AQA Physics A-level

RP02 - Interference Effects

Practical Flashcards

What safety precautions should be taken when operating a laser?

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- Never look directly at the beam
- Ensure no reflective surfaces are in the laser's vicinity
- Display a warning notice so others know that a laser is in use

Why should the screen, on which you use to display the interference patterns, have a matt finish?

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A matt screen should be used to reduce the likelihood of the laser beam reflecting from the screen into someone's eye and causing harm.

Describe how you should measure the fringe spacing of an interference pattern.

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When measuring the fringe spacing you should measure across a large number of fringes and then divide by the number of spaces measured across.

If you measure from the first bright fringe through to the twelfth bright fringe, what number should you divide by to obtain the fringe spacing?

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You need to divide by the number of fringe spaces (not fringes), so in this case you should divide by 11.

Suggest a measuring instrument you could use to measure the slit separation.

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A Vernier Calliper

Suggest a measuring instrument that could be used to measure the distance from the slit to the screen.

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A Metre Ruler

What equation links wavelength, slit separation, distance from screen and fringe spacing?

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$$\lambda = \frac{w\ s}{D}$$

How can the wavelength of the laser be determined from a graph of fringe width against the distance from the screen?

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The gradient of the graph will be w/D, and so by multiplying the gradient by the slit separation you will obtain the wavelength.

What is monochromatic light?

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Monochromatic light, is light of a single wavelength (or frequency).

What does it mean if two light sources are coherent?

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Coherent sources have the same wavelength and a constant phase difference.

What happens to light as it passes through a slit?

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Light diffracts as it passes through a slit. The maximum diffraction occurs when the slit spacing matches the light's wavelength.

Why do bright fringes form on a screen when light is passed through a double slit?

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The light diffracts as it passes through the slits and these diffracted waves meet and undergo superposition. At positions where the waves meet in phase, constructive interference occurs, and bright fringes are formed.

Why do dark fringes form on a screen when light is passed through a double slit?

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In a double slit experiment, why might the light be passed through a single slit before the double slit?

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The single slit acts as a point source, and diffracts the light widely so it can pass through the double slits. This means both slits are illuminated by the same source. They therefore have the same wavelength and a constant phase difference.

Describe the interference pattern produced if white light is passed through the double slits.

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A central bright white fringe will be produced. All other bright fringes would consist of a spectra of light, with blue light on the side closest to the centre, and red on the far side of each fringe.

What equation is used to determine the wavelength of light when using a diffraction grating?

What equation is used to determine the wavelength of light when using a diffraction grating?

$$n\lambda = d \sin\theta$$

n: order of diffraction pattern

λ: wavelength

d: diffraction grating spacing

θ: angle from centre

How is a diffraction grating spacing calculated?

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The diffraction grating spacing is the reciprocal of the number of lines per metre.

How can the angle from the centre, to a higher order line, be calculated?

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The distance from the diffraction grating to the screen (D) and the distance from the centre of the pattern to the higher order line (h) can be measured. The angle can then be calculated using trigonometry.

How does a diffraction pattern from a double slit experiment compare to one from a diffraction grating?

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As the number of slits increases, the pattern becomes sharper and the brightness of the fringes increases. This is because more rays are reinforcing the pattern.

Suggest a use for a diffraction grating.

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Diffraction gratings can be used instead of prisms to analyse spectra. An example use is in X-ray crystallography.