Length	Objectives- Chemistry 2nd Trimester	**Vocabulary**	Chapter &Activities
Unit 1 **Quantum Mechanics** **6 days**	*C2.4x* *Electron Movement* For each element, the arrangement of electrons surrounding the nucleus is unique. These electrons are found in different energy levels and can only move from a lower energy level (closer to nucleus) to a higher energy level (farther from nucleus) by absorbing energy in discrete packets. The energy content of the packets is directly proportional to the frequency of the radiation. These electron transitions will produce unique absorption spectra for each element. When the electron returns from an excited (high energy state) to a lower energy state, energy is emitted in only certain wavelengths of light, producing an emission spectra. C2.4a Describe energy changes in flame tests of common elements in terms of the (characteristic) electron transitions. C2.4b Contrast the mechanism of energy changes and the appearance of absorption and emission spectra. C2.4c Explain why an atom can absorb only certain wavelengths of light. C2.4d Compare various wavelengths of light (visible and nonvisible) in terms of frequency and relative energy. *C4.8x* *Electron Configuration* Electrons are arranged in main energy levels with sublevels that specify particular shapes and	Absorbance spectrum Atomic motion Bright line spectrum Chemical bond Electromagnetic field Electromagnetic radiation Electromagnetic spectra Electromagnetic wave Electron Electron configuration Emission spectra Energy level	Chapter Labs, test, HW

	geometry. Orbitals represent a region of space in which an electron may be found with a high level of probability. Each defined orbital can hold two electrons, each with a specific spin orientation. The specific assignment of an electron to an orbital is determined by a set of 4 quantum numbers. Each element and, therefore, each position in the periodic table is defined by a unique set of quantum numbers. C4.8e Write the complete electron configuration of elements in the first four rows of the periodic table. C4.8f Write kernel structures for main group elements. C4.8g Predict oxidation states and bonding capacity for main group elements using their electron structure. C4.8h Describe the shape and orientation of *s* and *p* orbitals. C4.8i Describe the fact that the electron location cannot be exactly determined at any given time.	Excited state Kernel Ground state Orbitals Probability Quantum energy Quantum numbers Release of energy Sublevel Valence electrons Wave amplitude Wavelength	
Unit 2 **Periodic table** **4 days**	*C4.9x Electron Energy Levels* The rows in the periodic table represent the main electron energy levels of the atom. Within each main energy level are sublevels that represent an orbital shape and orientation. C4.9c Predict general trends in atomic radius, first ionization energy, and electronegativity of the elements using the periodic table. *C5.5 Chemical Bonds-Trends* An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called	Atomic bonding principles Covalent bond Earth's elements Electrical conductivity Electronegativity Electron sharing Electron transfer	Chapter Labs, test, HW

	chemical bonds. C5.5c Draw Lewis structures for simple compounds. C5.5d Compare the relative melting point, electrical and thermal conductivity, and hardness for ionic, metallic, and covalent compounds.	Energy sublevels Periodic table of the elements Ionic bond Ionization energy Lewis structures Main energy level Main group Orbital shape Outer electron Thermal conductivity	
Unit 3 **Introduction to Bonding** **7 days**	*C2.1x* *Chemical Potential Energy* Potential energy is stored whenever work must be done to change the distance between two objects. The attraction between the two objects may be gravitational, electrostatic, magnetic, or strong force. Chemical potential energy is the result of electrostatic attractions between atoms. C2.1a Explain the changes in potential energy (due to electrostatic interactions) as a chemical bond forms and use this to explain why bond breaking always requires energy. C2.1b Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces). *C3.2x*	Bond energy Carbon atom Charged object Chemical bond Crystalline solid Double bond Electric force Electron Electron sharing Electron transfer Endothermic proces Enthalpy Exothermic proces Hydrocarbon Intermolecular force Ion	Chapter Labs, test, HW

