

## Essential Standards Chart: What is it we expect students to learn?

Grade:	10-12	Subject:	Chemistry	Semester	Team Members:	Rob Mahlman		
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Standard Description		Example Rigor	Prerequisite Skills	Common Assessment	When Taught?	Extension Standards		
What is the essential standard to be learned? Describe in student-friendly vocabulary.		What does proficient student work look like? Provide an example and/or description.	What prior knowledge, skills, and/or vocabulary is/are needed for a student to master this standard?	What assessment(s) will be used to measure student mastery?	When will this standard be taught?	What will we do when students have learned the essential standard(s)?		
<p>Properties of Matter: I understand the following:</p> <p>1) All matter is composed of atoms which can chemically combine to form compounds.</p> <p>2) Mixtures can be formed by a physical blending of elements and compounds.</p>		Draw the three phases of matter and apply the kinetic molecular theory to their movement, shape and volume.	<ul style="list-style-type: none"> <li>* familiarity with solid, liquid, and gasses</li> <li>* understanding of a mixture</li> </ul>	<ul style="list-style-type: none"> <li>* Properties of matter quiz</li> <li>* Intro to chemistry test</li> <li>* Lab: Chemical and physical differences</li> </ul>	Quarter 1	<b>Students know properties of the fourth state of matter plasma and imperfect phases.</b>		
<p>Atomic and Molecular Structure: I understand that the periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure.</p>		<p>1) Determining the number of Protons, Neutrons, and Electrons in Gold-197.</p> <p>2) Explain why Fluorine has a higher electronegativity than Sodium.</p>	<ul style="list-style-type: none"> <li>* know basic structure of the atom</li> <li>* need basic arithmetic skill set.</li> </ul>	<ul style="list-style-type: none"> <li>* Atomic Structures quiz including PEN.</li> <li>* Periodic trends quiz</li> <li>* Atomic Structure test</li> <li>* Lab: Flame ionization test</li> </ul>	Quarter 1 and 3	Students know the experimental basis for Thomson's discovery of the electron, Rutherford's nuclear atom, Millikan's oil drop experiment, and Einstein's explanation of the photoelectric effect.		
<p>Chemical Bonds: I understand that Biological, chemical, and physical properties of matter result from the ability of atoms to form</p>		<p>1) Describe the difference between an ionic bond and a covalent bond.</p> <p>2) Draw the Lewis structure for CO<sub>2</sub> and H<sub>2</sub>O.</p>	<ul style="list-style-type: none"> <li>* basic structure of the atom</li> <li>* determine number of valence electrons</li> <li>* know what an ion is</li> <li>* know the difference</li> </ul>	<ul style="list-style-type: none"> <li>* Lewis and VSEPR quiz</li> <li>* Bonding Test</li> <li>* Lab: molecular geometry</li> </ul>	Quarter 3	Students know how to identify solids and liquids held together by van der Waals forces or hydrogen bonding and relate these forces to volatility and		

bonds from electrostatic forces between electrons and protons and between atoms and molecules.		between an element and compound			boiling/ melting point temperatures
Conservation of Matter and Stoichiometry: 1) I understand that the conservation of atoms in chemical reactions leads to the principle of Conservation of matter. 2) I can calculate the mass of products and reactants.	1) Calculate the mass of water produced by the combustion of 32 grams of methane (CH <sub>4</sub> )	* Basic math skills * ability to apply unit conversions	* Mole quiz * Stoichiometry test * reaction type quiz * Balancing reactions quiz * Lab: Stoichiometry	Quarter 2	Students know how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions.
Gases and Their Properties: I understand the kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases.	Calculate the volume of a balloon that contains 96 grams of oxygen gas at 25 degrees C, and 1.5 atm of pressure.	* Algebra skills * unit conversions * Understand properties of matter standard. * mole conversions from stoichiometry	* Combined gas law quiz * Ideal gas law quiz * Gas Laws test * Lab: Determine R constant	Quarter 3	Students know how to apply Dalton's law of partial pressures to describe the composition of gases and Graham's law to predict diffusion of gases
Acids and Bases: I know that acids, bases, and salts are three classes of compounds that form ions in water solutions.	A solution has a hydronium ion concentration of $3.5 \times 10^{-4}$ M. Determine pH and describe the properties of that solution.	* know how to use and apply logarithms * Knowledge of exponents and exponential notation * know the definition of concentration * general characteristics of acid/bases from Biology	* Calculation of pH and pOH quiz * Acid/Base test * Lab: Titration	Quarter 4	Students know buffers stabilize pH in acid-base reactions.
Solutions: I know that solutions are homogenous mixtures of two or more substances.	Calculate the molarity of a solution with 100 grams of NaOH and a total volume of 800 mL. Is this solution homogenous or heterogeneous?	* basic algebraic math skills * mole conversions from Stoichiometry * volume conversions from mL to L * Vocabulary from	* Molarity quiz * Solutions test * Lab: Supersaturation	Quarter 4	Students know the relationship between the molarity of a solute in a solution and the solution's depressed freezing point or elevated boiling point.

