HADDONFIELD PUBLIC SCHOOLS
Curriculum Map for Chemistry (2018)

1st Marking Period

Targeted Standard(s): NJSLS-S 2016 (https://www.state.nj.us/education/cccs/2016/science/)
HS-PS1-8, HS-PS2-4, HS-PS3-2, HS-PS3-5, HS-PS4-1, HS-PS4-2, HS-PS4-3, HS-PS4-4, HS-PS4-5, HS-ESS1-1, HS-ESS1-2, HS-ESS1-3
Descriptions of Standards, Science and Engineering Practices, Disciplinary Core Ideas and Crosscutting Concepts: https://www.state.nj.us/education/cccs/2016/science/HS-PS1.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS2.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS3.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS4.pdf https://www.state.nj.us/education/cccs/2016/science/HS-ESS1.pdf

Enduring Understandings (*The big ideas*):
Laboratory safety; scientific inquiry; structure and properties of matter; atomic theory; scientific measurements

Essential Questions:
How do we use the tools of chemistry? How do we represent quantitative measurements and calculations in chemistry? What is the structure of atoms? How is matter classified? How is a weighted average used to calculate average atomic mass? What is the strong nuclear force and how does it affect nuclear stability? How does the sun evolve and how does it produce energy? What is the evidence for the Big Bang Theory? What are the origins of the chemical elements? What is radioactivity and how are nuclear reactions classified? How does Coulomb's Law describe and predict the forces between protons and electrons, between protons, between ions, and how do these relate to atomic structure? How does the nucleus change during nuclear reactions? What is the current model of the atom and how has it evolved? What is the nature of electromagnetic radiation and how does it relate to atomic structure? What is the electron configuration of an atom and how does it affect reactivity?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
Laboratory safety practices, precision and accuracy in measurement, problem solving using dimensional analysis, forms of energy, law of conservation of energy, what is temperature, states of matter, chemical and physical properties of matter, characteristics of elements, compounds, and mixtures at the particle-level and the macro level, separation methods for compounds and mixtures, early models of the atom, discoveries of atomic structure, development of modern atomic theory, the life cycle of the sun, evidence supporting the Big Bang Theory, the origins of the chemical elements, nuclear reactions, radioactive decay, radioisotopes, half-life, fission, fusion, changes in the nucleus and energy released during nuclear decay processes, radiant energy (frequency, wavelength, energy), quantum theory (energy-frequency relationship), continuous and quantized phenomena, Bohr's model of the atom, atomic orbitals, electron configuration	Apply lab safety principles, Use instruments for measurement, Convert quantities using dimensional analysis, Use significant figures in equations and measurements, Identify a substance as an element, compound or mixture, draw particle-level diagrams of elements, compounds, mixtures, Understand the evolution of atomic models, Components of atomic structure (electrons, protons, and neutrons, including location, relative mass and relative electric charge). Describe how Coulomb's Law describes the forces between subatomic particles, describe the life cycle of the sun, provide evidence supporting the Big Bang Theory, describe the origins of the chemical elements, Define isotopes and use isotope notation, Write nuclear equations to represent types of nuclear changes, Define half-life and solve related problems including carbon dating, Distinguish between nuclear and chemical reactions using atomic mass units, Understand that the strong nuclear force holds the nucleus together, Define fission and fusion and write nuclear equations to represent each, Develop models to illustrate changes in the nucleus, Describe the relationships among wavelength, frequency, velocity and energy, Recognize that the speed of light is a constant and the value of that constant, Describe the regions of the electromagnetic radiation (EMR) spectrum, Relate the line spectrum of hydrogen to the EMR spectrum and to other atoms, Distinguish between quantized and continuous systems, Describe the Bohr atomic model and its limitations, Contrast the quantum mechanic model to other previous atomic models, Write electron configurations using the Aufbau Principle, Hund's Rule, and the Pauli Exclusion Principle	Safety Scavenger Hunt Guided inquiry activities Student whiteboard presentations of dimensional analysis conversions Chemical and Physical changes lab Classification of matter lab Density lab Separating components of a mixture lab Drawing particle-level diagrams "Build an Atom", "Alpha Decay" and "Beta Decay" PhET simulations Photoelectric Effect simulation U-238 decay series card game Radioactivity and Half-life Lab Atomic Mass and Isotopes lab Flame test lab with Geissler tubes Electron probability lab/Orbital Model Lab	Matter concept inventory, Chemical concepts inventory, Safety quiz, Quizzes, tests, lab/simulation reports, writing assignments, portfolio

