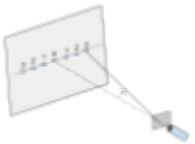
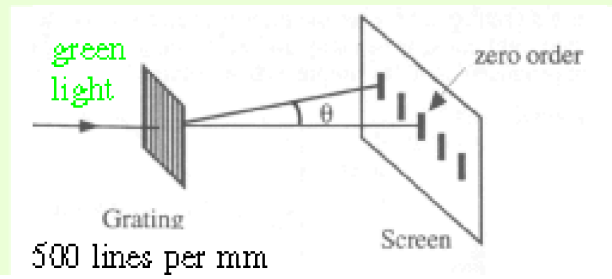
Particles and Waves

The Diffraction Grating



1. Find the distance between the slits, d in the following gratings given their line spacing value:
    a. 600 lines per mm
    b. 400 lines per mm
    c. 1000 lines per mm

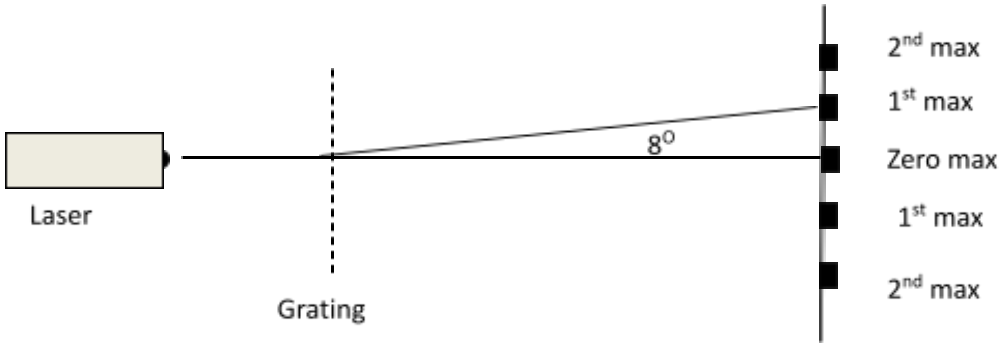
2. A physicist set up the following experiment to find the wavelength of a laser beam.



    a. The angle between the central maximum and the 2nd maximum is 57.1^{O} and the grating has 600 lines per millimeter.
    Calculate the wavelength of the light from the laser.
    b. What is the colour of the laser beam?

3. A laser beam is passed through a grating with 300 lines per millimeter. It is found that the third order maximum is 35^{O} from the central maximum.
    Calculate the wavelength of light used by the laser.

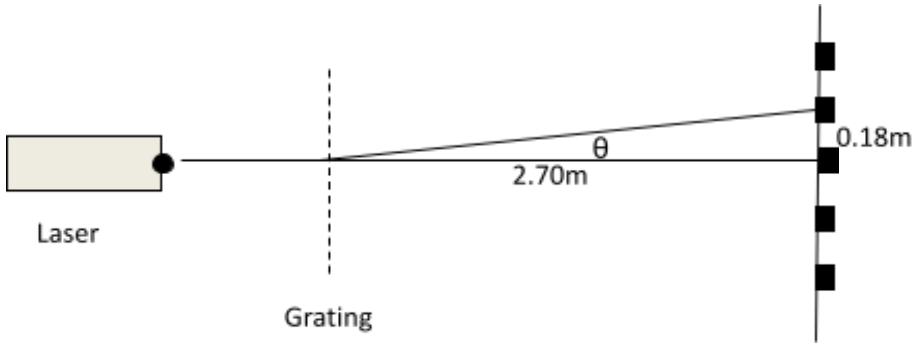
4. Light of wavelength 600 nm passes through a diffraction grating giving a first order maximum at an angle of 8^{O} from the central maximum.



    a. Calculate the separation of the grating`s slits.
    b. Describe what would happen to the angle of the first maximum if a diffraction grating of smaller slit width is used.

5. Sodium light of wavelength 589 nm is shone through a diffraction grating of line spacing 600 lines per millimetre.
    a. Calculate the angle from the central maximum where the second order bright fringe would be detected.
    b. If the 600 lines per mm grating was replaced by one of 300 lines per millimetre would the angle from the central maximum to the second order maximum increase or decrease, justify your response.

6. A laser is shone through a diffraction grating with 100 lines per millimetre. A series of maxima fringes appear on a screen 2.70 metres away.
   The distance between the central maximum and the first order maximum is 0.18 metres.



    a. Explain in terms of waves how a maximum is produced.
    b. Using the above data find sinθ and then calculate the wavelength of the laser
    c. State the colour of the light from this laser.
    d. What would be the effect on the interference pattern if a diffraction grating of 300 lines per millimetre replaced the 100 lines per millimetre.

7. The light from an LED is shone through a diffraction grating which has a spacing between its lines of 5.0×10^{-6} m.

    a. Calculate the wavelength of the light emitted from the LED.

    b. State what would happen to the diffraction pattern if another diffraction grating with a smaller spacing between the lines was used with the same LED.