# Curriculum Map 2013-2014

***St. Mary's School***

***Collaboration / Chemistry / Upper School (St. Mary's Education Group)***

| Essential Questions | Topics/Objectives | Skills | Content/ Key Terminology | Activities/ Assessments |
|---|---|---|---|---|
| • What is chemistry?<br>• What tools and instruments do chemists use to answer scientific questions, and how do chemists use these tools and instruments?<br>• What is the proper format for writing lab reports?<br>• What is the scientific method and how do scientists use the scientific method to perform laboratory tests?<br>• Why is it important for a measurement system to have an international standard?<br>• How does quantitative information differ from qualitative information?<br>• What are the seven base units of the metric system and the quantities they represent?<br>• What is a conversion factor?<br>• What is the difference | • Define chemistry.<br>• Identify and describe the different branches of chemistry.<br>• Compare and contrast basic research, applied research, and technological development.<br>• Identify and describe the building blocks of matter.<br>• Distinguish between the physical properties and chemical properties of matter.<br>• Compare and contrast physical changes and chemical changes.<br>• Classify changes in matter as physical or chemical.<br>• Demonstrate a basic understanding of the periodic table of elements.<br>• Explain the gas, liquid, and solid states in terms of particles.<br>• Explain how the law of conservation of energy applies to changes of matter. | • Use the periodic table to name elements, give their symbols.<br>• Use the periodic table to write the symbols of elements given their names.<br>• Properly use various instruments in the chemistry laboratory.<br>• Observe and collect data, formulate a hypothesis, and test a hypothesis.<br>• Use the scientific method to test a hypothesis.<br>• Use the metric units for length, mass, time, volume, and density.<br>• Perform density calculations.<br>• Transform a statement of equality into a conversion factor.<br>• Determine the number of significant figures in measurements and perform mathematical operations involving significant figures. | • Chemistry<br>• Branches of chemistry<br>• Chemical<br>• Basic research<br>• Applied research<br>• Technological development<br>• Mass<br>• Matter<br>• Building blocks of matter<br>• Atom<br>• Element<br>• Compound<br>• Extensive properties<br>• Intensive properties<br>• Physical property<br>• Physical change<br>• Change of sate<br>• Solid<br>• Liquid<br>• Gas<br>• Plasma<br>• Chemical property<br>• Chemical change<br>• Chemical reaction<br>• Products<br>• Mixture<br>• Homogeneous | • |

# Curriculum Map 2013-2014

## *St. Mary's School*

### ***Collaboration / Chemistry / Upper School (St. Mary's Education Group)***

| | | | | |
|---|---|---|---|---|
| between accuracy and precision?<br>• How is the average for a set of values calculated?<br>• What are the rules governing significant figures? | • Distinguish between a mixture and a pure substance.<br>• Use a periodic table to name elements given their symbol.<br>• Use a periodic table to write the symbols of elements given their names.<br>• Describe the arrangement of the periodic table.<br>• Describe the characteristics that distinguish metals, nonmetals, and metalloids.<br>• Identify and use the various instrumentation and equipment of the laboratory.<br>• Describe the purpose of the scientific method.<br>• Identify the steps of the scientific method and explain why scientists use the scientific method in laboratory tests.<br>• Describe the differences between hypotheses, theories, and models.<br>• Describe the international units of measurements used in chemistry.<br>• Distinguish between a quantity, a unit, and a measurement standard.<br>• Name and use SI units for | • Determine the densities of various liquids and solids.<br>• Name and use SI units for length, mass, time, volume, and density.<br>• Recognize and use conversion factors.<br>• Determine the number of significant figures in measurements.<br>• Perform mathematical operations involving significant figures.<br>• Convert measurements into scientific notation. | • Solutions<br>• Heterogeneous<br>• Pure substance<br>• Periodic table<br>• Groups/families<br>• Periods<br>• Metals<br>• Nonmetals<br>• Metalloids<br>• Noble gases<br>• Scientific method<br>• Hypothesis<br>• Model<br>• Theory<br>• Quantity<br>• Unit<br>• Measurement standard<br>• SI units<br>• SI base units<br>• Volume<br>• Density<br>• Conversion factor<br>• Dimensional analysis<br>• Accuracy<br>• Precision<br>• Percentage error<br>• Significant figures<br>• Scientific notation<br>• Directly proportional<br>• Inversely proportional | |

| | | | | |
|---|---|---|---|---|
| | length, mass, time, volume, and density.<br>• Distinguish between mass and weight.<br>• Perform density calculations.<br>• Recognize and use conversion factors.<br>• Transform a statement of equality into a conversion factor.<br>• Explain the similarities and differences between accuracy and precision.<br>• Determine the number of significant figures in measurements.<br>• Perform mathematical operations involving significant figures.<br>• Convert measurements into scientific notation<br>• Distinguish between inversely and directly proportional relationships. | | | |

