

## IB Physics SL YEAR 2 - Unit 5 Planner

<b>Teacher(s)</b>	Cole Phillips	<b>Subject Group and Course</b>	Group 4 - Physics		
<b>Course Part and Topic</b>	Topic E: Nuclear and Quantum	<b>SL or HL / Year 1 or 2</b>	SL Year 2	<b>Dates</b>	February/March (13 Weeks)
<b>Unit Description and Texts</b>		<b>DP Assessment(s) for Unit</b>			
Students will examine the fundamental parts of matter <ul style="list-style-type: none"> <li>Bowen-Jones, Michael, and David Homer. IB Physics. Oxford: Oxford UP, 2014. Print.</li> </ul>		<ul style="list-style-type: none"> <li>E.1 paper 1 quiz, E.2 paper 1 quiz, E.3 paper quiz, E.4 paper quiz, E.5 paper quiz</li> <li>Test (paper 1 + paper 2)</li> </ul>			

### ***INQUIRY: establishing the purpose of the unit***

<p><b>Transfer Goals</b></p> <p>List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to “transfer” or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.</p>
<p><u>Phenomenon</u>: Matter is made up of many fundamental particles.</p> <p><u>Statement of Inquiry</u>: The energy of a photon is dependent on its frequency.</p> <ol style="list-style-type: none"> <li>Students will discuss energy transformation and uses.</li> <li>Students will determine the amount of energy released in a nuclear reaction.</li> <li>Students will discuss the fundamental parts of matter.</li> </ol>

### ***ACTION: teaching and learning through inquiry***

Content / Skills / Concepts - Essential Understandings	Learning Process
<p><u>Students will know the following content:</u></p> <ul style="list-style-type: none"> <li>• <i>Specific energy and energy density of fuel sources</i></li> <li>• <i>Primary energy sources</i></li> <li>• <i>Black-body radiation</i></li> <li>• <i>Albedo and emissivity</i></li> <li>• <i>The solar constant</i></li> <li>• <i>Discrete energy and discrete energy levels</i></li> <li>• <i>Transitions between energy levels</i></li> <li>• <i>Radioactive decay</i></li> <li>• <i>Fundamental forces and their properties</i></li> <li>• <i>Alpha particles, beta particles and gamma rays</i></li> <li>• <i>Half-life</i></li> <li>• <i>Absorption characteristics of decay particles</i></li> <li>• <i>Isotopes</i></li> <li>• <i>Background radiation</i></li> <li>• <i>The unified atomic mass unit</i></li> <li>• <i>Mass defect and nuclear binding energy</i></li> <li>• <i>Nuclear fission and nuclear fusion</i></li> <li>• <i>Quarks, leptons and their antiparticles</i></li> <li>• <i>Hadrons, baryons and mesons</i></li> <li>• <i>The conservation laws of charge, baryon number, lepton number and strangeness</i></li> <li>• <i>The nature and range of the strong nuclear force, weak nuclear force and electromagnetic force</i></li> <li>• <i>Exchange particles</i></li> <li>• <i>Feynman diagrams</i></li> <li>• <i>Confinement</i></li> <li>• <i>The Higgs boson</i></li> </ul>	<p><i>Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.</i></p> <p>Learning experiences and strategies/planning for self-supporting learning:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Lecture</li> <li><input type="checkbox"/> Socratic seminar</li> <li><input checked="" type="checkbox"/> Small group/pair work</li> <li><input checked="" type="checkbox"/> PowerPoint lecture/notes</li> <li><input checked="" type="checkbox"/> Individual presentations</li> <li><input checked="" type="checkbox"/> Group presentations</li> <li><input checked="" type="checkbox"/> Student lecture/leading</li> <li><input type="checkbox"/> Interdisciplinary learning</li> </ul> <p>Details:</p> <p><i>Students will learn through a combination of presentations, small group work, practice problems, and lab work.</i></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Other(s): <i>practice problems</i></li> </ul> <hr/> <p><b>Formative assessment(s):</b></p> <p><i>Paper 1 quizzes at the end of each subtopic.</i></p>

