FLINT RIVER ACADEMY SCIENCE STANDARDS

CHEMISTRY I

1. Chemistry World Concepts

a. Explore the impact of technology on social, political, and economic systems
b. Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying and t\retesting
c. Explain the relationship between the properties of a material and the use of the material in application of a technology
d. Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems

2. Properties of Matter

a. Demonstrate the knowledge of classification and properties of matter and the changes substances undergo
b. Identify and explain physical properties and chemical properties Distinguish between physical, chemical and nuclear changes
c. Explain the difference between pure substances and mixtures
d. Identify a material as an element, compound or mixture; identify a mixture as a solution, colloid or suspension
e. Identify the solute and solvent composition of a solid, liquid or gaseous solution
f. Describe the three normal states of matter in terms of energy, particle motion, and phase transitions
g. Identify the plasma state

3. States of Matter, Kinetic Molecular Theory, Thermochemistry, and Nuclear Energy

a. Using the kinetic molecular theory, describe and contrast the properties of gases, liquids, and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions
b. Analyze the law of conservation of energy, energy transformation, and various forms of energy involved in chemical and nuclear changes
c. Compare and contrast the nature of heat and temperature
d. Analyze calorimetric measurement in simple systems and the energy involved in changes of state
e. Describe energy sources and the pros and cons of each energy source
f. Describe temperature and heat flow in terms of the motion of molecules (or atoms)
g. Discuss the concept of absolute zero
h. Distinguish between and relate with each other the Laws of Conservation of Mass, Energy and Mass-Energy
i. Examine $E = mc^2$ and arrive at an understanding that the energy released per gram of material is much larger in nuclear fusion and fission reactions

than in chemical reactions. The change in mass is small but significant in nuclear reactions

j. Describe the law of conservation of energy with respect to endothermic and exothermic processes
k. Interpret diagrams in terms of energy vs. reaction pathway, enthalpy and activation energy
l. Analyze the relationship between energy transfer, entropy and disorder in the universe
m. Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy)

4. Atomic Structure and Nuclear Chemistry

a. Identify the three main types of radioactive decay and compare their properties
b. Describe the process of radioactive decay by using nuclear equations, and explain the concept of half-life for an isotope
c. Compare and contrast nuclear fission and nuclear fusion
d. Demonstrate knowledge of subatomic particles in an atom
e. Identify the naturally occurring forces and relate to the structure of the atom
f. Summarize the development of current atomic theory. Recognize discoveries from Dalton, Thomson, Millikan, Rutherford, Chadwick, Bohr, Plank, de Broglie, and Schrodinger
g. Describe Rutherford's "gold foil" experiment that led to the discovery of the nuclear atom. Identify the major components of the nuclear atom and explain how they interact
h. Analyze and explain the nature and behavior of the atomic nucleus including radioactive isotopes and their practical application
i. Identify atomic number, atomic mass, mass number, isotopes and isotope notation
j. Apply the periodic table to determine the number of protons and electrons in a neutral atom
k. Determine the number of protons and neutrons for a particular isotope of an element
l. Compare the mass to volume ratio for an atom to its nucleus and cloud
m. Interpret and apply the laws of conservation of mass, definite proportions and multiple proportions.
n. Explain the relationship of an element's position on the periodic table to its atomic number and atomic mass.
o. Identify families (groups) and periods on the periodic table

5. The Electron and its Behavior in the Atom

a. Use the periodic table to identify the three classes of elements: metals, nonmetals, and metalloids
b. Discuss the experimental basis for the development the quantum theory of atomic structure (quantum mechanical electron-cloud model) and the historical importance of the Bohr model of the atom
c. Observe and interpret changes (emission/absorption) in electron energies in the hydrogen atom including the quantized levels and their relationship to atomic spectra.
d. Interpret a Bohr model of electron moving between its ground and excited states in terms of the absorption or emission of energy
e. Use electromagnetic spectra to relate wavelength and energy. Relate how the lines are the result of transitions of electrons between energy levels and that these lines correspond to photons with a frequency related to the energy spacing between levels by using Plank's relationship $E = hv$.
f. Compare s and p orbitals in terms of their shape, and order the s,p,d and f orbitals in terms of energy and possible number of electrons.
g. Represent an atom's electron arrangement in terms of orbital notation, electron configuration notation, and electron dot notation (diagram)

h. Use the periodic table to determine the number of electrons available for bonding
i. Explain the formation of anions and cations, and predict the charge of an ion formed by the main group (representative) elements
j. Begin initial formation of the explanation of how atoms combine to form compounds through both ionic and covalent bonding
k. Use the periodic table to identify the lanthanide, actinide, and transactinide elements and k now that the transuranium elements were synthesized and identified in laboratory experiments through use of nuclear accelerators
l. Relate the position of an element in the periodic table to its quantum electron configuration and to its reactivity with other elements in the table

