Waves: connecting models and evidence

Student activity • observation and reasoning

YEAR 11 / LESSON 67 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

Can one set of wave ideas explain sound, light and a moving source?

Use original short tasks to connect wave equations, electromagnetic ordering and optical behaviour.

Equipment

- Booklet, original diagram cards, ruler and calculator

Desk-based review. No sound generators, lasers, UV lamps or heating sources are used.

Course coverage: Shared Physics / Double Award: Review of shared wave, spectrum and optical concepts; separate-course extensions labelled.

Plan, model or apparatus sketch

Draw the relevant wavefront, particle or energy-transfer model and label its assumptions.

Method and reasoning

Read the whole sequence before starting

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1. Calculate the speed of a practice wave with frequency 8 Hz and wavelength 0.50 m. Find the period and label both answers with units.

2. Order the electromagnetic spectrum from radio to gamma rays and state what is common to their speeds in vacuum.

3. Draw light entering a denser optical medium from air at an oblique angle. Label the normal and explain what happens to frequency, speed and wavelength.

4. Explain the two requirements for total internal reflection and use a ray sketch to show confinement in a fibre core with lower-index cladding.

5. Use a moving-source wavefront diagram to explain a higher received frequency ahead and a lower received frequency behind, without changing the emitted frequency.

6. Correct one incomplete explanation using evidence from your previous work. Physics-only extension: calculate frequency from a supplied microphone trace; Double Award alternative: improve the longitudinal sound diagram.

Cleanup

- Retain corrected work and return cards and calculators.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Practice data only: f = 8 Hz, λ = 0.50 m. Optional Physics-only trace: five cycles occupy 20 ms. Keep the optional microphone-frequency task separate from shared course requirements.

Topic	Explanation / calculation	Correction
Wave equation		
Spectrum		
Refraction / TIR		
Doppler effect		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Find the practice wave speed.

2. Find its period.

3. Which EM region has the longest wavelength?

4. What is unchanged at a stationary refraction boundary?

5. State the requirements for total internal reflection.

6. Explain the Doppler shift ahead of a moving source.