<p><u>Students will develop the following skills:</u></p> <ul style="list-style-type: none"> <li>• Describing the emission and absorption spectrum of common gases</li> <li>• Solving problems involving atomic spectra, including calculating the wavelength of photons emitted during atomic transitions</li> <li>• Completing decay equations for alpha and beta decay</li> <li>• Determining the half-life of a nuclide from a decay curve</li> <li>• Investigating half-life experimentally (or by simulation)</li> <li>• Solving problems involving mass defect and binding energy</li> <li>• Solving problems involving the energy released in radioactive decay, nuclear fission and nuclear fusion</li> <li>• Sketching and interpreting the general shape of the curve of average binding energy per nucleon against nucleon number</li> <li>• Describing the Rutherford-Geiger-Marsden experiment that led to the discovery of the nucleus</li> <li>• Applying conservation laws in particle reactions</li> <li>• Describing protons and neutrons in terms of quarks</li> <li>• Comparing the interaction strengths of the fundamental forces, including gravity</li> <li>• Describing the mediation of the fundamental forces through exchange particles</li> <li>• Sketching and interpreting simple Feynman diagrams</li> <li>• Describing why free quarks are not observed</li> </ul>	
	<p><b>Summative assessments:</b></p> <p><i>Topic test consisting of questions from P1 and P2</i></p> <p><b>Differentiation:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Affirm identity - build self-esteem</li> <li><input type="checkbox"/> Value prior knowledge</li> <li>✓ Scaffold learning</li> <li>✓ Extend learning</li> </ul>

	<p>Details:</p> <ul style="list-style-type: none"> <li>• <i>SWD/504 – Accommodations Provided</i></li> <li>• <i>ELL – Reading &amp; Vocabulary Support</i></li> <li>• <i>Intervention Support</i></li> <li>• <i>Extensions – Enrichment Tasks and Project</i></li> </ul>
--	--

### Approaches to Learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see [the guide](#).

- Thinking
- Self-management
- Social
- Communication
- Research

Details:

*Students will be continuously challenged to develop higher-order thinking skills as they take prior knowledge, combine it with new content, and analyze the data they collected to reach a conclusion.*

*Students will communicate their findings to their peers in the form of small-group presentations.*

Language and Learning	TOK Connections	CAS Connections
<p>Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see <a href="#">the guide</a>.</p>	<p>Check the boxes for any explicit TOK connections made during the unit</p>	<p>Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.</p>
<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Activating background knowledge</li> <li><input checked="" type="checkbox"/> Scaffolding for new learning</li> <li><input checked="" type="checkbox"/> Acquisition of new learning through</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Personal and shared knowledge</li> <li><input type="checkbox"/> Ways of knowing</li> <li><input type="checkbox"/> Areas of knowledge</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Creativity</li> <li><input type="checkbox"/> Activity</li> </ul>

<p>✓ practice ✓ Demonstrating proficiency</p> <p>Details:</p> <p><i>Concepts throughout topic 7 build into understanding final concepts.</i></p> <p><i>Students will complete practice problems</i></p>	<p>☐ The knowledge framework</p> <p>Details:</p> <p>The use of nuclear energy inspires a range of emotional responses from scientists and society. How can accurate scientific risk assessment be undertaken in emotionally charged areas?</p>	<p>☐ Service</p> <p>Details:</p>
<p><b>Resources</b></p> <p><i>List and attach (if applicable) any resources used in this unit</i></p>		
<ul style="list-style-type: none"> <li>● Schoology Course Page</li> <li>● <a href="#">IB Physics Guide First Assessment 2025</a></li> <li>● Textbook TBD - evaluation of resources</li> <li>● Van de Lagemaat, R. <a href="http://www.inthinking.net">www.inthinking.net</a>: Andorra la Vella, Andorra, 2019</li> <li>● Discovery Education Physics Resources</li> </ul> <p>Additional resources from old syllabus</p> <ul style="list-style-type: none"> <li>● Hodder Study and Revision Guide for the IB Diploma</li> <li>● Hodder IA Internal Assessment for Physics</li> </ul>		

***REFLECTION: considering the planning, process, and impact of the inquiry***

What worked well	What didn't work well	Notes / Changes / Suggestions
<p><i>List the portions of the unit (content, assessment, planning) that were successful</i></p>	<p><i>List the portions of the unit (content, assessment, planning) that were not as successful as hoped</i></p>	<p><i>List any notes, suggestions, or considerations for the future teaching of this unit</i></p>

--	--	--