6. Nomenclature

a. Distinguish between ionic and molecular compounds
b. Predict formulas for stable ionic compounds (binary and tertiary) based on balance of charges
c. Use of IUPAC nomenclature for identifying chemical names and writing chemical formulas: Ionic compounds (Binary & tertiary)
Covalent compounds (Binary and tertiary)
Acidic compounds (Binary & and tertiary)
d. Initial exploration of organic nomenclature by examining the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring

Investigation and Experimentation

1. Make observations, raise questions and formulate hypotheses.
a. Observe the world from a scientific perspective
b. Pose questions and form hypotheses based on personal observations, scientific articles, experiments and knowledge
c. Read, interpret, and examine credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories
d. Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted

2. Design and conduct scientific investigations.
a. Articulate and explain the major concepts being investigated and the purpose of an investigation
b. Select required materials, equipment, and conditions for conducting an experiment
c. Identify independent and dependent variables
d. Write procedures that are clear and replicable

e. Employ appropriate methods for accurately and consistently making observations, making and recording measurements at appropriate levels of precision and collecting evidence or data in an organized way
f. Properly use instruments, equipment, and materials (scales, balances, meter sticks, probeware, microscopes, computers, etc…) including set up, calibration, technique, maintenance, and storage
g. Follow safety guidelines

3. Analyze and interpret results of scientific investigations.
a. Present relationships between and among variables in appropriate forms using charts, graphs, appropriate technology (graphing software) and other tools
b. Use mathematical operations to analyze and interpret data results
c. Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrollable conditions
d. Recognize, analyze, and evaluate alternative explanations for the same set of observations
e. Use results of an experiment to develop a conclusion to an investigation that addresses the initial questions and supports or refutes the stated hypothesis
f. State questions raised by an experiment that may require further investigation

4. Communicate and apply the results of scientific investigations.
a. Develop descriptions of explanations for scientific concepts that were a focus of one or more investigations
b. Review information, explain statistical analysis and summarize data collected and analyzed as the result of the investigation
c. Explain diagrams and charts that represent relationships between variables
d. Construct a reasoned argument and respond appropriately to critical comments and questions
e. Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology and other tools to present findings
f. Use and refine scientific models that stimulate physical processes or phenomena

Application of Mathematical Skills

a. Construct and use tables and graphs to interpret data sets
b. Solve simple algebraic expressions
c. Perform basic statistical procedures to analyze the center and spread of data
d. Measure with accuracy and precision (length, volume, mass temperature, time)
e. Convert within a unit.
f. Use common prefixes such as milli, centi, and kilo
g. Use scientific notation, where appropriate

h. Use ratio and proportions to solve problems
i. Translate data into the correct units and dimensions using conversion factors and scientific notation
j. Determine the correct number of significant figures
k. Determine percent error from experimental and accepted values
l. Use appropriate metric/standard international (SI) units of measurement
m. Use the Celsius and Kelvin scales

FLINT RIVER ACADEMY SCIENCE STANDARDS

Flint River Academy
Chemistry I

Curriculum Map

1st Nine Weeks			2nd Nine Weeks		3rd Nine Weeks		4th Nine Weeks		
Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 10**	**Unit 11**
Chemistry as a Science	Scientific Method	Scientific Measurement	Classification of Matter	Thermochemistry	Nuclear Energy	Historical Development of the Atom	Electromagnetic Radiation and Electron Behavior	Nomenclature	Initial Exploration of Organic Compounds
3 weeks	2 weeks	3 weeks	4 weeks	5 weeks	3 weeks	4 weeks	5 weeks	4 weeks	3 weeks