**STEM Innovation Academy Unit Plan**

| **Subject:** NJIT Chemistry 125/125A  **Unit Title:** Unit 3- Chemical Bonding  **Grade:** 11th | | | | | | | | | | | | **Teacher:** Ms. Dy-Anni Austin  **Duration:** 30-35 80 min blocks | | | | | | | | | |
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| **Unit Summary** | | | | | | | | | | | | | | | | | | | | | |
| In this unit of study, students investigate the types of chemical bonds and how their structures affect their properties. they explore the types of attractions between molecules and how intermolecular attractions influence the bulk properties of a material. | | | | | | | | | | | | | | | | | | | | | |
| ESSENTIAL QUESTION(S) AND ENDURING UNDERSTANDINGS | | | | | | | | | | | | | | | | | | | | | |
| **Essential Questions /Focus Questions** | | | | | | | | | | | **Enduring Understandings** | | | | | | | | | | |
| * How can one explain the structure, properties, and   interactions of matter?   * How do substances combine or change (react) to   make new substances?   * How can one explain the structure, properties, and   interactions of matter?   * How does one characterize and explain these   reactions and make predictions about them?   * How do particles combine to form the variety of   matter one observes?   * How are waves used to transfer energy and   information?   * How do we classify things around us? * What relationships exist among different kinds of   matter?   * How and why does matter change? * What separation techniques can be used to separate   mixtures? Compounds? Elements?   * How does molecular motion affect the behavior of   matter?   * In a system of fixed mass, what is the relationship   between pressure, volume, and temperature? | | | | | | | | | | | * Differences in the physical properties of solids, liquids, and gasses are explained by the ways in which atoms, ions, or molecules of the substances are arranged, and by the strength of the forces of attraction between the atoms, ions, or molecules. * In a neutral atom, the same number of negatively charged electrons surrounds the positively charged nucleus. * Electrons, protons, and neutrons, are parts of the atom and have measurable properties, including mass, and in the case of protons and electrons, charges. * Gas particles move independently and are far apart relative to each other. * The behavior of gasses can be explained by the kinetic molecular theory. The kinetic molecular theory can be used to explain the relationship between pressure and volume, volume and temperature, pressure and temperature, and the number of particles in a gas sample. * There is a natural tendency for a system to move in the direction of disorder or entropy. * An atom's electron configuration, particularly of the outermost electrons, determines how the atom interacts with other atoms. | | | | | | | | | | |
| **NJIT CHEM 125/125A Scope and Sequence** | | | | | | | | | | | | | | | | | | | | | |
| **Unit 1-**  **Atomic Structure** | | **Unit 2-**  **The Periodic Table** | | | | **Unit 3- Chemical Bonding** | | | | **Unit 4-**  **Gas Laws** | | | | | | **Unit 5-**  **The Mole and Chemical Quantities** | | | | **Unit 6- Chemical Reactions** | |
| **Standards**  HS-PS1-1 | | **Standards**  HS-PS1-1  HS-PS1-2 | | | | **Standards**  HS-PS1-2  HS-PS1-3  HS-PS1-7  HS-PS2-4  HS-PS3-5 | | | | **Standards**  HS-PS1-3  HS-PS2-4  HS-PS3-5 | | | | | | **Standards**  HS-PS1-7 | | | | **Standards**  HS-PS1-2  HS-PS1-4  HS-PS1-5  HS-PS1-7 | |
| **30-35 days** | | **15-20 days** | | | | **30-35 days** | | | | **9-10 days** | | | | | | **11-15 days** | | | | **12-15 days** | |
| **Pacing Guide** | | | | | | | | | | | | | | | | | | | | | |
| Section | | | | Lesson | | | | Learning Goal | | | | | | NJSLS | | | | Pacing | | | |
| **3.1 -Ionic Bonds and Nomenclature** | | | | [3.1 Ionic Bonds and Nomenclature](https://docs.google.com/presentation/d/1UCEGe0focTbdyPLSEveie6sctK-vPZHIAhKbav5Rxkk/edit) | | | | Describe the properties of ionic compounds characterize ionic bonds  Use the Pauling scale to determine the type of bond present.  Name ionic and molecular compounds | | | | | | HS-PS1-2  HS-PS1-3  HS-PS1-7  HS-PS2-4  HS-PS3-5 | | | | 8 days | | | |
