Attachment #1
March 2, 2021

WESTFIELD PUBLIC SCHOOLS

Westfield, New Jersey

Office of Instruction

Course of Study

CHEMISTRY CONCEPTS – 7130

School.....Westfield High School
Department.....Science
Length of Course.....Full Year
Credit.....6.0
Grade Level 10, 11, 12
Prerequisites .....Biology
Date.....

I. RATIONALE, DESCRIPTION AND PURPOSE

Chemistry Concepts is an introductory college preparatory laboratory course that presents the major concepts of inorganic chemistry. Students are provided with an understanding of the physical and chemical properties and behavior of matter. Chemistry Concepts, however, is not as dependent on mathematical calculations as Chemistry I or Chemistry I Honors. Students become familiar with the vocabulary of chemistry and understand the basic concepts of atomic and molecular structure, physical properties related to chemical structure and the fundamentals of chemical reactions. Emphasis is placed on examples and correlations to commonly encountered materials and scenarios. Laboratory experiences are conducted throughout the course to demonstrate the experimental foundations of the subject matter, to reinforce content, and to teach laboratory techniques and safety. Chemistry Concepts provides a practical understanding of chemistry and of the applications of chemistry in everyday experiences.

II. OBJECTIVES

The district objectives are aligned with the New Jersey Student Learning Standards for Science, the New Jersey Student Learning Standards for Mathematics, English Language Arts, Technology, and 21st Century Life and Careers. They are developed sequentially throughout the course.

Science Practices

Students:

A. Demonstrate proper lab technique and safety precautions when working with equipment in a laboratory setting
New Jersey Student Learning Standards for Science: Science and Engineering Practices P3
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2

B. Understand and differentiate between the interdependence of science and technology
New Jersey Student Learning Standards for Science: Science and Engineering Practices P6
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st Century Life and Careers CRP11

C. Utilize acute observation skills to formulate testable questions and hypotheses and then apply logic in interpreting their observations to design and conduct controlled experiments using various laboratory techniques
New Jersey Student Learning Standards for Science: Science and Engineering Practices P1,2,3
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.3
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,6,8

D. Collect qualitative and quantitative data, present it in table and graph form, analyze it and arrive at a conclusion that evaluates the data for sources of error and poses new hypotheses for communication and further study
New Jersey Student Learning Standards for Science: Science and Engineering Practices P4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.4
New Jersey Student Learning Standards for Mathematical Practice SMP4
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,4,8

E. Recognize that scientific knowledge is tentative and predictions or explanations can be revised as new evidence emerges, and evaluate the strength of scientific arguments based on the quality of the data and evidence presented
New Jersey Student Learning Standards for Science: Science and Engineering Practices P4,7,8
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.8
New Jersey Student Learning Standards for Mathematical Practice SMP8

F. Communicate with others to test new ideas, solicit and provide feedback, articulate and evaluate emerging explanations, develop shared representations and models, and reach consensus
New Jersey Student Learning Standards for Science: Science and Engineering Practices P2,7,8
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.1, 11-12.8
New Jersey Student Learning Standards for 21st Century Life and Careers CRP4,8
New Jersey Student Learning Standards for Mathematical Practice SMP3

G. Demonstrate proficiency in the use of laboratory technology including, but not limited to, data collection probe ware, and video analysis software and research microscopes.
New Jersey Student Learning Standards for Science: Science and Engineering Practices P3
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.9
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,11

Chemistry Practices:
Students:

A. Communicate scientific phenomenon using qualitative relationships to analyze scientific problems
New Jersey Student Learning Standards for Science:HS-PS1-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.9
New Jersey Student Learning Standards for Mathematical Practice: SMP 7,8

B. Engage in scientific questioning, develop scientific hypotheses, design and implement data collection strategies, analyze data, draw conclusions and describe the impact of errors on results

New Jersey Student Learning Standards for Science:HS-PS1-2
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

C. Interpret texts, articles and resources as they relate to everyday chemistry in the real world

New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,4,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 7,8

D. Classify reactions by type and predict the products of simple reactions

New Jersey Student Learning Standards for Science: HS-PS1-2
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P4
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3-4,8
New Jersey Student Learning Standards for Mathematical Practice: SMP 7,8

E. Apply mole concepts to solve basic chemical problems

New Jersey Student Learning Standards for Science: HS-PS1-7
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P5
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.4
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

F. Evaluate historical models that led to the development of the modern atomic model of the atom

New Jersey Student Learning Standards for Science: HS-PS1-8
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,4,6,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 3,8

G. Use the atomic model to explain changes in the nucleus and nuclear reactions such as radioactive decay, fission, and fusion

New Jersey Student Learning Standards for Science: HS-PS1-8, HS-PS4-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,5,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-4,6-8

H. Determine the "shell" model of electronic structure and apply concepts of "shell" model to explain periodic trends, reactivity and properties of elements
New Jersey Student Learning Standards for Science: HS-PS1-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P2,4,6,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

I. Predict and explain physical properties of substances by applying concepts of molecular structure (VSEPR Theory) and how it relates to the unique properties of water in nature
New Jersey Student Learning Standards for Science: HS-PS1-3, HS-PS2-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P2,3,4,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

J. Analyze various gaseous systems to determine the qualitative and some quantitative relationships between pressure, temperature and volume, and explain these relationships by applying the kinetic molecular theory
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2, 4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1, 3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

K. Examine the process of making solutions and the factors that influence solubility
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-6, 8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2, 4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1, 3, 4, 8
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-6,8

L. Evaluate the driving forces of reactions using concepts of enthalpy and entropy
New Jersey Student Learning Standards for Science: HS-PS1-4, HS-PS1-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,3,4,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 3,7-8

M. Predict how changes in concentrations, temperature, surface area, and the use of a catalyst affect the rate of a reaction and explain changes using collision theory
New Jersey Student Learning Standards for Science: HS-PS1-5, HS-PS3-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

N. Collect experimental data to distinguish between acids and bases, quantify acid/base properties using concepts of pH and the use of different indicators

New Jersey Student Learning Standards for Science: HS-PS1-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-4,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 2-8

III. CONTENT, SCOPE, AND SEQUENCE

Chemistry is the study of matter and its changes. This course presents real-life applications of chemicals and their reactions. Aspects of practical and consumer chemistry make the course valuable to students as they relate course content to everyday life. The course exposes students to the work of scientists with diverse backgrounds, including gender, political affiliation, religious background and beliefs, and ethnicity.

A. Matter and Measurement
   1. Steps of Claim, Evidence and Reasoning (CER)
   2. Characteristics of physical and chemical changes of matter and properties
   3. Elements, compounds, and mixtures
   4. Naming ionic and molecular compounds
   5. The Law of Conservation of Matter
   6. Balancing chemical equations
   7. Density concepts and the use of D=M/V

B. Moles
   1. Metric units and conversions (factor label method)
   2. The mole concept
   3. Scientific notation
   4. Avogadro’s hypothesis and the Avogadro's number
   5. Molar mass
   6. Mass and mole conversions

C. Atomic Structure
   1. Historical development of atomic structure: Democritus, Dalton, Thomson, Rutherford
   2. Visualize the basic structure of the atom—protons, neutrons, electrons
   3. Identification of an atomic number and mass number on the periodic table
   4. Isotopes

D. Nuclear Chemistry
   1. Stability of nuclei and radioactivity
   2. Radioactive decay and emission of alpha, beta, and gamma radiation
   3. Simple nuclear half-life calculations
   4. Applications of nuclear chemistry (e.g. food irradiation, radioactive dating, radiation therapy, etc.)

E. Bohr Atom and Electron Configuration
   1. Relationships among the concepts of energy, wavelength, and frequency of light
   2. Observation of emission spectra
   3. Emission spectra as evidence for the quantum energy levels of electrons in atoms
   4. Identification of shapes of s,p,d,f, orbitals from diagrams and physical models
   5. Use of electron configurations to predict the number of valence electrons

F. Periodic Table / Trends
   1. Periods and families and the relation to chemical and physical properties of elements
   2. Metallic and non-metallic properties of elements
   3. Periodic trends: atomic radius, ionization energy, and electronegativity
   4. The octet rule
   5. Common ion charges

G. Chemical Reactions
   1. Different types of chemical reactions
   2. Activity series of metals
   3. Batteries

H. Bonding
   1. Metallic substances and the relationship between metallic structure and physical properties
   2. Ionic Substances:
      a. Reaction of metals and nonmetals
      b. Determination of charges of ions in ionic compounds
   3. Covalent Substances:
      a. Formation of covalently bonded molecules
      b. Lewis dot structures

I. Polarity / Phase Changes
   1. 3D shape of molecules and the VSEPR theory
   2. Polar and non-polar molecules
   3. Relationship between polarity and solubility
   4. Relative strengths of intermolecular forces and their relationship to boiling points and melting points
   5. Special properties of the universal solvent, water, and the effects on our environment
   6. Kinetic theory and phase changes
   7. Fats - saturated and unsaturated

J. Gases
   1. Concept of gas pressure in terms of molecular collisions
   2. Relationships between pressure, volume, temperature and number of moles in a closed gaseous system
   3. Phase diagrams (solid, liquid, gas)

K. Thermochemistry / Rates of reaction
   1. Enthalpy (ΔH) - endothermic and exothermic reactions, energy diagrams
   2. Entropy (ΔS) - predicting increasing or decreasing disorder
   3. Activation energy rates of chemical reactions
   4. Factors which determine rates of reactions
   5. Activation energy and rates of chemical reactions
   6. Conditions which affect rates of reactions

L. Solutions / Acids and Bases
   1. Definitions of solubility, solute, solvent, and solution
   2. Saturation and supersaturation
   3. Concept of Molarity and simple concentration calculations
   4. Colligative properties (freezing point depression and boiling point elevation)
   5. Identification of acids, bases and salts based on characteristics of electrolytes and nonelectrolytes and pH
   6. Arrhenius and Bronsted-Lowry definitions of acids and bases

M. Consumer Chemistry/ Chemical Resources
   1. Food pyramid and a healthful diet
   2. Biochemistry: enzymes, DNA, drugs
   3. Fresh water resources and water treatment
   4. The chemistry of paper and plastic.

IV. INSTRUCTIONAL TECHNIQUES

A variety of instructional approaches are employed to engage all students in the learning process and accommodate differences in readiness levels, interests and learning styles. Teaching techniques include, but are not limited to, the following:

A. Teacher-directed, whole-group instruction and modeling of procedures
B. Flexible grouping
C. Differentiated tasks
D. Laboratory activities, demonstrations, and experiments that require collection, organization, representation, and analysis of data
E. Problem-based learning
F. Independent practice
G. Integration of technology into class activities
H. Visual models, animations, and video to illustrate or enhance class discussions
I. For strategies to differentiate for special education students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans, please consult the Accommodations and Modifications appendix in the appendices section of this document.

V. EVALUATION

The assessment tools the teacher employs to measure student mastery of course objectives include, but are not limited to, the following:

A. Baseline and benchmark assessments
B. Written tests and quizzes
C. Cumulative tests
D. Homework
E. Independent projects
F. Research papers
G. Presentations
H. Laboratory assignments and participation.

VI. PROFESSIONAL DEVELOPMENT

Opportunities for professional development include:

A. Teacher workshops, teacher conferences, and conventions
B. Access to professional books and journals
C. Collaboration with other departments to coordinate activities
D. College courses
E. Collaboration with colleagues about homework, unit plans, and assessment
F. Professional organizations
G. Collaboration with colleagues in the science department and interdepartmental areas to discuss and reflect upon unit plans, homework and assessment.

APPENDIX I

Instructional Resources and Pacing Guide

Instructional resource: *Conceptual Chemistry,* Suchocki, Pearson Publishers, 2004.

Unit	Approximate number of teaching days
Matter and Measurement	15-18
Moles and Stoichiometry	18-20
Atomic Theory and Nuclear Chemistry	15-18
Electronic Structure and Periodic Properties	12-15
Chemical Bonding and Molecular Structure	12-15
Polarity and Intermolecular Forces	10-13
Nomenclature of Compounds and Types of Reactions	10-12
Gases	13-15
Solutions	4-5
Thermodynamics and Rates of Reactions	12-15
Equilibrium	10-12
Acids and Bases	10-12
Electrochemistry	8-10

APPENDIX II

New Jersey Student Learning Standards for Science

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2. Construct and revise an explanation for the outcome 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.
HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS1-4. 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.
HS-PS1-5. 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.
HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS-PS1-8. Develop models 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.
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

NGSS Appendix F – Science and Engineering Practices
P1 - Asking Questions and Defining Problems
P2 - Developing and Using Models
P3 - Planning and Carrying Out Investigations
P4 - Analyzing and Interpreting Data
P5 - Using Mathematics and Computational Thinking
P6 - Constructing Explanations and Designing Solutions
P7 - Engaging in Argument from Evidence
P8 - Obtaining, Evaluating, and Communicating Information

The entire standards document may be viewed at: http://www.state.nj.us/education/cccs/2016/science/ http://www.nextgenscience.org/next-generation-science-standards.

