

## UNIT OVERVIEW

### WAVES

**Unit Issue:** Waves can have both helpful and harmful effects on human health.

**Anchoring Phenomenon:** Sound and light waves can both help and harm humans.

Listed below is a summary of the activities in this unit. Note that the total teaching time is listed as 16–24 periods of approximately 45–50 minutes (approximately 4–5 weeks). If you find you cannot finish in this time frame, consider skipping activities 6 and/or 9.

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
<p>1. <b>Investigation: It's a Noisy World</b> This activity introduces sound intensity and the decibel scale. Students examine cards that represent the relative intensity of various sounds and learn that an increase of 10 dB is equivalent to a 10-fold increase in sound intensity.</p>	<p>sound intensity, decibel, scale</p> <p>MATHEMATICS SENSEMAKING</p>			1–2
<p>2. <b>Investigation: Making Sound Waves</b> Students explore frequency and intensity through the pitch of everyday sounds. They use a long metal spring to model sound waves.</p>	<p>sound intensity, frequency, pitch, loudness, audiograms</p> <p>SENSEMAKING</p>	Gather objects that make different pitches (optional).	MOD A4	1–2
<p>3. <b>Reading: The Nature of Sound</b> Students read about the properties of longitudinal waves, such as sound, including wave speed, transmission through media, and how its energy is related to its amplitude.</p>	<p>longitudinal waves, sound transmission, media, speed of sound, energy of sound</p> <p>LITERACY MATHEMATICS SENSEMAKING</p>		AID A5	1
<p>4. <b>Investigation: Noise-Induced Hearing Loss</b> Students are introduced to the concept of noise-induced hearing loss. They analyze fictitious profiles and develop a list of strategies to reduce the risk of noise-induced hearing loss.</p>	<p>frequency, audiograms, decibel scale, effects of intense sounds on hearing, risk evaluation</p> <p>MATHEMATICS SENSEMAKING</p>	Prepare self case study.	ODA Proc.	1
<p>5. <b>Investigation: Telephone Model</b> Students investigate a method of sound transmission through a cord. Using this telephone model, they compare the transmission of sound as analog and digital signals.</p>	<p>Analog wave, digital signal, interference</p>	Construct telephones (optional).	COM A3	1
<p>6. <b>Reading: Analog and Digital Technology</b> Students read about the technology of digital hearing aids that receive sound waves and manipulate them for the user.</p>	<p>Analog wave, digital signal, interference, transmission, receiver, recording digital information</p> <p>LITERACY SENSEMAKING</p>		COM A2 (Assessment of PE MS-PS4-3)	1

## WAVES (continued)

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
<p><b>7. Investigation: Another Kind of Wave</b> Using a long metal spring, students investigate transverse waves. They examine the relationship between frequency and wavelength and revisit amplitude and energy.</p>	Transverse wave, transmission, wavelength  LITERACY MATHEMATICS SENSEMAKING		MOD A7 COM A8 AID A9 (Assessment of PE MS-PS4-1)	1–2
<p><b>8. Laboratory: Wave Reflection</b> In this activity, students first investigate the law of reflection by bouncing sound off a wall. They take what they have learned and design an investigation for light rays. Finally, they explore the reflection of light off a curved mirror.</p>	Sound, light, law of reflection, concave mirrors, communication dishes		PCI Proc.	2
<p><b>9. Laboratory: Refraction of Light</b> Students direct a ray of light through water and trace its path into and out of the water. Then students investigate the special case of total internal reflection.</p>	Light refraction, incident ray, refracted ray, total internal reflection	Prepare Student Sheets.	PCI Proc. AID A2	1–2
<p><b>10. Laboratory: Comparing Colors</b> Students explore the nature of light by investigation the colors of the visible spectrum. First they observe how a diffraction grating splits white light into its component colors. Then they investigate the frequency of the different colors of white light through the use of a phosphorescent material.</p>	Visible light spectrum, transmission of energy, ultraviolet, evidence	Gather flashlight.	E&T A6b	1
<p><b>11. Laboratory: Selective Transmission</b> Students learn more about the properties of light by investigating transmission reflection and absorption of waves outside the visible spectrum. Students investigate three thin films that selectively transmit light that is not visible, such as ultraviolet.</p>	Selective transmission, reflection, absorption, ultraviolet  LITERACY	Sunshine needed.	AID A2	1–2
<p><b>12. Reading: The Electromagnetic Spectrum</b> Students read about the kinds of electromagnetic energies emitted from the sun that are not visible. The wavelengths, frequencies, and energy levels of light are discussed. The discovery and applications of infrared and ultraviolet are introduced.</p>	Electromagnetic spectrum, infrared, ultraviolet,  LITERACY SENSEMAKING		COM A5	1

## WAVES (continued)

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
<p><b>13. Laboratory: Where Does the Light Go?</b> Students compare the reflection and absorption of sunlight off a dark surface and reflective surface. Then they consider the increased health risks due to the sunlight that is reflected onto the skin and eyes from sand, snow, or water.</p>	<p>Absorption, reflection, refraction, ultraviolet exposure, law of reflection, evidence</p> <p>SENSEMAKING</p>	<p>Sunshine needed; gather covering cloth.</p>	<p>MOD A2 (Assessment of PE MS-PS4-2)</p> <p>COM A5</p>	<p>1–2</p>
<p><b>14. Laboratory: Blocking Out Ultraviolet</b> Students design an experiment that compares the effects of sunblock lotion and moisturizing lotion for their ability to transmit, reflect, or absorb ultraviolet. They relate the results to the sun’s effects on human health and the use of sunscreens.</p>	<p>Ultraviolet properties, skin cancer, cataracts, vitamin D deficiency, increased risk</p> <p>SENSEMAKING</p>	<p>Sunshine needed.</p>	<p>PCI Proc.</p>	<p>1–2</p>
<p><b>15. Talking It Over: Personal Protection Plan</b> Students analyze a series of fictitious profiles to determine the relative risk of cataracts and skin cancer for each case. After analyzing these narratives, each student determines his or her own relative exposure risk from ultraviolet, and then creates a personal protection plan.</p>	<p>Health risks of ultraviolet exposure, benefits and trade-offs, risk evaluation</p>	<p>Prepare Student Sheets.</p>	<p>E&amp;T A5</p>	<p>1–2</p>