

AS Physics 9702

Unit 7 • Waves

Original worksheet

Name: _____ Date: _____

Suggested marks: 65. Work through the questions over more than one study session if needed. Use additional paper for extended working and graph paper where requested.

Show equations, substitutions, units and reasoning. Use the constants specified in each question. The questions are original practice, not an official Cambridge examination or mark scheme.

Scope: Cambridge International AS Physics 9702, 2025–2027 learning outcomes. The published 2028–2030 AS scope has been checked separately and is substantively unchanged. Version: 11 October 2026.

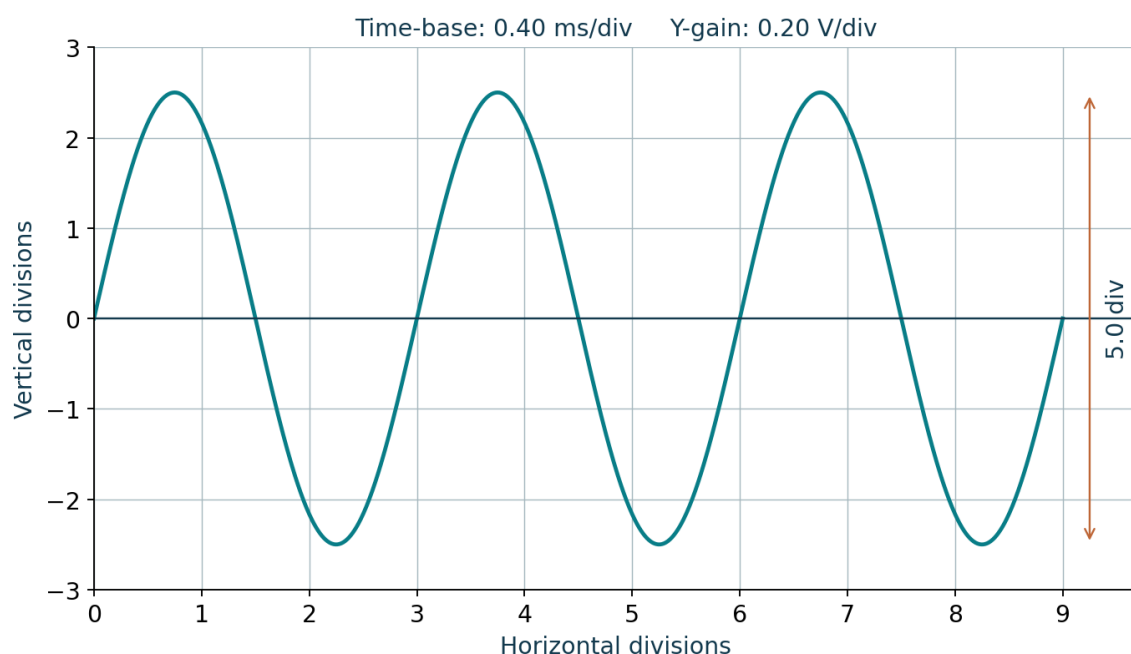
U7-Q1 • 6 marks

A hand shakes one end of a horizontal rope, producing a sinusoidal progressive wave. Adjacent crests are 0.60 m apart; each point completes 5.0 oscillations per second. (a) Explain what travels along the rope and what the rope particles do. [2] (b) State the wavelength and calculate period. [2] (c) Find the phase difference between positions 0.15 m apart along propagation. [2]

U7-Q2 · 6 marks

A CRO trace shows three complete cycles across 9.0 horizontal divisions. Time-base is 0.40 ms per division and y-gain is 0.20 V per division. Peak-to-peak trace height is 5.0 divisions. (a) Calculate period and frequency. [3] (b) Find voltage amplitude. [2] (c) Explain why measuring several cycles improves the frequency estimate. [1]