APPENDIX III

New Jersey Student Learning Standards for Educational Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

The entire standards document may be viewed at: http://www.nj.gov/education/cccs/2014/tech/

APPENDIX IV

New Jersey Student Learning Standards - Social Studies Practices

Social Studies practices are the skills that individuals who work in the field of social sciences use on a regular basis. Because the purpose of social studies is to provide students with the knowledge, skills and attitudes they need to be active, informed, responsible individuals and contributing members of their communities, many of the practices can be applied to daily life.

Practice	Description
Developing Questions and Planning Inquiries	Developing insightful questions and planning effective inquiry involves identifying the purposes of different questions to understand the human experience, which requires addressing real world issues. Inquiries incorporating questions from various social science disciplines build understanding of the past, present and future; these inquiries investigate the complexity and diversity of individuals, groups, and societies.
Gathering and Evaluating Sources	Finding, evaluating and organizing information and evidence from multiple sources and perspectives are the core of inquiry. Effective practice requires evaluating the credibility of primary and secondary sources, assessing the reliability of information, analyzing the context of information, and corroborating evidence across sources. Discerning opinion from fact and interpreting the significance of information requires thinking critically about ourselves and the world.
Seeking Diverse Perspectives	Making sense of research findings requires thinking about what information is included, whether the information answers the question, and what may be missing, often resulting in the need to complete additional research. Developing an understanding of our own and others' perspectives builds understanding about the complexity of each person and the diversity in the world. Exploring diverse perspectives assists students in empathizing with other individuals and groups of people; quantitative and qualitative information provides insights into specific people, places, and events, as well as national, regional, and global trends.
Developing Claims and Using Evidence	Developing claims requires careful consideration of evidence, logical organization of information, self-awareness about biases, application of analysis skills, and a willingness to revise conclusions based on the strength of evidence. Using evidence responsibly means developing claims based on factual evidence, valid reasoning, and a respect for human rights.

Presenting Arguments and Explanations	Using a variety of formats designed for a purpose and an authentic audience forms the basis for clear communication. Strong arguments contain claims with organized evidence and valid reasoning that respects the diversity of the world and the dignity of each person. Writing findings and engaging in civil discussion with an audience provides a key step in the process of thinking critically about conclusions and continued inquiry.
Engaging in Civil Discourse and Critiquing Conclusions	Assessing and refining conclusions through metacognition, further research, and deliberative discussions with diverse perspectives sharpens the conclusions and improves thinking as a vital part of the process of sense making. Responsible citizenship requires respectfully listening to and critiquing claims by analyzing the evidence and reasoning supporting them. Listening to and understanding contrary views can deepen learning and lay the groundwork for seeking consensus.
Taking Informed Action	After thoroughly investigating questions, taking informed action means building consensus about possible actions and planning strategically to implement change. Democracy requires citizens to practice discussion, negotiation, coalition-seeking, and peaceful conflict resolution. When appropriate, taking informed action involves creating and/or implementing action plans designed to solve problems and create positive change.

The entire standards document may be viewed at https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-SS.pdf

APPENDIX V

New Jersey Student Learning Standards for 21st Century Life & Careers

Career Ready Practices

CRP2. Apply appropriate academic and technical skills
CRP4. Communicate clearly and effectively and with reason
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
CRP11. Use technology to enhance productivity.

The entire standards document may be viewed at http://www.state.nj.us/education/cccs/

APPENDIX VI

New Jersey Student Learning Standards for English Language Arts

Progress Indicators for Reading Science and Technical Subjects

RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

The entire standards document can be viewed at http://www.state.nj.us/education/cccs/2016/ela/

APPENDIX VII

New Jersey Student Learning Standards for Mathematical Practice

SMP1 – Make sense of problems and persevere in solving them
SMP2 – Reason abstractly and quantitatively
SMP3 – Construct viable arguments and critique the reasoning of others
SMP4 – Model with mathematics
SMP5 – Use appropriate tools strategically
SMP6 – Attend to precision
SMP7 – Look for and make use of structure
SMP8 – Look for and express regularity in repeated reasoning.

The entire standards document may be viewed at http://www.state.nj.us/education/aps/cccs/math

APPENDIX VIII

Integrated Accommodations and Modifications for Special Education Students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans (N.J.A.C. 6A: 8)

Special Education
ENVIRONMENT
Preferential Seating
Adjust time for completion of assignments when needed
Adjust length of assignments when needed
Allow additional oral response time
Break tasks (including long range assignments) into manageable steps
Provide copies of notes
Reduce the number of problems on a page
Provide assistance with organizing a notebook or folder
Repeat/ clarify directions when needed
Make frequent checks for work/assignment completion.
Modify homework and class work if needed
Extend time on tests/quizzes
Provide study guides for tests
Provide oral component when needed

Modify format when needed- (ex: limit choices, word bank, shortened written responses)
Allow a private workspace when needed (study carrel, separate desk, desk away from the group)
Allow opportunities for movement (e.g., help with supplies, change to different part of room to work, carry messages to office)
Assist the student to keep only the materials required for the lesson on the desktop
Provide a seat away from distractions (or noise)
MATERIAL/BOOKS/EQUIPMENT
Allow use of a calculator
Allow use of a number line
Allow use of counting chips
Modify worksheets
Provide visual aids (pictures, flash cards, etc.)
Provide auditory aids (cues, tapes, etc.)
Use manipulatives
Provide hands-on learning activities
INSTRUCTIONAL STRATEGIES
Check work in progress
Provide immediate feedback
Provide extra drill/practice
Provide review sessions
Provide models

Highlight key words
Provide pictures/charts
Use mnemonics
Support auditory presentations with visuals
Have student restate information
Provide lecture notes/outline
Give oral reminders
Give visual reminders
Review directions
Use graphic organizers
Assign partners
Repeat instructions
Display key vocabulary
Monitor assignments
Provide visual reinforcement
Provide concrete examples
Use vocabulary word bank
ORGANIZATION
Post assignments
Provide a desktop list of tasks
Give one paper at a time

Provide extra space for work
List sequential steps
Provide folders to hold work
Post routines
Use pencil box for tools
Reorganize poorly designed worksheets to create simple, easy-to-follow layouts and formats
Give advance warning when transition is going to take place
Provide structure for success
Provide a contract, timer, etc., for self-monitoring
Give the student a prompt when he/she is off task (e.g., move close to the student; speak to the student, etc.)
TEST/QUIZZES/TIME
Give prior notice of test
Provide oral testing
Provide extra time for written work
Provide modified tests
Rephrase test questions/directions
Preview test procedures
Provide shortened tasks
Provide extra time for tests
Read test to student

Provide test study guides
Limit multiple choice options
Provide extra time for projects
Pace long term projects
Simplify test wording
Provide hands-on projects
Allow extra response time
ENGLISH LANGUAGE LEARNERS
GRADING
Standard Grades vs. Pass/Fail
CONTINUUM OF ENGLISH LANGUAGE DEVELOPMENT
Pre K-K WIDA CAN DO Descriptors
Grades 1-2 WIDA CAN DO Descriptors
Grades 3-5 WIDA CAN DO Descriptors
Grades 6-8 WIDA CAN DO Descriptors
Grades 9-12 WIDA CAN DO Descriptors
SIOP COMPONENTS AND FEATURES
PREPARATION
Write content objectives clearly for students
Write language objectives clearly for students
Choose content concepts appropriate for age and educational background levels of students

Identify supplementary materials to use
Adapt content to all levels of students proficiency
Plan meaningful activities that integrate lesson concepts with language practices opportunities for reading, writing, listening, and/or speaking
BUILDING BACKGROUND
Explicitly link concepts to students' backgrounds and experiences
Explicitly link past learning and new concepts
Emphasize key vocabulary for students
COMPREHENSIBLE INPUT
Use speech appropriate for students' proficiency level
Explain academics tasks clearly
Use a variety of techniques to make content concepts clear (e.g. modeling, visuals, hands-on activities, demonstrations, gestures, body language)
STRATEGIES
Provide ample opportunities for students to use strategies (e.g. problem solving, predicting, organizing, summarizing, categorizing, evaluating, self-monitoring)
Use scaffolding techniques consistently throughout lesson
Use a variety of question types including those that promote higher-order thinking skills throughout the lesson
INTERACTION
Provide frequent opportunities for interaction and discussion between teacher/students and among students about lessons concepts, and encourage elaborated responses
Use group configurations that support language and content objectives of the lesson
Provide sufficient wait time for student responses consistently
Give ample opportunities for students to clarify key concepts in LI as needed with aide, peer, or LI text

PRACTICE/APPLICATION
Provide hands-on materials and/ manipulatives for students to practice using new content knowledge
Provide activities for students to apply content and language knowledge in the classroom
Provide activities that integrate all language skills
LESSON DELIVERY
Support content objectives clearly
Support language objectives clearly
Engage students approximately 90-100% of the period
Pace the lesson appropriately to the students' ability level
REVIEW/EVALUATION
Give a comprehensive review of key vocabulary
Give a comprehensive review of key content concepts
Provide feedback to students regularly on their output
Conduct assessments of students comprehension and learning throughout lesson and all lesson objectives
STUDENTS AT RISK OF SCHOOL FAILURE (I&RS RESOURCE MANUAL)
ACADEMICS
Provide necessary services (Lit Support, Math Support, OT, PT, speech, etc.)
Literacy Support Interventions (Appendix B of IS forms)
Prompt before directions/questions are verbalized with visual cue between teacher and student
Task list laminated and placed on desk for classroom routines and organization
Preferential seating
Provide structure and positive reinforcements

Sustained working time connected to reward (If/Then statement)
Frequently check for understanding
Graphic organizers
Tracker
Slant board
Access to accurate notes
Additional time to complete tasks/long-term projects with adjusted due dates
Limit number of items student is expected to learn at one time
Break down tasks into manageable units
Directions repeated, clarified, or reworded
Frequent breaks during class
Allow verbal rather than written responses
Modify curriculum content based on student's ability level
Reduce readability level of materials
Allow typed rather than handwritten responses
Use of calculator
Use of a math grid
Provide models/organizers to break down independent tasks
Access to electronic text (e.g. Downloaded books)
Provide books on tape, CD, or read aloud computer software
Provide opportunities for using a Chromebook as well as assistive technologies
Provide buddy system

Adjust activity, length of assignment, and/or number of problems, including homework
Provide assessments in a small group setting
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Communication with parents
Gradual release of responsibility related to writing prompts (Proximity, Sentence Starter, Attempt independently)
Rubric-based checklist
Target specific number of details and focus on organization with post-its
Accept late work/homework without penalty
Previewing material (access to PowerPoint slides, novels, syllabus, study guides when available)
SOCIAL/EMOTIONAL
Children's books addressing presenting problem
Student jots down presenting problem and erase when it goes away
Meet with guidance counselor
Student jots down presenting problem and erase when it goes away
Attendance plan
Utilize nurse during episodes of presenting problem
Provide short breaks
Attendance plan
Communication with parents
Assign "jobs" to reduce symptoms
Counseling check-ins

Praise whenever possible
ATTENTION/FOCUS
Seat student near front of room
Preferential seating
Monitor on-task performance
Arrange private signal to cue student to off-task behavior
Establish and maintain eye contact when giving oral directions
Stand in proximity to student to focus attention
Provide short breaks when refocusing is needed
Use study carrel
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Refocusing and redirection
Behavior/time management system
Group directions 1 step at a time
Assign "jobs" to reduce symptoms
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Extended time on assignments/assessments
Provide assessments in a small group setting
Provide buddy system

Establish and maintain eye contact when giving oral directions
Permit the use of headphones while working
SCHOOL REFUSAL/ELEVATED ABSENTEEISM
Attendance plan
GIFTED AND TALENTED STUDENTS
CURRICULUM
Acceleration
Compacting
Telescoping
Advanced Placement Courses
INSTRUCTION
Grouping
Independent Study
Differentiated Conferencing
Project-Based Learning
Competitions
Cluster Grouping Model with Flexible Grouping
Differentiated Instruction
Summer Work
Parent Communication

WESTFIELD PUBLIC SCHOOLS

Westfield, New Jersey

Office of Instruction

Course of Study

CHEMISTRY I HONORS – 7133

School.....Westfield High School
Department.....Science
Length of Course.....Full Year
Credit.....6.0
Grade Level 9, 10, 11, 12
Prerequisites .....Biology I
Date.....

