

Day / Topic	Curriculum Expectations	Agenda	Timing	Materials Needed	Assessment/ Evaluation	Reference
<b>Chapter 9 – Waves and Light</b>						
<b>Day 1</b> Refraction (9.1, 9.2)	E2.1 use appropriate terminology related to the wave nature of light, including, but not limited to: <b>diffraction, dispersion, wave interference, nodal line, phase, oscillate, polarization, and electromagnetic radiation</b> [C]	<b>Do Now</b> <i>Diagnostic Assessment</i> - Hand out assessment as students walk in - Find out how much students remember from SPH3U (use modified unit test from SPH3U) - If possible try to complete at end of previous day's class	20 min	Diagnostic Assessment	Diagnostic	SPH3U SNC2D Optics Unit
		<b>Unit Hook</b> Write question on the board: <i>How can we use properties of light to create technologies that enhance our lives?</i> Use Think Pair Share to discuss. Possible answers: X-rays, MRI, CT scans, photocells, lasers, infrared cameras, night vision goggles, sunglasses, CFLs, LEDs, CD, DVDs, Fibre optics, holograms, GPS etc.	5 min		Formative (Discussion)	Nelson Physics 12 - Unit 4 - Chp. 9 & 10
		<b>Introduce Unit Project</b> - In teams of 4, prepare and deliver a 3-5 min oral presentation - Discuss topics, may choose own topic - Review rubric - analysis of principles of light, assess impact to society, careers - Choose own group and topic, sign up on Day 3 - Presentation on Day 9	10 min	<b>Unit Project Handout</b>		Nelson Physics 12 - Unit 4 - Chp. 9 & 10
		<b>Activity</b> <i>Lab - PhET Bending Light (Java applet)</i> - Create a worksheet with guiding questions - Work in pairs with elbow partner to complete lab	25 min	- Worksheet - Book computer lab - Need computers with Java and Internet access - Use PhET Simulation Lab	Formative	<a href="http://phet.colorado.edu/en/simulation/bending-light">http://phet.colorado.edu/en/simulation/bending-light</a>

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		<b>Consolidation/Exit Ticket</b> Match terminology to definitions: Periodic wave, Universal wave Equation, Law of Reflection, Refraction, Snell's Law, Dispersion, Total Internal Refraction, Fibre Optics etc.	10 min	Fill in the blanks handout	Formative	Nelson Physics 12 - Sections 9.1, 9.2
		<b>Homework (Problem Set)</b> Page 443 # 1-8, 12, 16, 20-21 Page 458 # 1-8	5 min		Formative	Nelson Physics 12 - Sections 9.1, 9.2

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<b>Day 2</b> Diffraction (9.3)	E2.2 conduct inquiries involving the <b>diffraction</b> and <b>interference</b> of waves, using ripple tanks or computer simulations [PR]	<b>Do Now</b> <i>Page 458 #10. Write out answers and hand in. This will test if students did the homework or not, of course bright students will be able to do this if they didn't do the homework.</i>	5 min	Blank paper	Formative	Nelson Physics 12 - Sections 9.3
		<b>Take up homework</b> Check if there are any questions from previous day's homework	5 min	Take up on board (if needed)		Nelson Physics 12 - Sections 9.1, 9.2
		<b>Hook - Observation Stations</b> Students to rotate through two stations <i>Station 1:</i> Ripple tank to observation diffraction Complete page 1 of worksheet <i>Station 2:</i> Interference from two speakers Complete page 2 of worksheet  Note: I did not create the worksheet.	15 min	- Ripple tank - Two speakers - Use computer simulations if equipment not available	Formative (Observation)	Nelson Physics 12 - Section 9.3 - <i>Station 1:</i> Investigation 9.3.1, p. 487-488 - <i>Station 2:</i> Mini-Investigation lab, p. 464 - Computer Simulation <a href="http://phet.colorado.edu/en/simulation/wave-interference">http://phet.colorado.edu/en/simulation/wave-interference</a>
		<b>Direct Instruction</b> Go through the derivations and sample problems p. 461, 466, 467 on board. Provide time to complete practice problems on p. 461, 467	15 min			
		<b>Activity</b> Homework problems - p 468-469 #1-7 Complete as group activity. Split class into 7 groups (table groups if easier). Each group to complete one question on chart paper and present answers to class.	20 min		Formative	Nelson Physics 12 - Section 9.3

