IB Physics YEAR 2 - Unit 6

Teacher(s)	IB Physics PLC	**Subject Group and Course**	Group 4 - Physics		
Course Part and Topic	Topic 7 - Atomic and Nuclear Physics	**SL or HL / Year 1 or 2**	SL Year 2	**Dates**	7 weeks

Unit Description and Texts	**DP Assessment(s) for Unit**
Students will examine the fundamental parts of matter ● Bowen-Jones, Michael, and David Homer. IB Physics. Oxford: Oxford UP, 2014. Print.	● 7.1 paper 1 quiz, 7.2 paper 1 quiz, 7.3 paper 1 quiz ● Test (paper 1 + paper 2)

INQUIRY: establishing the purpose of the unit

Transfer Goals

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.

Phenomenon: Matter is made up of many fundamental particles.

Statement of Inquiry: The energy of a photon is dependent on its frequency.

1. Students will determine the energy stored in electron energy levels.
2. Students will determine the amount of energy released in a nuclear reaction.
3. Students will discuss the fundamental parts of matter.

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	**Learning Process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
<u>Students will know the following content:</u> • ***Discrete energy and discrete energy levels*** • ***Transitions between energy levels*** • ***Radioactive decay*** • ***Fundamental forces and their properties*** • ***Alpha particles, beta particles and gamma rays*** • ***Half-life*** • ***Absorption characteristics of decay particles*** • ***Isotopes*** • ***Background radiation*** • ***The unified atomic mass unit*** • ***Mass defect and nuclear binding energy*** • ***Nuclear fission and nuclear fusion*** • ***Quarks, leptons and their antiparticles*** • ***Hadrons, baryons and mesons*** • ***The conservation laws of charge, baryon number, lepton number and strangeness*** • ***The nature and range of the strong nuclear force, weak nuclear force and electromagnetic force*** • ***Exchange particles*** • ***Feynman diagrams*** • ***Confinement*** • ***The Higgs boson*** <u>Students will develop the following skills:</u> • **Describing the emission and absorption spectrum of common gases** • **Solving problems involving atomic spectra, including calculating the wavelength of**	Learning experiences and strategies/planning for self-supporting learning: ☒ Lecture ☐ Socratic seminar ☒ Small group/pair work ☒ PowerPoint lecture/notes ☐ Individual presentations ☐ Group presentations ☐ Student lecture/leading ☐ Interdisciplinary learning Details: *Students will learn through a combination of presentations, small group work, practice problems, and lab work.* ☒ Other(s): *practice problems, lab work*

photons emitted during atomic transitions • Completing decay equations for alpha and beta decay • Determining the half-life of a nuclide from a decay curve • Investigating half-life experimentally (or by simulation) • Solving problems involving mass defect and binding energy • Solving problems involving the energy released in radioactive decay, nuclear fission and nuclear fusion • Sketching and interpreting the general shape of the curve of average binding energy per nucleon against nucleon number • Describing the Rutherford-Geiger-Marsden experiment that led to the discovery of the nucleus • Applying conservation laws in particle reactions • Describing protons and neutrons in terms of quarks • Comparing the interaction strengths of the fundamental forces, including gravity • Describing the mediation of the fundamental forces through exchange particles • Sketching and interpreting simple Feynman diagrams • Describing why free quarks are not observed	**Formative assessment(s):** *Paper 1 quizzes at the end of each subtopic.*
	Summative assessments: *Topic test consisting of questions from P1 and P2* *partial lab report*
	Differentiation: ❏ Affirm identity - build self-esteem ✓ Value prior knowledge ✓ Scaffold learning ✓ Extend learning Details: • *SWD/504 – Accommodations Provided*

	• *ELL – Reading & Vocabulary Support* • *Intervention Support* • *Extensions – Enrichment Tasks and Project*

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 ✓ Social ❏ Communication ❏ Self-management ✓ 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 conduct research on the different types of quantum particles and present them to their peers.* *Students will collaborate in groups to build an understanding of the different quantum particles.*

Language and Learning *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 [the guide.](#)*	**TOK Connections** *Check the boxes for any explicit TOK connections made during the unit*	**CAS Connections** *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.*
✓ Activating background knowledge ✓ Scaffolding for new learning ✓ Acquisition of new learning through	❏ Personal and shared knowledge ❏ Ways of knowing ✓ Areas of knowledge	❏ Creativity ❏ Activity ❏ Service

practice ✓ Demonstrating proficiency Details: *Concepts throughout topic 7 build into understanding final concepts.* *Students will complete practice problems*	❏ The knowledge framework Details: Does the belief in the existence of fundamental particles mean that it is justifiable to see physics as being more important than other areas of knowledge?	Details:

Resources *List and attach (if applicable) any resources used in this unit*
● Textbooks (see page 1) ● Laboratory resources ● Online notes and videos (Schoology)

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

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