I. RATIONALE, DESCRIPTION AND PURPOSE

Chemistry I Honors is a challenging introductory college preparatory inorganic chemistry course taught at a fast pace. The course is designed for students with a high interest and aptitude for science, especially students who have a strong understanding of mathematical concepts. This course stresses the experimental foundations of scientific theories and understandings. In Chemistry I Honors atomic and molecular structure is explored as the basis for understanding various physical and chemical properties of matter. Chemical demonstrations and laboratory work help to deepen a student's understanding of chemical principles and to expose students to common experimental techniques. The reliance on an inductive approach to the course content is greater in Chemistry I Honors than in the other first-year chemistry offerings. By the end of the course, students develop an appreciation of the experimental foundations for the models describing the behavior of matter.

Compared to Chemistry I, similar course content is presented at a faster pace with more complexity and depth. In addition, more extensive, multi-step calculations are required. Stronger math, visualization and spatial reasoning skills, similar to those in Geometry Advanced or Geometry Honors, are crucial in Chemistry Honors.

II. OBJECTIVES

The district objectives are aligned with the New Jersey Student Learning Standards for Science, the New Jersey Student Learning Standards for Mathematics, English Language Arts, Technology, and 21st Century Life and Careers. They are developed sequentially throughout the course.

Science Practices
Students:

A. Demonstrate proper lab technique and safety precautions when working with equipment in a laboratory setting
New Jersey Student Learning Standards for Science: Science and Engineering Practices P3
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2

B. Understand and differentiate between the interdependence of science and technology
New Jersey Student Learning Standards for Science: Science and Engineering Practices P6
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st Century Life and Careers CRP11

C. Utilize acute observation skills to formulate testable questions and hypotheses and then apply logic in interpreting their observations to design and conduct controlled experiments using various laboratory techniques
New Jersey Student Learning Standards for Science: Science and Engineering Practices P1,2,3
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.3
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,6,8

D. Collect qualitative and quantitative data, present it in table and graph form, analyze it and arrive at a conclusion that evaluates the data for sources of error and poses new hypotheses for communication and further study
New Jersey Student Learning Standards for Science: Science and Engineering Practices P4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.4
New Jersey Student Learning Standards for Mathematical Practice SMP4
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,4,8

E. Recognize that scientific knowledge is tentative and predictions or explanations can be revised as new evidence emerges, and evaluate the strength of scientific arguments based on the quality of the data and evidence presented
New Jersey Student Learning Standards for Science: Science and Engineering Practices P4,7,8
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.8
New Jersey Student Learning Standards for Mathematical Practice SMP8

F. Communicate with others to test new ideas, solicit and provide feedback, articulate and evaluate emerging explanations, develop shared representations and models, and reach consensus
New Jersey Student Learning Standards for Science: Science and Engineering Practices P2,7,8
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.1, 11-12.8
New Jersey Student Learning Standards for 21st Century Life and Careers CRP4,8
New Jersey Student Learning Standards for Mathematical Practice SMP3

G. Demonstrate proficiency in the use of laboratory technology including, but not limited to, data collection probe ware, and video analysis software and research microscopes.
New Jersey Student Learning Standards for Science: Science and Engineering Practices P3
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.9
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,11

Chemistry Practices:

Students:

A. Explain the outcomes of simple chemical reactions by using concepts of electron configuration, periodic trends and patterns of chemical properties.
New Jersey Student Learning Standards for Science: HS-PS1-2
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 7,8

B. Analyze experimental data and apply stoichiometric concepts to determine chemical formulas and masses of reactants/products in chemical reactions
New Jersey Student Learning Standards for Science: HS-PS1-7
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1,2,4,5,6

C. Evaluate experimental evidence from historical models that led to the development of the modern quantum mechanical atomic model
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9

D. Develop models to explain the compositional and energy changes of the nucleus that occur during radioactive decay, fission and fusion.
New Jersey Student Learning Standards for Science: HS-PS1-8
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1,2

E. Evaluate experimental evidence supporting the "shell" model of electronic structure and apply concepts of "shell" model to explain and predict periodic trends, reactivity and properties of elements
New Jersey Student Learning Standards for Science: HS-PS1-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 3,4,5

F. Predict and explain physical properties of substances by applying concepts of molecular structure (VSEPR Theory) and types/strengths of attractions between particles
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 3,8

G. Analyze various gaseous systems to determine the quantitative relationships between volume, pressure, temperature and moles of molecules, and explain these relationships by applying the kinetic molecular theory
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

H. Describe the formation of solutions and the factors that influence solvation and solubility; solve concentration problems involving relationships between concentration and physical properties
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1,2,4,5,6

I. Investigate changes in thermal energy by conducting and analyzing calorimetry experiments to determine the specific heat of metals and the enthalpy of reactions
New Jersey Student Learning Standards for Science: HS-PS3-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

J. Evaluate the thermodynamic properties of reactions using concepts of enthalpy/bond energy, entropy, Gibbs Free Energy and the Gibbs-Helmholtz Equation
New Jersey Student Learning Standards for Science: HS-PS3-4
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

K. Predict and calculate how changes in concentrations, temperature, surface area, and the use of a catalyst affect the rate of a reaction and explain changes using collision theory
New Jersey Student Learning Standards for Science: HS-PS1-5
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

L. Examine homogeneous and heterogeneous equilibrium systems, explain behavior in terms of reaction reversibility and predict shifts in equilibrium when external stresses are applied to the system

New Jersey Student Learning Standards for Science: HS-PS1-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

M. Collect experimental data to distinguish between acids and bases, quantify acid and base properties using concepts of pH, equilibrium and the analysis of titration data

New Jersey Student Learning Standards for Science: HS-PS1-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

N. Construct and analyze an electrochemical cell by applying concepts of electron transfer and chemical reactivity.

New Jersey Student Learning Standards for Science: HS-PS1-2
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

III. CONTENT, SCOPE, AND SEQUENCE

Chemistry is the study of the composition, structure, and properties of matter and the changes it undergoes. It applies to both living and nonliving matter, so chemistry is central to all sciences. To understand the physical universe, students must appreciate the historical development of chemistry theory through disciplined inquiry. The course exposes students to the work of scientists with diverse backgrounds, including gender, political affiliation, religious background and beliefs, and ethnicity.

The content, scope and sequence of the three first-year chemistry courses - Chemistry Concepts, Chemistry I, and Chemistry I Honors - are similar since all three courses introduce topics associated with a first-year physical-inorganic chemistry course. However, Chemistry I Honors includes a more in-depth content coverage and classroom discussion than in the other courses. For example, mathematical calculations are more complex and challenging. In addition, the reliance on an inductive approach to the development of concepts and classroom instruction is more prevalent.

While the topics covered in course instruction, labs experiments and activities are often the same or similar in the three different classes, the expectations for content depth and sophistication are significantly greater in Chemistry I Honors than in Chemistry 1 and Chemistry Concepts. A more mathematical and sophisticated graphical analysis of results is typical in Chemistry I Honors.

A. Matter and Measurement
   1. The scientific method and use of the process during laboratory procedures
   2. Physical and chemical properties and changes, including properties of metal, non-metals, and metalloids
   3. Elements, compounds, mixture types (colloids, suspensions), and separation techniques
   4. Calculations using scientific notation
   5. Significant figures – determining the precision of measurements and predicting the correct number of significant digits in calculations
   6. Density concepts and calculations
   7. Metric system (SI) and multi-step unit conversions using dimensional analysis (factor label method)
   8. Law of Conservation of Energy; Law of Conservation of Mass: concepts and calculations
   9. Graphical representation, analysis and interpretation of data
   10. Specific heat of different substances with calculations involving experimental data

D. Moles and Stoichiometry
   1. Historical development of the early atomic theory, the logic and experimental evidence analyzed by Democritus, Dalton, Gay-Lussac, and Avogadro
   2. Moles, Avogadro's Hypothesis and conversions between volume and moles of a gas
   3. Conversions between mass and moles by using molar mass and Avogadro's number
   4. Multi-step calculations involving any combination of grams, moles, atoms and volume
   5. Calculations of percent composition, empirical and molecular formulas, and formulas of hydrates
   6. Balancing of chemical equations
   7. Stoichiometry with multi-step calculations involving amounts of reactants and products
   8. Limiting reactants – concept, complex, stoichiometric calculations involving limiting and excess reactants
   9. Theoretical and percent yields – calculations using experimental data

E. Atomic Structure and Nuclear Chemistry
   1. Historical development of atomic structure – ideas and experimental evidence of Democritus, Dalton, Thomson, Millikan, Rutherford, Chadwick, and others
   2. Mass spectrometer – basic concept and purpose
   3. Basic structure of the atom – protons, neutrons, electrons, charges of ions, atomic number, mass number and symbols, isotopes, and calculation of average atomic mass
   4. Radioactive decay – properties of alpha, beta and gamma radiation and overall decay equations (alpha, beta, positron emission, electron capture)
   5. Stability of nuclei – importance of both the strong force and electromagnetic force; calculating neutron-to-proton ratio and application to band of stability graphical analysis
   6. Half-life – concept and calculations; radiometric dating

7. Mass defect and binding energy-mass conversion - concepts and calculations using $E=mc^2$
8. Fission and Fusion – specific changes in composition and energy
9. Nuclear power plants, atomic bombs, and star formation

F. Electronic Structure and the Periodic Table
1. Relationship among energy, wavelength, and frequency of light.
2. Calculations using $c=\lambda f$ and $E=hf$
3. Investigation of color and absorbance of light
4. Emission spectra as evidence for the Bohr Model (shell model) of atom
5. Electron orbitals, electron configurations, valence electrons and charges of ions
6. Introduction to the concept of the wave-particle duality of light and electrons
7. Organization of elements in the periodic table with respect to electron structure, physical properties, and chemical reactivity
8. Periodic Trends – reasons for trends of atomic and ionic radii, ionization energy and electronegativity

G. Chemical Bonding and Molecular Geometry
1. Metallic substances – atomic structure, malleability and conductivity
2. Ionic Substances:
   a. Reaction of metals and nonmetals to form ionic substances
   b. Determination of charges of ions, octet rule
   c. Reactivity of metals – understanding trends with respect to radius and ionization energy
3. Covalent Substances:
   a. Reaction of nonmetals to form covalent molecules
   b. Lewis Dot structures of molecules using the octet rule
   c. Identifying partial charges using electronegativity differences
4. Molecular Geometry and Hybridization
   a. Three-dimensional models of molecules using VSEPR theory
   b. Sigma and pi bonds (a model of single, double and triple bonds)
   c. Shapes of molecules using the model of hybridization of atomic orbitals (sp^3, sp^2, sp)
   d. Structures and conductivity of the network covalent substances of diamond (sp^3) and graphite (sp^2)
   e. Predictions of the chemistry of compounds based on these models of molecular bonding

H. Polarity and Intermolecular Forces
1. Determination of type of substance – ionic, polar covalent, non-polar covalent or metallic
2. Relationship between compound polarity and solubility
3. Types of intermolecular forces: London dispersion forces, dipole-dipole, hydrogen bonding
4. Relative strengths of intermolecular forces and the observed effect on boiling and melting points
5. Hydrogen bonding and the physical properties of water – density of ice, surface tension, boiling and melting point

I. Nomenclature of Ionic/Covalent compounds and types of reactions
   1. Formulas of ionic and covalent bonded compounds
   2. Nomenclature of compounds
   3. Formulas of hydrates
   4. Types of chemical reactions and predicting products: synthesis, decomposition, single replacement (activity series), double replacement, and combustion

J. Gases
   1. The kinetic-molecular theory of gases
   2. Pressure – concept units, barometers and manometers
   3. Mathematical relationships between pressure, volume, temperature and moles of gases
   4. Calculations using Boyle's Law, Charles's Law, Gay-Lussac's Law, combined Gas Law and Ideal Gas Law
   5. Ideal vs. real gases
   6. Concept of temperature, absolute zero and Kelvin temperature units
   7. Diffusion and Effusion of gases – relationships among kinetic energy, speed and mass of molecules, Graham's Law calculations
   8. Dalton's Law for partial pressure of gases: concepts and calculations
   9. Relationships among atmospheric pressure, vapor pressure and boiling point of a liquid
   10. Phase diagrams – interpreting and constructing phase diagrams

K. Solutions
   1. Concentration of solutions – molarity, molality and percentage units
   2. Saturated, unsaturated and supersaturated solutions
   3. Interpreting solubility curves
   4. Temperature and pressure effects on the solubility of solids and gases
   5. Colligative properties – concepts of freezing point depression and boiling point elevation

L. Thermodynamics and Rates of Reactions
   1. Enthalpy – identifying endothermic and exothermic reactions; drawing energy diagrams
   2. Calculating the enthalpy of a reaction using bond energies
   3. Entropy – identifying increasing and decreasing entropy changes
   4. Prediction of thermodynamic favorability of reactions
   5. Gibbs Free Energy – calculations using the Gibbs-Helmholtz equation: $\Delta G = \Delta H - T\Delta S$
   6. Activation energy and rates of reactions
   7. Factors affecting rates of reactions – concentration, temperature, surface area, catalysts
   8. Rate Equations – zero order, first order, and second order rate equations
   9. Rate-determining steps in multi-step mechanisms and the effect on selecting correct rate equations

M. Chemical Equilibrium
   1. Concept of chemical equilibrium
   2. The equilibrium constants of K_c or K_{eq} , and K_{sp} - concepts and calculations
   3. Le Chatelier's principle, shifting equilibrium positions due to concentrations and temperature and other system stresses

N. Acids and Bases
   1. Electrical conductivity of various solutions of non-electrolytes, acids, bases and salts
   2. Arrhenius model for acids and bases – writing overall reactions
   3. Bronsted-Lowry Model for acids and bases – writing overall reactions, labeling acid-base conjugate pairs
   4. Acid and base strength and determining equilibrium favored substances
   5. Equilibrium constants for acids and bases (K_a and K_b) - definitions and calculations
   6. Equilibrium constant for water (K_w) and its relationship to $[H_3O^+]$ and $[OH^-]$
   7. pH & pOH: definition and calculations
   8. Titration processes, laboratory titration techniques and calculations
   9. Buffers: concepts and applications

O. Electrochemistry
   1. Concepts of oxidation and reduction
   2. Oxidation and reduction half reactions, calculating net electrical potential
   3. Voltaic cells: setting up cells, labeling parts, and producing electricity
   4. Commercial batteries
   5. Electrolytic cells: construction and operation.

