

C.2 Wave model

Practice Worksheet – name: _____ date: _____

FORMULAS FOR THIS TOPIC

WAVE SPEED $v = f\lambda = \frac{\lambda}{T}$

SECTION A — MULTIPLE CHOICE

A1. Sound of frequency 440 Hz travels at 340 m s^{-1} in air. Its wavelength is approximately:

- A 0.77 m
- B 1.3 m
- C 77 cm and 1.3 m are both wrong
- D 0.13 m

A2. A wave passes from one medium to another and its speed doubles. Its frequency:

- A Doubles
- B Halves
- C Stays the same, so the wavelength doubles
- D Stays the same, so the wavelength halves

A3. Which is a correct difference between sound and light?

- A Sound is transverse; light is longitudinal
- B Sound requires a medium; light does not
- C Sound can be reflected; light cannot
- D Sound transfers energy; light does not

SECTION B — SHORT ANSWER

B1. Describe the motion of air particles as a sound wave passes, and define compression and rarefaction. [3 marks]

B2. A displacement–time graph for one particle on a wave shows a period of 0.020 s. A displacement–distance snapshot shows crests 1.7 m apart. Calculate the wave speed. [2 marks]

B3. State two similarities and two differences between mechanical and electromagnetic waves. [4 marks]

ANSWER KEY

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Section A

A1: 0.77 m — $\lambda = v/f = 340/440 \approx 0.77$ m. Concert-pitch A has a wavelength close to the height of a desk — useful for sanity checks.

A2: Stays the same, so the wavelength doubles — Frequency is set by the source and cannot change at a boundary — the same number of crests must leave as arrive each second. With $v = f\lambda$ and f fixed, doubling v doubles λ .

A3: Sound requires a medium; light does not — Sound is a mechanical (longitudinal) wave of pressure variations in a medium; electromagnetic waves are self-sustaining field oscillations that travel through vacuum. Both reflect, and all waves transfer energy.

Section B

B1: Particles oscillate back and forth about fixed positions, parallel to the direction the wave travels — they are not carried along. A compression is a region of higher pressure where particles crowd together; a rarefaction is a lower-pressure region where they are spread apart.

B2: $f = 1/T = 50$ Hz and $\lambda = 1.7$ m, so $v = f\lambda = 85$ m s⁻¹. Each graph supplies exactly one of the two needed quantities.

B3: Similarities: both transfer energy without net matter transfer; both obey $v = f\lambda$ and show reflection, refraction, diffraction and interference. Differences: mechanical waves need a material medium, EM waves do not; EM waves travel at c in vacuum and are always transverse, while mechanical waves can be transverse or longitudinal and travel much slower.