

# Unit 7: Waves, Sound and Light



**cds** | Cheongna Dalton School

# 7.Waves, Sound and Light

## Introduction

This unit we will begin by studying vibrations and waves and then build up our knowledge working towards light and sound. We will look out how we can draw ray diagrams to study reflection and refraction of mirrors and lenses. Study the wave nature of sound and light as transverse and longitudinal waves that carry energy and can interfere with other waves. In recent decades the study of waves has led to the invention of things such as Wi-Fi and X-ray machines. These things are integral in our modern society and we will explore other ways in which the properties of waves can be used.

## Unit Priority Standards

- HS-PS4-1: I understand the mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves travelling in various media.
- HS-PS4-2: I am able to evaluate questions about the advantages of using a digital transmission and storage of information.
- HS-PS4-3: I am able to evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other

# Unit Transfer Goals

- The ability to create visual and verbal analysis of a scientific investigation or experiment.
- Obtaining information using discourse, various texts, and a variety of media, to evaluate content, and communicate information.

| Unit Essential questions  |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. How has digital communication influenced the way we record and store information and are we losing something in the process?</li> <li>2. Has the ability to create computer simulations and access to the internet made us better problem solvers?</li> <li>3. What are the consequences of light waves interacting with matter?</li> <li>4. How can the ways that waves and vibrations naturally occur be manipulated to produce desired results?</li> </ol> |  |
| Acquisition of Knowledge Skill  |  |
| <i>Students will know...</i> <ol style="list-style-type: none"> <li>1. Students will know that light is a small part of the electromagnetic spectrum</li> <li>2. Students will know waves can add constructively and destructively.</li> <li>3. The digital storage of data has both advantages and disadvantages.</li> </ol>   | <i>Students will be skilled at...I can...</i> <ol style="list-style-type: none"> <li>1. Manipulating a slinky to show different wave interactions.</li> <li>2. Designing an experiment to show wave phenomena</li> </ol> |

# Unit Plan

## 701. Simple Harmonic Motion Inquiry

*Goals: To understand simple harmonic motion, the restoring force and Hooke's Law.*

Introduce periodic motion and simple harmonic motion such as a swinging pendulum.

Group Lab: Simple Harmonic Motion

Group Activity: Vibrating rulers

**Homework: Complete lab report questions**

## 702. Simple Harmonic Motion

*Goals: To understand simple harmonic motion, the restoring force and Hooke's Law.*

Group Activity: Vibrating rulers

**Homework: Complete ruler activity**

## 703. Properties of Waves

*Goals: To understand wave vibration and particle motion. Understand transverse and longitudinal waves.*

Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).

**Homework: Selection of Albert.io questions**

## 704. Wave Interactions

*Goals: To understand the superposition of waves, constructive, destructive and standing waves.*

Introduce wave interactions, nodes and standing waves.

Group Lab: Wave velocity along a slinky as a function of wavelength and frequency

**Homework: Lab experiment write up**

## 705. Sound Waves

*Goals: Explain how sound waves are made; understand the speed of sound and the Doppler Effect.*

Introduce sound waves, frequency and pitch, and the Doppler Effect

Demonstration: Inability to hear high frequencies with age.

## 706. Project Introductions

*Goal: To introduce the projects that will be completed this term.*

Activity: Introduce Term projects.

Activity: Group assignments and project distributions

**Homework: Project research**

### **707. Harmonics and Beats**

*Goals: To understand how an instrument makes different sounds*

Introduce beats and timbre

Demonstration: Desmos graphing exercise

### **708. Sound Intensity and Resonance**

*Goals: Calculate the intensity of sound, understand decibels and resonance.*

Introduce intensity, decibel levels, loudness and resonance of sound waves.

Demonstration: Resonance in an air column.

**Homework: Selection of Albert.io questions**

### **709. Light and Reflection**

*Goals: Investigate the EM spectrum and the speed of light. Understand the wave equation.*

Understand the components of the EM spectrum. Calculate the frequency and wavelength of light in a vacuum.

Demonstration: Laser light

### **710. Project Day (Sound and Light) – Project Time**

*Goals: Give student's chance to work on their projects.*

### **711. Mirrors and Reflections**

*Goals: Understand the laws of reflections and the nature of images.*

Introduce Ray diagrams, interactions with mirrors and images formed.

Group stations activity – Measuring the temperature of objects around us

Demonstration: Image formed by concave mirror.

**Homework: Write up class summaries and class challenge**

### **712. Colour and Polarisation**

*Goals: Understand how colours can be combined and seen. Understand polarisation of light.*

Introduce colour and its relationship to wavelength / frequency.

Introduce polarisation.

Demonstration: Light mixing of additive and subtractive colours

**Homework: Selection of Albert.io questions**

### **713. Refraction**

*Goals: Understand how refraction occurs and Snell's Law.*

Introduce refraction and Snell's Law

**Homework: Write up class summaries and class challenge**

### **714. Project Day (Sound and Light) – project presentations**

*Goals: Have students present their projects and receive feedback and criticism.*

**Homework: Write a reflection based on student feedback in class.**

### **715. Refraction and Critical Angles (Experiment)**

*Goals: Investigate refraction through a variety of Perspex blocks and find the critical angle for different boundaries.*

Group Lab: Laser and refraction lab

**Homework: Write up Experiment**

### **716. Digital Transmission**

*Goals: Understand total internal reflection and dispersion.*

Introduce analogue and digital signals and their conversions

Group Activity: TBA

**Homework: Research digital transmission methods**

### **717. Computer Encryption**

*Goals: To understand about how encryption works and how to protect yourself online*

Introduce Caesar Cipher program

**Homework: Finish encryption program in python**

### **718. Project Presentation Day (Research Project)**

*Goals: Students present their projects on their chosen research topic*

**Homework: Write a reflection based on student feedback in a group report.**

### **719. Unit 7 Workshop and Review Class**

*Goals: Give students the chance to answer a selection of questions and go through past problems to aid understanding*

**Homework: Finish class handouts**

### **720. Waves, Light and Sound Quiz**

*Goals: Check understanding of the term's information*

Activity: Group review and question time

**Quiz: Waves, Light and Sound**

### **721. Project Day Research project presentations**

*Goals: Have students present their projects and receive feedback and criticism.*

**Homework: Write a reflection based on student feedback in class.**

# Assessment Details

| Evidence  |  |
|---|--|
| I will check students' understanding throughout the unit by...  |  |
| <b>Summative</b><br>Lab Reports <ul style="list-style-type: none"><li>Students are required to conduct lab experiments and communicate their findings in a report.</li><li><a href="#">Lab Report Rubric</a></li></ul> Projects <ul style="list-style-type: none"><li>Students will undergo a project to demonstrate some physical phenomena related to sound or light and present their findings to the class.</li></ul> | <b>Formative</b><br>Group Activities <ul style="list-style-type: none"><li>The class engages in small group activities to help each other and get help and feedback from myself. These group activities usually involve simulations / demonstrations or practice problems.</li></ul> Workshop Classes <ul style="list-style-type: none"><li>Each unit will have a dedicated workshop day where students can practice questions of varying difficulty on that unit.</li></ul> |