**Curriculum Map 2013-2014**
***St. Mary's School***
***Collaboration / Chemistry / Upper School (St. Mary's Education Group)***

# Unit II: Atoms – The Building Blocks of Matter (1 week)

| Essential Questions | Topics/Objectives | Skills | Content/ Key Terminology |
|---|---|---|---|
| • What are the components of the Modern Atomic Theory?<br>• What is an atom?<br>• What composes an atom?<br>• What experiments led to the discovery of electrons and the atomic nucleus?<br>• What is the modern atomic theory?<br>• What characteristics make up an isotope?<br>• What is a mole<br>• How is mass converted? | • Explain the law of conservation of mass, the law of definite proportions, and the law of multiple proportions.<br>• Summarize the five essential points of Dalton's atomic theory.<br>• Explain the relationship between Dalton's atomic theory and the law of conservation of mass, the law of definite proportions, and the law of multiple proportions.<br>• Summarize the observed properties of cathode rays that led to the discovery of the electron.<br>• Summarize the experiment carried out by Rutherford and his co-workers that led to the discovery of the nucleus.<br>• Explain what isotopes are.<br>• Define atomic number and mass number, and describe how they apply to isotopes.<br>• Given the identity of a nuclide, determine its number of protons, neutrons, and electrons.<br>• Define mole, Avogadro's number, and molar mass and explain how all three are related.<br>• Solve problems involving mass in | • Create a chart describing the five essential points of Dalton's atomic theory.<br>• Create a model that demonstrates the structure of an atom.<br>• Demonstrate the properties of cathode rays that led to the discovery of the electron.<br>• Given the identity of a nuclide, determine its number of protons, neutrons, and electrons.<br>• Solve problems involving mass in grams, amount in moles, and number of atoms of an element. | • Law of conservation of mass<br>• Law of definite proportions<br>• Law of multiple proportions<br>• Dalton's Atomic Theory<br>• Modern Atomic Theory<br>• Cathode rays<br>• Electrons<br>• Nucleus<br>• Protons<br>• Neutrons<br>• Atomic number<br>• Isotope<br>• Mass number<br>• Nuclide<br>• Atomic mass unit<br>• Average atomic mass<br>• Mole<br>• Avogadro's Number<br>• Molar mass |

| | | | |
|---|---|---|---|
| | grams, amount in moles, and number of atoms of an element. | | |

**Curriculum Map 2013-2014**
***St. Mary's School***
***Collaboration / Chemistry / Upper School (St. Mary's Education Group)***

