

Waves that add: fringes and grating spectra

Physics grades 11-12 (A Level · IB · Class 11-12) · Test

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

This test lasts 45 minutes and is worth 20 marks. Show every step of your working, give answers with units, and remember to convert nanometres, micrometres and millimetres into metres.

Level: Physics grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB C.3

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Path difference (3 marks)

Two coherent point sources emit light of wavelength 550 nm. At point P, the path difference is 1.65 μm .

- Calculate the path difference in wavelengths. (1 mark)
- State whether the interference at P is constructive or destructive, with a reason. (1 mark)
- Define the term coherent. (1 mark)

Question 2 Young double slit (3 marks)

Blue-green light of wavelength 480 nm passes through slits 0.20 mm apart. The screen is 1.80 m away.

- Calculate the fringe spacing. (2 marks)
- State the effect on the fringe spacing of doubling the slit separation. (1 mark)

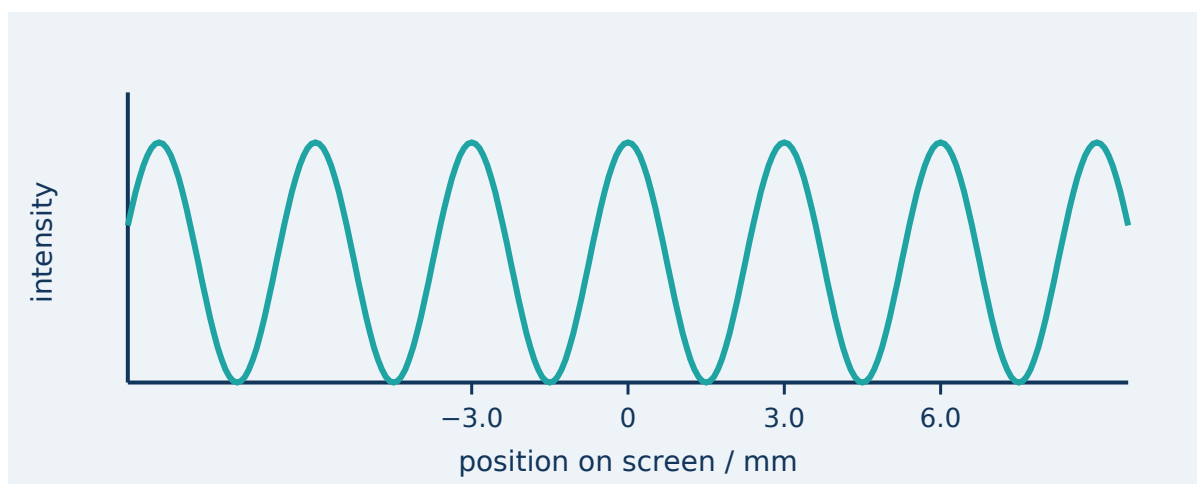
Question 3 Grating at work (3 marks)

A grating has 250 lines per mm. Light of wavelength 600 nm falls at right angles on it.

- Calculate the angle of the first order. (2 marks)
- Calculate the highest order that can be seen. (1 mark)

Question 4 Reading a pattern (3 marks)

The graph shows a double-slit pattern in a school hall in Kampala. The slit separation is 0.40 mm and the screen is 2.0 m away.



Intensity against position.

- State the fringe spacing. (1 mark)
- Calculate the wavelength in nm. (2 marks)

Question 5 Two torches (2 marks)

Explain why two separate torches shining on a wall do not produce an interference pattern but a laser and a double slit do.

Question 6 White light fringes (2 marks)

A double-slit experiment uses white light. Describe and explain the appearance of the pattern.

Question 7 Fringes in water (2 marks)

The whole double-slit apparatus is placed under water of refractive index 1.33. In air the fringe spacing was 4.0 mm. Calculate the new spacing and explain.

Question 8 Grating versus two slits (2 marks)

Explain why a diffraction grating gives sharper and brighter maxima than a pair of slits.