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		<b>Homework</b> Complete the questions you did not do.	5 min		Formative	Nelson Physics 12 - Section 9.3
		<b>Consolidation</b> - Summarize Lesson verbally	5 min			
		<b>Exit Ticket</b> 1. Name one thing you learned today. 2. Name one thing you would like to know more about.	5 min	<i>Exit ticket</i>	Formative	

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<b>Day 3</b> Double Slit Concepts (9.4)	E2.3 conduct inquiries involving the <b>diffraction, refraction, polarization, and interference of light waves</b> (e.g., shine lasers through <b>single, double, and multiple slits</b> ; observe a computer simulation of <b>Young's double-slit experiment</b> ; measure the index of refraction of different materials; observe the effect of crossed polarizing filters on transmitted light) [PR]	<b>Do Now</b> <i>Terminology Review Worksheet</i> - Hand out worksheet as students walk in - Take up answers, have students go up and fill in the blanks on the SmartBoard - Announce Chp. 9 Quiz on Day 5	5 min	- <i>Terminology Review Worksheet</i> - <i>SmartBoard</i>	Formative	Nelson Physics 12 - Review of 9.1, 9.2, 9.3
		<b>Take up homework</b> Check if there are any questions from previous day's homework	5 min	Take up on board (if needed)		
		<b>Hook</b> Write question on the board: <i>Is light a wave or particle?</i> - Use Think Pair Share (TPS) to discuss and take up answers. - Extension: Use debate format as an alternative to TPS (depends on class/group dynamics)	5 min		Formative (Discussion)	Nelson Physics 12 - Section 9.4
		<b>Direct Instruction</b> Watch and discuss Dr. Quantum video	10 min	YouTube Video		<a href="http://www.youtube.com/watch?v=DfP enrO7oGc">http://www.youtube.com/watch?v=DfP enrO7oGc</a>
		<b>Activity</b> <i>Lab - PhET Quantum lab (Java applet)</i> - Complete question 1 together as a class - Work in pairs with elbow partner to complete lab	30 min	- <i>PhET Lab Handout</i> - Book computer lab - Need computers with Java and Internet access - Use PhET Simulation Lab	Formative	<a href="http://phet.colorado.edu/en/simulation/quantum-wave-interference">http://phet.colorado.edu/en/simulation/quantum-wave-interference</a>
		<b>Homework (to hand in)</b> Complete questions 2-9 (required) Challenge questions 10-17 (optional)	5 min		Formative	
		<b>Consolidation</b> - Summarize Lesson verbally	5 min			

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		<b>Exit Ticket</b> 1. Name one thing you learned today. 2. Name one thing you would like to know more about.	5 min	<i>Exit ticket</i>	Formative	

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<b>Day 4</b> Double Slit Math (9.5)	E2.4 analyse diffraction and interference of water waves and light waves (e.g., with reference to two-point source interference in a ripple tank, thin-film interference, multiple-slit interference), and solve related problems [PR, AI]	<b>Do Now</b> <i>Hand in PhET Quantum Lab</i> - Hand out worksheet as students walk in - Write a note about Young's double-slit experiment. Create a fill in the blank worksheet. Take up answers.	5 min	- Young's double-slit experiment note - SmartBoard	Formative	Nelson Physics 12 - Section 9.4
		<b>Take up homework</b> Check if there are any questions from previous day's homework	5 min	Take up on board (if needed)		Nelson Physics 12 - Section 9.4
		<b>Direct Instruction</b> Show proofs and derivations for the formulas used pp. 479-482.	10 min			Nelson Physics 12 - Section 9.5
		<b>Activity</b> Homework problems - p 484 #2-8 Complete as group activity. Split class into 7 groups (table groups if easier). Each group to complete one question on chart paper and present answers to class.	30 min	- Chart Paper - Markers	Formative	Nelson Physics 12 - Section 9.5
		<b>Homework</b> Complete the questions you did not do.	5 min		Formative	Nelson Physics 12 - Section 9.5
		<b>Consolidation</b> - Summarize Lesson verbally - Review content covered in Chapter 9 - Review quiz expectations (20 min, multiple choice, fill in the blanks etc.)	15 min			

