

Grade 5 - Unit 1 - Light and Waves

Unit Focus

In this unit, students will build a conceptual understanding of the properties of light, energy, and waves, through the development of models that can predict and explain seen and unseen phenomenon. These phenomena involve the use of lenses, mirrors, and prisms. This unit will culminate in a project that synthesizes learning as students design and engineer unique constructions that utilize solar energy and manipulate light.

Stage 1: Desired Results - Key Understandings

Established Goals	Transfer	
<p>Next Generation Science <i>Elementary Standards: 4</i></p> <ul style="list-style-type: none"> Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. <i>4-PS3-4</i> Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. <i>4-PS4-1</i> Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. <i>4-PS4-2</i> Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. <i>4-PS3-2</i> <p><i>Elementary Standards: 5</i></p> <ul style="list-style-type: none"> Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. <i>3-5-ETS1-1</i> Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. <i>3-5-ETS1-3</i> <p>Next Generation Science Standards (DCI) <i>Science: 4</i></p>	<p>T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions. T2 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.</p>	
	Meaning	
	Understandings	Essential Questions
<p>U1 When light shines on an object, it is reflected, absorbed, or transmitted (refracted) through the object, depending on the object’s material and the frequency (color) of the light. U2 Wavelength, frequency, and amplitude are properties of a wave that determine its characteristics such as pitch, color, sound and energy. U3 Energy can be transferred from place to place by light waves (e.g. light to heat). U4 The structures of our eye provide specific functions that allow us to see. Changes to these structures impact the functioning of our eyes. U5 People continually find ways to harness the natural energy sources on Earth to improve their lives. U6 The Engineering Design Process is a method that requires planning, creating, testing, sharing and redesigning.</p>	<p>Q1 What is light? Q2 How do we see? Q3 Based on current information, how do I develop a testable design? 3-12 Q4 What do the results tell me? What patterns do I see or what conclusions can I draw?</p>	

Stage 1: Desired Results - Key Understandings

<ul style="list-style-type: none"> • An object can be seen when light reflected from its surface enters the eyes. PS4.4.B1 • Light also transfers energy from place to place. PS3.4.B2 • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). PS4.4.A2 <p><i>Science: 5</i></p> <ul style="list-style-type: none"> • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. ETS1.5.B2 • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. ETS1.5.C1 • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. ETS1.5.A1 • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. ETS1.5.B3 <p>Student Growth and Development 21st Century Capacities Matrix</p> <p><i>Critical Thinking</i></p> <ul style="list-style-type: none"> • Synthesizing: Students will be able to thoughtfully combine information/data/evidence, concepts, texts, and disciplines to draw conclusions, create solutions, and/or verify generalizations for a given purpose. MM.1.3 <p><i>Creative Thinking</i></p> <ul style="list-style-type: none"> • Design: Students will be able to engage in an appropriate process to refine their product. MM.2.3 	Acquisition of Knowledge and Skill	
	Knowledge	Skills
	<p>K1 To see things clearly light must be focused/refracted on the back of the eye (convex and concave lenses affect light refraction and what we see).</p> <p>K2 Structures in the eye allow us to see light. Light needs to be reflected into the eye in order for us to see.</p> <p>K3 Light travels in straight lines unless it travels through different mediums.</p> <p>K4 Refraction happens when light changes speed resulting in the bending of light.</p> <p>K5 The law of reflection - the angle of the incoming ray equals the angle of the reflected ray. Reflect means to bounce light. Shiny, smooth surfaces reflect light best.</p> <p>K6 Wavelengths of different sizes produce different colors of light in the electromagnetic spectrum.</p> <p>K7 The electromagnetic spectrum includes different size wavelengths of energy in the visible spectrum of light as well as invisible light.</p> <p>K8 A prism bends/refracts white light into the different wavelengths(colors) of light.</p> <p>K9 The speed of light (in a vacuum) is 300,000 km per second.</p> <p>K10 Materials are either transparent, translucent, or opaque and affect what we see.</p> <p>K11 Black pigment absorbs all colors of light and transfers light energy into heat energy, while white reflects all colors (wavelengths) of light.</p> <p>K12 <u>Vocabulary</u>: refraction, refract , reflect, convex, concave, transmit, transparent, translucent, opaque, lens, pupil, cornea, retina, iris, nearsightedness, farsightedness, electromagnetic spectrum, wavelength, frequency, solar energy, law of reflection, and pigment.</p>	<p>S1 Comparing and contrasting the effect of convex and concave lenses and mirrors on light.</p> <p>S2 Apply knowledge of how the structures of the eye interact with light in order to determine what vision problems a person may have and how to correct the issue.</p> <p>S3 Measuring temperature and angles using tools such as a thermometer and protractor.</p> <p>S4 Using the engineering design process to create a structure that harnesses light to cook food.</p>