	Enthalpy Chemical reactions involve breaking bonds in reactants (endothermic) and forming new bonds in the products (exothermic). The enthalpy change for a chemical reaction will depend on the relative strengths of the bonds in the reactants and products. C3.2b Describe the relative strength of single, double, and triple covalent bonds between nitrogen atoms. *C3.3x* *Bond Energy* Chemical bonds possess potential (vibrational and rotational) energy. C3.3c Explain why it is necessary for a molecule to absorb energy in order to break a chemical bond. *C4.4x* *Molecular Polarity* The forces between molecules depend on the net polarity of the molecule as determined by shape of the molecule and the polarity of the bonds. C4.4a Explain why at room temperature different compounds can exist in different phases. C4.4b Identify if a molecule is polar or nonpolar given a structural formula for the compound. *C5.8* *Carbon Chemistry* The chemistry of carbon is important. Carbon atoms can bond to one another in chains, rings, and branching networks to form a variety of structures, including synthetic polymers, oils, and the large molecules essential to life. C5.8A Draw structural formulas for up to ten carbon chains of simple	Isomers Monomer Moving electric charge Polarity Potential energy Protein Release of energy Single bond Synthetic polymer	

	hydrocarbons. C5.8B Draw isomers for simple hydrocarbons. C5.8C Recognize that proteins, starches, and other large biological molecules are polymers.		
Unit 4 **States of Matter** 4 days	*C2.2* *Molecules in Motion* Molecules that compose matter are in constant motion (translational, rotational, vibrational). Energy may be transferred from one object to another during collisions between molecules. C2.2A Describe conduction in terms of molecules bumping into each other to transfer energy. Explain why there is better conduction in solids and liquids than gases. C2.2B Describe the various states of matter in terms of the motion and arrangement of the molecules (atoms) making up the substance. *C2.2x* *Molecular Entropy* As temperature increases, the average kinetic energy and the entropy of the molecules in a sample increases. C2.2c Explain changes in pressure, volume, and temperature for gases using the kinetic molecular model. C2.2f Compare the average kinetic energy of the molecules in a metal object and a wood object at room temperature.		Chapter Labs, test, HW

	C3.3 *Heating Impacts* Heating increases the kinetic (translational, rotational, and vibrational) energy of the atoms composing elements and the molecules or ions composing compounds. As the kinetic (translational) energy of the atoms, molecules, or ions increases, the temperature of the matter increases. Heating a sample of a crystalline solid increases the kinetic (vibrational) energy of the atoms, molecules, or ions. When the kinetic (vibrational) energy becomes great enough, the crystalline structure breaks down, and the solid melts. C3.3A Describe how heat is conducted in a solid. C3.3B Describe melting on a molecular level. *C4.3* *Properties of Substances* Differences in the physical and chemical properties of substances are explained by the arrangement of the atoms, ions, or molecules of the substances and by the strength of the forces of attraction between the atoms, ions, or molecules. C4.3A Recognize that substances that are solid at room temperature have stronger attractive forces than liquids at room temperature, which have stronger attractive forces than gases at room temperature. C4.3B Recognize that solids have a more ordered, regular arrangement of their particles than liquids and that liquids are more ordered than gases. *C4.5x* *Ideal Gas Law* The forces in gases are explained by the ideal		

	gas law. C4.5a Provide macroscopic examples, atomic and molecular explanations, and mathematical representations (graphs and equations) for the pressure-volume relationship in gases. C4.5b Provide macroscopic examples, atomic and molecular explanations, and mathematical representations (graphs and equations) for the pressure-temperature relationship in gases. C4.5c Provide macroscopic examples, atomic and molecular explanations, and mathematical representations (graphs and equations) for the temperature-volume relationship in gases.		
Unit 5 **Advanced Bonding Concepts** **3 days**	*C4.3x* *Solids* Solids can be classified as metallic, ionic, covalent, or network covalent. These different types of solids have different properties that depend on the particles and forces found in the solid. C4.3c Compare the relative strengths of forces between molecules based on the melting point and boiling point of the substances. C4.3d Compare the strength of the forces of attraction between molecules of different elements. (For example, at room temperature, chlorine is a gas and iodine is a solid.) C4.3e Predict whether the forces of attraction in a solid are primarily metallic, covalent, network covalent, or ionic based upon the elements' location on the periodic table. C4.3f Identify the elements necessary for hydrogen bonding (N, O, F).	Atomic weight Boiling point Chemical bond Dipole-dipole bond Dispersion forces Endothermic process Exothermic process	Chapter Labs, test, HW