IV. INSTRUCTIONAL TECHNIQUES

A variety of instructional approaches are employed to engage all students in the learning process and accommodate differences in readiness levels, interests and learning styles. Teaching techniques include, but are not limited to, the following:

A. Teacher-directed, whole-group instruction and modeling of procedures
B. Flexible grouping
C. Differentiated tasks
D. Laboratory activities, demonstrations, and experiments that require collection, organization, representation, and analysis of data
E. Problem-based learning
F. Independent practice
G. Integration of technology into class activities
H. Visual models, animations, and video to illustrate or enhance class discussions
I. For strategies to differentiate for special education students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans, please consult the Accommodations and Modifications appendix in the appendices section of this document.

V. EVALUATION

The assessment tools the teacher employs to measure student mastery of course objectives include, but are not limited to, the following:

A. Baseline and benchmark assessments
B. Written tests and quizzes
C. Cumulative tests
D. Homework
E. Independent projects
F. Research papers
G. Presentations
H. Laboratory assignments and participation.

VI. PROFESSIONAL DEVELOPMENT

Opportunities for professional development include:

A. Teacher workshops, teacher conferences, and conventions
B. Access to professional books and journals
C. Collaboration with other departments to coordinate activities
D. College courses
E. Collaboration with colleagues about homework, unit plans, and assessment
F. Professional organizations
G. Collaboration with colleagues in the science department and interdepartmental areas to discuss and reflect upon unit plans, homework and assessment.

APPENDIX I

Instructional Resources and Pacing Guide

Instructional resource: *Modern Chemistry*, Davis, Metcalfe, Williams, & Castka, Holt Rinehart and Winston Publishers, 1999.

Unit	Approximate number of teaching days
Matter and Measurement	15-18
Moles and Stoichiometry	18-20
Atomic Theory and Nuclear Chemistry	15-18
Electronic Structure and Periodic Properties	12-15
Chemical Bonding and Molecular Structure	12-15
Polarity and Intermolecular Forces	10-13
Nomenclature of Compounds and Types of Reactions	10-12
Gases	13-15
Solutions	4-5
Thermodynamics and Rates of Reactions	12-15
Equilibrium	10-12
Acids and Bases	10-12
Electrochemistry	8-10

APPENDIX II

New Jersey Student Learning Standards for Science

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2. Construct and revise an explanation for the outcome 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.
HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS1-4. 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.
HS-PS1-5. 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.
HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS-PS1-8. Develop models 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.
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

NGSS Appendix F – Science and Engineering Practices
P1 - Asking Questions and Defining Problems
P2 - Developing and Using Models
P3 - Planning and Carrying Out Investigations
P4 - Analyzing and Interpreting Data
P5 - Using Mathematics and Computational Thinking
P6 - Constructing Explanations and Designing Solutions
P7 - Engaging in Argument from Evidence
P8 - Obtaining, Evaluating, and Communicating Information

The entire standards document may be viewed at: http://www.state.nj.us/education/cccs/2016/science/ http://www.nextgenscience.org/next-generation-science-standards.

APPENDIX III

New Jersey Student Learning Standards for Educational Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

The entire standards document may be viewed at: http://www.nj.gov/education/cccs/2014/tech/

APPENDIX IV

New Jersey Student Learning Standards - Social Studies Practices

Social Studies practices are the skills that individuals who work in the field of social sciences use on a regular basis. Because the purpose of social studies is to provide students with the knowledge, skills and attitudes they need to be active, informed, responsible individuals and contributing members of their communities, many of the practices can be applied to daily life.

Practice	Description
Developing Questions and Planning Inquiries	Developing insightful questions and planning effective inquiry involves identifying the purposes of different questions to understand the human experience, which requires addressing real world issues. Inquiries incorporating questions from various social science disciplines build understanding of the past, present and future; these inquiries investigate the complexity and diversity of individuals, groups, and societies.
Gathering and Evaluating Sources	Finding, evaluating and organizing information and evidence from multiple sources and perspectives are the core of inquiry. Effective practice requires evaluating the credibility of primary and secondary sources, assessing the reliability of information, analyzing the context of information, and corroborating evidence across sources. Discerning opinion from fact and interpreting the significance of information requires thinking critically about ourselves and the world.
Seeking Diverse Perspectives	Making sense of research findings requires thinking about what information is included, whether the information answers the question, and what may be missing, often resulting in the need to complete additional research. Developing an understanding of our own and others' perspectives builds understanding about the complexity of each person and the diversity in the world. Exploring diverse perspectives assists students in empathizing with other individuals and groups of people; quantitative and qualitative information provides insights into specific people, places, and events, as well as national, regional, and global trends.
Developing Claims and Using Evidence	Developing claims requires careful consideration of evidence, logical organization of information, self-awareness about biases, application of analysis skills, and a willingness to revise conclusions based on the strength of evidence. Using evidence responsibly means developing claims based on factual evidence, valid reasoning, and a respect for human rights.

Presenting Arguments and Explanations	Using a variety of formats designed for a purpose and an authentic audience forms the basis for clear communication. Strong arguments contain claims with organized evidence and valid reasoning that respects the diversity of the world and the dignity of each person. Writing findings and engaging in civil discussion with an audience provides a key step in the process of thinking critically about conclusions and continued inquiry.
Engaging in Civil Discourse and Critiquing Conclusions	Assessing and refining conclusions through metacognition, further research, and deliberative discussions with diverse perspectives sharpens the conclusions and improves thinking as a vital part of the process of sense making. Responsible citizenship requires respectfully listening to and critiquing claims by analyzing the evidence and reasoning supporting them. Listening to and understanding contrary views can deepen learning and lay the groundwork for seeking consensus.
Taking Informed Action	After thoroughly investigating questions, taking informed action means building consensus about possible actions and planning strategically to implement change. Democracy requires citizens to practice discussion, negotiation, coalition-seeking, and peaceful conflict resolution. When appropriate, taking informed action involves creating and/or implementing action plans designed to solve problems and create positive change.

The entire standards document may be viewed at https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-SS.pdf

APPENDIX V

New Jersey Student Learning Standards for 21st Century Life & Careers

Career Ready Practices

CRP2. Apply appropriate academic and technical skills
CRP4. Communicate clearly and effectively and with reason
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
CRP11. Use technology to enhance productivity.

The entire standards document may be viewed at http://www.state.nj.us/education/cccs/

APPENDIX VI

New Jersey Student Learning Standards for English Language Arts

Progress Indicators for Reading Science and Technical Subjects

RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

The entire standards document can be viewed at http://www.state.nj.us/education/cccs/2016/ela/

APPENDIX VII

New Jersey Student Learning Standards for Mathematical Practice

SMP1 – Make sense of problems and persevere in solving them
SMP2 – Reason abstractly and quantitatively
SMP3 – Construct viable arguments and critique the reasoning of others
SMP4 – Model with mathematics
SMP5 – Use appropriate tools strategically
SMP6 – Attend to precision
SMP7 – Look for and make use of structure
SMP8 – Look for and express regularity in repeated reasoning.

The entire standards document may be viewed at http://www.state.nj.us/education/aps/cccs/math

APPENDIX VIII

Integrated Accommodations and Modifications for Special Education Students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans (N.J.A.C. 6A: 8)

Special Education
ENVIRONMENT
Preferential Seating
Adjust time for completion of assignments when needed
Adjust length of assignments when needed
Allow additional oral response time
Break tasks (including long range assignments) into manageable steps
Provide copies of notes
Reduce the number of problems on a page
Provide assistance with organizing a notebook or folder
Repeat/ clarify directions when needed
Make frequent checks for work/assignment completion.
Modify homework and class work if needed
Extend time on tests/quizzes
Provide study guides for tests
Provide oral component when needed

Modify format when needed- (ex: limit choices, word bank, shortened written responses)
Allow a private workspace when needed (study carrel, separate desk, desk away from the group)
Allow opportunities for movement (e.g., help with supplies, change to different part of room to work, carry messages to office)
Assist the student to keep only the materials required for the lesson on the desktop
Provide a seat away from distractions (or noise)
MATERIAL/BOOKS/EQUIPMENT
Allow use of a calculator
Allow use of a number line
Allow use of counting chips
Modify worksheets
Provide visual aids (pictures, flash cards, etc.)
Provide auditory aids (cues, tapes, etc.)
Use manipulatives
Provide hands-on learning activities
INSTRUCTIONAL STRATEGIES
Check work in progress
Provide immediate feedback
Provide extra drill/practice
Provide review sessions
Provide models

Highlight key words
Provide pictures/charts
Use mnemonics
Support auditory presentations with visuals
Have student restate information
Provide lecture notes/outline
Give oral reminders
Give visual reminders
Review directions
Use graphic organizers
Assign partners
Repeat instructions
Display key vocabulary
Monitor assignments
Provide visual reinforcement
Provide concrete examples
Use vocabulary word bank
ORGANIZATION
Post assignments
Provide a desktop list of tasks
Give one paper at a time

Provide extra space for work
List sequential steps
Provide folders to hold work
Post routines
Use pencil box for tools
Reorganize poorly designed worksheets to create simple, easy-to-follow layouts and formats
Give advance warning when transition is going to take place
Provide structure for success
Provide a contract, timer, etc., for self-monitoring
Give the student a prompt when he/she is off task (e.g., move close to the student; speak to the student, etc.)
TEST/QUIZZES/TIME
Give prior notice of test
Provide oral testing
Provide extra time for written work
Provide modified tests
Rephrase test questions/directions
Preview test procedures
Provide shortened tasks
Provide extra time for tests
Read test to student

Provide test study guides
Limit multiple choice options
Provide extra time for projects
Pace long term projects
Simplify test wording
Provide hands-on projects
Allow extra response time
ENGLISH LANGUAGE LEARNERS
GRADING
Standard Grades vs. Pass/Fail
CONTINUUM OF ENGLISH LANGUAGE DEVELOPMENT
Pre K-K WIDA CAN DO Descriptors
Grades 1-2 WIDA CAN DO Descriptors
Grades 3-5 WIDA CAN DO Descriptors
Grades 6-8 WIDA CAN DO Descriptors
Grades 9-12 WIDA CAN DO Descriptors
SIOP COMPONENTS AND FEATURES
PREPARATION
Write content objectives clearly for students
Write language objectives clearly for students
Choose content concepts appropriate for age and educational background levels of students

Identify supplementary materials to use
Adapt content to all levels of students proficiency
Plan meaningful activities that integrate lesson concepts with language practices opportunities for reading, writing, listening, and/or speaking
BUILDING BACKGROUND
Explicitly link concepts to students' backgrounds and experiences
Explicitly link past learning and new concepts
Emphasize key vocabulary for students
COMPREHENSIBLE INPUT
Use speech appropriate for students' proficiency level
Explain academics tasks clearly
Use a variety of techniques to make content concepts clear (e.g. modeling, visuals, hands-on activities, demonstrations, gestures, body language)
STRATEGIES
Provide ample opportunities for students to use strategies (e.g. problem solving, predicting, organizing, summarizing, categorizing, evaluating, self-monitoring)
Use scaffolding techniques consistently throughout lesson
Use a variety of question types including those that promote higher-order thinking skills throughout the lesson
INTERACTION
Provide frequent opportunities for interaction and discussion between teacher/students and among students about lessons concepts, and encourage elaborated responses
Use group configurations that support language and content objectives of the lesson
Provide sufficient wait time for student responses consistently
Give ample opportunities for students to clarify key concepts in LI as needed with aide, peer, or LI text

