

Geometric Optics and the Microbit		Grade 10 - Physics	
Lesson Plan	Coding Tool	Microbit	
	Cross-curricular	Coding	
<p>Big Ideas</p> <p>E1. evaluate the effectiveness of technological devices and procedures designed to make use of light, and assess their social benefits;</p> <p>E2. investigate, through inquiry, the properties of light, and predict its behaviour, particularly with respect to reflection in plane and curved mirrors and refraction in converging lenses;</p>	<p>Specific Expectations</p> <p>E1.2 analyse a technological device that uses the properties of light (e.g., microscope, retro- reflector, solar oven, camera), and explain how it has enhanced society [A1, C]</p> <p>E2.1 use appropriate terminology related to light and optics, including, but not limited to: angle of incidence, angle of reflection, angle of refraction, focal point, luminescence, magnification, mirage, and virtual image [C]</p> <p>E2.2 use an inquiry process to investigate the laws of reflection, using plane and curved mirrors, and draw ray diagrams to summarize their findings [PR, C]</p>		
<p>Description</p> <p>A hands-on inquiry lesson where students use the micro:bit V2 light sensor and data logging tools to collect and analyze quantitative light-intensity data. Students design and carry out investigations on how light intensity changes with angle, distance, and transparent materials, then graph results and connect evidence to core concepts in geometric optics (reflection and refraction) using a Claim–Evidence–Reasoning explanation</p>			
<p>Materials</p> <ul style="list-style-type: none"> micro:bit V2 	<p>Computational Thinking Skills</p> <ul style="list-style-type: none"> Variables Loops 		

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| <ul style="list-style-type: none"> • USB cable or battery pack • Computer with MakeCode • Flashlight or desk lamp • Plane mirror • Clear plastic or glass blocks or containers • Protractor and compass | <ul style="list-style-type: none"> • Data visualization |
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Introduction

In this lesson, students use the BBC micro:bit V2 as a scientific tool to measure light intensity and collect reliable, quantitative data. Working through a series of guided investigations, they will program the micro:bit's data logger, test how light intensity changes with distance, angle, and the presence of transparent materials, and record observations in a consistent way. Students will then graph and interpret their results to explain patterns in terms of key geometric optics ideas, including reflection and refraction.

Action

Setting up and coding the microbit

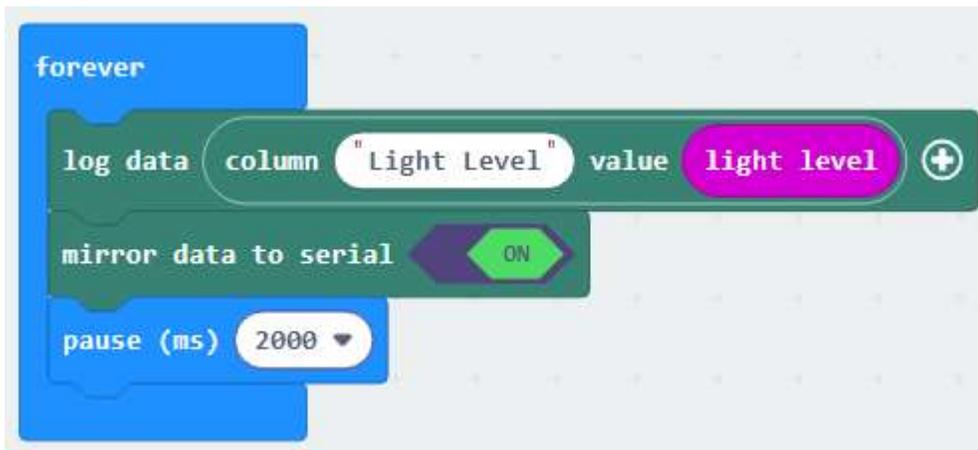
For this lesson Plan you'll need to code a microbit, this is a brief explanation on how to code the microbit and get it set up for the experiment.

- **Step 1:**
Add the Extension: In MakeCode, click the gear icon and choose "Extensions." Search for "Data Logger" and add it to your project.

- **Step 2:**
Using the new Data Logger Blocks added by the extension use a log data block and name the column "Light Level" then set the value to the "light level" block found in the input section place this block in the "forever" bracket.

- **Step 3:**
From the Data Logger section grab the “mirror data to serial block” and set it to ON
- **Step 4:**
Set a “Pause block” to 2 seconds (2000ms) from the Basic Section

Example:



Conducting the Reflection Investigation

- **Step 1:** Place the plane mirror on a flat surface. Shine the flashlight or desk lamp at the mirror at a set angle. Use the protractor to measure the angle of incidence (the angle at which light hits the mirror).
- **Step 2:** Place the micro:bit where the reflected light beam appears. Make sure the LED grid faces the light. Use the ruler to measure distances if needed. With the microbit connected to a laptop, click “show data device” to get live updates of the light intensity.
- **Step 3:** Reset or restart the micro:bit to begin recording. Change the angle of incidence (e.g., 30°, 45°, 60°) and record the light intensity for each angle. Wait for several intervals of 2 seconds at each position to gather data.
- **Step 4:** For each angle, note the measured light intensity. Consider repeating measurements for accuracy.

Conducting the Refraction Investigation

- **Step 1:** Shine the flashlight directly at the micro:bit (no block in the way). Record the light level for a short period.
- **Step 2:** Place the clear plastic or glass block between the flashlight and the micro:bit. Make sure the setup is the same as before, except with the block in place.
- **Step 3:** Allow the micro:bit to record light levels for the same time interval. Repeat if needed to ensure consistency.
- **Step 4:** You will compare the data from “without” and “with” the transparent material to see how the block affects light intensity reaching the sensor.

Interpreting Data

- **Step 1:** After your students run their experiments, connect the micro:bit to your computer and follow MakeCode’s instructions to download the logged data as a CSV file. Found at the top of the show data button.
- **Step 2:** Open the CSV file in a spreadsheet program. Check the light intensity at each angle (reflection) or in each setup (refraction).
- **Step 3:** Look for trends, such as changes in intensity at different angles or before and after adding the transparent block. Use graphs to visualize their results. Have them think about what their data suggests about how light behaves in each situation.

Consolidation/Extension

Using their sensors student could create light mazes with their new understanding of refractions and reflections.

Assessment

Students graphs and notes make excellent forms of assessment.

Additional Resources

<https://makecode.microbit.org/>