InkPhysics

ANSWER BOOK

Stationary waves

Waves · Year 12

AQA 3.3.1.3 · CIE 8.1 · OCR A 4.4.4

10 questions · 29 marks

NAVY EDITION

inkphysics.co.uk

SECTION A · Warm-up

A1 Two progressive waves of the same frequency and amplitude travel in opposite directions (for example an incident wave and its reflection) and superpose, producing a pattern of nodes and antinodes that does not move along the string. [2]

A2 Half a wavelength, $\lambda/2$. [2]

A3 A node is a point of zero amplitude (no displacement); an antinode is a point of maximum amplitude. [2]

SECTION B · Standard

B1 (a) Fundamental: $\lambda = 2L = 2 \times 0.60 = 1.2$ m. (b) $f = v/\lambda = 240/1.2 = 200$ Hz. [3]

B2 Second harmonic: $\lambda = L = 0.60$ m, $f = 240/0.60 = 400$ Hz. Third harmonic: $f = 3v/2L = 600$ Hz. [3]

B3 Fundamental: $\lambda = 2L = 1.6$ m. $v = f\lambda = 150 \times 1.6 = 240$ m s^{-1}. [3]

B4 Node to node $= \lambda/2 = 0.25$ m. Node to antinode $= \lambda/4 = 0.125$ m. [3]

SECTION C · Stretch

C1 Fundamental $f_1 = v/2L = 180/2.4 = 75$ Hz. First three harmonics: 75 Hz, 150 Hz, 225 Hz. [4]

C2 $\lambda = v/f = 200/300 = 0.667$ m. Number of half-wavelengths $n = 2L/\lambda = 2 \times 1.0/0.667 = 3$, so it is the third harmonic. [4]

C3 A progressive wave transfers energy along its path and every particle has the same amplitude (reached at different times); a stationary wave transfers no net energy and the amplitude varies with position from zero at nodes to a maximum at antinodes, with all particles in a loop in phase. [3]