PRACTICE/APPLICATION
Provide hands-on materials and/ manipulatives for students to practice using new content knowledge
Provide activities for students to apply content and language knowledge in the classroom
Provide activities that integrate all language skills
LESSON DELIVERY
Support content objectives clearly
Support language objectives clearly
Engage students approximately 90-100% of the period
Pace the lesson appropriately to the students' ability level
REVIEW/EVALUATION
Give a comprehensive review of key vocabulary
Give a comprehensive review of key content concepts
Provide feedback to students regularly on their output
Conduct assessments of students comprehension and learning throughout lesson and all lesson objectives
STUDENTS AT RISK OF SCHOOL FAILURE (I&RS RESOURCE MANUAL)
ACADEMICS
Provide necessary services (Lit Support, Math Support, OT, PT, speech, etc.)
Literacy Support Interventions (Appendix B of IS forms)
Prompt before directions/questions are verbalized with visual cue between teacher and student
Task list laminated and placed on desk for classroom routines and organization
Preferential seating
Provide structure and positive reinforcements

Sustained working time connected to reward (If/Then statement)
Frequently check for understanding
Graphic organizers
Tracker
Slant board
Access to accurate notes
Additional time to complete tasks/long-term projects with adjusted due dates
Limit number of items student is expected to learn at one time
Break down tasks into manageable units
Directions repeated, clarified, or reworded
Frequent breaks during class
Allow verbal rather than written responses
Modify curriculum content based on student's ability level
Reduce readability level of materials
Allow typed rather than handwritten responses
Use of calculator
Use of a math grid
Provide models/organizers to break down independent tasks
Access to electronic text (e.g. Downloaded books)
Provide books on tape, CD, or read aloud computer software
Provide opportunities for using a Chromebook as well as assistive technologies
Provide buddy system

Adjust activity, length of assignment, and/or number of problems, including homework
Provide assessments in a small group setting
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Communication with parents
Gradual release of responsibility related to writing prompts (Proximity, Sentence Starter, Attempt independently)
Rubric-based checklist
Target specific number of details and focus on organization with post-its
Accept late work/homework without penalty
Previewing material (access to PowerPoint slides, novels, syllabus, study guides when available)
SOCIAL/EMOTIONAL
Children's books addressing presenting problem
Student jots down presenting problem and erase when it goes away
Meet with guidance counselor
Student jots down presenting problem and erase when it goes away
Attendance plan
Utilize nurse during episodes of presenting problem
Provide short breaks
Attendance plan
Communication with parents
Assign "jobs" to reduce symptoms
Counseling check-ins

Praise whenever possible
ATTENTION/FOCUS
Seat student near front of room
Preferential seating
Monitor on-task performance
Arrange private signal to cue student to off-task behavior
Establish and maintain eye contact when giving oral directions
Stand in proximity to student to focus attention
Provide short breaks when refocusing is needed
Use study carrel
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Refocusing and redirection
Behavior/time management system
Group directions 1 step at a time
Assign "jobs" to reduce symptoms
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Extended time on assignments/assessments
Provide assessments in a small group setting
Provide buddy system

Establish and maintain eye contact when giving oral directions
Permit the use of headphones while working
SCHOOL REFUSAL/ELEVATED ABSENTEEISM
Attendance plan
GIFTED AND TALENTED STUDENTS
CURRICULUM
Acceleration
Compacting
Telescoping
Advanced Placement Courses
INSTRUCTION
Grouping
Independent Study
Differentiated Conferencing
Project-Based Learning
Competitions
Cluster Grouping Model with Flexible Grouping
Differentiated Instruction
Summer Work
Parent Communication

WESTFIELD PUBLIC SCHOOLS

Westfield, New Jersey

Office of Instruction

Course of Study

CHEMISTRY I – 7131

School.....Westfield High School
Department.....Science
Length of Course.....Full Year
Credit.....6.0
Grade Level 9, 10, 11, 12
Prerequisites .....Biology
Date.....

I. RATIONALE, DESCRIPTION AND PURPOSE

Chemistry I is an introductory college preparatory laboratory course in inorganic chemistry. The course explores atomic and molecular structure to understand various physical and chemical properties of matter. Students must be able to explain chemical concepts and make calculations involving unit conversions and simple algebraic equations. Chemistry, like geometry, requires spatial reasoning and visualization skills. Laboratory experiences are conducted throughout the year to demonstrate the experimental foundations of the subject matter, to reinforce content learned through lecture, discussion and readings, and to teach laboratory techniques and safety.

II. OBJECTIVES

The district objectives are aligned with the New Jersey Student Learning Standards for Science, the New Jersey Student Learning Standards for Mathematics, English Language Arts, Technology, and 21st Century Life and Careers. They are developed sequentially throughout the course.

Science Practices

Students:

A. Demonstrate proper lab technique and safety precautions when working with equipment in a laboratory setting
New Jersey Student Learning Standards for Science: Science and Engineering Practices P3
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2

B. Understand and differentiate between the interdependence of science and technology
New Jersey Student Learning Standards for Science: Science and Engineering Practices P6
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st Century Life and Careers CRP11

C. Utilize acute observation skills to formulate testable questions and hypotheses and then apply logic in interpreting their observations to design and conduct controlled experiments using various laboratory techniques
New Jersey Student Learning Standards for Science: Science and Engineering Practices P1,2,3
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.3
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,6,8

D. Collect qualitative and quantitative data, present it in table and graph form, analyze it and arrive at a conclusion that evaluates the data for sources of error and poses new hypotheses for communication and further study
New Jersey Student Learning Standards for Science: Science and Engineering Practices P4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.4
New Jersey Student Learning Standards for Mathematical Practice SMP4
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,4,8

E. Recognize that scientific knowledge is tentative and predictions or explanations can be revised as new evidence emerges, and evaluate the strength of scientific arguments based on the quality of the data and evidence presented
New Jersey Student Learning Standards for Science: Science and Engineering Practices P4,7,8
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.8
New Jersey Student Learning Standards for Mathematical Practice SMP8

F. Communicate with others to test new ideas, solicit and provide feedback, articulate and evaluate emerging explanations, develop shared representations and models, and reach consensus
New Jersey Student Learning Standards for Science: Science and Engineering Practices P2,7,8
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.1, 11-12.8
New Jersey Student Learning Standards for 21st Century Life and Careers CRP4,8
New Jersey Student Learning Standards for Mathematical Practice SMP3

G. Demonstrate proficiency in the use of laboratory technology including, but not limited to, data collection probe ware, and video analysis software and research microscopes.
New Jersey Student Learning Standards for Science: Science and Engineering Practices P3
New Jersey Student Learning Standards for English Language Arts: Science & Technical Subjects RST.11-12.9
New Jersey Student Learning Standards for 21st Century Life and Careers CRP2,11

Chemistry Practices:
Students:

A. Explain the outcomes of simple chemical reactions by using concepts of electron configuration, periodic trends and patterns of chemical properties.
New Jersey Student Learning Standards for Science: HS-PS1-2
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 7,8

B. Analyze experimental data and apply stoichiometric concepts to determine chemical formulas and masses of reactants/products in chemical reactions
New Jersey Student Learning Standards for Science: HS-PS1-7
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1,2,4,5,6

C. Evaluate experimental evidence from historical models that led to the development of the modern quantum mechanical atomic model
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1,2,4,6,7,8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9

D. Develop models to explain the compositional and energy changes of the nucleus that occur during radioactive decay, fission and fusion.
New Jersey Student Learning Standards for Science: HS-PS1-8, HS-PS4-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1,2

E. Evaluate experimental evidence supporting the "shell" model of electronic structure and apply concepts of "shell" model to explain and predict periodic trends, reactivity and properties of elements
New Jersey Student Learning Standards for Science: HS-PS1-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 3,4,5

F. Predict and explain physical properties of substances by applying concepts of molecular structure (VSEPR Theory) and types/strengths of attractions between particles
New Jersey Student Learning Standards for Science: HS-PS1-3, HS-PS2-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 3,8

G. Analyze various gaseous systems to determine the quantitative relationships between volume, pressure, temperature and moles of molecules, and explain these relationships by applying the kinetic molecular theory
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

H. Describe the formation of solutions and the factors that influence solvation and solubility; solve concentration problems involving relationships between concentration and physical properties
New Jersey Student Learning Standards for Science: HS-PS1-3
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.1,3,4,8,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1,2,4,5,6

I. Investigate changes in thermal energy by conducting and analyzing calorimetry experiments to determine the specific heat of metals and the enthalpy of reactions
New Jersey Student Learning Standards for Science: HS-PS3-1
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

J. Evaluate the thermodynamic properties of reactions using concepts of enthalpy/bond energy, entropy, Gibbs Free Energy and the Gibbs-Helmholtz Equation
New Jersey Student Learning Standards for Science: HS-PS3-4
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

K. Predict and calculate how changes in concentrations, temperature, surface area, and the use of a catalyst affect the rate of a reaction and explain changes using collision theory
New Jersey Student Learning Standards for Science: HS-PS1-5
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

L. Examine homogeneous and heterogeneous equilibrium systems, explain behavior in terms of reaction reversibility and predict shifts in equilibrium when external stresses are applied to the system
New Jersey Student Learning Standards for Science: HS-PS1-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

M. Collect experimental data to distinguish between acids and bases, quantify acid and base properties using concepts of pH, equilibrium and the analysis of titration data
New Jersey Student Learning Standards for Science: HS-PS1-6
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

N. Construct and analyze an electrochemical cell by applying concepts of electron transfer and chemical reactivity.

New Jersey Student Learning Standards for Science: HS-PS1-2
New Jersey Student Learning Standards for Science: Science and Engineering Practices: P1-8
New Jersey Student Learning Standards for Educational Technology 8.1
New Jersey Student Learning Standards for 21st-Century Life and Careers: CRP 2,4,8,11
New Jersey Student Learning Standards for English Language Arts RST.11-12.3,4,9
New Jersey Student Learning Standards for Mathematical Practice: SMP 1-8

III. CONTENT, SCOPE, AND SEQUENCE

Chemistry represents the combined inspired thinking and creativity of many cultures over many centuries. Each significant development rests upon the previous discoveries of other scientists and mathematicians. This historical perspective is stressed throughout the course. Chemical principles are universal and the course presents real-life applications that relate to all students. The course exposes students to the work of scientists with diverse backgrounds, including gender, political affiliation, religious background and beliefs, and ethnicity. Students are exposed to a variety of career paths in chemistry and science.

The content, scope and sequence of the three first-year chemistry courses - Chemistry Concepts, Chemistry I, and Chemistry I Honors - are similar since all three courses cover introductory topics associated with a first year chemistry course. In Chemistry I, mathematical calculations are included in every unit. Students develop essential problem solving skills, especially the analysis of word problems and construction of the proper mathematical formulas.

