

COURSE: Grade11 Physics, University Preparation Level

Unit of Study: Waves and Sound		
	<p>Summary:</p> <p>-The focus of this unit is on Demonstrate an understanding of the properties of mechanical waves and sound and the principles underlying the production, transmission, interaction, and reception of mechanical waves and sound.</p> <p>-investigate the properties of mechanical waves and sound through experiments or simulations, and compare predicted results with actual results</p> <p>-describe and explain ways in which mechanical waves and sound are produced in nature, and evaluate the contributions of technologies that make use of mechanical waves and sound to entertainment, health, and safety</p>	<p>E1. analyse how mechanical waves and sound affect technology, structures, society, and the environment, and assess ways of reducing their negative effects;</p> <p>E2. investigate, in qualitative and quantitative terms, the properties of mechanical waves and sound, and solve related problems;</p> <p>E3. demonstrate an understanding of the properties of mechanical waves and sound and of the principles underlying their production, transmission, interaction, and reception.</p> <p>Key Expectations:</p> <ul style="list-style-type: none"> • define and describe the concepts and units related to mechanical waves (e.g., longitudinal wave, transverse wave, cycle, period, frequency, amplitude, phase, wavelength, speed, superposition, constructive and destructive interference, standing waves, resonance) • describe and illustrate the properties of transverse and longitudinal waves in different media, and analyze the speed of waves travelling in those media in quantitative terms • explain and graphically illustrate the principle of superposition, and identify examples of constructive and destructive interference • analyze the components of resonance and identify the conditions required for resonance to occur in vibrating objects • identify the properties of standing waves and explain the conditions required for standing waves to occur; • draw, measure, analyze, and interpret the properties of waves (e.g., reflection, diffraction, and interference, including interference that results in standing waves) during their transmission in a medium and from one medium to another, and during their interaction with matter

Designing the Learning

Note: A Day is one 75 minute period.

Learning Skills (LS) Key:

R = Responsibility, O = Organization, IW = Individual Work, C = Collaboration, I = Initiative, SR = Self-Regulation

The timeliness of all submissions (within timelines appropriate to the needs of individual students) will be considered as part of the Responsibility skill.

Cluster/Topic	Day	Concept/Subtopic with Learning Goals for Each Lesson	Teaching & Learning Strategies	Assessment (A) and Evaluation (E); Learning Skills Assessment	Expectations Addressed
Definition and overview	1	<p>Introduction, including introduction to assignment</p> <p>By the end of the lesson, students will be able to show waves being produced on a rope that has one end tied tightly to a post.</p> <p>Describe in their own words the differences between noise and music.</p> <p>What Causes Objects to Vibrate?</p> <p>Learn some of the terms they will encounter in this unit : infrasonic sounds, ultrasonic sounds, sound barrier, sonic boom, subsonic speed, and supersonic speed.</p>	<p>Whole-Class Brainstorm on the differences between noise and music</p> <p>Lecture (brief)</p> <p>http://www.acoustics.salford.ac.uk/schools/lesson1/flash/mexicanwave.swf</p> <p>What do you think each of these terms means?</p> <p>Lecture (brief) on functional group and naming</p> <p>Think-Pair-Share Predict-Explain: put propane, 1-propanol, propanal and propanone in order of b.p., from lowest to highest.</p>	Agree/Disagree chart; brainstormed responses	E1.1

Chapter 6 – Vibrations and Waves (Part 1)	2	<p>The main concepts in this chapter relate to the properties of vibrations and waves. Summarize as many ideas from this chapter as possible by drawing labelled diagrams of pendulums, springs, ropes, and water waves. On the diagrams, include Key Terms and equations wherever you can.</p> <p>By the end of the lesson, students will be able to:</p> <ul style="list-style-type: none"> -understand and explain: wave, Periodic motion Transverse vibration, Longitudinal vibration, torsional vibration cycle, frequency, period 	<p>Using SmartBoard lessons</p> <p>Students group work to answer to the question sheet</p> <p>http://www.acoustics.salford.ac.uk/schools/lesson1/flash/long.swf</p> <p>Wave Types discussion : http://www.acoustics.salford.ac.uk/schools/lesson1/flash/slinky.swf</p>	<p>Student responses during Smart Board work</p> <p>Sample Problem 1,2,3 on Smart Board without displaying the answers (p.197 Nelson)</p> <p>Group-Testing Contest: Why frequency and period are reciprocals of each other? $f=1/T$ and $T= 1/f$</p>	<p>E1.1 E3.1 E2.1 E2.2</p>
--	---	---	---	--	--

