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JC Schools Chemistry Yearly Science Standards

	Overarching Standards
	9-12.ETS1.A.1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants **9-12.ETS1.A.2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **9-12.ETS1.B.1** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts **9-12.ETS1.B.2** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem
Units	**Priority Standards**
Unit 1 Atomic Models & Electron Arrangement	**PS1.A.3** **PLAN and CONDUCT** an investigation to gather evidence to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tensions, and chemical reactivity to infer the relative strength of attractive forces between particles. **PS1.A.1** **USE** the organization of the periodic table to **PREDICT** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. **9-12. PS1.C**

	USE symbolic representations 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. {Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations
Unit 2 Periodic Trends	**PS1.A.1** **USE** the organization of the periodic table to **PREDICT** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
Unit 3 Ionic Bonding	**PS1.A.3** **PLAN and CONDUCT** an investigation to gather evidence to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tensions, and chemical reactivity to infer the relative strength of attractive forces between particles. **PS1.A.1** **USE** the organization of the periodic table to **PREDICT** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms{Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed and reactions with oxygen} **PS1.A.2** **CONSTRUCT and REVISE** an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.{Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, or of oxygen and hydrogen}
Unit 4 Covalent Bonding	**PS1.A.1** **USE** the organization of the periodic table to **PREDICT** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms{Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed and reactions with oxygen} **PS1.A.2** **CONSTRUCT and REVISE** an explanation for the products of a simple chemical reaction based on the outermost electrons states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. {Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, or of oxygen and hydrogen boiling point, vapor pressure, surface tensions, and chemical reactivity to infer the relative strength of attractive forces between particles

	PS1.A.3 **PLAN and CONDUCT** an investigation to gather evidence to COMPARE physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tensions, and chemical reactivity to infer the relative strength of attractive forces between particles. **PS1.A.4** **APPLY** the concepts of bonding and crystalline/molecular structure to **EXPLAIN** the macroscopic properties of various categories of structural materials, i.e. metals, ionic (ceramics) and polymers. {Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors}
Unit 5 Chemical Reactions	**PS1.A.2** **CONSTRUCT and REVISE** an explanation for the outcome for the simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. **PS1.A.3** **PLAN and CONDUCT** an investigation to gather evidence **to COMPARE** physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tensions, and chemical reactivity to infer the relative strength of attractive forces between particles. **PS1.B.1** **APPLY** scientific principles and evidence to provide an explanation about the effect of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. {Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules} **PS1.B.3** **USE** symbolic representations and mathematical calculations **to SUPPORT t**he claim that atoms, and therefore mass, are conserved during a chemical reaction.
Unit 6 Significant Figures and Mole Conversions	**A1.NQ.B.3** **USE** units of measure as a way to **UNDERSTAND** and **SOLVE** problems involving quantities **A1.NQ.B.4** **DEFINE** and **USE** appropriate quantities for representing a given context or problem **A1.NQ.B.5** **CHOOSE** a level of accuracy appropriate to limitations on measurement when reporting quantities

	PS1.B.3 **USE** symbolic representations and mathematical calculations to **SUPPORT** the claim that atoms, and therefore mass, are conserved during a chemical reaction.
Unit 7 Stoichiometry	**PS1.B.3** **USE** symbolic representations and mathematical calculations **to SUPPORT** the claim that atoms, and therefore mass, are conserved during a chemical reaction **A1.NQ.B.4** **DEFINE** and **USE** appropriate quantities for representing a given context or problem **A1.NQ.B.5** **CHOOSE** a level of accuracy appropriate to limitations on measurement when reporting quantities **A1.NQ.B.3** **USE units of measure as a way to UNDERSTAND and SOLVE problems involving quantities.**
Unit 8 Attractive Forces and Gas Laws	**PS1.A.3** **PLAN and CONDUCT** an investigation to gather evidence to **COMPARE** physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles. {Clarification Statement: Emphasis is on understanding the relative strength of forces between particles. Examples of particles could include ion, atoms, molecules, and networked materials such as graphite **PS1.A.5** **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. {Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved. **PS3.A.2** **DEVELOP** and **USE** models to **ILLUSTRATE** that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects) **PS3.B** **PLAN and CONDUCT** an investigation to **PROVIDE** evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in more uniform energy distribution among the components in the system (second law of thermodynamics) {Clarification Statement:

	Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually, Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water} **PS1.B.3** **USE** symbolic representations and mathematical calculations **to SUPPORT** the claim that atoms, and therefore mass, are conserved during a chemical reaction.
Unit 9 Energy Changes in Chemical Reactions	**PS1.A.5** **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 **PS3.B** **PLAN and CONDUCT** an investigation to **PROVIDE** evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in more uniform energy distribution among the components in the system (second law of thermodynamics) {Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually, Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water} **PS3.A.1** **CREATE** a computations model to calculate the changes in the energy of one component in a system when the changes in energy are known.{Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model} **PS3.A2** **DEVELOP and USE** models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). {Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object **PS3.A.3** **DESIGN, BUILD, and REFINE** a device that works within given constraints to convert one form of energy into another form of energy **PS1.B.1** **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.

	A1.NQ.B.3 **USE** units of measure as a way to **UNDERSTAND** and **SOLVE** problems involving quantities