P10.W Diffraction

Please Show All Work!

1. Determine the wavelength of monochromatic light that produces an order \( m = 1 \) fringe pattern on the screen, at \( \theta = 25^\circ \), when it is incident upon a diffraction grating of 5200 lines/cm.

2. Place all the letters that apply next to the expressions relating the single slit width, \( a \), and the wavelength of the light incident on the slit, \( \lambda \).

   a. \( a << \lambda \)
   b. \( a \sim \lambda \)
   c. \( a >> \lambda \)

   a. The ray approximation is no longer valid (light is also wave like).
   b. The primary effect of the opening is to act like a point source of waves.
   c. The primary effect of the opening is minimal; light travels in a straight line through it.
   d. The primary effect of the opening is to diffract the light.

3. Explain, in one sentence, how diffraction affects the multiple-slit patterns. Sketch (with some accuracy, i.e. use straight axes, note the scale correspondence of the two sketches) the intensity patterns as a function of \( \sin \theta \), where \( \theta \) is the angle of incidence, for a two-slit and a three-slit experiment. Consider \( a \sim \lambda \).