Saint Patrick High School

Curriculum Guide: Chemistry

Department:	Science	**Grade and Level:**	10 & 11
Class:	Chemistry	**Term (Semester or Year):**	Year

Required Text:	Chemistry Concepts – Intermediate (ck12.org online textbook) Author: CK-12
Additional Resources (i.e. texts, materials, apps, etc.):	iPad Apps Calculator

Course Description

This is a one-year laboratory course stressing the fundamental principles of chemistry. The goal of the course is to introduce the basic chemical concepts for further study in the natural sciences.

The laboratory portion of the course will focus on reinforcing these concepts and honing the student's technical skills with first-hand experience. Laboratory reports are required by the student. Successful completion of this course will assist the student in future science courses in high school and college.

Academic Standards Addressed (NGSS):

Chemical Reactions

- HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron state of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-4: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- HS-PS1-5: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium *(through a practice or disciplinary core idea).
- HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Structures & Properties of Matter

- HS-PS1-1: Use the periodic table to predict relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-Ps1-3: Plan and conduct an investigation to gather evidence to compare the

structure of substances at the bulk scale to infer the strength of electrical forces between particles.

- HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
- HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit Themes (Table of Contents)

Theme 1:	Introduction to Chemistry
Theme 2:	The Periodic Table
Theme 3:	Bonding
Theme 4:	Chemical Reactions
Theme 5:	States of Matter
Theme 6:	Liquids
Theme 7:	Acids and Bases
Theme 8:	Thermochemistry

The first 4 units will be in the first semester and the final 4 will be in the second semester.

Agreed Upon Assessments

Forms of assessments may include but are not limited to….

- Chapter labs and quizzes weekly
- Quarter Projects
- Unit tests
- Semester Final Exams

Research and Writing Expectations

Students will complete quarterly projects which will incorporate a demanding laboratory experiment as well as a complete written report. Each quarter project is an inquiry-based project in which students will work in groups, applying their knowledge and skills to provide solutions to macroscopic and worldly problems.

Unit 1:	Introduction to Chemistry	**Duration:**	4 weeks

Essential Questions:

- What is the study of chemistry? How do we define chemistry?

- What are the five primary disciplines of chemistry?
- What are the ways in which matter is capable of changing and how we can make sense of those changes?
- What are the critical skills of making, reporting, and performing calculations with measurements?
- What model of the atom was initially developed and how it has changed over time

Affirmation Statements:

Students will be able to…:

- Know the relationship between pure chemistry and applied chemistry
- Differentiate between the macroscopic and the microscopic as it relates to chemistry
- Identify the steps of the scientific method.
- Describe a substance according to its physical properties
- Distinguish between extensive and intensive properties
- Describe the three states of matter
- Explain the law of conservation of mass
- Distinguish between the three main subatomic particles
- Describe the structure of the nuclear atom

Common Assessments:

- Chapter 1-4 tests
- Chapter 1-4 labs

Unit 2:	The periodic table	**Duration:**	4 Weeks

NGSS Alignment:

- HS-PS1-1: Use the periodic table to predict relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

Essential Questions:

- What is the periodic table, how was it developed, and how it can be used to make learning chemistry easier?
- Where are electrons located? What are their energies?
- How do electrons they move?
- What are the different ways to measure the amount of something and the interrelationships between those measurements?
- What is the mole?

Affirmation Statements:

Students will be able to…:

- Describe various components of the modern periodic table, including periods, groups, metals, nonmetals, and metalloids.
- Identify each block of the periodic table and be able to determine which block each element belongs to based on its electron configuration.
- Learn the periodic trends for atomic radius.
- Know the relationship between group number and valence electrons.
- Describe how ions are formed.
- Learn the periodic trends for ionization energy.
- Describe the relationships between speed, wavelength, and frequency of light
- Know the four quantum numbers and how they are related to the arrangement of electrons in an atom.
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- Describe the interrelationships between principal energy level, sublevel, orbital and electron spin and how they relate to the number of electrons of an atom.
- Understand how to apply the Aufbau principle, the Pauli exclusion principle, and Hund's rule to determine ground state electron configurations.
- Use Avogadro's number to convert between moles and the number of representative particles of a substance.

Common Assessments:

- Chapters 5,6,10 labs
- Chapters 5,6,10 tests and quizzes
- Quarter 1 project

Unit 3:	Bonding	**Duration:**	4 weeks

Essential Questions:

- What are the rules of nomenclature and allow you to name and write formulas for many simple chemical compounds?
- How are atoms capable of forming chemical bonds?
- What are the specific guidelines that can be used to determine the ways in which electron sharing occurs and the shapes of the molecules that result.

Affirmation Statements:

Students will be able to…:

- What are the properties of crystals?
- Be able to determine the number of valence electrons for any

element and draw an electron dot diagram for any atom.
- Use the octet rule to predict the charges of the most common ions formed by the representative elements.
- Write electron configurations for ions.

Common Assessments:

- Chapter 7,8,9 labs
- Chapter 7,8,9 tests and quizzes

Unit 4:	Chemical Reactions	**Duration:**	4 Weeks

Essential Questions:

- What are the different ways for recognizing chemical reactions by writing chemical equations?
- How are the reactants in a given reaction converted into products?
- What are the methods of organizing chemical reactions into several distinctive categories?
- What are ways to aid you in predicting the products of many different chemical reactions?
- How it is the specific ratio of moles of reactants that governs reactions and determines the amount of products that can be formed in a specific reaction?

