VCE Physics: Sample teaching plan

Sample Course Outline – VCE Physics Unit 4: How can two contradictory models explain both light and matter?

**Note:** This is a sample guide only and indicates one way to present the content from the Study Design over the weeks in each school term. Teachers are advised to consider their own contexts in developing learning activities: Which local fieldwork sites would support learning in the topic area? Which local issues lend themselves to debate and investigation? Which experiments can students complete within the resource limitations of their learning environments?

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| **Week** | **Area** | **Topics** | **Learning activities** |
| 1 | **Practical investigation** | * **Practical investigation** (experimental variables; scientific research methodologies and ethics; data organisation, analysis and evaluation; organisation of chemical concepts; nature of evidence; scientific report writing conventions) | * Poster evaluation: strengths/weaknesses/opportunities/threats of provided examples * Investigation design brainstorming: motion * Test: hypothesis formulation and experimental design * Student investigation: negotiation, confirmation and materials preparation * Student undertaking of investigation * Reporting/poster write-up phase |
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| 4 | **How can waves explain the behaviour of light?** | * **Properties of mechanical waves** (wave transmission; distinction between transverse and longitudinal waves; identification and calculation of wave characteristics; constructive and destructive interference; Doppler effect; resonance; standing waves in strings; diffraction) | * Experiment: slinky springs exploration of longitudinal and transverse waves * Demonstration: Doppler effect * Research: use of the Doppler effect in identification of objects in the night sky * Demonstration: resonance in stretched spring |
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| 7 | * **Light as a wave** (definition; speed in a vacuum; electromagnetic spectrum; polarisation; refraction; total internal reflection and critical angle; colour dispersion in prisms and lenses; Young’s double slit experiment) | * Experiment: refraction * Demonstration: optical fibres and fish task * Experiment: effects of changing concentration and temperature of liquids on refractive index * Experiment: prisms and colour dispersion * Demonstration: polarisation * Research: determination of ratings of polaroid lenses OR effects of exposure to ‘blue light’ emitted by electronic devices |
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| 10 | **How are light and matter similar?** | * **Behaviour of light** (diffraction patterns and effect of varying width of a gap or obstacle diameter; photoelectric effect; limitations of wave model of light referring to photoelectric effect) | * Demonstration: water and sound waves * Demonstration: sound waves * Experiment: interference and diffraction * Experiment: diffraction and resolution * Experiment: photoelectric effect |
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| 12 | * **Matter as particles or waves** (electron diffraction patterns and wave-like nature of matter; diffraction patterns produced by photons and electrons; calculation of de Broglie wavelength of matter) |
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| 14 | * **Similarities between light and matter** (comparison of momentum of photons and of matter of the same wavelength; atomic absorption and emission spectra; absorption of photons by atoms; quantised states of the atom; single photon/electron double slit experiment as evidence for light/matter duality; Heisenberg’s uncertainty principle; evaluation of classical laws of physics to explain motion at very small scales) | * Exploration: use of applets to explore the production of atomic absorption and emission line spectra * Experiment: spectral lines * Data analysis: comparison of interference patterns produced by light and matter |
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| 17 | * **Production of light from matter** (light production in lasers, synchrotrons, LEDs and incandescent lights) | * Investigation: triggering voltage for different coloured LEDs * Investigation: factors that affect the flashing of an LED |
| 18 | **Unit revision** | | |
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