

Unit P1 - Revision Lesson 2 The EM Spectrum				
Specification learning outcomes	HSW statements	Exemplar teaching activities	Main differentiation	Resource sheets
<p>2.1 Demonstrate an understanding of how Herschel and Ritter contributed to the discovery of waves outside the limits of the visible spectrum.</p> <p>2.2 Demonstrate an understanding that all electromagnetic waves are transverse and that they travel at the same speed in a vacuum.</p> <p>2.3 Describe the continuous electromagnetic spectrum including (in order) radio waves, microwaves, infrared, visible (including the colours of the visible spectrum), ultraviolet, X-rays and gamma rays.</p> <p>2.4 Demonstrate an understanding that the electromagnetic spectrum is continuous from radio waves to gamma rays, but the radiations within it can be grouped in order of decreasing wavelength and increasing frequency.</p> <p>2.5 Demonstrate an understanding that the potential danger associated with an electromagnetic wave increases with increasing frequency.</p> <p>2.6 Relate the harmful effects, to life, of excessive exposure to the frequency of the electromagnetic radiation, including: a) microwaves: internal heating of body cells b) infrared: skin burns c) ultraviolet: damage to surface cells and eyes, leading to skin cancer and eye conditions d) X-rays and gamma rays: mutation or damage to cells in the body.</p> <p>2.7 Describe some uses of electromagnetic radiation: a) radio waves: including broadcasting, communications and satellite transmissions, b) microwaves: including cooking, communications and satellite transmissions, c) infrared: including cooking, thermal imaging, short range</p>	<p>HSW 2, 6, 10, 12, 14</p>	<p><u>The theme of this lesson is the electromagnetic spectrum.</u></p> <p>Starter: <i>Herschel and Ritter go further.</i> Recap how it was that Herschel came upon his discovery of IR somewhat accidentally, and then Johann Ritter tested a consequent hypothesis rigorously in order to discover UV. Ask the students to write out the colours of the visible spectrum with IR and UV added on the ends. Looking at the list, ask the question 'What should Ritter try next?' Explain that there are more waves further out, and that different detectors are needed for the various types. This can be exemplified by the fact that Herschel used thermometers but Ritter used the reaction of silver chloride to detect UV.</p> <p>Main: <i>Evaluating a replica of Herschel's experiment.</i> Worksheet P1.6c allows pupils to revise Herschel's work and do some data analysis. <i>Researching the Electromagnetic Spectrum.</i> The table on Worksheet P1.9a should help students to structure their ideas about the uses of the waves in the EM spectrum and the 'other uses' column could be used to include the dangers of each part of the spectrum. You could also include information down the side of the table to explain that all EM waves travel at the same speed in a vacuum and that a decrease in wavelength is accompanied by an increase in frequency.</p> <p>Plenary: <i>Start my sentence.</i> In pairs, the students write the ends of three sentences each. These are swapped and their partner must write the first part of the sentence, so that it makes sense and is correct physics. Each sentence ending must use a word from a list on the board, such as 'vacuum', 'transverse', 'spectrum', 'wavelength', 'frequency', 'ionising' or other suitable words.</p> <p>Homework: Worksheets P1.10b contains questions on ionising radiation.</p>	<p>Stretch: Ask students to draw their own table or concept map of the EM spectrum.</p> <p>Support: Use worksheet P1.8a in conjunction with worksheet P1.9a. P1.8a contains cut out cards to match the parts of the EM spectrum to the dangers. You could also amend the table to include the uses and give this to students as well.</p>	<p>Worksheet P1.6c Worksheet P1.8a Worksheet P1.9a Worksheet P1.10b</p>

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<p>communications, optical fibres, television remote controls and security systems, d) visible light: including vision, photography and illumination, e) ultraviolet: including security marking, fluorescent lamps, detecting forged bank notes and disinfecting water, f) X-rays: including observing the internal structure of objects, airport security scanners and medical X-rays, g) gamma rays: including sterilising food and medical equipment, and the detection of cancer and its treatment</p> <p>2.8 Recall that ionising radiations are emitted all the time by radioactive sources.</p> <p>2.9 Describe that ionising radiation includes alpha and beta particles and gamma rays and that they transfer energy.</p>				
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