



## Physics Unit 6- Modern Physics

**Unit Overview:** In this unit students will explore the dual nature of light, basic quantum physics and the Standard Model. Students will be able to use an energy level diagram to describe the emission spectrum of an element. Students will quantitatively and qualitatively describe the energy mass conversion. Students will describe the four fundamental forces.

### Essential Questions:

- What is the significance of energy level diagrams?
- What are spectral lines and how are they generated?
- What is the Standard Model?
- How are matter and energy related?
- What is the meant by matter and light having a dual nature?

### *MST Standard 4 - Science*

#### *Key Idea 5*

Energy and matter interact through forces that result in changes in motion.



Time Frame	Skills, Practices or Expectations	Specific Standards / Performance Indicators	Resources	Content Vocabulary	Measurement of Student Learning
<p><b>4 weeks</b> <b>5.01.23 - 5.26.23</b></p>	<p><b>Modern Physics</b></p> <ul style="list-style-type: none"> <li>● Explain that the transfer of energy takes place in a quantized fashion.</li> <li>● Interpret the energy level diagrams to calculate the energy of a photon emission or absorption.</li> <li>● Recognize that the charge on a quark is a fraction of an elementary charge.</li> <li>● Relate the energy of a photon to the frequency.</li> <li>● Discuss the evidence of the dual nature of light and matter.</li> <li>● Recognize situations involving the conservation of mass-energy and charge.</li> <li>● Classify particles according to the Standard Model.</li> <li>● Compare and contrast the characteristics of the four fundamental forces.</li> </ul>	<p><b>5.3a-j</b></p>	<p>Holt Textbook Chapters 21-22 Castle Learning</p> <p>Interactive Simulations: <a href="http://phet.colorado.edu">http://phet.colorado.edu</a></p>	<p>quantum photon emission spectrum absorption spectrum strong electromagnetic weak gravitational anti-particle quarks baryons mesons hadron lepton</p> <p><b>Higher Level Questions</b></p> <p><b>From June 2015 Exam</b></p> <p>An electron in a mercury atom changes from energy level <i>b</i> to a higher energy level when the atom absorbs a single photon with an energy of 3.00 eV.</p> <p>76 Determine the letter that identifies the energy level to which the electron jumped when the mercury atom absorbed the photon. [1]</p> <p>77 Determine the energy of the photon, in joules. [1]</p> <p>78-79 Calculate the frequency of the photon. [Show all work, including the equation and substitution with units.] [2]</p> <p>80 Classify the photon as one of the types of electromagnetic radiation listed in the electromagnetic spectrum. [1]</p>	<p>Ticket out the door Formative assessment using Castle Learning Unit test Weekly quizzes Homework using Castle Learning</p>