	C4.3g Given the structural formula of a compound, indicate all the intermolecular forces present (dispersion, dipolar, hydrogen bonding). C4.3h Explain properties of various solids such as malleability, conductivity, and melting point in terms of the solid's structure and bonding. C4.3i Explain why ionic solids have higher melting points than covalent solids. (For example, NaF has a melting point of 995°C while water has a melting point of 0° C.) *C5.4x* *Changes of State* All changes of state require energy. Changes in state that require energy involve breaking forces holding the particles together. The amount of energy will depend on the type of forces. C5.4c Explain why both the melting point and boiling points for water are significantly higher than other small molecules of comparable mass (e.g., ammonia and methane). C5.4d Explain why freezing is an exothermic change of state. C5.4e Compare the melting point of covalent compounds based on the strength of IMFs (intermolecular forces).	Hydrogen bonding Ion Ionic solid (crystal) Melting point Metal Network solid Relative mass Release of energy Temporary dipole	

Unit **Thermochemistry and Solutions** **5 days**	*C2.1x* *Chemical Potential Energy* Potential energy is stored whenever work must be done to change the distance between two objects. The attraction between the two objects may be gravitational, electrostatic, magnetic, or strong force. Chemical potential energy is the result of electrostatic attractions between atoms. C2.1c Compare qualitatively the energy changes associated with melting various types of solids in terms of the types of forces between the particles in the solid. *C2.2x* *Molecular Entropy* As temperature increases, the average kinetic energy and the entropy of the molecules in a sample increases. C2.2d Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. *C3.1x* *Hess's Law* For chemical reactions where the state and amounts of reactants and products are known, the amount of energy transferred will be the same regardless of the chemical pathway. This relationship is called Hess's law. C3.1c Calculate the ΔH for a chemical reaction using simple coffee cup calorimetry. C3.1d Calculate the amount of heat produced for a given mass of reactant from a balanced chemical equation. *C3.4x*	Boiling point elevation Calorie Change of state Chemical bond Concentration Convection current Convection heating Crystalline solid Electrostatic attractions Enthalpy Entropy Equilibrium Exothermic reaction Freezing point depression Hess's Law Ionic motion Joules Kinetic energy Mass to energy conversion Potential energy	Chapter Labs, test, HW

	Enthalpy and Entropy All chemical reactions involve rearrangement of the atoms. In an exothermic reaction, the products have less energy than the reactants. There are two natural driving forces: (1) toward minimum energy (enthalpy) and (2) toward maximum disorder (entropy). C3.4g Explain why gases are less soluble in warm water than cold water. *C4.7x* *Solutions* The physical properties of a solution are determined by the concentration of solute. C4.7a Investigate the difference in the boiling point or freezing point of pure water and a salt solution. *C5.4* *Phase/Change Diagrams* Changes of state require a transfer of energy. Water has unusually high-energy changes associated with its changes of state. C5.4A Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. C5.4B Measure, plot, and interpret the graph of the temperature versus time of an ice-water mixture, under slow heating, through melting and boiling. *C5.5x* *Chemical Bonds* Chemical bonds can be classified as ionic, covalent, and metallic. The properties of a compound depend on the types of bonds holding the atoms together. C5.5e	Release of energy Solute Specific heat Transforming matter and/or energy	

	Relate the melting point, hardness, and electrical and thermal conductivity of a substance to its structure.		
Unit **Acid/Base** **10 days**	*C5.7* *Acids and Bases* Acids and bases are important classes of chemicals that are recognized by easily observed properties in the laboratory. Acids and bases will neutralize each other. Acid formulas usually begin with hydrogen, and base formulas are a metal with a hydroxide ion. As the pH decreases, a solution becomes more acidic. A difference of one pH unit is a factor of 10 in hydrogen ion concentration. C5.7A Recognize formulas for common inorganic acids, carboxylic acids, and bases formed from families I and II. C5.7B Predict products of an acid-based neutralization. C5.7C Describe tests that can be used to distinguish an acid from a base. C5.7D Classify various solutions as acidic or basic, given their pH. C5.7E Explain why lakes with limestone or calcium carbonate experience less adverse effects from acid rain than lakes with granite beds. *C5.7x* *Bronsted-Lowry* Chemical reactions are classified according to	Acid rain Acid/base reaction Acidic Alkaline Basic Bronsted-Lowry Carboxyl group Hydrogen ion Hydronium ion Hydroxide Ion K_w, Neutral Neutralize pH	Chapter Labs, test, HW

