

The Nature of Light

PH12-14

4 inquiry questions · 17 dot points

1 What is light?

- investigate Maxwell's contribution to the classical theory of electromagnetism, including:...
- describe the production and propagation of electromagnetic waves and relate these processes qualitatively to the predictions made by Maxwell's electromagnetic theory
- conduct investigations of historical and contemporary methods used to determine the speed of light and its current relationship to the measurement of time and distance
- conduct an investigation to examine a variety of spectra produced by discharge tubes, reflected sunlight or incandescent filaments
- investigate how spectroscopy can be used to provide information about:...
- investigate how the spectra of stars can provide information on:...

2 What evidence supports the classical wave model of light and what predictions can be made using this model?

- conduct investigations to analyse qualitatively the diffraction of light
- conduct investigations to analyse quantitatively the interference of light using double slit apparatus and diffraction gratings $d\sin\theta = m\lambda$
- analyse the experimental evidence that supported the models of light that were proposed by Newton and Huygens
- conduct investigations quantitatively using the relationship of Malus' Law $I = I_{\max}\cos^2\theta$ for plane polarisation of light, to evaluate the significance of polarisation in developing a model for light

3 What evidence supports the particle model of light and what are the implications of this evidence for the development of the quantum model of light?

- analyse the experimental evidence gathered about black body radiation, including Wien's Law related to Planck's contribution to a changed model of light
- investigate the evidence from photoelectric effect investigations that demonstrated inconsistency with the wave model for light
- analyse the photoelectric effect $K_{\max} = hf - \phi$ as it occurs in metallic elements by applying the law of conservation of energy and the photon model of light,

4 How does the behaviour of light affect concepts of time, space and matter?

- analyse and evaluate the evidence confirming or denying Einstein's two postulates:...
- investigate the evidence, from Einstein's thought experiments and subsequent experimental validation, for time dilation $t = t_0 / \sqrt{1 - v^2/c^2}$ and length contraction $l = l_0 \sqrt{1 - v^2/c^2}$, and analyse quantitatively situations in which these are observed, for example:...
- describe the consequences and applications of relativistic momentum with reference to:...
- Use Einstein's mass–energy equivalence relationship $E = mc^2$ to calculate the energy released by processes in which mass is converted to energy, for example:...