

Exercise walk-through

2.1

Wave quantities and graphs (statements 33–37)

Pearson Edexcel · International A-Level · Physics

Intensity needs an area conversion

- 1 **Convert** $A = 25 \times 10^{-4} = 0.0025 \text{ m}^2$
- 2 **Incident** $P = IA = 800 \times 0.0025 = 2.0 \text{ W}$
- 3 **Useful** $P_{out} = \eta P = 0.20 \times 2.0 = 0.40 \text{ W}$

Decision

A 0.50 W device cannot run from this useful output.

Frequency and intensity change different things

Change	Photon energy	Maximum electron energy
Intensity rises; frequency fixed	Unchanged	Unchanged
Frequency rises	Increases	Increases above threshold

Exercises 2.1·2.2

2.1 State the meanings of amplitude and period.

[2]

2.2 A buoy completes 15 oscillations in 12 s. The water-wave wavelength is 2.4 m. Calculate frequency, period and wave speed. [3]

15 oscillations in 12 s



$\lambda = 2.4 \text{ m}$

Exercises 2.1·2.2

2.1 State the meanings of amplitude and period. [2]

2.1 Amplitude is the maximum displacement from equilibrium. Period is the time for one complete vibration.

2.2 A buoy completes 15 oscillations in 12 s. The water-wave wavelength is 2.4 m. Calculate frequency, period and wave speed. [3]

15 oscillations in 12 s

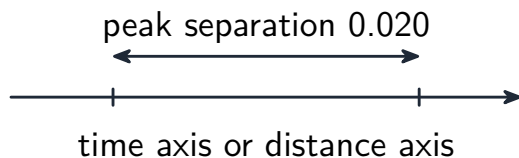


$\lambda = 2.4 \text{ m}$

2.2 Frequency counts cycles per second: $f = N/t = 15/12 = 1.25 \text{ Hz}$. $T = 1/f = 0.80 \text{ s}$. The disturbance speed is $v = f\lambda = 1.25 \times 2.4 = 3.0 \text{ m s}^{-1}$.

Exercise 2.3

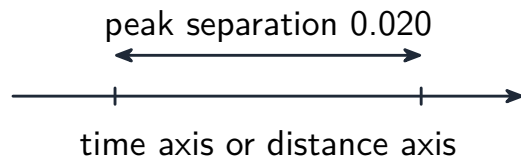
2.3 A displacement graph has neighbouring peaks separated horizontally by 0.020. Explain what this separation gives if the horizontal axis is (a) time in seconds; (b) distance in metres. State why the graph shape alone is not enough. [3]



3 Exam-style questions

Exercise 2.3

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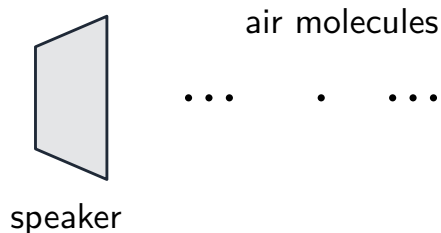


3 Exam-style questions

2.3 (a) Period $T = 0.020$ s. (b) Wavelength $\lambda = 0.020$ m. The axis identifies whether the graph follows one point over time or many points at one instant.

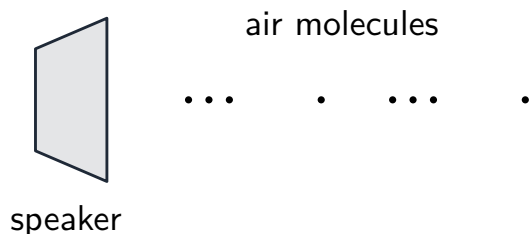
Exercise 3.1

3.1 A loudspeaker sends sound through still air. Describe the direction of molecular motion, the motion of the disturbance, and the pressure at a compression. Explain why a pressure maximum is not a maximum molecular displacement. [4]



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3.1 Molecules vibrate parallel to propagation, about fixed mean positions while the disturbance travels onwards. A compression has above-equilibrium pressure/density. It occurs where neighbouring molecular displacements crowd molecules together, rather than where displacement itself is greatest.

Exercises 3.2·3.3

3.2 A time trace shows 8.0 complete sound cycles across 4.0 horizontal divisions. The time base is 0.50 ms per division. Sound speed is 340 m s^{-1} . Calculate the period, frequency and wavelength. A student calls the trace a picture of the wavelength. Explain the mistake. [5]

8 cycles / 4 divisions 0.50 ms per division
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$$v = 340 \text{ m/s}$$

3.3 Sketch displacement against distance for a transverse wave of amplitude 2.0 cm and wavelength 0.60 m. Label both axes and show two complete wavelengths. Explain what a point on this curve represents. [4]

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8 cycles / 4 divisions
0.50 ms per division

$$v = 340 \text{ m/s}$$

3.2 The full time is $t = 4.0 \times 0.50 = 2.0 \text{ ms}$. $T = t/N = 2.0 \times 10^{-3}/8.0 = 2.5 \times 10^{-4} \text{ s}$.

3.3 Sketch displacement against distance for a transverse wave of amplitude 2.0 cm and wavelength 0.60 m. Label both axes and show two complete wavelengths. Explain what a point on this curve represents. [4]

3.3 Vertical axis is displacement with centimetres; horizontal axis is distance with metres. A repeating curve reaches +2.0 and -2.0 cm. Two full cycles occupy 1.20 m, with successive crests 0.60 m apart. A point gives the displacement of a particle at that position at one common instant, rather than its whole path through time.