21st Century Learning: 9.1.A. Critical thinking and Problem Solving: Evaluate outcomes from data, predict outcomes from data, apply learned concepts to new situations, create an experimental procedure, gather and evaluate knowledge and information from a variety of sources; 9.1.B Creativity and Innovation: Apply knowledge and information from a variety of sources to demonstrate understanding through efforts such as projects, presentations, experiments, authentic investigations; 9.1.C Collaboration, Teamwork, and Leadership: Develop and enhance collaboration and leadership skills through joint assignments, lab work, projects, and report writing; 9.1.D Cross-Cultural Understanding and Interpersonal Communication: Appreciate the contributions of different cultures to the development and understanding of scientific knowledge and the importance of the unifying nature of scientific communication; 9.1.E Communications and Media Fluency: Use of digital media to enhance learning through methods such as distributing information, conducting assessments, exchanging information and ideas between/among students, presenting, and collecting and analyzing data; 9.1.F Accountability, Productivity, and Ethics: Recognize the importance of individual accountability and ethical behavior in learning and living.

Resources/Technology: On-line textbook: https://openstax.org/details/books/chemistry-atoms-first . Computers/Lab Probe-ware/MS Word and Excel, Google docs; Textbook technology resources: simulation software (PhET, Concord Consortium), laserdiscs, videos etc. Internet resources – videos, data, simulations, on-line homework program (Canvas)

HADDONFIELD PUBLIC SCHOOLS

Curriculum Map for Chemistry

3rd Marking Period

Targeted Standard(s): NJSLS-S 2016
HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-7, HS-PS2-6, HS-PS3-1, HS-PS3-2, HS-PS3-4, HS-PS3-5
Descriptions of Standards, Science and Engineering Practices, Disciplinary Core Ideas and Crosscutting Concepts: https://www.state.nj.us/education/cccs/2016/science/HS-PS1.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS2.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS3.pdf

Enduring Understandings (*The big ideas*):
Limiting reactants, percent yield, reactions involving heat (exothermic/endothermic), enthalpy, enthalpy changes, kinetic molecular theory and behavior of gases, solids, and liquids, gas laws, intermolecular attractive forces, changes of state, solution properties (concentration and solubility), colligative properties

Essential Questions:
What limits the amount that a reaction can produce? How is percent yield determined? What are the heat effects in chemical reactions (thermochemistry) and how can they be measured? What are the features of phase diagrams and heating curves? How does the kinetic molecular theory account for the behavior of gases? How are pressure, temperature, volume, and the number of moles of a gas related? How are atoms/molecules/ions attracted to each other and how do these attractions affect physical properties? How do changes of state occur? How is solution concentration represented? How is solubility determined? What are colligative properties and how are they measured?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation Interdisciplinary Connections*	Assessment *How learning will be assessed*
limiting reactants, percent yield, Heat and enthalpy changes, exothermic and endothermic reactions, Hess's Law, calorimetry, kinetic molecular theory, properties of gases, gas laws, properties of solids and liquids, intermolecular attractive forces, changes of state, properties and types of solutions, concentration, solubility, colligative properties	Make conversions using limiting reactants, Define and calculate percent yield. Distinguish exothermic and endothermic reactions, Define enthalpy, change in enthalpy and how they are used in equations, Define standard conditions for standard enthalpy change and its notation, State Hess's law, Use Hess's law to find ΔH^o for a reaction, Describe the process of calorimetry, $q = mC_p\Delta T$, Describe the kinetic molecular theory (KMT) and use the KMT to describe the behavior of gases, describe changes in pressure, temperature and volume on a molecular level in terms of KMT, define gas pressure and describe its measurement, state and use the gas laws to predict properties of ideal gases both qualitatively and quantitatively, compare real and ideal gas behavior, use KMT to describe behavior of solids and liquids, differentiate the intermolecular attractive forces, explain how solutions form, describe properties and types of solutions, define solubility and factors that affect it, differentiate unsaturated, saturated, and supersaturated solutions, use solubility curves to predict state of a solution, measure concentration in terms of molarity, Define colligative properties, Describe the six changes of state (melting, freezing, boiling, condensing, sublimation, deposition), Describe the features of a heating curve, Distinguish heat of fusion and heat of vaporization and use each in calculations, Identify the features of a phase diagram, Use a phase diagram to predict how a change in pressure or temperature will change a given substance,	Guided inquiry activities, student whiteboard presentations of calculations, Iron-copper chloride reaction lab, Percent Composition lab, Make 1.00 gram of a Compound lab, Energy of Combustion lab, Specific heat of an Unknown Metal lab, Kinetic Molecular Theory simulation activity, Properties of gases lab, Determination of the Value of the Gas constant lab	Quizzes, tests, lab/simulation reports, writing assignments, Portfolio

