Physics 20 Work Plan

Units/Topics	Time Frame	Major Learning Outcomes Unit	Major Resource(s) Assessment methods
Unit 2 **Wave Motion**	**4 – 5 weeks** **Sept – Oct.**		**Resources:** Newfoundland Distance learning – www.cdli.ca Textbook: Irwin Physics Concepts and Connections Other personal resources where applicable **Informal assessments:** Asking questions in class to ensure students' comprehension of material. Revisit previous concepts as needed to ensure success **Formal assessments:** Regular assignments on each topic to get students to demonstrate their understanding of the material. Unit test upon completion of unit.
A. Properties of waves **1. Wave terminology** **2. Universal wave equation** **3. Principle of Superposition**		• Define the following terms: wave, disturbance, medium, pulse, vibration, cycle, periodic motion, simple harmonic motion, transverse vibration, longitudinal vibration, crest, trough, compression, rarefaction, frequency, period, amplitude, phase, wave length. • Give examples of periodic motion. • Apply the correct units for period and frequency in problem solving and applications. • Solve problems involving period, frequency, and wave motion. • Explain that the universal wave equation applies to all types of waves. • Apply the universal wave equation to various types of problems relating to waves.	
B. Wave Phenomena **1. Transmission, reflection, refraction** **2. Diffraction and other waves**		• Define the following terms: diffraction, phase, nodal lines (nodes), antinodes (loops), standing wave pattern, resonant frequency, dispersion, dispersive medium, phase delay. • Explain that the speed of waves depends on the frequency in a dispersive medium. • Describe the two conditions that would lead to a maximization of the degree of diffraction experienced by waves. • Explain that nodal points are located one-half of the wavelength of the interfering waves from one another. • Explain standing wave interference patterns by relating them to an understanding of constructive and destructive interference.	

		• Explain that the fixed ends of a one dimensional standing wave pattern must always be nodal points. • Explain that only certain resonant frequencies will produce standing wave interference patterns. • Explain that waves exhibit other properties such as scattering and polarization.	
Unit 3 **Light**	**4-5 weeks** **Oct. – Nov.**		**Resources:** Newfoundland Distance learning – www.cdli.ca Textbook: Irwin Physics Concepts and Connections Other personal resources where applicable **Informal assessments:** Asking questions in class to ensure students' comprehension of material. Revisit previous concepts as needed to ensure success **Formal assessments:** Regular assignments on each topic to get students to demonstrate their understanding of the material. Unit test upon completion of unit.
A. Characteristics of Light **1. Sources and transmission of Light** **2. The Speed of Light**		• Define the following terms: luminous, nonluminous, rectilinear propagation, beam, incandescence, ray, transparent, translucent, opaque, penumbra, umbra, eclipse. • Give examples of some common luminous and nonluminous objects. • Explain that light usually travels in straight lines. • Give some examples which illustrate the rectilinear propagation of light. • Identify objects which are transparent, translucent, and opaque. • Apply and understanding of the inverse square law relationship between the intensity of light and the distance from the source. • Define the following terms: speed, absolute index of refraction, index of refraction, relative index of refraction, light year. • Describe the methods used by Galileo, Roemer, and Michelson to measure the speed of light. • Explain why the speed of light is difficult to measure. • State the value of the speed of light in a vacuum to three significant figures. • Explain that the speed of light is fastest in a vacuum and slower in other materials. • Recognize that the index of refraction for a particular medium can be used to determine the speed of light in	

		that medium. • Apply the definition of the absolute index of refraction (or the definition of the index of refraction) to solve problems. • Explain that light travels slightly slower in air than in a vacuum, but in many situations this difference is negligible. • Recognize that the higher the value of the index of refraction for a particular medium the slower light will travel through that medium. • Solve problems to determine the relative index of refraction between any two given media. • Calculate the distance, in metres, that light travels in one light year, based on its speed in metres per second. • Explain why the light year is used to measure astronomical distances. •	
B. Reflection **1. Laws of reflection** **2. Plane Mirrors** **3. Curved Mirrors**		• Define the following terms: real image, virtual image, plane mirror, magnification, ray diagram. • Identify the characteristics of an image formed by a plane mirror. • Distinguish between a real and a virtual image. • Identify some optical systems which produce either a real or a virtual image. • Draw ray diagrams neatly, accurately, and to some appropriate scale. • Apply the correct use of solid and dotted lines on ray diagrams. • Interpret solid and dotted lines on ray diagrams. • Label ray diagrams correctly, using conventional symbols. • Determine appropriate scales to use when drawing ray diagrams. • Apply the magnification formula and the mirror	