<p>(Part 2) Chapter 6 – Vibrations and Waves Vibrations, Wave motion, Types of Waves, The universal wave equation, Transmissio n and Reflection (6.1, 6.2, 6.3, 6.4)</p>	3	<p>By the end of the lesson, students will be able to explain what is meant by Vibrations, Wave motion, Types of Waves, The universal wave equation, Transmission and Reflection</p>	<p>Using Smart Board lessons , direct teaching method, explain the introductory terms, definitions etc. Cooperative activity method Line up some students single file, each with their hands on the shoulders of the student in front (Figure 2(b)) p.195. Gently push and pull the last student forward and back. Watch as the motion is passed up the line from student to student as a longitudinal wave.</p> <ul style="list-style-type: none"> • Tie a long length of light rope to a door knob or other rigid point. After stretching the rope taut, shake the free end back and forth sending a series of waves down the rope. <p>(a) In each case, how does the medium move with respect to the direction in which the wave is moving? (p.195) Activities involved: Simple Pendulum, Spring producing longitudinal waves, other daily life examples like swings etc. Show the students what is the meaning of terms like amplitude and frequency etc. The students will search at least two internet resources on waves and vibrations in small groups. Material Used: A spring, A Simple Pendulum (A clamp, utility stand, test-tube rubber stopper, string, stop watch etc), A swing</p>	<p>Check the students participation in the class activities Check the homework assigned from page 198 and 199 Involvement in the class activity, Group Discussion, Solve problems based on the Universal Wave Equation in the class. Homework – Page 198, 199 (Problems 2, 3, 5, 7) – Nelson Physics 11 These problems cover all four levels of Bloom’s Taxonomy (Knowledge, Analysis, Assessment and Evaluation etc.)</p>	<p>E2.2 E2.2</p>
--	---	--	--	--	----------------------

<p>Waves in Two Dimensions (Transmission and Reflection of Water Waves, Refraction and Reflection), Interference of Waves (Constructive and Destructive Interference)</p> <p>6.5-6.7</p>	<p>4</p>	<p>By the end of the lesson, students will be able to know:</p> <ul style="list-style-type: none"> • Pulses reflected from a fixed end are inverted. • Pulses reflected from a free end are not inverted. • When a pulse enters a new medium, no inversion occurs. • When a wave enters a slower medium, its wavelength decreases; in a faster medium the wavelength increases. • When waves strike the boundary between two different media, partial reflection occurs. • The phase of transmitted waves is unaffected in all partial reflections, but inversion of the reflected wave occurs when the wave passes from a fast medium to a slow medium. 	<p>Class group Activity (Using Mirrors and Prism) to define and explain the terms Refraction, Reflection and wave motion.</p> <p>Explain the Principle of superposition of waves by using a slinky spring. Note: You will receive full credit for each prediction made in this preliminary section whether or not it matches conclusions you reach in the next section. As part of the learning process it is important to compare your predictions with your results. Do not change your predictions!</p> <p>Students will participate in activity “Demonstrating Interference with Springs”</p> <p>Reference: Nelson Physics 11 Page 221</p> <p>Group work to discuss problems on pages 213, 214, 218 (Nelson Physics 11)</p> <p>Material Used: An overhead projector and transparent sheets to show the students the concept of interference, reflection and refraction. AM and FM radio to help them understand the different types of waves (Amplitude Modulation or Frequency).</p>	<p>Group Activity1: Page 221</p> <p>undrestanding concept investigation (Groups of 2)</p> <p>Group Activity2: The students will understand the concept of Interference using Slinky spring.</p> <p>The work done on problems listed on pages 213, 214, 218 of the Nelson Physics 11) will be assessed as an in class activity.</p> <p>The students will be given home work – Solve problems on page 211 (1 and 2) based on Universal Wave Equation.</p> <p>Check the students’ participation in the class activities like the activity on Slinky Spring. (The concept of Interference with Spring)</p> <p>Check the homework assigned from page 211.</p>	<p>E2.3</p> <p>E2.4</p> <p>E3.1</p> <p>E3.3</p> <p>E3.4</p>
---	----------	--	--	--	---