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HADDONFIELD . .BLIC SCHOOLS
Curriculum Map for Chemistry (2018)

2nd Marking Period

Targeted Standard(s): NJSLS-S 2016
HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-7, HS-PS2-6, HS-PS3-5
Descriptions of Standards, Science and Engineering Practices, Disciplinary Core Ideas and Crosscutting Concepts: https://www.state.nj.us/education/cccs/2016/science/HS-PS1.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS2.pdf https://www.state.nj.us/education/cccs/2016/science/HS-PS3.pdf

Enduring Understandings (*The big ideas*):
The Periodic Table, chemical formulas and bonding, molecular shape and polarity, chemical reactions (characteristics, balancing, types)the mole, mathematics of chemical equations

Essential Questions:
How is the Periodic Table organized? What information can be obtained from the Periodic Table? How do atoms bond? How are compounds represented? How are Lewis structures drawn? What are the shapes of small molecules? How does VSEPR theory predict molecular shape? How are atoms/molecules/ions attracted to each other and how does these affect physical properties? What are the characteristics of a chemical reaction? How are chemical reactions represented with equations? How are chemical reactions classified? How is the mole used to account for chemical quantities? How can chemical equations be used to predict stoichiometic relationships and chemical quantities?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation Interdisciplinary Connections*	Assessment *How learning will be assessed*
Ionic bonding, covalent bonding, bond polarity, chemical nomenclature, VSEPR (valence-shell electron pair repulsion) theory and molecular shape, hybrid orbitals, characteristics of chemical reactions, balancing chemical equations, classifying chemical reactions, definition and use of the mole, convert between mass, moles and number of particles, determination of empirical and molecular formulas, chemical stoichiometry.	Identify groups / families and periods, Identify the representative families and the similarities and differences in their electron configurations, Use periodic patterns and trends to organize elements within a period or group, Distinguish between ionic and covalent chemical bonding, Identify general properties of ionic compounds and of covalent compounds, Use Lewis Structures to represent ionic and covalent bonding in formula units and molecules, Recognize types of ions: cation and anion, monatomic and polyatomic, Write formulas for and name ionic compounds and covalent compounds, Distinguish between molecular and empirical formulas, Describe and illustrate multiple covalent bonds, Describe the cause of polar and nonpolar covalent bonds and identify molecules containing each, Apply electronegativity concepts to predict the type of chemical bond between two atoms, Use Ball and Stick models to construct simple molecules, Draw and describe the shape of simple molecules, Apply the VSEPR (valence-shell electron pair repulsion) Theory to explain hybrid orbitals, Write unbalanced formula equations when given a word equation, Write a balanced equation when given and unbalanced formula equation, Write a balanced equation when given a word equation, Correctly use all four state symbols (s,l,g,aq) Classify equations as synthesis, decomposition, single replacement, double displacement, and combustion reactions, and as acid/base, redox (oxidation-reduction), precipitation. Define a mole in terms of Avogadro's number and molar mass, Convert between moles, mass, and number of particles, Describe molar volume of a gas Use molar volume of a gas at STP to convert between number of particles, mass, and moles, Calculate percent composition from a chemical formula, Use percent composition to determine empirical formula, Find the empirical formula associated with a molecular formula, Find a molecular formula given a molar mass and an empirical formula, Use stoichiometry to make conversions using balanced chemical equations.	Guided inquiry activities, student whiteboard presentations of calculations, Research project on the properties and uses of an element (Element Project), Periodic Chart lab, Periodic Trends Graphing activity, Intro to Ionic and Covalent Bonding activity, Ionic Bonding lab Molecular Shapes and Polarity Lab, Equation Writing and Predicting Products lab, Reactivity of metals lab, Single replacement lab (iron – copper chloride lab)	Quizzes, tests, lab/simulation reports, writing assignments, Portfolio. Midterm