| **3.2- Metallic Bonding** | | | | [3.2 Metallic Bonds](https://docs.google.com/presentation/d/18UeG7gzZBcG7OiAMvDWshYZcAtkn9e2L1QEqR6iB1OM/edit#slide=id.g25b466b8a6f_0_0) | | | | Describe the properties of metals and characterize metallic bonds. | | | | | | HS-PS1-2  HS-PS1-3  HS-PS1-7  HS-PS2-4  HS-PS3-5 | | | | 6 days | | | |
| **3.3- Covalent Bonds** | | | | [3.3 Covalent Bonds and Advanced Topics in Covalent Bonding](https://docs.google.com/presentation/d/1EuExSdD5E4cfmqo0ArEKzuLNgqbgx2-rJoLEpZA8PXs/edit#slide=id.g2cd4e37bf53_0_0) | | | | Investigate covalent bonds.  Use the Pauling scale to determine the type of bond present.  Label the molecular dipoles and determine the polarity of a molecule.  Calculate the formal charge of an element in a molecular compound.  Determine the molecular geometry using VSEPR theory.  Identify sigma and pi bonds in a molecular compound.  Identify the hybridization of elements in a molecule.  Calculate the specific heat capacity in a material.  Calculate the enthalpy of reaction using bond energies. | | | | | | HS-PS1-2  HS-PS1-3  HS-PS1-7  HS-PS2-4  HS-PS3-5 | | | | 10 days | | | |
| **3.4- Intermolecular Forces** | | | | [3.4 IMF](https://docs.google.com/presentation/d/1WqgMiX-AViSEJNt5owNGHigU_RMaeoBtA5EF1Rp011E/edit#slide=id.g1beda262999_0_0) | | | | Compare and contrast intermolar forces and intramolecular forces.  Identify hydrogen bonds, van der Waals forces, dipole-dipole interactions, and ion- dipole interactions.  Predict the properties of materials, including boiling point, vapor pressure, surface tension, melting point, freezing point, through the identification of intermolecular forces. | | | | | | HS-PS1-2  HS-PS1-3  HS-PS1-7  HS-PS2-4  HS-PS3-5 | | | | 5 days | | | |
| **Student Self-Assessment and Reflection** | | | | | | | | | | | | | | | | | | | | | |
| Students will write down their questions and or comments of the day’s events. They will write their questions about any topics or problems they have, and they will discuss them as a class the following day. Students will also write down any observations they experienced during labs and/or lecture presentations into their Journals. | | | | | | | | | | | | | | | | | | | | | |
| **Differentiated Instruction (by student readiness):** | | | | | | | | | | | | | | | | | | | | | |
| **Tiers 2-3**: Students who have scored a 3 or below (approaching expectations) on the ELA and Math NJSLAs   1. Scaffolding 2. Group work 3. Peer tutoring 4. One on one discussions 5. Office hour appointments 6. Laboratory Investigations 7. Group PowerPoint Presentation 8. Unit Test   **Tier 1**: for students who have scored a 4 or 5 (met or exceeded expectations) on the ELA and Math NJSLAs   1. One on one discussions 2. Office hour appointments 3. Laboratory Investigations 4. Group PowerPoint Presentation 5. Unit Test | | | | | | | | | | | | | | | | | | | | | |
| **Literacy Connections** | | | | | | | | | | | | | | | | | | | | | |
| **ELA/Literacy**  **RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.  **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.  **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  **WHST.11-12.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.  **WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research.  **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.  **WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.  **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. | | | | | | | | | | | | | | | | | | | | | |
| **Expert/Field Experiences** | | | | | | | | | | | | | | | | | | | | | |
| Students will attend a field trip to the Mignone Hall of Gems and Minerals at the American Museum of Natural History. They will use this experience to better understand the properties of elements and compounds through the study of rocks and minerals. Students will complete a pre-trip assignment and a scavenger hunt on site.  Students will also travel to NJIT in June to take the American Chemical Society Chemistry End of Course Exam, which will cover all of the topics in our scope and sequence. | | | | | | | | | | | | | | | | | | | | | |