MEDFORD HIGH SCHOOL
COURSE SYLLABUS

Department:	Science

Course Title:	Chemistry

Level and/or Grade:	Honors; Grades 10-11

Prerequisite:	A grade of "B-" or better in Honors Biology or "A-" or better in Standard Biology and "B-"or better in Algebra 1 and concurrent enrollment in Algebra 2 or "B" or better in Algebra 2

Course Description:

This course is an accelerated and honors version of Standard Chemistry. Strong mathematical and reading abilities are essential. Standards are covered in more depth and at higher levels of sophistication than those for the standard level course. The course uses inquiry and lab-based experiences to explore the properties of matter and how these properties help to organize elements on the periodic table. Students develop an understanding of the structure of the atom and of chemical reactions, including the involvement of energy and sub-atomic particles to better understand the nature of chemical changes. They learn about chemical reactions (e.g. oxidation-reduction, combustion, decomposition), and gain an understanding of acids and bases and rates of reaction. By calculating stoichiometry problems and molar concentrations, students strengthen proportionality and other mathematical skills. They will encounter other standards in the areas of *Properties of Matter; Atomic Structure and Nuclear Chemistry; Periodicity; Chemical Bonding; Chemical Reactions and Stoichiometry; States of Matter, Kinetic Theory, and Thermochemistry; Solutions, Rates of Reactions, and Equilibrium; and Acids, Bases, and Reduction-Oxidation Reactions.*

Learning Standards: *Through inquiry, experimentation, labs, use of tools, discussion, presentation, and composition, students will be able to…*

Properties of Matter:
- Identify and explain physical properties that are used to classify matter.
- Distinguish between chemical and physical changes.
- Explain the difference between mixtures and pure substances.
- Describe the states of matter in terms of energy, particle motion, and phase transitions.

Atomic Structure and Nuclear Chemistry:
- Trace the development of atomic theory and structure of an atom from the ancient Greeks to the present.
- Use Bohr's model of the atom to interpret changes (emission, absorption) in electron energies in the hydrogen atom corresponding to emission transitions between quantum levels.
- Describe the electromagnetic spectrum; identify regions of the electromagnetic spectrum.
- Identify the major components of the nuclear atom; explain how they interact.
- Interpret Dalton's atomic theory in terms of the Laws of conservation of Mass, Constant Composition, and Multiple Proportions.
- Write the electron configurations for elements of the periodic table.
- Describe alpha, beta, and gamma particles; discuss properties of alpha, beta, and gamma radiation.
- Write balanced equations.
- Explain the concept of half-life of a radioactive element; describe the process of radioactive decay.

Atomic Structure and Nuclear Chemistry (cont.):

- Explain the difference between stable and unstable isotopes.
- Compare nuclear fission and nuclear fusion and mass defect.

Periodicity:

- Explain the relationship of an element's position on the periodic table to its atomic number and mass.
- Use the periodic table to identify metals, nonmetals, metalloids, families/groups, periods, valence electrons, and reactivity with other elements in the table.
- Relate the position of an element on the periodic table to its electron configuration.
- Identify trends on the periodic table.

Chemical Bonding:

- Explain how atoms combine to form compounds through both ionic and covalent bonding.
- Draw Lewis dot structures for simple molecules.
- Relate electronegative and ionization energy to the type of bonding an element is likely to undergo.
- Predict the geometry of simple molecules and their polarity (valence-shell electron pair repulsion).
- Identify the types of intermolecular forces present based on molecular geometry and polarity.
- Predict chemical formulas based on the number of valence electrons.
- Identify how hydrogen bonding in water affects a variety of physical, chemical, and biological phenomena (such as, surface tension, capillary action, density, and boiling point).
- Name and write chemical formulas for simple ionic and molecular compounds.

Chemical Reactions and Stoichiometry:

- Balance chemical equations by applying the laws of conservation of mass.
- Recognize synthesis, decomposition, single displacement, double displacement, combustion, and neutralization reactions.
- Understand the mole concept in terms of number of particles, mass, and gaseous volume.
- Determine molar mass, percent composition, empirical formulas, and molecular formulas.
- Calculate mass-mass, mass-volume, volume-volume, and limiting reactant problems.
- Calculate percent yield in a chemical reaction.

