2022 Ph H1 Q16

Section: Particles and Waves

Topic: Interference

Question Summary

Light from a laser is incident on a diffraction grating. A student considers three statements about the separation of maxima: I: Increasing distance grating→screen increases separation, II: Increasing distance laser→grating increases separation, III: Decreasing slit spacing decreases separation. Which are correct?

Worked Solution

Condition for maxima: $d \sin\theta = m\lambda$.

On the screen, separation of fringes $y \approx L \tan\theta \approx L\theta$ for small θ.

I: Increasing L (grating–screen distance) → y increases → correct.

II: Distance from laser to grating does not affect geometry of interference → false.

III: Decreasing d → larger $\sin\theta$ → bigger y → correct.

Final Answer

C — I and III only

Revision Tips

• Diffraction grating condition: $d \sin\theta = m\lambda$.

• Fringe separation depends on λ, d, and grating–screen distance L.

• Laser–grating distance does not affect interference angle.

• Smaller slit spacing (d) increases angular separation.