**A Natural Approach to Chemistry**

Overall Rating of Standards

| **Standard** | **Determined Rating** |
| --- | --- |
| CH.1 The student will demonstrate an understanding of the scientific and engineering practices. | This standard was evaluated in the context of the content standards. |
| CH.2 The student will investigate and understand that elements have properties based on their atomic structure. The periodic table is an organizational tool for elements based on these properties. | Adequate |
| CH.3 The student will investigate and understand that atoms are conserved in chemical reactions. Knowledge of chemical properties of the elements can be used to describe and predict chemical interactions. | Adequate |
| CH. 4 The student will investigate and understand that molar relationships compare and predict chemical quantities. | Adequate |
| CH.5 The student will investigate and understand that solutions behave in predictable and quantifiable ways. | Adequate |
| CH.6 The student will investigate and understand that the phases of matter are explained by the kinetic molecular theory. | Adequate |
| CH.7 The student will investigate and understand that thermodynamics explains the relationship between matter and energy. | Adequate |

Overall Rating for Instructional Design and Support

| **Instructional Design and Support** | **Determined Rating** |
| --- | --- |
| Materials emphasize the use of effective instructional practices and learning theory. | Adequate |
| The science content is significant and accurate. | Adequate |
| Materials present content in an accurate, unbiased manner. | Adequate |

Review of Standards with Curriculum Framework

| Standard | Expectation |
| --- | --- |
| CH.1 The student will demonstrate an understanding of the scientific and engineering practices by:   1. asking questions and defining problems 2. planning and carrying out investigations 3. interpreting, analyzing, and evaluating data 4. constructing and critiquing conclusions and explanations 5. developing and using models 6. obtaining, evaluating, and communicating information. | The expectation of the 2018 *Science Standards of Learning* is that the scientific and engineering practices are embedded into the instruction of content standards.  The rating for an individual standard includes the evaluation of standard 1 as it pertained to that standard.  For specific grade level/course expectations for standard 1, see the Standards of Learning and the Curriculum Framework. |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| CH.2 The student will investigate and understand that elements have properties based on their atomic structure. The periodic table is an organizational tool for elements based on these properties. Key information pertaining to the periodic table includes |  |  |  |
| 1. average atomic mass, isotopes, mass number, and atomic number; | X |  |  |
| 1. nuclear decay; | X |  |  |
| 1. trends within groups and periods including atomic radii, electronegativity, shielding effect, and ionization energy; | X |  |  |
| 1. electron configurations, valence electrons, excited electrons, and ions; and | X |  |  |
| 1. historical and quantum models. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| CH.3 The student will investigate and understand that atoms are conserved in chemical reactions. Knowledge of chemical properties of the elements can be used to describe and predict chemical interactions. Key ideas include |  |  |  |
| 1. chemical formulas are models used to represent the number of each type of atom in a substance; | X |  |  |
| 1. substances are named based on the number of atoms and the type of interactions between atoms; | X |  |  |
| 1. balanced chemical equations model rearrangement of atoms in chemical reactions; | X |  |  |
| 1. atoms bond based on electron interactions; | X |  |  |
| 1. molecular geometry is predictive of physical and chemical properties; and | X |  |  |
| 1. reaction types can be predicted and classified. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| CH.4 The student will investigate and understand that molar relationships compare and predict chemical quantities. Key ideas include |  |  |  |
| 1. Avogadro’s principle is the basis for molar relationships; and | X |  |  |
| 1. stoichiometry mathematically describes quantities in chemical composition and in chemical reactions. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| CH.5 The student will investigate and understand that solutions behave in predictable and quantifiable ways. Key ideas include |  |  |  |
| 1. molar relationships determine solution concentration; | X |  |  |
| 1. changes in temperature can affect solubility; | X |  |  |
| 1. extent of dissociation defines types of electrolytes; | X |  |  |
| 1. pH and pOH quantify acid and base dissociation; and | X |  |  |
| 1. colligative properties depend on the extent of dissociation. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| CH.6 The student will investigate and understand that the phases of matter are explained by the kinetic molecular theory. Key ideas include |  |  |  |
| 1. pressure and temperature define the phase of a substance; | X |  |  |
| 1. properties of ideal gases are described by gas laws; and | X |  |  |
| 1. intermolecular forces affect physical properties. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| CH.7 The student will investigate and understand that thermodynamics explains the relationship between matter and energy. Key ideas include |  |  |  |
| 1. heat energy affects matter and interactions of matter; | X |  |  |
| 1. heating curves provide information about a substance; | X |  |  |
| 1. reactions are endothermic or exothermic; | X |  |  |
| 1. energy changes in reactions occur as bonds are broken and formed; | X |  |  |
| 1. collision theory predicts the rate of reactions; | X |  |  |
| 1. rates of reactions depend on catalysts and activation energy; and | X |  |  |
| 1. enthalpy and entropy determine the extent of a reaction. | X |  |  |

