

MALUS'S LAW

Lesson Plan

(KS5)



Learning objectives:	<ul style="list-style-type: none"> Recall Malus's Law for transmitted intensity of light from a polarising filter. Carry out an experiment to verify Malus's Law. Apply Malus's Law for transmitted intensity of light from a polarising filter.
Resources:	<ul style="list-style-type: none"> Lascells Malus's Law Apparatus Student Worksheet Graph Paper Milli-Volt Meter Malus's Law Presentation
Prior Knowledge:	<p>For this lesson it is assumed that students already have knowledge of the following syllabus requirements: These could be reinforced as part of a starter activity.</p> <ul style="list-style-type: none"> Polarisation of light. Link between amplitude and intensity for electromagnetic waves.
Lesson Outline:	<ul style="list-style-type: none"> Review knowledge by having students answer a selection of starter questions in their workbooks or otherwise. (There are a selection of questions and solutions on the accompanying presentation.) Reinforce the effect of a polarising filter on polarised light (This may be demonstrated using Polaroid squares or by showing the cartridge from the apparatus) Explain how to calculate transmitted amplitude. Link back to prior knowledge that intensity of light is proportional to amplitude squared. Introduce Malus's law and explain where the \cos^2 term comes from. Students must be aware of the meaning of $\cos^2\theta$ if they are not already. Introduce the students to the apparatus. They can remove the cartridge and rotate the dial to observe the intensity change with angle. Explain how the apparatus works and relate the voltage output to intensity. (The voltage output rises linearly with intensity.) Explain the limitations of the experiment with regards to a non-zero reading at $\pm 90^\circ$. Have students suggest how this issue could be resolved. Have students feedback ideas and explain how to correct their results. Students should draw a table for their results. (Column heading suggestions are available on the slideshow along with a sample table.) Remember to emphasise the necessity for units in column headings, this is a good opportunity to reinforce dimensionless quantities such as cosine and V/V_0. Students should take their results either individually, in groups or as a class as equipment allows. Students should plot a graph of V/V_0 against $\cos^2\theta$, draw a line of best fit and calculate a gradient. Students should be able to form a conclusion using their results, (Expressing their results in the form $y=mx+c$ should obviously lead them to the expression for Malus's Law.) To summarise the lesson there are a set of questions and solutions on the presentation.