		equation in problem solving. • State the four important image characteristics which need to be considered for any type of optical system. • Recognize and explain the importance of ray diagrams in geometric optics. • Demonstrate an understanding of important principles of drawing ray diagrams. • Draw ray diagrams for analysis and for solving problems dealing with optics. • Recognize the combined use of ray diagrams and equations in solving problems related to optics. • Define the following terms: real image, virtual image, plane mirror, magnification, ray diagram. • Identify the characteristics of an image formed by a plane mirror. • Distinguish between a real and a virtual image. • Identify some optical systems which produce either a real or a virtual image. • Draw ray diagrams neatly, accurately, and to some appropriate scale. • Apply the correct use of solid and dotted lines on ray diagrams. • Interpret solid and dotted lines on ray diagrams. • Label ray diagrams correctly, using conventional symbols. Determine appropriate scales to use when drawing ray diagrams. • Apply the magnification formula and the mirror equation in problem solving. • State the four important image characteristics which need to be considered for any type of optical system. • Recognize and explain the importance of ray diagrams in geometric optics. • Demonstrate an understanding of important principles of drawing ray diagrams.	

		• Draw ray diagrams for analysis and for solving problems dealing with optics. • Recognize the combined use of ray diagrams and equations in solving problems related to optics. • Define the following terms: converging mirror, concave surface, diverging mirror, convex surface, vertex, principal axis, focal plane, centre of curvature, radius of curvature, focal length, paraxial rays, axial point, principal focus, spherical mirror, cylindrical mirror, aberration, spherical aberration, parabolic mirror, conjugate points. • Explain the Principle of Reversibility. • Distinguish between a concave and a convex surface. • Draw diagrams of converging and diverging mirrors, showing the principal axis and important points located on the principal axis for each. • Explain the difference between a focal point and a focal plane. • Explain one way that spherical aberration can be corrected in a curved mirror. • Express the relationship between the focal length and the radius of curvature of a curved mirror. • Apply the relationship between the focal length and the radius of curvature of a curved mirror in solving problems. • Use the rules for drawing ray diagrams for converging and diverging mirrors (parallel-ray method) to position an object on the principal axis and locate the position and other characteristics of the image. • Interpret the characteristics of an image from a ray diagram. • Demonstrate an understanding of the importance and use of a procedure of verification when using ray diagrams and equations. • Observe and explain that the image position in either	

		a converging or a diverging mirror depends on the location of the object. • Observe and explain that except for the image position, all other characteristics of an image formed in a diverging mirror are independent of the object position. • Observe and explain that the characteristics of an image formed in a converging mirror depend on the object position. • Apply mirror equations to solving problems. • Apply the sign conventions for mirror equations correctly when solving problems. • Recognize that ray tracing and the use of equations are techniques that developed from experimentation.	
C. Refraction **1. Snell's Law** **2. Total Internal Reflection**		• Define the following terms: refraction, boundary, partial reflection, point of incidence, refracted ray, angle of refraction, spectrum, dispersion, dispersive medium, chromatic aberration, lateral displacement, angle of deviation. • Explain why refraction occurs. • Explain that no bending of the incident ray occurs if it strikes the boundary while travelling along the normal. • Draw and label a diagram which illustrates the way in which light behaves when it undergoes refraction. • State the three laws of refraction. • Apply Snell's Law to solve problems relating to refraction. • Recognize the direction that a refracted light ray will bend, depending on the relative index of refraction for the two media. • Explain what causes chromatic aberration. • Solve problems relating to the refraction of light. • Identify several applications or examples from common experience which illustrate the refraction of light.	

