bonds; Lewis structures of inorganic, organic, and biological compounds; resonance structures; formal charge; Lewis acids and bases; coordinate covalent bonds; octet rule exceptions; ionic versus covalent bonds; polarisability of anions, polarizing power of cations and their periodic trends; electronegativity; dipole moments; bond lengths, strengths and dissociation energies; intermolecular forces and hydrogen bonding

**Molecular Shape and Structure**

determining molecular shape and polarity using VSEPR; predicting bond angles; sigma and pi bonds and their role in structure and shape in organic and biological molecules; hybridization (sp, sp2 sp3, dsp3, d2sp3) and inorganic and organic compounds

**Coordination Compounds and their Biological Importance**

naming, oxidation states, shape and structures of coordination compounds; biological functions and examples (e.g., hemoglobin, chemotherapy drugs)

**Acid and Base Structures and Properties**

structure and properties of inorganic, organic, and biological acids and bases; amphoteric compounds; Bronsted and Lewis acids and bases; conjugate acids and bases; polyprotic acids and bases; pH scale; pH calculations involving strong acids and bases; cations, anions, and salts that are acidic or basic; environmental and biological examples (e.g., air pollution and acid rain, carbon dioxide and blood pH)