A. Matter and Measurement

1. The scientific method and use of the process during laboratory procedures
2. Physical and chemical properties and changes
3. Elements, compounds, mixture types and separation techniques
4. Calculations using scientific notation
5. Significant figures – determining the precision of measurements and predicting the correct number of significant digits in a calculation
6. Density concepts and calculations
7. Metric system (SI) and multi-step unit conversions using dimensional analysis (factor label method)
8. Law of Conservation of Energy; Law of Conservation of Mass: concepts and calculations
9. Graphical representation, analysis and interpretation of data

B. Atomic Structure/ Nuclear Chemistry
   1. Experimental evidence for the historical development of the model for the atom – Democritus, Dalton, Thomson, and Rutherford
   2. Mass, charge and location of the subatomic particles – protons, neutrons, and electrons
   3. Isotopes and calculation of average atomic mass
   4. Nuclear stability and radioactivity
   5. Radioactive Decay equations – alpha, beta and gamma
   6. Half-Life calculations and radio-isotopic dating
   7. Fission, fusion, and their application for uses of energy

C. Chemical Reactions - Balancing Reactions - Naming compounds
   1. Common monatomic and polyatomic ions and their structure and charge
   2. Chemical nomenclature of ionic and covalent compounds, and writing chemical formulas
   3. Predict products of a chemical reaction for various types of reactions: synthesis, decomposition, single displacement, double displacement, and combustion
   4. Balancing equations based on the conservation of mass

D. Moles and Stoichiometry
   1. Mole concept
   2. Avogadro's hypothesis and Avogadro's number
   3. Conversions between mass, moles and particles
   4. Percent composition, empirical formulas
   5. Stoichiometry and multi-step calculations using conversions of grams, moles, number of particles, and volumes
   6. Determination of theoretical yield and experimental percent yield
   7. Stoichiometry - limiting and excess reactants

E. Bohr Atom/ Electron Configuration
   1. Light Photons - relationship among energy, wavelength, and frequency
   2. Quantized energy states for electrons using emission spectra of different gases in their excited states
   3. Quantized Model of the s, p, d, f bonding orbitals
   4. Electron configurations and orbital diagrams and the relationship to chemical reactivity
   5. Fluorescence and phosphorescence

F. Periodic Table/Trends
   1. Mendeleev's organization of the periodic table
   2. Periods, Groups, and the relation to chemical and physical properties
   3. Properties of metallic, non-metallic, and metalloid elements
   4. Chemical periodic trends, atomic radius, ionization energy, and electronegativity
   5. Valence electrons and charges of ions
   6. The Octet rule and relationship to atomic and ionic stability

G. Bonding
    1. Metallic substances and the relationship between metallic structure and an element's physical properties of malleability and conductivity
    2. Ionic substances
    3. Reaction of metals and nonmetals to form ionic substances by transferring electrons
    4. Determination of charges of ions in ionic compounds
    5. Covalent substances:
        a. Reaction of nonmetals to form covalent molecules by sharing valence electrons
        b. Prediction of stable molecules using Lewis dot structures
        c. 3D shapes of molecules and the VSEPR model

H. Polarity and Phase Changes
    1. Determination of polar and non-polar molecules
    2. The role of structure and partial charges in molecular polarity
    3. Relationship between polarity and solubility
    4. London dispersion forces, dipole-dipole forces, hydrogen bonding
    5. Relative strengths of intermolecular forces and effect on boiling point and freezing point
    6. Hydrogen bonding in water and other compounds
    7. Phase changes and kinetic theory
    8. Phase diagrams for the solid, liquid and gaseous states

I. Thermochemistry & Thermodynamics
    1. Enthalpy change, endothermic and exothermic reactions, energy diagrams
    2. Bond energies and the concept of energy involved in making or breaking bonds
    3. Entropy change, determination of increasing or decreasing entropy
    4. Calorimetry and heat capacity
    5. Gibb's Free Energy, the Gibbs-Helmholtz equation and the concept of spontaneity

J. Rates of reaction/Equilibrium
    1. Activation energy in chemical reaction mechanisms
    2. Collision theory and factors which affect the rates of reactions: temperature, surface area, catalysts, and concentration
    3. Multistep mechanisms and determination of the rate-determining step
    4. Equilibrium concepts and Kc, Keq, K_a, K_{sp}
    5. Le Châtelier's Principle and the impact of stresses to equilibrium systems

K. Gases
    1. Gas pressure and kinetic-molecular model
    2. Mathematical relationships between pressure, volume, temperature and moles
    3. Boyle's and Charles' Laws for ideal gases
    4. Graham's Law of Effusion
    5. The general equation of state for ideal gases and the combined gas law
    6. Relationships between pressure and boiling point of liquids

L. Solutions
   1. Concepts of solubility and definitions of solute, solvent, and solutions
   2. Solubility and temperature relationship using graphical analysis of solubility curves
   3. Molarity of solutions – calculations, making chemical solutions
   4. Colligative properties molality and freezing point depression and boiling point elevation
   5. Electrical conductivity and characteristics of electrolytes and non-electrolytes

M. Acids and Bases
   1. Arrhenius model for acids and bases and writing neutralization equations
   2. Bronsted-Lowry model for acids and bases, the hydronium ion in B-L neutralization
   3. pH and pOH calculations
   4. Acid-base titration and neutralization products

N. Oxidation and Reduction
   1. Electron loss or gain in an electrochemical cell
   2. Redox half reactions
   3. Balancing simple redox reactions
   4. Concepts of voltaic cells, electroplating and batteries.

IV. INSTRUCTIONAL TECHNIQUES

A variety of instructional approaches are employed to engage all students in the learning process and accommodate differences in readiness levels, interests and learning styles. Teaching techniques include, but are not limited to, the following:

A. Teacher-directed, whole-group instruction and modeling of procedures
B. Flexible grouping
C. Differentiated tasks
D. Laboratory activities, demonstrations, and experiments that require collection, organization, representation, and analysis of data
E. Problem-based learning
F. Independent practice
G. Integration of technology into class activities
H. Visual models, animations, and video to illustrate or enhance class discussions
I. For strategies to differentiate for special education students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans, please consult the Accommodations and Modifications appendix in the appendices section of this document.

V. EVALUATION

The assessment tools the teacher employs to measure student mastery of course objectives include, but are not limited to, the following:

A. Baseline and benchmark assessments
B. Written tests and quizzes
C. Cumulative tests
D. Homework
E. Independent projects
F. Research papers
G. Presentations
H. Laboratory assignments and participation.

VI. PROFESSIONAL DEVELOPMENT

Opportunities for professional development include:

A. Teacher workshops, teacher conferences, and conventions
B. Access to professional books and journals
C. Collaboration with other departments to coordinate activities
D. College courses
E. Collaboration with colleagues about homework, unit plans, and assessment
F. Professional organizations
G. Collaboration with colleagues in the science department and interdepartmental areas to discuss and reflect upon unit plans, homework and assessment.

APPENDIX I

Instructional Resources and Pacing Guide

Instructional resource: *Chemistry: Matter and Change,* Dingrando, Tallman, Hainen, & Wistrom, Glencoe/McGraw Hill Publishers, 2005.

Unit	Approximate number of teaching days
Matter and Measurement	18-20
Moles and Stoichiometry	20-22
Atomic Theory and Nuclear Chemistry	15-18
Electronic Structure and Periodic Properties	12-15
Chemical Bonding and Molecular Structure	12-15
Polarity and Intermolecular Forces	13-15
Nomenclature of Compounds and Types of Reactions	12-14
Gases	13-15
Solutions	5-6
Thermodynamics and Rates of Reactions	12-15
Equilibrium	5-8
Acids and Bases	8-10
Electrochemistry	4-5

APPENDIX II

New Jersey Student Learning Standards for Science

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2. Construct and revise an explanation for the outcome 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.
HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS1-4. 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.
HS-PS1-5. 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.
HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS-PS1-8. Develop models 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.
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

NGSS Appendix F – Science and Engineering Practices
P1 - Asking Questions and Defining Problems
P2 - Developing and Using Models
P3 - Planning and Carrying Out Investigations
P4 - Analyzing and Interpreting Data
P5 - Using Mathematics and Computational Thinking
P6 - Constructing Explanations and Designing Solutions
P7 - Engaging in Argument from Evidence
P8 - Obtaining, Evaluating, and Communicating Information

The entire standards document may be viewed at: http://www.state.nj.us/education/cccs/2016/science/ http://www.nextgenscience.org/next-generation-science-standards.

APPENDIX III

New Jersey Student Learning Standards for Educational Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

The entire standards document may be viewed at: http://www.nj.gov/education/cccs/2014/tech/

APPENDIX IV

New Jersey Student Learning Standards - Social Studies Practices

Social Studies practices are the skills that individuals who work in the field of social sciences use on a regular basis. Because the purpose of social studies is to provide students with the knowledge, skills and attitudes they need to be active, informed, responsible individuals and contributing members of their communities, many of the practices can be applied to daily life.

Practice	Description
Developing Questions and Planning Inquiries	Developing insightful questions and planning effective inquiry involves identifying the purposes of different questions to understand the human experience, which requires addressing real world issues. Inquiries incorporating questions from various social science disciplines build understanding of the past, present and future; these inquiries investigate the complexity and diversity of individuals, groups, and societies.
Gathering and Evaluating Sources	Finding, evaluating and organizing information and evidence from multiple sources and perspectives are the core of inquiry. Effective practice requires evaluating the credibility of primary and secondary sources, assessing the reliability of information, analyzing the context of information, and corroborating evidence across sources. Discerning opinion from fact and interpreting the significance of information requires thinking critically about ourselves and the world.
Seeking Diverse Perspectives	Making sense of research findings requires thinking about what information is included, whether the information answers the question, and what may be missing, often resulting in the need to complete additional research. Developing an understanding of our own and others' perspectives builds understanding about the complexity of each person and the diversity in the world. Exploring diverse perspectives assists students in empathizing with other individuals and groups of people; quantitative and qualitative information provides insights into specific people, places, and events, as well as national, regional, and global trends.
Developing Claims and Using Evidence	Developing claims requires careful consideration of evidence, logical organization of information, self-awareness about biases, application of analysis skills, and a willingness to revise conclusions based on the strength of evidence. Using evidence responsibly means developing claims based on factual evidence, valid reasoning, and a respect for human rights.

Presenting Arguments and Explanations	Using a variety of formats designed for a purpose and an authentic audience forms the basis for clear communication. Strong arguments contain claims with organized evidence and valid reasoning that respects the diversity of the world and the dignity of each person. Writing findings and engaging in civil discussion with an audience provides a key step in the process of thinking critically about conclusions and continued inquiry.
Engaging in Civil Discourse and Critiquing Conclusions	Assessing and refining conclusions through metacognition, further research, and deliberative discussions with diverse perspectives sharpens the conclusions and improves thinking as a vital part of the process of sense making. Responsible citizenship requires respectfully listening to and critiquing claims by analyzing the evidence and reasoning supporting them. Listening to and understanding contrary views can deepen learning and lay the groundwork for seeking consensus.
Taking Informed Action	After thoroughly investigating questions, taking informed action means building consensus about possible actions and planning strategically to implement change. Democracy requires citizens to practice discussion, negotiation, coalition-seeking, and peaceful conflict resolution. When appropriate, taking informed action involves creating and/or implementing action plans designed to solve problems and create positive change.

The entire standards document may be viewed at https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-SS.pdf

APPENDIX V

New Jersey Student Learning Standards for 21st Century Life & Careers

Career Ready Practices

CRP2. Apply appropriate academic and technical skills
CRP4. Communicate clearly and effectively and with reason
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
CRP11. Use technology to enhance productivity.

The entire standards document may be viewed at http://www.state.nj.us/education/cccs/

APPENDIX VI

New Jersey Student Learning Standards for English Language Arts

Progress Indicators for Reading Science and Technical Subjects

RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

The entire standards document can be viewed at http://www.state.nj.us/education/cccs/2016/ela/

APPENDIX VII

New Jersey Student Learning Standards for Mathematical Practice

SMP1 – Make sense of problems and persevere in solving them
SMP2 – Reason abstractly and quantitatively
SMP3 – Construct viable arguments and critique the reasoning of others
SMP4 – Model with mathematics
SMP5 – Use appropriate tools strategically
SMP6 – Attend to precision
SMP7 – Look for and make use of structure
SMP8 – Look for and express regularity in repeated reasoning.

The entire standards document may be viewed at http://www.state.nj.us/education/aps/cccs/math

APPENDIX VIII

Integrated Accommodations and Modifications for Special Education Students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans (N.J.A.C. 6A: 8)

Special Education
ENVIRONMENT
Preferential Seating
Adjust time for completion of assignments when needed
Adjust length of assignments when needed
Allow additional oral response time
Break tasks (including long range assignments) into manageable steps
Provide copies of notes
Reduce the number of problems on a page
Provide assistance with organizing a notebook or folder
Repeat/ clarify directions when needed
Make frequent checks for work/assignment completion.
Modify homework and class work if needed
Extend time on tests/quizzes
Provide study guides for tests
Provide oral component when needed

Modify format when needed- (ex: limit choices, word bank, shortened written responses)
Allow a private workspace when needed (study carrel, separate desk, desk away from the group)
Allow opportunities for movement (e.g., help with supplies, change to different part of room to work, carry messages to office)
Assist the student to keep only the materials required for the lesson on the desktop
Provide a seat away from distractions (or noise)
MATERIAL/BOOKS/EQUIPMENT
Allow use of a calculator
Allow use of a number line
Allow use of counting chips
Modify worksheets
Provide visual aids (pictures, flash cards, etc.)
Provide auditory aids (cues, tapes, etc.)
Use manipulatives
Provide hands-on learning activities
INSTRUCTIONAL STRATEGIES
Check work in progress
Provide immediate feedback
Provide extra drill/practice
Provide review sessions
Provide models

Highlight key words
Provide pictures/charts
Use mnemonics
Support auditory presentations with visuals
Have student restate information
Provide lecture notes/outline
Give oral reminders
Give visual reminders
Review directions
Use graphic organizers
Assign partners
Repeat instructions
Display key vocabulary
Monitor assignments
Provide visual reinforcement
Provide concrete examples
Use vocabulary word bank
ORGANIZATION
Post assignments
Provide a desktop list of tasks
Give one paper at a time

Provide extra space for work
List sequential steps
Provide folders to hold work
Post routines
Use pencil box for tools
Reorganize poorly designed worksheets to create simple, easy-to-follow layouts and formats
Give advance warning when transition is going to take place
Provide structure for success
Provide a contract, timer, etc., for self-monitoring
Give the student a prompt when he/she is off task (e.g., move close to the student; speak to the student, etc.)
TEST/QUIZZES/TIME
Give prior notice of test
Provide oral testing
Provide extra time for written work
Provide modified tests
Rephrase test questions/directions
Preview test procedures
Provide shortened tasks
Provide extra time for tests
Read test to student