Affirmation Statements:

Students will be able to…:

- Describe chemical reactions using word equations.
- Know the correct symbols to use in order to write skeleton equations for chemical reactions.
- Use coefficients to balance chemical equations so that the law of conservation of mass is followed.
- Define and give general equations for combination, decomposition, single-replacement, and double-replacement reactions.
- Classify a reaction as combination, decomposition, single-replacement, double- replacement, or combustion.
- What do the coefficients of a balanced chemical equation represent?
- How is a mole ratio used to convert from moles of one reactant or product to moles of another?

Common Assessments:

- Chapter 11 and 12 labs
- Chapter 11 and 12 tests and quizzes
- Quarter 2 project
- Semester 1 final exam

Unit 5:	States of Matter	**Duration:**	4 Weeks

Essential Questions:

- What is the kinetic-molecular theory?
- How do particles behave when they undergo changes from one state of matter to another?
- What are the properties of gases and the mathematical relationships between the pressure, volume, temperature, and amount of a gas?

Affirmation Statements:

Students will be able to…:

- State the main points of the kinetic molecular theory, and describe how it relates to the properties of an ideal gas.
- Define pressure and describe how gases exert pressure.
- Describe a liquid according to the kinetic-molecular theory.
- Describe how a liquid exhibits surface tension.
- Describe the evaporation of a liquid and its relationship to the kinetic energy of the evaporating particles.
- Define vapor pressure and understand its relationship to intermolecular forces and to the temperature of the liquid.
- Describe the process of boiling and differentiate between boiling point and normal boiling point.
- Use a vapor pressure curve to determine boiling points at different atmospheric pressures.
- Describe a solid according to the kinetic-molecular theory.
- Understand that a solid also has a vapor pressure, and describe the relationship between the vapor pressure of a solid and sublimation.
- Describe the general features of a phase diagram, including the triple point and the critical point.
- Use Boyle's law, Charles's law, Gay-Lussac's law, Avogadro's law and the combined gas law to calculate pressure, volume, temperature and amount changes at constant temperature.

Common Assessments:

- Chapter 13 and 14 labs
- Chapter 13 and 14 tests and quizzes

Unit 6:	Liquids	**Duration:**	4 Weeks

Essential Questions:

- What is the structure and properties of the most amazing and essential little compound – water?
- What are the different aspects of solutions, including their formation and their physical and chemical behavior, and how do these aspects effect solubility?

Affirmation Statements:

Students will be able to…:

- Describe the structure and polarity of a water molecule.
- Describe the hydrogen bonding that occurs in water and ice.
- Discuss the unique properties of water and ice.
- Define a solution and describe the parts of a solution.
- Describe how an aqueous solution is formed from both ionic compounds and molecular compounds.
- Explain the reasons why some compounds are insoluble in water.
- Describe the properties of a suspension.
- Describe the properties of a colloid and distinguish from a solution or a suspension.
- List and explain three factors that affect the rate of dissolving of a solid solute in a liquid solvent.
- Explain solution equilibrium and distinguish between saturated, unsaturated, and supersaturated solutions.
- Calculate the concentration of a solution as either a mass percent or a volume percent.
- Calculate the molarity of a solution. Use molarity to calculate the mass of solute needed to prepare a particular solution.

Common Assessments:

- Chapter 15 and 16 labs
- Chapter 15 and 16 tests and quizzes
- Quarter 3 project

Unit 7:	Acids and Bases	**Duration:**	4 Weeks

Essential Questions:

- What exactly does pH measure?
- What are the connections between acidity and basicity?
- What treatments may have to be considered if the pH is not within an ideal range so that the water can remain hospitable to the plants and animals?

- What are the general terms given to processes in which electrons are lost or gained by the reacting substances?

Affirmation Statements:

Students will be able to…:

- Describe the properties of acids and bases.
- Define an acid and a base according to the Arrhenius theory.
- Define an acid and a base according to the Brønsted-Lowry theory. Be able to identify the conjugate acid-base pairs in a Brønsted-Lowry acid-base reaction.
- Define an acid and a base according to the Lewis theory.
- Explain the difference between a strong acid or base and a weak acid or base.
- Write balanced molecular and net ionic equations for acid-base neutralization reactions.
- Define oxidation and reduction in terms of a gain or loss of oxygen atoms.
- Define oxidation and reduction in terms of a gain or loss of electrons.
- Define oxidation and reduction in terms of a change in oxidation number.
- Identify which atoms are being oxidized and which atoms are being reduced in a redox reaction.

Common Assessments:

- Chapter 21 and 22 labs
- Chapter 21 and 22 tests and quizzes

Unit 8:	Thermochemistry	**Duration:**	4 Weeks

Essential Questions:

- What is heat flow and how some chemical reactions naturally release energy while some other reactions absorb energy?
- How does knowledge of reaction rates helps chemists better understand and control the reactions they study both in and out of the laboratory?
- What are the different types of equilibrium and how do changes to the reaction conditions manipulate equilibrium?
- What are the thermodynamic quantities of entropy and free energy and what is their relationship to chemical reactivity?

Affirmation Statements:

Students will be able to…:

- Describe how chemical potential energy relates to heat and work.
- Describe the law of conservation of energy and how heat flows between system and surroundings during both endothermic and

exothermic processes.

- Define enthalpy and know the conditions under which the enthalpy change in a reaction is equal to the heat absorbed or released.
- Express the rate of a chemical reaction.
- Describe the collision theory as it relates to chemical reactions.
- Draw and analyze a potential energy diagram for a reaction, including heat of reaction, activation energy and the activated complex.
- Describe the nature of a reversible reaction.
- Define chemical equilibrium.
- Write chemical equilibrium expressions from balanced chemical equations.
- Describe entropy and be able to predict whether the entropy change for a reaction is increasing or decreasing.

Common Assessments:

- Chapters 17-20 labs
- Chapters 17-20 tests and quizzes
- Quarter 4 project
- Semester 2 final exam