D4 Interference

D4.1 Complete the questions in the table:

Wavelength	Slit Separation	Distance to Screen /m	Fringe Spacing /mm
633 nm	0.10 mm	4.00	(a)
530 nm	(b)	6.00	4.0
(c)	1.0 mm	1.50	0.20
0.30 cm	0.10 m	2.50	(d)

D4.2 Complete the questions in the table:

Wavelength	Slit Separation	Order of interference n	Angle to 'Straight Through' Direction
633 nm	0.10 mm	2	(a)
530 nm	600 lines/mm	1	(b)
(c)	1000 lines/mm	1	10°
1.0×10^{-11} m	(d)	3	20°

D4.3 A diffraction grating has 600 lines/mm. Yellow light from a street-lamp is shone onto the grating. The yellow light contains two main wavelengths - of 589.6 nm and 589.0 nm. Calculate the angular separation of the second order ($n = 2$) of these two components as they emerge from the grating.

D4.4 A slide looks like it has one fine transparent line ruled on a black background. In fact there are two lines very close together. When red light (633 nm) is shone through it, and a screen is placed 5.0 m away from the slits, ten fringe-spacings measure 5.3 cm. Calculate the separation of the slits on the slide.

D4.5 The light from a 'special LED' consists of two colours of light with wavelengths of 530 nm and 630 nm respectively. The light is shone through a diffraction grating with 500 lines/mm, and the two colours need to be separated by at least 5.0°. What is the minimum order of interference needed in order to do this?

D4.6 A teacher is trying to demonstrate 'Young's fringes' using green (530 nm) light. Assuming that the slit separation is 0.050 mm, how far away from the slits will she need to put the screen to ensure that the fringe spacing is at least 1.0 mm?