

Interference, resonance and the Doppler shift

AP Physics 2 (algebra-based) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test checks calculations with interference, standing waves and the Doppler effect together with short explanations. Give every answer with its unit. Show every step for full credit.

Level: AP Physics 2 (algebra-based) · **Curriculum:** AP P2 Unit 14

Time: 40 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Double slit calculation (3 marks)

A laser of wavelength 520 nm lights two slits 0.15 mm apart. The screen is 1.80 m away.

- Calculate the spacing between neighbouring bright fringes. (2 marks)
- Calculate the distance from the centre to the third bright fringe. (1 mark)

Question 2 Changing the set-up (2 marks)

The slit spacing is halved and the screen is moved to half the distance. All other conditions stay the same.

- Predict the new fringe spacing in terms of the old one. (1 mark)
- Explain your reasoning. (1 mark)

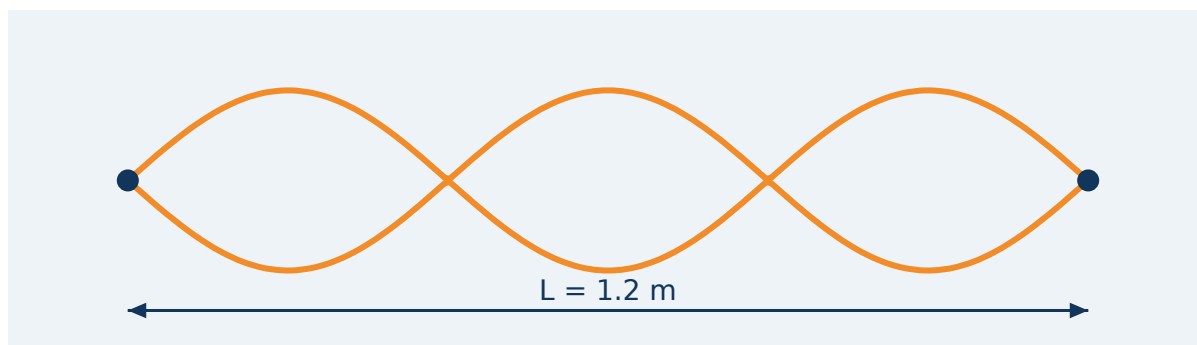
Question 3 Oil film (3 marks)

A thin film of oil ($n = 1.45$) floats on water ($n = 1.33$). Light of wavelength 580 nm in air strikes it at normal incidence.

- State which reflection flips the phase. (1 mark)
- Calculate the minimum thickness for strong reflection. (2 marks)

Question 4 Standing wave on a string (2 marks)

The figure shows a standing wave on a string fixed at both ends.



A standing wave on a string with three loops.

The wave speed on the string is 48 m/s.

- Calculate the wavelength. (1 mark)
- Calculate the frequency. (1 mark)

Question 5 Closed pipe (3 marks)

A pipe of length 0.85 m is closed at one end. Sound speed is 340 m/s.

- Calculate the fundamental frequency. (1 mark)
- Calculate the frequency of the next resonance. (1 mark)
- Explain why no resonance occurs at twice the fundamental. (1 mark)

Question 6 Moving source (3 marks)

A source of frequency 800 Hz moves toward a listener at 20 m/s. Sound speed is 340 m/s.

- Calculate the frequency heard as it approaches. (1 mark)
- Calculate the frequency heard as it recedes. (1 mark)
- Explain why the frequency changes. (1 mark)

Question 7 White-light fringes (2 marks)

White light is passed through a double slit.

- State the colour of the central fringe. (1 mark)
- Explain why coloured edges appear on the other fringes. (1 mark)

Question 8 Beats (2 marks)

Two notes of frequency 512 Hz and 516 Hz sound together.

- Calculate the beat frequency. (1 mark)
- Calculate the time between loud sounds. (1 mark)