

# FLINT RIVER ACADEMY SCIENCE STANDARDS

## CHEMISTRY II

### Chemical Quantities

- a. Analyze the mole concept and Avogadro's number. Apply both to conceptualize and calculate relationships between mass, moles, number of particles and molar volume of gases at STP
- b. Determine percent composition, empirical formulas, molecular formulas and formulas of hydrate
- c. Examine the concept of molarity and calculate solution concentrations

### 1. Chemical Reactions

- a. Describe a chemical reaction by writing a balanced equation while applying the laws of conservation of mass and constant composition (definite proportions)
- b. Analyze and classify chemical reactions as synthesis, decomposition, single displacement (replacement), double displacement (replacement) and combustion
- c. Predict products given reactants and conditions
- d. Use activity series or solubility product table information to predict the products of a chemical reaction
- e. Predict the products of a neutralization reaction involving inorganic acids and bases
- f. Identify and balance reactions that involve oxidation and reduction
- g. Write an ionic equation, net ionic equation and identify spectator ions for a redox equation
- h. Track the transfer of electrons in oxidation/reduction reaction and assign oxidation numbers
- i. Identify the oxidizing and reducing agents in a reaction
- j. Assess practical application of oxidation and reduction reactions
- k. Identify the indicators of a chemical change:
  - formation of a precipitate.
  - evolution of a gas.
  - color change.
  - absorption or release of heat.

### 2. Stoichiometry

- a. Fully analyze the quantitative aspects of a chemical reaction in terms of amounts of products and reactants
- b. Calculate quantitative relationships involving mass, moles, numbers of particles, volumes of gases at STP, and molarity
- c. Determine theoretical yield, actual yield and percent yield for a given reaction
- d. Calculate the amounts of remaining reactants and products in which one of the reactants is the limiting reactant
- e. Construct thermochemical equations and solve for enthalpy changes by using heats of reaction

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- f. Solve for enthalpy changes by using Hess's Law or standard heats of formation
  - g. Use the Gibbs Free Energy equation to determine whether a reaction would be spontaneous
- 3. Periodicity**
- a. Recognize that periodic (repeating) patterns of physical and chemical properties occur among elements and define families with similar properties
  - b. Identify trends on the periodic table (ionization energy, electronegativity, relative sizes of atoms and ions)
  - c. Relate the arrangement of electrons surrounding an atom with observed periodic trends
- 4. Chemical Bonds**
- a. Explain how atoms combine to form compounds through both ionic and covalent bonding
  - b. Discuss the nature of salt crystals as repeating patterns of positive and negative ions held together by electrostatic attraction
  - c. Explain how atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form
  - d. Draw Lewis Dot Structures for atoms, molecules and polyatomic ions
  - e. Predict the shape of simple molecules and their polarity from Lewis Dot Structures
  - f. Relate electronegativity and ionization energy to bond formation
  - g. Use Lewis structures to illustrate the structure, shape, and characteristics of polyatomic ions, ionic and molecular compounds
  - h. Use valence-shell electron-pair repulsion theory (VSEPR) to predict the molecular geometry (linear, trigonal planar, and tetrahedral ) of simple molecules
  - i. Determine the polarity of a molecular compound by examining its bond dipoles and shape
  - j. Apply Lewis Structures and formal charge analysis to determine if a compound or polyatomic ion forms resonance structures
  - k. Identify solids and liquids held together by Van der waals Forces or hydrogen bonding and relate these forces to volatility and boiling/melting point temperatures
  - l. Identify how hydrogen bonding in water affects a variety of physical, chemical and biological phenomena (surface tension, capillary action, density, boiling point)
- 5.** Summarize characteristics of ionic bonding, covalent bonding and metallic bonding
- 6. Acids and Bases**
- a. Identify the observable properties of acids, bases and salt solutions

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- b. Define the Arrhenius theory of acids and bases in terms of the presence of hydronium and hydroxide ions in water and the Bronsted-Lowry theory of acids and bases in terms of proton donors or acceptors
- c. Relate hydrogen ion concentration to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases
- d. Explain how a buffer works
- e. Predict the products of a neutralization reaction involving inorganic acids and bases
- f. Identify several examples indicating the important roles acids and bases play in chemical processes that occur from industrial to biological aspects

### 7. Solutions, Rates of Reaction and Equilibrium

- a. Acknowledge that rates of reaction and chemical equilibrium are dynamic processes that are significant in biological, ecological and geological systems
- b. Describe the process by which solutes dissolve in solvents
- c. Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry
- d. Identify and explain the factors that affect the rate of dissolving such as temperature, concentration, surface area, pressure and mixing
- e. Compare and contrast qualitatively the properties of solutions and pure solvents. (colligative properties such as boiling and freezing point)
- f. Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst)
- g. Predict the shift in equilibrium when a system is subjected to a stress (LeChatelier's principle) and identify the factors that can cause a shift in equilibrium (concentration, pressure, volume, temperature)

### 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

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- 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

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- 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

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## Flint River Academy Chemistry II

### Curriculum Map

Curriculum Map								
1 <sup>st</sup> Nine Weeks		2 <sup>nd</sup> Nine Weeks		3 <sup>rd</sup> Nine Weeks			4 <sup>th</sup> Nine Weeks	
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9
The Mole	Periodicity	Chemical Bonding	Intermolecular Forces At Work	Metallic Bonding	Chemical Reactions	Stoichiometry	Thermochemical Equations	Acids, Bases and Salt Solutions
5 weeks	4 weeks	5 weeks	4 weeks	2 weeks	4 weeks	3 weeks	4 weeks	5 weeks