SPH4U **Light Questions**

Use the 4-box problem-solving structure: pictorial & words, physics, mathematical, prediction.

1. 2 point sources are creating waves in phase. If the distance from one source to a point on the 3rd antinodal line is 13.0 cm and the wavelength is 2.1 cm, how far is the point from the other source? (6.7 cm or 19.3 cm. Why are there two answers?)

2. Red light at wavelength of 720. nm is directed a double slit of separation 0.13 mm and an interference pattern is created on a screen 2.5 m away. How far from the central bright fringe is (a) the 2nd nodal line and (b) the third maximum? (2.0 cm, 4.2 cm)

3. A transmission grating, with lines 3.00×10^{-6} m apart, is illuminated by a narrow beam of red light ($\lambda = 694.3$ nm) from a ruby laser. Bright spots of red light are seen on both sides of the central beam, on a screen 2 .00m away. How far from the central axis is each of the spots? (69.4 cm)

4. Monochromatic light is directed though a double slit of separation 0.15 mm onto a screen 3.0 m away. The distance between the first and eighth consecutive dark lines is 8.0 cm. What colour is the light? (570. nm = green light)

5. Monochromatic light at 620. nm is passed though a diffraction grating of 650 lines/cm onto a screen. The bright spots are 10. cm apart. How far away is the screen? (2.5 m)

6. In an interference experiment, reddish light of wavelength 6.0×10^2 nm passes through a double slit. The distance between the first and eleventh dark bands, on a screen 1.5 m away, is 13.2 cm.
   a. Calculate the separation of the slits.
   b. Calculate the spacing between adjacent nodal lines using blue light of wavelength 4.5×10^2 nm. (68 μm, 1.0 cm)

7. The wavelength of the laser beam used in a certain CD player is 7.80×10^2 nm. A diffraction grating creates two first-order tracking beams 1.2 mm apart, at a distance of 3.0 mm from the grating. Calculate the spacing between the slits of the grating. (3.9 μm)

8. When a certain transmission grating is illuminated at a wavelength of 638 nm, a third-order maximum forms at an angle of 19.0°. Calculate the number of lines per centimetre in the grating. (1.70×10^3 lines/cm)

9. Sunlight incident on a screen containing two narrow slits 0.20nm apart casts a pattern on a white sheet of paper 2.0 m beyond. Find the distance separating the violet ($\lambda = 400.$ nm) in the first-order band from the red ($\lambda = 600.$ nm) in the second-order band. (1.5 mm)

4-box solution structure

1. Pictorial and word representation	2. Physics representation
3. Mathematical representation	4. Prediction I predict that ...