States of Matter, Kinetic Molecular Theory, and Thermochemistry:

- Using the kinetic molecular theory, explain the relationship between pressure and volume, volume and temperature, and number of particles in a gas sample.
- Interpret Dalton's empirical Law of Partial Pressures and use it to calculate partial and total pressures.
- Use the combined gas law to determine changes in pressure, volume, and temperature.
- Perform calculations using the ideal gas law.
- Describe the conditions under which a real gas deviates from the ideal behavior.
- Explain the relationship between temperature and average kinetic energy.
- Using the kinetic molecular theory, describe and contrast the properties of gases, liquids, and solids.
- Describe and interpret the law of conservation of energy.
- Explain the difference between an endothermic process and an exothermic process.
- Analyze the energy changes involved in physical and chemical processes using calorimetry.
- Apply Hess' Law to determine the heat of a reaction.
- Use Heat Energy and Entropy to determine free energy, and use it to predict spontaneity.
- Explain the relationship between energy transfer and disorder in the universe.

Solutions, Rates of Reaction, and Equilibrium:

- Describe the process by which solutes dissolve in solvents.
- Calculate concentration in terms of molarity, molality, and percent by mass.
- Identify and explain the factors affecting the rate of dissolving (e.g. temperature, concentration, mixing).
- Use a solubility curve to determine saturation values at different temperatures.
- Calculate the freezing point depression and boiling point elevation of a solution.
- Use the structures of crystals to explain their behaviors.
- Identify the factors that affect the rate of a chemical reaction.

Solutions, Rates of Reaction, and Equilibrium (cont.):

- Define the role of activation energy in a chemical reaction.
- Explain rates of reaction in terms of collision frequency, energy of collisions, and orientation of colliding molecules.
- Understand and predict the shift in equilibrium when the system is subjected to stress (LeChatelier's Principle); identify factors that cause the shift (concentration, pressure, volume, temperature).
- Write the equilibrium expression and calculate the equilibrium constant for a reaction (or acid's imitation or a salt's dissolving).

Acids and Bases and Oxidation-Reduction Reactions:

- Define the Arrhenius theory of acids and bases in terms of the presence of hydronium and hydroxide ions in water and the Bronsted-Lowry theory of acids and bases in terms of proton donor and acceptor.
- Calculate the pH or pOH of aqueous solutions using the hydronium or hydroxide ion concentration.
- Compare and contrast the nature, behavior, concentration, and strength of acids and bases.
- Explain how indicators are used in titrations and how they are selected.
- Describe an acid-base titration. Identify and explain significance of equivalence point.
- Identify a buffer and explain how it works.
- Use principals of solubility and pH to identify ions in a qualitative analysis.
- Describe the chemical processes of oxidation and reduction.
- Assign oxidation numbers in a reaction.
- Balance oxidation-reduction equations using half-reactions.

Electrochemistry:

- Identify the components, and describe the processes that occur in an electrochemical cell.
- Explain how a typical battery works.
- Compare and contrast voltaic and electrolytic cells and their uses.
- Calculate net voltage of a cell given a table of standard reduction potentials.
- Use Faraday's Law to determine amounts of plating/gal evolved.

Organic Chemistry:

- Name all the simple hydrocarbons and benzenes.
- Identify basic functional groups.
- Predict and name products of simple reactions.
- Draw isomers of organic structures with their names.

Standards for Literacy in History/Social Studies, Science, and Technical Subjects:

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Range of Reading and Level of Text Complexity

10. Read and comprehend complex literary and informational texts independently and proficiently.

Standards for Writing in History/Social Studies, Science, and Technical Subject:

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development organization and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, and trying a new approach.
6. Use technology, including the internet, to produce and publish writing and to interact and collaborate with others.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects based on focused questions,

demonstrating understanding of the subject under investigation.

8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary and informational texts to support analysis, reflection, and research.

Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Course Alignment with 21st Century Learning Expectations:

Students will…

- Become self-directed learners.
- Communicate effectively.
- Apply problem-solving skills and critical and creative thinking.
- Use technology appropriately as a tool for learning, collaboration, presentation, research, and design.
- Act with integrity, respect and responsibility toward themselves, others and the environment.
- Exhibit flexibility and adaptability.
- Collaborate in diverse groups to share knowledge, build consensus, and achieve goals.
- Practice leadership in and service to their community.
- Become contributing citizens in a global society.

Assessment:

- See grading policy attached.