		• Define the following terms: total internal reflection, critical angle. • Solve problems involving the refraction of light. • Recognize situations in which total internal reflection could occur. • Determine the critical angle for light travelling from any medium into some other medium. • Recognize that the critical angle depends on the relative index of refraction between two media. • Explain how an incident ray, travelling towards a medium with a lower index of refraction, would behave if the angle of incidence were smaller than the critical angle, the same size as the critical angle, or larger than the critical angle.	
Unit 1 **Physics of Everyday Things**	**3 weeks**		**Resources:**
A. Intro to Physics	**Nov.** **Will also be done as part of other units**	• Formulate a response to the question: "What is physics?" • Identify some of the topics often studied within the realm of physics. • Recognize that different disciplines have evolved in science. • Suggest some reasons why different disciplines exist within science. • Give an example of a situation in which a person studying physics might need to know something about the other disciplines within science. • Demonstrate that observation is an essential part of science. • Recognize that new things are always being learned in science. • Point out that all things in science are tentative.	Newfoundland Distance learning – www.cdli.ca Textbook: Irwin Physics Concepts and Connections Other personal resources where applicable **Informal assessments:**

B. Discovering Physics		• Recognize that important ideas in physics are all around us. • Demonstrate an enjoyment of learning about physics. • Explore common items that operate on the basis of important principles in physics. • Manipulate a variety of tangible objects found around the home or elsewhere. • Disassemble and re-assemble a variety of everyday things to try to discover what makes them work. • Apply important principles in physics to solve typical problems that might occur around the home or elsewhere.	Asking questions in class to ensure students' comprehension of material. Revisit previous concepts as needed to ensure success **Formal assessments:**
C. Measurement and Data Analysis		• Express physical quantities using a value, appropriate SI units, and (if necessary) direction. • Recognize the advantages of the SI system of measurement. • Distinguish between fundamental units and derived units. • Demonstrate the correct use of the SI system of measurement. • Recognize the limited accuracy of measured quantities. • Express numbers in scientific notation. • Express numerical information to the correct number of significant figures. • Determine the order of magnitude of physical quantities. • Collect experimental data. • Graph numeric information. • Interpret information from a graph. • Extrapolate and interpolate graphical information.	Regular assignments on each topic to get students to demonstrate their understanding of the material. Unit test upon completion of unit.

Unit 4 **Heat**	**3 – 4 weeks**		**Resources:**
A. Heat and Temperature	**Dec- Jan**	• Define the following terms: thermal energy, heat, temperature, convection, conduction, radiation, thermal expansion, linear expansion, coefficient of linear expansion. • Identify some important postulates of the kinetic molecular theory. • State what is meant by a theory. • Explain that, as new information accumulates, a theory could be supported, modified, or rejected in favour of new theories which better help to explain the evidence. • Describe the difference between a theory and a law. • Give an example of an observable phenomenon which lends support to the kinetic molecular theory. • Explain the difference between heat and temperature. • State the correct units used to measure heat energy and temperature. • Explain that heat cannot be measured directly whereas temperature can. • State that a thermometer, like any other measuring instrument, must be calibrated in some way. • Recognize the limitations of certain materials that are used in making thermometers. • Explain the reference points that were used to calibrate the Celsius temperature scale. • Compare the Celsius and Kelvin temperature scales.	Newfoundland Distance learning – www.cdli.ca Textbook: Irwin Physics Concepts and Connections Sask. Learning Chemistry 30 Website Other personal resources where applicable **Informal assessments:** Asking questions in class to ensure students' comprehension of material. Revisit previous concepts as needed to ensure success **Formal assessments:** Regular assignments on each topic to get

		• Convert a temperature reading from degrees Celsius to Kelvin and vice versa. • State that substances vary in their amount of thermal expansion. • Solve problems involving heat and temperature, and thermal expansion.	students to demonstrate their understanding of the material. Unit test upon completion of unit.
B. Specific Heat Capacity and Latent Heat		• Define the following terms: specific heat capacity, specific latent heat, specific latent heat of fusion, specific latent heat of vaporization. • Solve problems involving specific heat capacity and specific latent heat. • Distinguish between specific heat capacity and specific latent heat. • Use the correct units for specific heat capacity and specific latent heat. • Identify several unique physical properties of water. • Suggest some environmental implications leading from the physical properties of water	
C. Thermodynamics		• Define the following terms: calorimeter, heat engine, heat pump. • State the Law of Conservation of Energy. • Give a practical example which illustrates the Law of Conservation of Energy. • State the Principle of Heat Exchange. • Give a practical example which illustrates the Principle of Heat Exchange. • State the Zeroth, First, Second and Third Laws of Thermodynamics. • Give examples to illustrate the Laws of Thermodynamics. • Explain that it is impossible to build a perfect heat engine. • Explain that as one attempts to reach absolute zero, it becomes progressively more difficult to	

		reach it, such that it becomes impossible to actually ever attain it.	