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<b>Chapter 10 – Applications of the Wave Nature of Light</b>						
<b>Day 5</b> - Quiz - Diffraction Gratings (10.3)	<b>E3.1</b> describe and explain the <b>diffraction</b> and <b>interference of water waves in two dimensions</b>	<b>Chapter 9 Quiz</b> - Closed book, put all notes away, need a pen or pencil - No talking - 20 minutes If you finish early read section 10.3 of textbook	20 min	Quiz (did not create)	Summative	Nelson Physics 12 - Chapter 9
		<b>Hook</b> Watch and try to explain why this works. Laser show videos (if equipment available, replicate in the classroom as a demonstration)	5 min	YouTube Video from Thomas Altman	Formative	<a href="http://www.youtube.com/watch?v=lmz7IYEJZJ4">http://www.youtube.com/watch?v=lmz7IYEJZJ4</a> <a href="http://altmanscience.com/Lasers.html">http://altmanscience.com/Lasers.html</a>
		<b>Direct Instruction</b> - Discuss how a spectrometer works - Discuss how this relates to CDs or DVDs - Show proofs (maxima, minima) and derivations for the formulas used pp. 523.	10 min			Nelson Physics 12 10.3
		<b>Activity</b> Complete worksheet courtesy of Robert Tevlin.	30 min	Worksheet from Roberta Tevlin Day 1.5	Formative	<a href="http://roberta.tevlin.ca/12U%20Course/1%20Wave%20Nature%20of%20Light/Wave%20nature%20Main.htm">http://roberta.tevlin.ca/12U%20Course/1%20Wave%20Nature%20of%20Light/Wave%20nature%20Main.htm</a>
		<b>Consolidation</b> - Summarize Lesson verbally	5 min			
		<b>Exit Ticket</b> 1. Name one thing you learned today. 2. Name one thing you would like to know more about.	5 min	<i>Exit ticket</i>	Formative	

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<b>Day 6</b> - Polarization (10.5) - Thin Film and Single Slit Interference (10.1, 10.2)	E3.2 describe and explain the diffraction, refraction, <b>polarization</b> , and <b>interference of light waves</b> (e.g., <b>reduced resolution caused by diffraction</b> , <b>mirages caused by refraction</b> , <b>polarization caused by reflection and filters</b> , <b>thin-film interference in soap films and air wedges</b> , <b>interference of light on CDs</b> )  E3.3 use the concepts of refraction, diffraction, <b>polarization</b> , and <b>wave interference</b> to explain the <b>separation of light into colours</b> in various situations (e.g., light travelling through a prism; <b>light contacting thin film, soap film, stressed plastic between two polarizing filters</b> )	<b>Return Quizzes</b> Take up questions that everyone missed. Post answers. Tell students to see me after class if there are specific questions they want to discuss.	5 min	Marked Quizzes	Formative	Nelson Physics 12 - Chapter 9
		<b>Click questions (or individual white board questions)</b> 5 multiple choice questions to review previous day's content (need to create)	5 min	Take up on board (if needed)	Formative	Nelson Physics 12 10.3
		<b>Direct Instruction</b> Complete observation lab, hand in by end of class	5 min			
		<b>Activity - Observation Stations</b> Students to rotate and make observations for each station Station 1: Reflection (Mirror and laser/light beam) Station 2: Thin film (soap) on glass Station 3: Thin film (oil) on water Station 4: Interference of light on CDs Station 5: Newton's Rings and Air Wedges Station 6: Anti-reflective coatings on glasses, windshields, cellphone cameras Station 7: Polarizing camera filter (or sunglasses) Station 8: LCD displays and Polarization  Complete observations on worksheet Note: I did not create the worksheet.  If finished early, start homework.	45 min	- Mirror - Light beam - glass - beaker with water - soap - oil - CDs - Newton's Rings - Air Wedges - Old glasses with anti-reflective coating - polarizing camera filter or sunglasses - LCD display (picture frame)	Formative (Observation)	Nelson Physics 12 - Section 10.1, 10.2, 10.5
		<b>Homework</b> p. 511 #1-3,5 p. 519 #1-3,7-10 p. 537 #1-2,5-6,11-12	5 min		Formative	Nelson Physics 12 - Section 10.1, 10.2, 10.5

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		<b>Consolidation</b> - Summarize Lesson verbally	5 min			
		<b>Exit Ticket</b> 1. Name one thing you learned today. 2. Name one thing you would like to know more about.	5 min	<i>Exit ticket</i>	Formative	

