**Essential Physics**

Overall Rating of Standards

| **Standard** | **Determined Rating** |
| --- | --- |
| PH.1 The student will demonstrate an understanding of the scientific and engineering practices. | This standard was evaluated in the context of the content standards. |
| PH.2 The student will investigate and understand, through mathematical and experimental processes, that there are relationships between position and time. | Adequate |
| PH.3 The student will investigate and understand, through mathematical and experimental processes, that there are relationships among force, mass, and acceleration. | Adequate |
| PH.4 The student will investigate and understand, through mathematical and experimental processes, that conservation laws govern all interactions. | Adequate |
| PH.5 The student will investigate and understand, through mathematical and experimental processes, that waves transmit energy and move in predictable patterns. | Adequate |
| PH.6 The student will investigate and understand, through mathematical and experimental processes, that optical systems form a variety of images. | Adequate |
| PH.7 The student will investigate and understand, through mathematical and experimental processes, that fields provide a unifying description of force at a distance. | Adequate |
| PH.8 The student will investigate and understand, through mathematical and experimental processes, that electrical circuits are a system used to transfer energy. | Adequate |
| PH.9 The student will investigate and understand that extremely large and extremely small quantities are not necessarily described by the same laws as those studied in Newtonian physics. | 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 |
| --- | --- |
| PH.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 |
| --- | --- | --- | --- |
| PH.2 The student will investigate and understand, through mathematical and experimental processes, that there are relationships between position and time. Key topics include |  |  |  |
| 1. displacement, velocity, and uniform acceleration; | X |  |  |
| 1. linear motion; | X |  |  |
| 1. uniform circular motion; and | X |  |  |
| 1. projectile motion. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.3 The student will investigate and understand, through mathematical and experimental processes, that there are relationships among force, mass, and acceleration. Key laws include |  |  |  |
| 1. Newton’s laws of motion; and | X |  |  |
| 1. Newton’s law of universal gravitation. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.4 The student will investigate and understand, through mathematical and experimental processes, that conservation laws govern all interactions. Key ideas include |  |  |  |
| 1. momentum is conserved unless an impulse acts on the system; and | X |  |  |
| 1. mechanical energy is conserved unless work is done on, by, or within the system. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.5 The student will investigate and understand, through mathematical and experimental processes, that waves transmit energy and move in predictable patterns. Key ideas include |  |  |  |
| 1. waves have specific characteristics; | X |  |  |
| 1. wave interactions are part of everyday experiences; and | X |  |  |
| 1. light and sound transmit energy as waves. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.6 The student will investigate and understand, through mathematical and experimental processes, that optical systems form a variety of images. Key ideas include |  |  |  |
| 1. the laws of reflection and refraction describe light behavior; and | X |  |  |
| 1. ray diagrams model light as it travels through different media. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.7 The student will investigate and understand, through mathematical and experimental processes, that fields provide a unifying description of force at a distance. Key ideas include |  |  |  |
| 1. gravitational, electric, and magnetic forces can be described using the field concept; and | X |  |  |
| 1. field strength diminishes with increased distance from the source. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.8 The student will investigate and understand, through mathematical and experimental processes, that electrical circuits are a system used to transfer energy. Key ideas include |  |  |  |
| 1. circuit components have different functions within the system; | X |  |  |
| 1. Ohm’s law relates voltage, current, and resistance; | X |  |  |
| 1. different types of circuits have different characteristics and are used for different purposes; | X |  |  |
| 1. electrical power is related to the elements in a circuit; and | X |  |  |
| 1. electrical circuits have everyday applications. | X |  |  |

| Standard | Adequate | Limited | No Evidence |
| --- | --- | --- | --- |
| PH.9 The student will investigate and understand that extremely large and extremely small quantities are not necessarily described by the same laws as those studied in Newtonian physics. Topics, such as these listed, may be included. |  |  |  |
| 1. wave/particle duality; | X |  |  |
| 1. quantum mechanics and uncertainty; | X |  |  |
| 1. relativity; | X |  |  |
| 1. nuclear physics; | X |  |  |
| 1. solid state physics; |  | X |  |
| 1. nanotechnology; |  | X |  |
| 1. superconductivity; |  | X |  |
| 1. the standard model; and | X |  |  |
| 1. dark matter and dark energy. |  |  | 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. |