Test/ Review of all concepts in unit to date	5				
--	---	--	--	--	--

<p><i>Chapter 7</i> -What Is Sound? - Production and Transmission of Sound Energy -The Speed Of Sound</p>	6	<p>Properties of Sound Waves (What is Sound, Tuning Fork Activity, Sound as a type of Energy, Production and Transmission of Sound Energy, The Speed of Sound, Activity Measuring the Speed of Sound Outside (7.3.1) Pages 237 to 244 Nelson Physics 11</p>	<p>-Ask students what is sound and let them to think and brainstorm -Watch: http://www.youtube.com/watch?v=oCmGjD9j9bU&feature=related & http://www.youtube.com/watch?v=at50acNlke8</p> <p>Tuning Fork Activity to introduce the concept of sound waves. An electric bell as an example of sound producing instrument. Explain that sound needs a medium to travel from one point to another and to show that medium effects the travel speed of light. Conducting and Analysing Experiments teaching method. Power Point presentation to explain the sound waves. The speed of sound in air, steel and other medium and the effect of temperature, humidity on the propagation of sound waves. classroom activity (7.3.1) : Measure the speed of sound in the— page 244 Nelson Physics 11</p>	<p>The students will work on the problems and reflect with their possible answers. Nelson Physics 11 page 242 questions 1 – 7. Solve problems 1- 5 on page 241 Nelson Physics 11. The participation in class activities of the students</p>	<p>E2.6 E2.7</p>
--	---	--	---	--	-------------------------------

<p>-The Intensity Of Sound</p> <p>-The human ear</p> <p>-The Reflection Of Sound Wave</p>	7	<p>Intensity of Sound, Units of measurement (Decibel db) of sound intensity, The Human Ear, The reflection of sound waves (Sonar, Echolocation), Ultrasound Medical Applications (Refraction and Reflection in Sound Waves) Reading and Reference material: # 7.4, 7.5, 7.6 – Pages 247 to 258 Nelson Physics 11</p>	<p>Starting the class with: http://www.youtube.com/watch?v=UG5M_CzR1RI</p> <p>Ask: What the sound pollution is? List the factors effecting human ears</p> <p>-Divide the black board into five and ask students to come to the board and write at least one factor</p> <p>Discuss in groups of 4 questions 4-7 page 258 (to enhance their curiosity)</p> <p>The students will work in groups to understand the frequency range of hearing</p> <p>1- What is Echo and how sound is reflected?</p> <p>2- What is Ultrasound and how ultrasound waves are used in the medical science?</p> <p>3-What is Echolocation? How Dolphins, Whales and Bats use propagation of sound to communicate?</p>	<p>Problems on page 257 Nelson Physics 11 (Questions 1, 2, 3, 4) as in class activity.</p> <p>Their participation in the class solving problems on page 258 will also be considered as their assessment.</p> <p>Home Work – Page 258 Nelson Physics 11 Questions 1, 2, 3</p>	<p>E2.6</p> <p>E2.7</p>
---	---	--	---	--	-------------------------

-Diffraction and Refraction of Sound Waves -The Interference of sound Waves	8	Diffraction and Refraction of Sound Waves, Interference of Sound Waves,	Showing or teaching like: http://www.youtube.com/watch?v=z7RbHBK58h8 Direct Lecture Method, Power Point Presentation Group Discussion	Practice Page 260 Home Work will be evaluated.	E3.4 E3.5 E3.6
--	---	---	--	---	----------------------

-Beat Frequency	9	Beats (Periodic changes in sound intensity caused by interference between two nearly identical sound waves), Beat Frequency	Discussing: http://www.school-for-champions.com/science/sound_beat_frequencies.htm In class Activity (7.9.1) Beats from Nearly Identical Forks (Page 264 Nelson Physics 11)	Practice (page 266) Q. 1,2,3 formative assessment	E3.5 E3.6
--------------------	---	---	--	---	--------------

The Doppler Effect and Supersonic Travel	10	Doppler Effect and Supersonic Travel – Pages 258 to 268 Nelson Physics 11	Explain Supersonic Travel, Breaking Sound Barrier by using a small video and direct lecture method. Work together Page 270 (Practice)	Home Work – Page 270 Nelson Physics 11 problems 3, 4, 5 and problem numbers 5, 6, 8,9 on page 274 (Nelson Physics 11)	E2.7 E2.6
--	----	---	--	---	--------------

