InkPhysics

QUESTION WORKBOOK

Longitudinal, transverse and polarisation

Waves · Year 12

AQA 3.3.1.2 · CIE 7.2.1, 7.2.2, 7.4.1, 7.4.2, 7.4.3, 7.5.1, 7.5.2
OCR A 4.4.1(a), 4.4.1(e), 4.4.1(f)(i), 4.4.2(a), 4.4.2(b), 4.4.2(c)

17 questions · 49 marks

PRINT EDITION

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SECTION A · Warm-up

A1 Explain the difference between a transverse and a longitudinal wave, in terms of the direction of particle oscillation. [2]

A2 A sound wave of frequency 170 Hz travels through air at 340 m s^{-1}. Calculate its wavelength. [2]

A3 Give one example of a transverse wave and one example of a longitudinal wave. [2]

A4 Sound travels through air as a longitudinal wave. State what is meant by a compression and by a rarefaction. [2]

A5 All electromagnetic waves travel at the same speed in a vacuum. State this speed and give the approximate range of wavelengths of visible light. [2]

SECTION B · Standard

B1 State what is meant by plane-polarised light, and explain why only transverse waves can be polarised. [3]

B2 Unpolarised light passes through a single polarising filter, which is then slowly rotated in its own plane. Describe what happens to the brightness of the transmitted light, and contrast this with rotating a filter placed in front of already-polarised light. [3]

B3 Microwaves of frequency 3.0×10^9 Hz travel at 3.0×10^8 m s^{-1}. Calculate their wavelength, and state one way to show that microwaves are polarised. [3]

B4 Television signals are transmitted as plane-polarised radio waves. Explain why a receiving aerial must be mounted with its rods parallel to the plane of polarisation of the signal, and describe what happens to the received signal strength as the aerial is slowly rotated through 90° about the line to the transmitter. [3]

B5 Visible light in a vacuum has wavelengths from about 400 nm to about 700 nm. The speed of light in a vacuum is 3.00×10^8 m s^{-1}. Calculate the range of frequencies of visible light. [3]

B6 A sound wave and a radio wave both travel due north. State the possible direction(s) of oscillation of (a) the air particles carrying the sound and (b) the oscillations of the radio wave. [2]

SECTION C · Stretch

C1 Two polarising filters are arranged with their axes crossed (at 90°), so no light passes. A third filter is then inserted between them with its axis at 45°. Explain why light now emerges from the arrangement. [4]

C2 Explain why polarising sunglasses reduce glare from reflective surfaces such as water or a wet road. [3]

C3 Explain why sound waves cannot be polarised. [3]

C4 A student is given two beams of light of equal brightness. One beam is unpolarised; the other is plane polarised. The beams look identical to the eye. Deduce how the student can use a single polarising filter to identify which beam is which, stating the observation expected for each beam. [4]

C5 Describe an experiment, using a microwave transmitter and a receiver connected to a meter, to show that the microwaves emitted by the transmitter are plane polarised. Explain how the results also show that microwaves are transverse waves. [5]

C6 The table gives the wavelengths in a vacuum of four electromagnetic waves. P: 3.0 cm; Q: 550 nm; R: 10 μm; S: 3.0 nm. Deduce which wave is visible light and which is a microwave, and calculate the frequency of the visible wave. The speed of electromagnetic waves in a vacuum is 3.00×10^8 m s^{-1}. [3]