		properties of matter unit (ex: homogenous)			
Chemical Thermodynamics: I know that energy is exchanged or transformed in all chemical reactions and physical changes of matter.	Draw a graph(Energy vs temperature) of water heating from ice to steam. Be sure to label the phases of water at each point of the graph.	<ul style="list-style-type: none"> <li>* Algebraic functions</li> <li>* use unit conversions</li> <li>* Ability to read and create a basic graph.</li> </ul>	<ul style="list-style-type: none"> <li>* Specific Heat capacity quiz</li> <li>* Thermodynamics test</li> <li>* Lab: Specific heat capacity</li> </ul>	Quarter 4	Students know how to apply Hess's law to calculate enthalpy change in a reaction. Students know how to use the Gibbs free energy equation to determine whether a reaction would be spontaneous.
Reaction Rates: I understand that chemical reaction rates depend on factors that influence how often molecules collide.	List three ways to increase the reaction rate of a typical chemical reaction.	<ul style="list-style-type: none"> <li>* write and balance a chemical reaction</li> <li>* Understanding of kinetic molecular theory</li> <li>* Understand the meaning or rate.</li> </ul>	<ul style="list-style-type: none"> <li>* Kinetics quiz</li> <li>* Lab: reaction rate</li> </ul>	Quarter 3,4	Students know the definition and role of activation energy in a chemical reaction.
Chemical Equilibrium : I understand that a chemical reaction at equilibrium the forward reaction rate is equivalent to the reverse reaction rate, and the equilibrium can be changed.	Use Le Chatlier's principal to determine which way the reaction will shift in the following reaction: $\text{HC}_2\text{H}_3\text{O}_2 \rightarrow \text{H}^+ + \text{C}_2\text{H}_3\text{O}_2^-$ when more acid ( $\text{H}^+$ ) is added.	<ul style="list-style-type: none"> <li>* Write and balance chemical equations</li> <li>* Understanding concentration</li> </ul>	<ul style="list-style-type: none"> <li>* Equilibrium quiz</li> <li>* Rate and Equilibrium test</li> <li>* Lab: Le Chatlier</li> </ul>	Quarter 4	Students know how to write and calculate an equilibrium constant expression for a reaction.
Nuclear Processes : I know that nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion.	List the three forms of ionizing radiation along with their composition, and radiation power.	<ul style="list-style-type: none"> <li>* Knowledge of atomic structure</li> <li>* Basic arithmetic skills</li> <li>* Calculations of the number of protons, neutrons, and electrons.</li> </ul>	<ul style="list-style-type: none"> <li>* Nuclear Transformation quiz</li> <li>* Nuclear Test</li> <li>* Lab: 1/2 life</li> </ul>	Quarter 4 if given time	Students know how to calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed.

<p>Investigation and Experimentation: I know that scientific progress is made by asking meaningful questions and conducting careful investigations.</p>	<p>Describe how you would calculate the density of an irregularly shaped object. Include units and proper devices used to determine the objects density.</p>	<ul style="list-style-type: none"> <li>* Basic measurement skills</li> <li>* Exposure to the scientific method</li> <li>* Basic algebra skills</li> </ul>	<ul style="list-style-type: none"> <li>* Tested throughout class</li> <li>* Lab: alka seltzer</li> <li>* Lab: Density</li> </ul>	<p>Quarter 1 through 4</p>	<p>Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings.</p>
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