**Resources**

<http://ngss.nsta.org/Classroom-Resources.aspx>

<http://newyorkscienceteacher.com/sci/>



<p><b>English Language Learners (ELL) Enhancements</b></p> <p>To access <a href="#">hyperlinked</a> material, you must be logged into your BPS Google Drive</p>	<p><b><u>Listening</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Cross- Linguistic Practices:</u></b> Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates.)</li> <li>● <b><u>Build background knowledge</u></b></li> <li>● <b><u>Activating Prior Knowledge</u></b> Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content</li> <li>● <b><u>Activating Prior Knowledge</u></b></li> <li>● <b><u>Visuals</u></b> - GIFs, pictures- will assist students in understanding what they are listening to. Use <a href="#">visual thinking strategies</a> to set the lens for learning.</li> <li>● Video to review or introduce a topic – use <a href="#">closed captioning</a> to help students see the words and pronunciations while they listen to the content.</li> <li>● <b><u>Word stretching / Vowel stretching</u></b> when instructing allows student to listen closely to the pronunciation of the word</li> <li>● <b><u>Performance Level Descriptors</u></b> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening Scroll for grades 9-12.</li> </ul>	<p><b><u>Speaking</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Sentence Frames</u></b> - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i></li> <li>● <b><u>Academic Conversation Starters:</u></b> Have a visual of a list of academic sentence starters that students can refer to in a discussion. Examples include- I expect ____ to happen. My data shows that... This helps students have a more science focused dialogue.</li> <li>● <b><u>Choral Reading</u></b> - To build fluency, self-confidence and motivation with <a href="#">reading/speaking</a></li> <li>● Create <a href="#">movement</a> to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning</li> <li>● <b><u>Performance Level Descriptors</u></b> This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking. Scroll for grades 9-12</li> </ul>	<p><b><u>Reading</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Supplementary Text</u></b> to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension.</li> <li>● <b><u>Visual Aids</u></b> - Pictures or models to support vocabulary words and concepts</li> <li>● Video to review or introduce a topic - use <a href="#">closed captioning</a> to help students read along while they listen to the content</li> <li>● <b><u>4 Square / Frayer models</u></b> to help students gain a deeper understanding of vocabulary.</li> <li>● <b><u>Highlighting</u></b> important text to assist students in answering questions after the reading.</li> <li>● <b><u>Chunking</u></b>-Break reading of text into chunks or paragraphs</li> <li>● <b><u>Performance Level Descriptors</u></b> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading. Scroll for grades 9-12.</li> <li>● <b><u>Vocabulary Morphology-</u></b> Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can be critical to expanding a student’s vocabulary.</li> </ul>	<p><b><u>Writing</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Sentence Frames</u></b> - to begin a sentence- such as <i>Biodiversity is...</i> or <i>An example of competition is....</i></li> <li>● <b><u>Cloze passages</u></b> with word banks</li> <li>● <b><u>Word banks</u></b></li> <li>● <b><u>Graphic Organizers</u></b> to help break down the writing process and organize thoughts</li> <li>● <b><u>Standards-based sentence stems</u></b></li> <li>● <b><u>Performance Level Descriptors</u></b> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of writing. Scroll for grades 9-12.</li> </ul>	<p><b><u>Instructional Accommodations (depending on the student’s needs)</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Extended time</u></b> for tests in class, projects and assignments</li> <li>● <b><u>Directions read.</u></b> Broken down as necessary</li> <li>● <b><u>Model</u></b> how to complete the activity in the lesson</li> <li>● <b><u>Oral simplification</u></b> of directions or questions</li> <li>● <b><u>Translated version</u></b> of test when available. Student may have both version English and native language version</li> <li>● Use of <a href="#">approved bilingual glossaries</a> from NYS in each subject</li> </ul>
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<p><b>Special Education Modifications</b></p> <p>Special Education students must have accommodations as per Individual Educational Plan (IEP)</p>	<p><b><u>Instructional</u></b></p> <ul style="list-style-type: none"> <li>● <b>Pre-teach</b> vocabulary</li> <li>● Use <b>picture vocabulary</b></li> <li>● Scaffold <b>Depth of Knowledge</b> questions</li> <li>● Provide copy of notes/<b>notes in “cloze”</b> form</li> <li>● Use of <b>Think, Pair, and Share</b> strategy to help process information</li> <li>● <b>Scaffold</b> written assignments with the use of <b>graphic organizers</b></li> <li>● Allow for <b>multiple ways to respond</b> (verbal, written, response board)</li> <li>● Provide <b>model of performance task</b></li> <li>● <b>Modify informational text</b> to fit the needs of the students</li> <li>● Provide a digital or paper <b>interactive notebook</b></li> <li>● Present complex <b>tasks in multiple ways</b></li> <li>● Provide <b>mnemonic strategies</b> for Physics concepts</li> </ul>	<p><b><u>Technology:</u></b></p> <ul style="list-style-type: none"> <li>● <b>Audio</b> reading of text</li> <li>● <b>Text to type</b> functions</li> <li>● <b>Videos</b> to clarify/visualize Physics concepts</li> <li>● <b>Record class lecture/discussions</b> and make accessible to student</li> <li>● <b>Nearpod</b>- interactive presentations of notes</li> <li>● <b>Playposit</b> - show a video clip about the topic and add your own questions for them to answer as they watch</li> <li>● Allow students to type answers in chat on <b>Teams</b></li> </ul> <p><b><u>Other:</u></b></p> <ul style="list-style-type: none"> <li>● Arrange seating for maximum engagement and minimum distraction</li> <li>● Accessible lab space (counter level)</li> </ul>	<p><b><u>In Class Assessments</u></b></p> <ul style="list-style-type: none"> <li>● Provide <b>review packet or review sheet</b> of concepts covered on the test</li> <li>● Practice similar questions prior to the test</li> <li>● Provide <b>multiple options</b> for projects</li> <li>● Give a <b>timeline</b> of when things are due and remind them of the process often.</li> <li>● <b>Use of timer</b> in class</li> <li>● Break all complex tasks into chunks</li> </ul>
<p>BPS Science K-12 Schoology Group Resources Grades 9-12 Resources Physics Physics Curriculum Materials</p>	<p><b><u>SUTW Strategies</u></b></p> <ul style="list-style-type: none"> <li>● Informal Outline</li> <li>● Color-Coding – Informative/Explanatory Text</li> <li>● Two-column notes</li> <li>● I-V-F Topic Sentence progressing to Four Step Summary Paragraph</li> <li>● CUPS – Capitalization, Usage, Punctuation, Spelling</li> <li>● Transitions</li> </ul>		