Rubric for Instructional Design and Support

|  |  |  |
| --- | --- | --- |
| **Adequate** | **Limited** | **No Evidence** |
| 1. Materials emphasize the use of effective instructional practices and learning theory. | | |
| * 1. Students are guided through critical thinking and problem-solving approaches. | | |
| Materials consistently include content promoting use of critical thinking and problem-solving approaches. | Materials inconsistently include content promoting use of critical thinking and problem-solving approaches. | Materials do not include content promoting use of critical thinking and problem-solving approaches. |
| * 1. Concepts are introduced through concrete experiences that incorporate the scientific and engineering practices. | | |
| Materials consistently promote the introduction of concepts through concrete experiences. | Materials inconsistently promote the introduction of concepts through concrete experiences. | Materials do not promote the introduction of concepts through concrete experiences. |
| * 1. Multiple opportunities are provided for students to develop and apply concepts through scientific and engineering practices. | | |
| Materials consistently provide development and application of concepts through appropriate technologies. | Materials inconsistently provide development and application of concepts through appropriate technologies. | Materials do not provide development and application of concepts through appropriate technologies. |
| * 1. Students use a variety of representations (graphical, numerical, symbolic, verbal, and physical) to connect science concepts. | | |
| Materials provide consistent use of a variety of representations of science content and concepts. | Materials provide inconsistent use of a variety of representations of science content and concepts. | Materials do not provide use of a variety of representations of science content and concepts. |
| 1. The science content is significant and accurate. | | |
| * 1. Materials are presented in an organized, logical manner which represents the current thinking on how students learn science. | | |
| Materials consistently support the balanced use of conceptual and procedural approaches. | Materials inconsistently support the balanced use of conceptual and procedural approaches. | Materials do not support a balanced use of conceptual and procedural approaches. |
| * 1. Materials are organized appropriately within and among units of study. | | |
| Materials are consistently organized within and among units of study. | Materials are inconsistently organized within and among units of study. | Materials are inappropriately organized within and among units of study. |
| * 1. Format design includes titles, subheadings, and appropriate cross-referencing for ease of use. | | |
| Materials consistently use formatting that is user-friendly. | Materials inconsistently use formatting that is user-friendly. | Materials do not use formatting that is user-friendly. |
| * 1. Writing style, length of sentences, vocabulary, graphics, and illustrations are appropriate. | | |
| Materials consistently include writing and visuals that are appropriate for the grade level. | Materials inconsistently include writing and visuals that are appropriate for the grade level. | Materials do not include writing and visuals that are appropriate for the grade level. |
| * 1. Level of abstraction is appropriate, and practical/real-life examples, including careers, are provided. | | |
| Materials consistently provide the appropriate level of abstraction and appropriate practical/real-life examples. | Materials inconsistently provide the appropriate level of abstraction and appropriate practical/real-life examples. | Materials do not provide the appropriate level of abstraction and appropriate practical/real-life examples. |
| * 1. Sufficient applications are provided to promote depth of application. | | |
| Materials consistently provide sufficient applications to promote depth of application and are appropriate for the grade level. | Materials inconsistently provide sufficient applications to promote depth of application and are appropriate for the grade level. | Materials do not provide sufficient applications to promote depth of application and are not appropriate for the grade level. |
| 1. Materials present content in an accurate, unbiased manner. | | |
| Materials consistently present content in an accurate, unbiased manner. | Materials inconsistently present content in an accurate, unbiased manner. | Materials do not present content in an accurate, unbiased manner. |