Figure for U7-Q2

**U7-Q3 · 5 marks**

(a) Derive $v = f\lambda$ from the distance a crest travels in one period. [2] (b) A wave of frequency 18 Hz has speed 2.7 m s^{-1} . Calculate wavelength. [1] (c) The wave enters a region where speed falls to 1.8 m s^{-1} , with frequency unchanged. Calculate the new wavelength and explain the change. [2]

U7-Q4 · 6 marks

A uniform wave beam carries 0.036 W through a perpendicular area of 0.012 m^2 . (a) Define and calculate intensity. [2] (b) With frequency and medium unchanged, amplitude falls to 60% of its initial value. Find the new intensity. [2] (c) Explain why the intensity factor is not 0.60 and state the new power through the same area. [2]

U7-Q5 · 6 marks

A longitudinal sound-wave sketch shows compression centres at positions 0.10, 0.34 and 0.58 m. A separate graph plots particle displacement against distance. (a) Compare particle oscillation directions in longitudinal and transverse waves. [2] (b) Find wavelength and the distance from a compression centre to an adjacent rarefaction centre. [2] (c) Explain why a sinusoidal longitudinal-displacement graph does not show particles moving up and down, and why a compression is not a displacement maximum. [2]

U7-Q6 · 7 marks

A sound source emits 900 Hz while travelling directly towards a stationary observer at 25 m s^{-1} . Speed of sound in stationary air is 340 m s^{-1} . (a) Explain why the observer hears a higher frequency. [2] (b) Calculate the approaching frequency. [2] (c) Calculate the frequency when the source recedes at the same speed. [2] (d) State whether source motion changes sound speed through the air in this model. [1]

U7-Q7 · 8 marks

(a) Name all seven principal electromagnetic regions in order of decreasing wavelength and give an approximate wavelength range for each. [4] (b) State the wave type and speed in free space common to all seven. [2] (c) Light has wavelength 450 nm. Calculate its frequency and state whether it is visible. Use $c = 3.00 \times 10^8 \text{ m s}^{-1}$. [2]

U7-Q8 · 6 marks

Plane-polarised light of intensity 48 W m^{-2} meets an ideal polariser. (a) Explain why polarisation is evidence of transverse wave motion. [2] (b) Calculate transmitted intensity when its axis is 35° to the incident polarisation. [2] (c) Find the angle between 0° and 90° giving intensity 12 W m^{-2} . [2]

U7-Q9 · 5 marks

A plane-polarised beam of intensity 120 W m^{-2} is polarised at 0° . It crosses three ideal filters with axes at 20° , 50° and 90° to that original direction. (a) State the angle used at each filter in Malus's law. [2] (b) Calculate the final intensity. [2] (c) Explain why using $\cos^2 90^\circ$ at the final filter would be wrong. [1]

U7-Q10 · 6 marks

A displacement-distance snapshot of a transverse wave has adjacent crests at 0.10 m and 0.50 m; peak and trough displacements are +3.0 mm and -3.0 mm. At a fixed position, 12 complete cycles take 0.60 s. (a) Find amplitude, wavelength and frequency. [3] (b) Calculate wave speed. [1] (c) In a second trial at the same frequency and in the same medium, amplitude is 2.0 mm. Calculate the intensity ratio and explain why the time measurement cannot directly give wavelength. [2]

U7-Q11 · 2 marks

Diagnostic multiple choice. A displacement-time graph at a fixed position has 4.0 ms between consecutive crests. Which quantity can be determined from this spacing alone? Choose one option and justify it. [2]

- A. Wavelength, 4.0 mm
 - B. Wave speed, 250 m s^{-1}
 - C. Frequency, 250 Hz
 - D. Amplitude, 4.0 ms
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U7-Q12 · 2 marks

Diagnostic multiple choice. A source emits frequency f_s and approaches a stationary observer at speed $0.10v$, where v is sound speed in stationary air. Which expression gives the observed frequency? Choose one option and justify it. [2]

- A. $0.90f_s$
 - B. $1.10f_s$
 - C. $f_s/0.90$
 - D. $f_s/1.10$
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