Provide test study guides
Limit multiple choice options
Provide extra time for projects
Pace long term projects
Simplify test wording
Provide hands-on projects
Allow extra response time
ENGLISH LANGUAGE LEARNERS
GRADING
Standard Grades vs. Pass/Fail
CONTINUUM OF ENGLISH LANGUAGE DEVELOPMENT
Pre K-K WIDA CAN DO Descriptors
Grades 1-2 WIDA CAN DO Descriptors
Grades 3-5 WIDA CAN DO Descriptors
Grades 6-8 WIDA CAN DO Descriptors
Grades 9-12 WIDA CAN DO Descriptors
SIOP COMPONENTS AND FEATURES
PREPARATION
Write content objectives clearly for students
Write language objectives clearly for students
Choose content concepts appropriate for age and educational background levels of students

Identify supplementary materials to use
Adapt content to all levels of students proficiency
Plan meaningful activities that integrate lesson concepts with language practices opportunities for reading, writing, listening, and/or speaking
BUILDING BACKGROUND
Explicitly link concepts to students' backgrounds and experiences
Explicitly link past learning and new concepts
Emphasize key vocabulary for students
COMPREHENSIBLE INPUT
Use speech appropriate for students' proficiency level
Explain academics tasks clearly
Use a variety of techniques to make content concepts clear (e.g. modeling, visuals, hands-on activities, demonstrations, gestures, body language)
STRATEGIES
Provide ample opportunities for students to use strategies (e.g. problem solving, predicting, organizing, summarizing, categorizing, evaluating, self-monitoring)
Use scaffolding techniques consistently throughout lesson
Use a variety of question types including those that promote higher-order thinking skills throughout the lesson
INTERACTION
Provide frequent opportunities for interaction and discussion between teacher/students and among students about lessons concepts, and encourage elaborated responses
Use group configurations that support language and content objectives of the lesson
Provide sufficient wait time for student responses consistently
Give ample opportunities for students to clarify key concepts in LI as needed with aide, peer, or LI text

PRACTICE/APPLICATION
Provide hands-on materials and/ manipulatives for students to practice using new content knowledge
Provide activities for students to apply content and language knowledge in the classroom
Provide activities that integrate all language skills
LESSON DELIVERY
Support content objectives clearly
Support language objectives clearly
Engage students approximately 90-100% of the period
Pace the lesson appropriately to the students' ability level
REVIEW/EVALUATION
Give a comprehensive review of key vocabulary
Give a comprehensive review of key content concepts
Provide feedback to students regularly on their output
Conduct assessments of students comprehension and learning throughout lesson and all lesson objectives
STUDENTS AT RISK OF SCHOOL FAILURE (I&RS RESOURCE MANUAL)
ACADEMICS
Provide necessary services (Lit Support, Math Support, OT, PT, speech, etc.)
Literacy Support Interventions (Appendix B of IS forms)
Prompt before directions/questions are verbalized with visual cue between teacher and student
Task list laminated and placed on desk for classroom routines and organization
Preferential seating
Provide structure and positive reinforcements

Sustained working time connected to reward (If/Then statement)
Frequently check for understanding
Graphic organizers
Tracker
Slant board
Access to accurate notes
Additional time to complete tasks/long-term projects with adjusted due dates
Limit number of items student is expected to learn at one time
Break down tasks into manageable units
Directions repeated, clarified, or reworded
Frequent breaks during class
Allow verbal rather than written responses
Modify curriculum content based on student's ability level
Reduce readability level of materials
Allow typed rather than handwritten responses
Use of calculator
Use of a math grid
Provide models/organizers to break down independent tasks
Access to electronic text (e.g. Downloaded books)
Provide books on tape, CD, or read aloud computer software
Provide opportunities for using a Chromebook as well as assistive technologies
Provide buddy system

Adjust activity, length of assignment, and/or number of problems, including homework
Provide assessments in a small group setting
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Communication with parents
Gradual release of responsibility related to writing prompts (Proximity, Sentence Starter, Attempt independently)
Rubric-based checklist
Target specific number of details and focus on organization with post-its
Accept late work/homework without penalty
Previewing material (access to PowerPoint slides, novels, syllabus, study guides when available)
SOCIAL/EMOTIONAL
Children's books addressing presenting problem
Student jots down presenting problem and erase when it goes away
Meet with guidance counselor
Student jots down presenting problem and erase when it goes away
Attendance plan
Utilize nurse during episodes of presenting problem
Provide short breaks
Attendance plan
Communication with parents
Assign "jobs" to reduce symptoms
Counseling check-ins

Praise whenever possible
ATTENTION/FOCUS
Seat student near front of room
Preferential seating
Monitor on-task performance
Arrange private signal to cue student to off-task behavior
Establish and maintain eye contact when giving oral directions
Stand in proximity to student to focus attention
Provide short breaks when refocusing is needed
Use study carrel
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Refocusing and redirection
Behavior/time management system
Group directions 1 step at a time
Assign "jobs" to reduce symptoms
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Extended time on assignments/assessments
Provide assessments in a small group setting
Provide buddy system

Establish and maintain eye contact when giving oral directions
Permit the use of headphones while working
SCHOOL REFUSAL/ELEVATED ABSENTEEISM
Attendance plan
GIFTED AND TALENTED STUDENTS
CURRICULUM
Acceleration
Compacting
Telescoping
Advanced Placement Courses
INSTRUCTION
Grouping
Independent Study
Differentiated Conferencing
Project-Based Learning
Competitions
Cluster Grouping Model with Flexible Grouping
Differentiated Instruction
Summer Work
Parent Communication

WESTFIELD PUBLIC SCHOOLS
Westfield, New Jersey

Office of Instruction

Course of Study

MAKERSPACE

School .....Westfield High School
Department.....Practical Arts
Length of Course.....Half Year
Credits.....2.5
Grade Level(s) 9-12
Prerequisite .....None
Date.....

I. RATIONALE, DESCRIPTION AND PURPOSE

Makerspace is a half-year practical arts elective course open to freshmen, sophomores, juniors and seniors who wish to experiment, problem-solve, create, build and deconstruct. The course places students in an environment filled with possibilities and ideas, and students have the chance to deepen their ingenuity in any number of ways. They will gain an understanding of designing through inquiry, and will put this to work using various tools. This course is intended to provide students with the opportunity to build resilience, synthesize information, experiment, construct, design and communicate their ideas. It also serves as an introductory course toward the higher-level engineering, design, industrial arts and architecture courses at Westfield High School. In addition, Makerspace complements the broader STEM movement in our schools, and offers our students additional chances to work on the social and emotional competencies that support their success across disciplines.

Makerspaces can be found in schools throughout the district. A Makerspace course in Westfield High School offers an opportunity to model many of the principles of student-centered inquiry that educators are promoting throughout our schools. The constructionist learning ideology argues that our best learning takes place when students are building their own understanding through the process of constructing things that they will share with others. In addition, the Design Thinking model seeks to shift students away from feeling like they need to reproduce knowledge that teachers have laid out for them, and instead toward building upon the knowledge they are given to learn even more. At a time when many students are "doing school" with an eye toward ready-made knowledge, this philosophy encourages exploration, comfort with discomfort, and a search for answers through our own innovation and collaboration. In a sense, Makerspace is more of a mindset than any specific place or classroom; it offers students the chance to move beyond consumption and into the much richer and more rewarding act of creation. The end products are not the point here; it is the process that holds within it each student's educational growth.

There will be units and stations within the Makerspace room with activities ranging from building or deconstructing objects to reusing things to programming. The units and stations will focus on process, and the Design Thinking model and constructionist learning philosophy leave ample room for student creation and discovery. In essence, the course gives students of all grade and skill levels the chance to dive into hands-on activities while at the same time helping them learn how to learn.

II. OBJECTIVES

The following objectives are aligned with the New Jersey Student Learning Standards for: Technology, 21st Century Life and Careers, Science, Career Ready Practices, English Language Arts, and the New Jersey Competencies for Social and Emotional Learning.

A. Identify and practice the norms and habits of mind of Maker-Centered Education and Guided Inquiry Design
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8
New Jersey Competencies for SEL: Responsible Decision-Making

B. Develop the skills to design one's own design work through documentation
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
NJ Student Learning Standards for English Language Arts: NJSLSA.W5
New Jersey Competencies for SEL: Self-Awareness, Self-Management, Responsible Decision-Making

C. Develop the ability to ideate, create and construct
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
New Jersey Competencies for SEL: Self-Awareness, Self-Management, Responsible Decision-Making

D. Develop the ability to problem-solve, experiment and navigate ambiguity
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
New Jersey Competencies for SEL: Self-Awareness, Self-Management, Responsible Decision-Making

E. Communicate with and learn from others in exploring solutions
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP4, CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
NJ Student Learning Standards for English Language Arts: NJSLSA.SL1
New Jersey Competencies for SEL: Self-Awareness, Social Awareness, Relationship Skills

F. Share ideas, feedback, solutions and successes with others
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP4, CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
NJ Student Learning Standards for English Language Arts: NJSLSA.SL1
New Jersey Competencies for SEL: Social Awareness, Relationship Skills

G. Practice and learn from the act of deconstructing
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
New Jersey Competencies for SEL: Responsible Self-Awareness, Responsible Decision-Making

H. Practice and learn from the act of upcycling and reusing
NJ Student Learning Standards for Technology 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8
NJ Student Learning Standards for Science: HS-ETS1-2
New Jersey Competencies for SEL: Responsible Self-Awareness, Responsible Decision-Making

I. Practice and learn from the acts of coding and programming
NJ Student Learning Standards for Technology 8.1, 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8, CRP11
NJ Student Learning Standards for Science: HS-ETS1-2

J. Practice both hands-on experimentation and simulations
NJ Student Learning Standards for Technology 8.1, 8.2
NJ Student Learning Standards for 21st Century Life and Careers 9.3.ST-ET
NJ Career Ready Practices CRP6, CRP8, CRP11
NJ Student Learning Standards for Science: HS-ETS1-2
New Jersey Competencies for SEL: Responsible Self-Awareness, Responsible Decision-Making

K. Collaborate with peers through student partnerships
NJ Career Ready Practice CRP4
NJ Student Learning Standards for English Language Arts: NJSLSA.SL1
New Jersey Competencies for SEL: Social Awareness, Relationship Skills

III. CONTENT, SCOPE AND SEQUENCE

A. Introduction to Makerspace (~2 weeks)
1. Class norms
2. Maker-centered design
    a. Principles of experimentation
    b. Principles of problem-solving
    c. Principles of building intentionally
3. Guided inquiry design
4. Design Thinking model
5. Core abilities of design
6. Documentation
7. Resources
8. Safety norms

B. Rapid Prototyping (~2 weeks)
    1. Introductory examples
        a. Paperclip Brainstorm
        b. Spaghetti-Marshmallow Challenge
        c. Others
    2. Everyday-material assignments
        a. Experimentation
        b. Learning from failure
        c. Problem-solving
    3. Simulations

C. Electronics and Control (~4 weeks)
    1. Programming
        a. Composition of a program
        b. Simulation and testing of a program
        c. De-bugging of a program
        d. Adjustments to a program before completion
    2. Components and/or Robotics
        a. Understanding of the hardware
        b. Assembly
        c. Experimentation
        d. Simulation
        e. Adjustments
        f. Problem-solving

D. Building Intentionally (~6 weeks)
    1. Additive
        a. Retrieval of existing file
        b. Creation of file
        c. Incorporation of software
        d. Monitoring of machine
        e. Troubleshooting
    2. Subtractive
        a. Act of planning
        b. Measurements
        c. Incorporation of software
        d. Act of cutting
        e. Act of testing
    3. Assembling
        a. Act of planning
        b. Measurements
        c. Act of cutting
        d. Act of combining
        e. Act of testing

E. Reverse Engineering (~2 weeks)
    1. Fundamentals of reverse engineering (deconstructing)
    2. Deconstruction of devices
        a. Appropriate tools for deconstructing
        b. Documentation
        c. Identification of parts
        d. Determination of functions
    3. Plans for putting it back together / upcycling
    4. Experimentation with reconstructing the device
    5. Reflection on ways to improve upon the device

F. Repurposing and Reflection (~4 weeks)
    1. New uses for common items
        a. Summative project based on semester's work
        b. Connections to sustainability of our planet
        c. Presentation of projects
        d. Reflection on semester's work

IV. INSTRUCTIONAL TECHNIQUES

Teachers employ a variety of teaching methodologies and instructional approaches to accommodate differences in readiness levels, learning styles and the diversity of learners. In order to differentiate instruction based upon student readiness, the teacher will vary the pace, complexity and depth of instruction. Techniques include, but are not limited to:

A. Demonstration/modeling
B. Teacher-directed, whole-group instruction
C. Discussion
D. Reading
E. Hands-on activities: small, collaborative groups & individual work
F. Experimentation, problem-solving
G. Feedback
H. Simulation
I. Video with corresponding activities
J. Journaling
K. Projects and student-generated presentations
L. Flexible grouping
M. Use of technology
N. For strategies to differentiate for special education students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans, please consult the Accommodations and Modifications appendix in the appendices section of this document.