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<b>Day 7</b> Electromagnetic Radiation (10.4) Projects work period (1/2 period)	<b>E3.4</b> describe, in qualitative terms, the production of <b>electromagnetic radiation</b> by an oscillating electric dipole (e.g., a radio transmitter, a microwave emitter, an X-ray emitter, electron energy transitions in an atom)	<b>Do Now</b> <i>Page 537 #7. Write out answers and hand in. This will test if students did the homework or not, of course bright students will be able to do this if they didn't do the homework.</i>	5 min	Blank paper	Formative	Nelson Physics 12 - Section 10.1, 10.2, 10.5
		<b>Take up homework</b> Check if there are any questions from previous day's homework	5 min	Take up on board (if needed)	Formative	Nelson Physics 12 - Section 10.1, 10.2, 10.5
		<b>Hook</b> Write question on the board: <i>What is an example of electromagnetic radiation? I can think of ten, how many can you come up with?</i> - Use Think Pair Share (TPS) to discuss and take up answers.	5 min		Formative (Discussion)	Nelson Physics 12 - Section 10.4
		<b>Direct Instruction</b> Show image of electromagnetic spectrum Discuss practical examples	10 min	Image of Electromagnetic Spectrum		Nelson Physics 12 - Page 527
		<b>Consolidation</b> - Summarize Lesson verbally - Handout Unit 4 - Chp. 9 & 10 Review Package so students can start their review - Review content covered in Chapter 9 and 10 - Review quiz expectations (60 min, multiple choice, fill in the blanks etc.)	5 min	Review Package		
		<b>Homework (to hand in)</b> p. 531 #1-6, 10-11	5 min		Formative	Nelson Physics 12 - Section 10.4
		<b>Activity</b> <i>Work period to complete group projects.</i>	40 min		Formative	

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<b>Day 8</b> Group Presentations	<p><b>E1.1</b> analyse, with reference to the <b>principles</b> related to the wave nature of light, a <b>technology</b> that uses these principles (e.g., Xeon lights, spectroscopes, polarized sunglasses) [A1, C]</p> <p><b>E1.2</b> assess the <b>impact on society and the environment</b> of technologies that use the wave nature of light (e.g., <b>DVDs, polarized lenses, night vision goggles, wireless</b></p>	<p><b>Group Presentations</b></p> <ul style="list-style-type: none"> <li>- Review format, ground rules, respect for each other</li> <li>- Questions: each person to come up with a question to ask. I will call on you randomly. Every person will ask at least one question. Complete and hand in worksheet.</li> <li>- peer evaluation - presentation skills only (not content)</li> </ul>	5 min	Question Worksheet	Summative	
		<p><b>Timeline</b></p> <ul style="list-style-type: none"> <li>7 groups @ 10 min per group</li> <li>3-5 min presentation</li> <li>5 min for questions/comments</li> </ul>	70 min			Nelson Physics 12 - Unit 4 - Chp. 9 & 10

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Day 9 Review		<b>Take up homework</b> Check if there are any questions from previous day's homework	5 min	Take up on board (if needed)	Formative	Nelson Physics 12 - Section 10.4
		<b>Activity</b> <i>Work period to review/study for summative test.</i> If there are any misconceptions or particular topics that need to be reviewed, do as a class, otherwise it is a work period.  Students should use this opportunity to ask any questions they have or work on the review package if they haven't started yet.	70 min		Formative	Nelson Physics 12 - Unit 4 - Chp. 9 & 10
Day 10 Summative Test	<p><b>E1.</b> analyse technologies that use the wave nature of light, and assess their impact on society and the environment;</p> <p><b>E2.</b> investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems;</p> <p><b>E3.</b> demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and</p>	<p>Unit 4 - Chp. 9 &amp; 10 Summative</p> <ul style="list-style-type: none"> <li>- Closed book, put all notes away, need a pen or pencil</li> <li>- No talking</li> <li>- 60 minutes</li> </ul> <p>If you finish early read start Diagnostic for next unit</p>	60 min	<b>Unit Test</b>	Summative	Nelson Physics 12 - Unit 4 - Chp. 9 & 10
		<p><b>Unit 5 Diagnostic</b></p> <ul style="list-style-type: none"> <li>- Closed book, put all notes away, need a pen or pencil</li> <li>- No talking</li> <li>- 15 minutes</li> </ul> <p>If you finish early read or do quiet work</p>	15 min	Diagnostic Assessment	Diagnostic	