# Unit III: The Arrangement of Electrons in Atoms (1 week)

| Essential Questions | Topics/Objectives | Skills | Content/ Key Terminology |
|---|---|---|---|
| • How do the atom's negatively charged electrons occupy the space surrounding its positively charged nucleus?<br>• What prevents the negative electrons from being drawn into the positive nucleus?<br>• What is the relationship between light and an atom's electrons?<br>• Why does hydrogen's electrons exist around the nucleus only in certain allowed orbits with defined energies?<br>• Why couldn't electrons exist in limitless orbits with different energies?<br>• What are the rules governing electron configuration? | • Explain the mathematical relationship among the speed, wavelength, and frequency of electromagnetic radiation.<br>• Discuss the dual wave-particle nature of light.<br>• Discuss the significance of the photoelectric effect and the line-emission spectrum of hydrogen to the development of the atomic model.<br>• Describe the Bohr model of the hydrogen atom.<br>• Discuss Louis de Broglie's role in the development of the quantum model of the atom.<br>• Compare and contrast the Bohr model and the quantum model of the atom.<br>• Explain how the Heisenberg uncertainty principle and the Schrodinger wave equation led to the idea of atomic orbitals.<br>• List the four quantum numbers and describe their significance.<br>• Relate the number of sublevels corresponding to each of an atom's main energy levels, the number of orbitals per sublevel, | • Demonstrate the mathematical relationship between the speed, wavelength, and frequency of electromagnetic radiation.<br>• Explain in writing the dual-wave particle nature of light.<br>• Interpret the significance of the photoelectric effect and the line-emission spectrum of hydrogen in the development of the atomic model.<br>• Create a model explaining the Bohr model of the hydrogen atom.<br>• Explain how Heisenberg's uncertainty principle and Schrodinger's wave equation led to the idea of atomic orbitals.<br>• Describe the electron configuration for the atoms of any element using orbital notation and electron-configuration notation. | • Electromagnetic radiation<br>• Electromagnetic spectrum<br>• Wavelength<br>• Frequency<br>• Photoelectric effect<br>• Quantum<br>• Photon<br>• Hydro-atom line-emission spectrum<br>• Ground state<br>• Excited state<br>• Line-emission spectrum<br>• Continuous spectrum<br>• Bohr model of the hydrogen atom<br>• Heisenberg Uncertainty Principle<br>• Quantum theory<br>• Orbital<br>• Quantum numbers<br>• Principal quantum number<br>• Angular momentum quantum number<br>• Magnetic quantum number<br>• Spin quantum number<br>• Aufbau principle<br>• Pauli exclusion principle<br>• Hund's rule<br>• Orbital notation |

| | | | |
|---|---|---|---|
| | and the number of orbitals per main energy level.<br>• List the total number of electrons needed to fully occupy each main energy level.<br>• State the Aufbau principle, the Pauli Exclusion Principle, and Hund's rule.<br>• Describe the electron configurations for the atoms of any element using orbital notation, electron-configuration notation, and, when appropriate, noble-gas notation. | | • Electron-configuration notation<br>• Elements of the second period<br>• Elements of the third period<br>• Noble gases<br>• Noble-gas notation<br>• Noble-gas configuration<br>• Elements of the fourth period<br>• Elements of the fifth period<br>• Elements of the sixth and seventh periods |

**Curriculum Map 2013-2014**
***St. Mary's School***
***Collaboration / Chemistry / Upper School (St. Mary's Education Group)***

# Unit IV: The Periodic Law (1 week)

| Essential Questions | Topics/Objectives | Skills | Content/ Key Terminology |
|---|---|---|---|
| • How is the modern periodic table organized?<br>• How and why are elements grouped together in the periodic table?<br>• What is the relationship between electrons in sublevels and the length of each period of the periodic table?<br>• What are the general properties of each group in the periodic table?<br>• What are the meaning of ionic radii, ionization energy, electron affinity, and electronegativity?<br>• What are valence electrons? | • Explain the role of Mendeleev and Moseley in the development of the periodic table.<br>• Describe the modern periodic table.<br>• Explain how the periodic law can be used to predict the physical and chemical properties of elements.<br>• Describe how the elements belonging to the periodic table are interrelated in terms of atomic number.<br>• Describe the relationship between electrons in sub-levels and the length of each period of the periodic table.<br>• Locate and name the four blocks of the periodic table and explain the reasons for these names.<br>• Discuss the relationship between group configurations and group numbers.<br>• Describe the locations in the periodic table and the general properties of the alkali metals, the alkaline-earth metals, the halogens, and the noble gases.<br>• Define atomic and ionic radii, | • Use the periodic table to describe the trends found on the modern periodic table.<br>• Use the periodic table to identify groups and periods on the periodic table.<br>• Create a chart describing the general trends of properties of the elements: electron affinity, electronegativity, ionization energy, atomic radii, and ionic radii.<br>• Demonstrate how the valence electrons in an atom are available to be lost, gained, or shared, resulting in the formation of chemical compounds.<br>• Determine the electron configuration of elements. | • Periodic law<br>• Periodic table<br>• Lanthanides<br>• Actinides<br>• Periodicity<br>• Blocks of the periodic table<br>• Alkali metals<br>• Alkaline-earth metals<br>• Transition elements<br>• Main-group elements<br>• Halogens<br>• Atomic radius<br>• Ion<br>• Ionization<br>Ionization energy<br>• Electron affinity<br>• Cation<br>• Anion<br>• Valence electrons<br>• Electronegativity |