



ANSWER BOOK

Longitudinal, transverse and polarisation

Waves · Year 12

AQA 3.3.1.2 · CIE 7.2, 7.5 · OCR A 4.4.1, 4.4.2

9 questions · 25 marks

NAVY EDITION

SECTION A · Warm-up

- A1** In a transverse wave the particles oscillate at right angles to the direction of energy transfer; in a longitudinal wave they oscillate parallel to it. [2]
- A2** $\lambda = c/f = 340/170 = 2.0 \text{ m}$. [2]
- A3** Transverse: light (or any electromagnetic wave, or a wave on a string). Longitudinal: sound (or a compression wave on a spring). [2]
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SECTION B · Standard

- B1** Plane-polarised light has its oscillations confined to a single plane. Only transverse waves can be polarised because their oscillations are perpendicular to the travel direction, so a plane can be selected; longitudinal oscillations are along the travel direction, so there is no such choice. [3]
- B2** For unpolarised light the transmitted brightness stays roughly constant as the single filter rotates (about half the light passes at any angle). For already-polarised light, the brightness varies from a maximum to zero and back as the filter rotates, being zero when its axis is perpendicular to the polarisation. [3]
- B3** $\lambda = c/f = (3.0 \times 10^8)/(3.0 \times 10^9) = 0.10 \text{ m}$. Rotating a metal grille (or receiver) between transmitter and detector changes the received signal, which shows the microwaves are polarised. [3]
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SECTION C · Stretch

- C1** Each filter transmits the component of the oscillation along its axis. The first filter polarises the light; the 45° filter transmits a component at 45° , re-orienting the polarisation; that light then has a component along the final filter's axis, so some passes. Without the middle filter the light reaching the last filter is perpendicular to its axis and is blocked. [4]
- C2** Light reflected from such surfaces is partially polarised in the horizontal plane. Polarising sunglasses have a vertical transmission axis, so they block much of this horizontally-polarised reflected glare while still letting other light through. [3]
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- C3** Sound is longitudinal: its oscillations are along the direction of travel, not perpendicular to it. There is no plane of oscillation to select, so a filter cannot restrict it and sound cannot be polarised.
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