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HADDONFIELD . JBLIC SCHOOLS
Curriculum Map for Chemistry (2018)

4th Marking Period

Targeted Standard(s): NJSLS-S 2016
HS-PS1-3, HS-PS1-5, HS-PS1-6, HS-PS3-1, HS-PS3-2, HS-PS3-5
Descriptions of Standards, Science and Engineering Practices, Disciplinary Core Ideas and Crosscutting Concepts: https://www.state.nj.us/education/cccs/2016/science/HS-PS1.pdf
https://www.state.nj.us/education/cccs/2016/science/HS-PS3.pdf

Enduring Understandings (*The big ideas*):
Reversible reactions, chemical equilibrium, equilibrium constant, factors that shift equilibrium (Le Chatelier's Principle), dissolution and precipitation, solubility equilibria, net ionic equations, common ion effect, acids and bases (definitions, properties, equilibria, pH, titration), kinetics (reaction rates), reaction mechanisms and rate laws, activation energy, energy diagrams, factors that affect reaction rate, spontaneous processes, entropy, free energy

Essential Questions:
What is a reversible reaction and how is chemical equilibrium characterized? How are solubility and equilibrium related? How are acids and bases defined? How are acid-base reactions and equilibrium related? What is pH and how is it determined? What is titration and how is it performed? What affects the rate of a reaction? What is entropy? How are changes in entropy and enthalpy related to reaction spontaneity?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation Interdisciplinary Connections*	Assessment *How learning will be assessed*
Reversible reactions, chemical equilibrium, equilibrium constant, factors that shift equilibrium (Le Chatelier's Principle), dissolution and precipitation, solubility equilibria, net ionic equations, common ion effect, acids and bases (definitions, properties, equilibria, pH, titration), kinetics (reaction rates), reaction mechanisms and rate laws, activation energy, energy diagrams, factors that affect reaction rate, spontaneous processes, entropy, free energy	Explain the concept of reversibility in chemical reactions, Determine K (the equilibrium constant) for a given reaction using the law of mass action, Use the reaction quotient (Q) to determine if a system is at equilibrium, and if not how a system will shift to attain equilibrium, Define and explain Le Chatelier's principle, Describe how changes in concentration, pressure, and temperature affect a reaction at equilibrium Define solubility product (Ksp) and write the equation relating solubility product to concentration, Evaluate whether or not a precipitate will form using Ksp, Describe how a common ion can shift the solubility equilibrium State Arrhenius, Bronsted-Lowry, and Lewis definitions of Acids and Bases, Identify properties of acids and bases, Differentiate strong and weak acids and distinguish acid strength from acid concentration, Identify conjugate acids and conjugate bases, Calculate KA for a given acid and Kb for a given base, Use Kw to relate Ka and Kb, Relate pH to [H+], Describe how titration is used to determine the concentration of an unknown acid or base, Determine a rate law for a reaction from empirical data, describe collision theory and how it relates to reaction rate, describe the factors that affect reaction rate in terms of collision theory, explain the concept of activation energy and activated complex, define entropy, describe how an increase in entropy is a driving force for a reaction to occur (2^{nd} law of thermodynamics), create and explain an energy diagram for an exothermic or endothermic reaction, use the change in Gibbs free energy to explain reaction spontaneity and how changes in enthalpy and entropy affect the change in Gibbs free energy	Guided inquiry activities, student whiteboard presentations of calculations, Intermolecular Attractions simulation, Phase Changes simulation, Solutions and dilutions lab Identifying Unknown Solutions using Solubility lab, Properties of Acids and Bases lab, Acid-Base titration lab	Quizzes, tests, lab/simulation reports, writing assignments, Portfolio, Final Exam

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