Test/ Review of all concepts in unit to date	11				
--	----	--	--	--	--

<p>-Music, Musical Instruments and Acoustics - Music and Musical Scales - Vibrating Strings</p>	12	<p>Music, Musical Instruments and Acoustics Music and Musical Scales – Music, Noise, Pure tone, Consonance, Dissonance, Octave, The Standard Frequency, The Musicians’ Scale, Vibrating Strings, Dependency of frequency of a vibrating string on length and tension in the string. Pages 276 – 283 Nelson Physics 11</p>	<p>Discuss: Questions page 276 Activity: Seeing Sound page 277 The students will be given notes using smart board and black board to explain the terms like Music, Noise, Pure Tone, Consonance, Dissonance, Octave and The Standard Frequency. The relationship between frequency (f) and length of the string (l) and Density (D) $F = L / \sqrt{D}$ The students will work in groups of two to solve problems on page 283 Nelson Physics 11, Problems 1-5.</p>	<p>-The students will be assessed on the basis of their in class participation and the home work. - The students have to finish numerical problems on page 283. Homework and In class activity and participation.</p>	<p>E3.2 E2.7</p>
---	----	---	--	---	----------------------

Modes of Vibration – Quality of Sound, Resonance in Air Columns, Resonance in Closed Air Columns, Resonance in Open Air columns, Musical Instruments (Stringed Instruments, Wind Instruments, Percussion Instruments)	13	Modes of Vibration – Quality of Sound, Resonance in Air Columns, Resonance in Closed Air Columns, Resonance in Open Air columns, Musical Instruments (Stringed Instruments, Wind Instruments, Percussion Instruments Pages 284 – 298 – Nelson Physics 11	<p>I bring a few musical instrument for the students' investigation</p> <p>Use Smart board, Stethoscope to explain Percussion.</p> <p>Resonator, A harp, One Percussion instrument.</p> <p>Investigation and Experimental</p> <p>The students will participate in an activity on “Resonance in Closed Air Columns”</p> <p>The Materials required are: Plastic Pipe, Large Graduated Cylinder, Metre Stick and Thermometer.</p> <p>Lecture Method:</p> <p>The students will learn the methods of Resonance, Resonance in Closed Air Columns, Resonance in Open Air Columns and Speed of Sound in Closed Air Columns.</p> <p>Group Activity: Activity 8.5.1 (Waveforms of Stringed Instruments)</p>	<p>-Home work and the students' participation in the activities will be considered as formative evaluation. The students will work on finding musical instruments and classify them as Stringed, Wind, Percussion instruments.</p> <p>- The students will be asked to show their individual participation in the classroom and lab activities. The students are also required to work in the lab activities done time to time towards their final assessment.</p> <p>Home work on page 292, Problems 1-10</p>	E3.5 E3.6
---	----	--	---	---	--------------

Review/ Quiz	14				
-----------------	----	--	--	--	--

The Human Voice as a Musical Instrument ,	15	The Human Voice as a Musical Instrument, Electrical Instruments and Audio Reproduction, Digital Sound, Activity on Evaluating Headphones – Harmonic and Headphones. Pages 299 to 304 – Nelson Physics 11	<p>Use smart board to show the production of human voice, explain the terms like pharynx, soft palate, epiglottis, larynx, vocal cords and esophagus.</p> <p>Investigation and Analysis method: Various electrical instruments like An electric guitar, Loud speakers and concept of Digital Sound.</p> <p>The students will investigate and find the difference between electrical sound instruments and other instruments. Why an electric guitar is considered an acoustic guitar?</p> <p>In Class Activity: The students will work cooperatively on activity 8.7.1 (Evaluating Headphones) on page 303 of Nelson Physics 11</p>	- Home work will be used for evaluation.	E2.6 E2.7
---	----	--	---	--	--------------

Field Trip to Ontario Science Center	16				
---	----	--	--	--	--

Review/ Quiz	17				
-----------------	----	--	--	--	--

Electronic Musical Instruments, Acoustics, Reverberation time, Experimental Determination of Reverberation time.	18	Electronic Musical Instruments, Acoustics, Reverberation time, Experimental Determination of Reverberation time. 305- 309 – Nelson Physics 11	Use computers, Overhead projector, Microphone and Oscilloscope, computer to find reverberation time. Show to the students a portable electronic synthesizer, Acoustics, the importance of acoustics, Reverberation time and its importance in acoustics. The students will work in groups to find various shapes of the buildings as examples of acoustics. They will investigate why the theatre halls have certain shape and how acoustics is important in construction technology. .	-The group activity and their individual participation. Home work -Quiz - The students will be assessed on the basis of home work and their individual participation in class activity. The assessment will be done on the basis of the Quiz in the class. Home Work: write one page on acoustic and its importance in construction technology or building	E2.2 E2.7
--	----	--	--	---	--------------

Unit Review	19		Unit summary /Smart Board		
-------------	----	--	---------------------------	--	--

Unit Test	20				
-----------	----	--	--	--	--