	the fundamental molecular or submolecular changes that occur. Reactions that involve proton transfer are known as acid/base reactions. C5.7f Write balanced chemical equations for reactions between acids and bases and perform calculations with balanced equations. C5.7g Calculate the pH from the hydronium ion or hydroxide ion concentration. C5.7h Explain why sulfur oxides and nitrogen oxides contribute to acid rain.		
Unit **Redox/Equilibrium** **2 days**	*C5.3x* *Equilibrium* Most chemical reactions reach a state of dynamic equilibrium where the rates of the forward and reverse reactions are equal. C5.3a Describe equilibrium shifts in a chemical system caused by changing conditions (Le Chatelier's Principle). C5.3b Predict shifts in a chemical system caused by changing conditions (Le Chatelier's Principle). C5.3c Predict the extent reactants are converted to products using the value of the equilibrium constant. *C5.6x* *Reduction/Oxidation Reactions* Chemical reactions are classified according to the fundamental molecular or submolecular changes that occur. Reactions that involve electron transfer are known as oxidation/reduction (or "redox"). C5.6a	Anode Cathode Electrochemical Cell Equilibrium K_{eq} Le Châtelier Oxidation Oxidation-reduction reactions Reduction	Chapter Labs, test, HW

	Balance half-reactions and describe them as oxidations or reductions. C5.6c Explain oxidation occurring when two different metals are in contact. C5.6d Calculate the voltage for spontaneous redox reactions from the standard reduction potentials. C5.6e Identify the reactions occurring at the anode and cathode in an electrochemical cell.		
Unit **Thermodynamics** **5 days**	*C2.2x* *Molecular Entropy* As temperature increases, the average kinetic energy and the entropy of the molecules in a sample increases. C2.2e Compare the entropy of solids, liquids, and gases. *C2.3x* *Breaking Chemical Bonds* For molecules to react, they must collide with enough energy (activation energy) to break old chemical bonds before their atoms can be rearranged to form new substances. C2.3a Explain how the rate of a given chemical reaction is dependent on the temperature and the activation energy. C2.3b Draw and analyze a diagram to show the activation energy for an exothermic reaction that is very slow at room temperature. *C3.1x* *Hess's Law* For chemical reactions where the state and amounts of reactants and products are known, the amount of energy	Activation energy Disorder Endothermic reaction Enthalpy Entropy Exothermic reaction Gibb's Free Energy Hess's Law Reaction rate Release of energy Spontaneous	Chapter Labs, test, HW

	transferred will be the same regardless of the chemical pathway. This relationship is called Hess's law. C3.1a Calculate the ΔH for a given reaction using Hess's Law. C3.1b Draw enthalpy diagrams for exothermic and endothermic reactions. *C3.2x* *Enthalpy* Chemical reactions involve breaking bonds in reactants (endothermic) and forming new bonds in the products (exothermic). The enthalpy change for a chemical reaction will depend on the relative strengths of the bonds in the reactants and products. C3.2a Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. *C3.4* *Endothermic and Exothermic Reactions* Chemical interactions either release energy to the environment (exothermic) or absorb energy from the environment (endothermic). C3.4B Explain why chemical reactions will either release or absorb energy. *C3.4x* *Enthalpy and Entropy* All chemical reactions involve rearrangement of the atoms. In an exothermic reaction, the products have less energy than the reactants. There are two natural driving forces: (1) toward minimum energy (enthalpy) and (2) toward maximum disorder (entropy). C3.4d		

	Draw enthalpy diagrams for reactants and products in endothermic and exothermic reactions. C3.4e Predict if a chemical reaction is spontaneous given the enthalpy (ΔH) and entropy (ΔS) changes for the reaction using Gibb's Free Energy, $\Delta G = \Delta H - T\Delta S$ (Note: mathematical computation of ΔG is not required.) C3.4f Explain why some endothermic reactions are spontaneous at room temperature.		