V. EVALUATION

Multiple techniques are employed to measure and assess student performance in this hands-on, creation-based course. Evaluation tools include, but are not limited to, the following:

A. Makerspace journals
B. Exercises and projects
C. Evaluation of project work
D. Self- and peer assessments
E. Presentations
F. Reports
G. Self- and peer critiques.

VI. PROFESSIONAL DEVELOPMENT

The following recommended activities support the curriculum and provide opportunities for the teacher's continued professional development:

A. Professional development within district
B. Additional professional development outside district, including workshops and courses
C. State and national conferences
D. Visiting and/or networking with colleagues in New Jersey schools
E. Professional organizations.

APPENDIX I

New Jersey Student Learning Standards For Technology

NJSLS 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

STANDARD 8.2 Technology Education, Engineering, and Design: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

The entire standards document may be viewed at https://www.nj.gov/education/aps/cccs/tech/

APPENDIX II

New Jersey Student Learning Standards for 21st Century Life and Careers

Career Cluster® : Agriculture, Food & Natural Resources (AG), Pathway: Natural Resources Systems (AG-NR)

9.3.12.AG-NR.2 Analyze the interrelationships between natural resources and humans.

Career Cluster® : Architecture & Construction (AC)

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.

9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

Pathway: Design/Pre -construction (AC- DES)

9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.

9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings.

9.3.12.AC-DES.5 Identify the diversity of needs, values and social patterns in project design, including accessibility standards.

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.

Career Cluster® : Science, Technology, Engineering & Mathematics (ST)

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

Pathway: Engineering & Technology Career Pathway (ST-ET)

9.3.ST-ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST-ET.2 Display and communicate STEM information.

9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST-ET.4 Apply the elements of the design process.

9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems.

Pathway: Science & Mathematics Career Pathway (ST -SM)

9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

The entire standards document may be viewed at https://www.state.nj.us/education/cccs/2014/career/93.pdf

APPENDIX III

New Jersey Student Learning Standards for Science / Next Generation Science Standards

Engineering Design

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3. 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.

HS-ETS1-4. 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.

The entire standards document may be viewed at https://www.nj.gov/education/cccs/2016/science/HS-ETS1.pdf

Earth and Human Activity

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

The entire standards document may be viewed at f https://www.state.nj.us/education/cccs/2016/science/HS-ESS3.pdf

APPENDIX IV

New Jersey Career Ready Practices

CRP1. Act as a responsible and contributing citizen and employee.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

The entire standards document may be viewed at https://www.state.nj.us/education/cccs/2014/career/CareerReadyPractices.pdf

APPENDIX V

New Jersey Student Learning Standards for English Language Arts

Anchor Standards for Speaking and Listening

NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

NJSLSA.SL4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

NJSLSA.SL5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

NJSLSA.SL6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

The entire standards document may be viewed at ***https://www.state.nj.us/education/cccs/2016/ela/q0910.pdf***

Progress Indicators for Reading Science and Technical Subjects

RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

RST.11-12.2. Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST.11-12.5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11-12.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. Integration of Knowledge and Ideas

RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

RST.11-12.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

The entire standards document may be viewed at https://www.state.nj.us/education/cccs/2016/ela/CompanionG1112.pdf

APPENDIX VI

New Jersey Competencies for Social and Emotional Learning

Social and emotional learning (SEL) refers to the process by which children and adults acquire and effectively apply the knowledge, attitudes and skills necessary to do the following: understand and manage emotions; set and achieve positive goals; feel and show empathy for others; and make responsible decisions. Students in SEL programs are more likely to attend school and receive better grades, and are less likely to have conduct problems. Successful infusion of SEL can result in positive behaviors, increased academic success, and caring communities.

The New Jersey Department of Education has been promoting social and emotional learning to enhance the building of positive school climates and the healthy development of young people.

The entire competency document may be viewed at https://www.state.nj.us/education/students/safety/sandp/sel/.

APPENDIX VII

Integrated Accommodations and Modifications for Special Education Students, English Language Learners, Students at Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans

Teachers and administrators can consult these accommodations and modifications in order to:

- implement additional ideas to meet the needs of the students in these subgroups
- meet the minimum number of interventions before referring to I&RS
- include them in the Instructional Techniques section of the Curriculum Revision/Writing template
- assist any students or whole group that might benefit from them.

Special Education
ENVIRONMENT
Preferential Seating
Adjust time for completion of assignments when needed
Adjust length of assignments when needed
Allow additional oral response time
Break tasks (including long range assignments) into manageable steps
Provide copies of notes
Reduce the number of problems on a page

Provide assistance with organizing a notebook or folder
Repeat/ clarify directions when needed
Make frequent checks for work/assignment completion.
Modify homework and class work if needed
Extend time on tests/quizzes
Provide study guides for tests
Provide oral component when needed
Modify format when needed- (ex: limit choices, word bank, shortened written responses)
Allow a private workspace when needed (study carrel, separate desk, desk away from the group)
Allow opportunities for movement (e.g., help with supplies, change to different part of room to work, carry messages to office)
Assist the student to keep only the materials required for the lesson on the desktop
Provide a seat away from distractions (or noise)
MATERIAL/BOOKS/EQUIPMENT

Allow use of a calculator
Allow use of a number line
Allow use of counting chips
Modify worksheets
Provide visual aids (pictures, flash cards, etc.)
Provide auditory aids (cues, tapes, etc.)
Use manipulatives
Provide hands-on learning activities
INSTRUCTIONAL STRATEGIES
Check work in progress
Provide immediate feedback
Provide extra drill/practice
Provide review sessions

Provide models
Highlight key words
Provide pictures/charts
Use mnemonics
Support auditory presentations with visuals
Have student restate information
Provide lecture notes/outline
Give oral reminders
Give visual reminders
Review directions
Use graphic organizers
Assign partners
Repeat instructions

Display key vocabulary
Monitor assignments
Provide visual reinforcement
Provide concrete examples
Use vocabulary word bank
ORGANIZATION
Post assignments
Provide a desktop list of tasks

Give one paper at a time
Provide extra space for work
List sequential steps
Provide folders to hold work
Post routines

Use pencil box for tools
Reorganize poorly designed worksheets to create simple, easy-to-follow layouts and formats
Give advance warning when transition is going to take place
Provide structure for success
Provide a contract, timer, etc., for self-monitoring
Give the student a prompt when he/she is off task (e.g., move close to the student, speak to the student, etc.)
TEST/QUIZZES/TIME
Give prior notice of test
Provide oral testing
Provide extra time for written work
Provide modified tests
Rephrase test questions/directions
Preview test procedures

Provide shortened tasks
Provide extra time for tests
Read test to student
Provide test study guides
Limit multiple choice options
Provide extra time for projects
Pace long term projects
Simplify test wording
Provide hands-on projects
Allow extra response time

ENGLISH LANGUAGE LEARNERS
GRADING

Standard Grades vs. Pass/Fail
CONTINUUM OF ENGLISH LANGUAGE DEVELOPMENT
Pre K-K WIDA CAN DO Descriptors
Grades 1-2 WIDA CAN DO Descriptors
Grades 3-5 WIDA CAN DO Descriptors
Grades 6-8 WIDA CAN DO Descriptors
Grades 9-12 WIDA CAN DO Descriptors
SIOP COMPONENTS AND FEATURES
PREPARATION
Write content objectives clearly for students
Write language objectives clearly for students
Choose content concepts appropriate for age and educational background levels of students
Identify supplementary materials to use
Adapt content to all levels of students proficiency
Plan meaningful activities that integrate lesson concepts with language practices opportunities for reading, writing, listening, and/or speaking
BUILDING BACKGROUND

Explicitly link concepts to students' backgrounds and experiences
Explicitly link past learning and new concepts
Emphasize key vocabulary for students
COMPREHENSIBLE INPUT
Use speech appropriate for students' proficiency level
Explain academics tasks clearly
Use a variety of techniques to make content concepts clear (e.g. modeling, visuals, hands-on activities, demonstrations, gestures, body language)
STRATEGIES
Provide ample opportunities for students to use strategies (e.g. problem solving, predicting, organizing, summarizing, categorizing, evaluating, self-monitoring)
Use scaffolding techniques consistently throughout lesson
Use a variety of question types including those that promote higher-order thinking skills throughout the lesson
INTERACTION
Provide frequent opportunities for interaction and discussion between teacher/students and among students about lessons concepts, and encourage elaborated responses
Use group configurations that support language and content objectives of the lesson
Provide sufficient wait time for student responses consistently

Give ample opportunities for students to clarify key concepts in LI as needed with aide, peer, or LI text
PRACTICE/APPLICATION
Provide hands-on materials and/ manipulatives for students to practice using new content knowledge
Provide activities for students to apply content and language knowledge in the classroom
Provide activities that integrate all language skills
LESSON DELIVERY
Support content objectives clearly
Support language objectives clearly
Engage students approximately 90-100% of the period
Pace the lesson appropriately to the students' ability level
REVIEW/EVALUATION
Give a comprehensive review of key vocabulary
Give a comprehensive review of key content concepts
Provide feedback to students regularly on their output
Conduct assessments of students comprehension and learning throughout lesson and all lesson objectives

STUDENTS AT RISK OF SCHOOL FAILURE (I&RS RESOURCE MANUAL)
ACADEMICS
Provide necessary services (Lit Support, Math Support, OT, PT, speech, etc.)
Literacy Support Interventions (Appendix B of IS forms)
Prompt before directions/questions are verbalized with visual cue between teacher and student
Task list laminated and placed on desk for classroom routines and organization
Preferential seating
Provide structure and positive reinforcements
Sustained working time connected to reward (If/Then statement)
Frequently check for understanding
Graphic organizers
Tracker

Slant board
Access to accurate notes
Additional time to complete tasks/long-term projects with adjusted due dates
Limit number of items student is expected to learn at one time
Break down tasks into manageable units
Directions repeated, clarified, or reworded
Frequent breaks during class
Allow verbal rather than written responses
Modify curriculum content based on student's ability level
Reduce readability level of materials
Allow typed rather than handwritten responses
Use of calculator
Use of a math grid

Provide models/organizers to break down independent tasks
Access to electronic text (e.g. Downloaded books)
Provide books on tape, CD, or read aloud computer software
Provide opportunities for using a Chromebook as well as assistive technologies
Provide buddy system
Adjust activity, length of assignment, and/or number of problems, including homework
Provide assessments in a small group setting
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Communication with parents
Gradual release of responsibility related to writing prompts (Proximity, Sentence Starter, Attempt independently)
Rubric-based checklist
Target specific number of details and focus on organization with post-its
Accept late work/homework without penalty

Previewing material (access to PowerPoint slides, novels, syllabus, study guides when available)
SOCIAL/EMOTIONAL
Children's books addressing presenting problem
Student jots down presenting problem and erase when it goes away
Meet with guidance counselor
Student jots down presenting problem and erase when it goes away
Attendance plan
Utilize nurse during episodes of presenting problem
Provide short breaks
Attendance plan
Communication with parents
Assign "jobs" to reduce symptoms
Counseling check-ins

Praise whenever possible
ATTENTION/FOCUS
Seat student near front of room
Preferential seating
Monitor on-task performance
Arrange private signal to cue student to off-task behavior
Establish and maintain eye contact when giving oral directions
Stand in proximity to student to focus attention
Provide short breaks when refocusing is needed
Use study carrel
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Refocusing and redirection

Behavior/time management system
Group directions 1 step at a time
Assign "jobs" to reduce symptoms
Arrange physical layout to limit distractions
Frequently ask questions to engage student
Educate/train relevant staff with regards to the signs/symptoms, promote tolerance of needs, and/or providing assistance
Extended time on assignments/assessments
Provide assessments in a small group setting
Provide buddy system
Establish and maintain eye contact when giving oral directions
Permit the use of headphones while working
SCHOOL REFUSAL/ELEVATED ABSENTEEISM
Attendance plan
GIFTED AND TALENTED STUDENTS

CURRICULUM
Acceleration
Compacting
Telescoping
Advanced Placement Courses
INSTRUCTION
Grouping
Independent Study
Differentiated Conferencing
Project-Based Learning
Competitions
Cluster Grouping Model with Flexible Grouping
Differentiated Instruction

Summer Work
Parent Communication