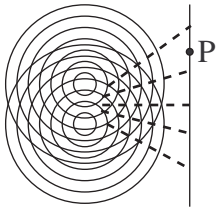
Part I

1. Two in-phase sources produce circular waves of wavelength λ and the interference pattern is shown to the right, with dotted lines indicating where constructive interference occurs.
The difference in the path length from each of the sources to point P is



(a) $\lambda/2$ (b) λ (c) $3\lambda/2$ (d) $5\lambda/2$

2. A diffraction grating is illuminated with yellow light. The pattern seen on a screen behind the grating consists of three yellow spots, one at zero degrees (straight through) and one each at $\pm 45^o$. You now add red light of equal intensity, coming in the same direction as the yellow light.The new pattern consists of

   (a) red spots at 0^o and $\pm 45^o$

   (b) orange spots at 0^o and$\pm 45^o$

   (c) an orange spot at 0^o, yellow spots at $\pm 45^o$, and red spots slightly farther out.

   (d) an orange spot at 0^o, yellow spots at $\pm 45^o$, and red spots slightly closer in.

3. An interference pattern is formed on a screen by shining a planar wave on a double- slit arrangement If we cover one slit with a glass plate (right), the phases of the two emerging waves will be different because the wavelength is shorter in glass than in air. If the phase difference is 180^o, how is the interference pattern changed?

   (a) The pattern vanishes.

   (b) The bright spots lie closer together.

   (c) The bright spots are farther apart.

   (d) Bright and dark spots are interchanged.

4. Blue light of wavelength λ passes through a a double slit with separation d and forms an interference pattern on a screen. If the blue light is replaced by red light of wavelength 2λ, the original interference pattern is reproduced if the slit separation is changed to

   (a) $2d$

   (b) $d/2$

   (c) No change is necessary.

   (d) There is no separation that can be used to reproduce the original pattern.

Part II

1. Monochromatic light illuminates a narrow slit which is 4.0 m from a screen. Two very narrow parallel slits 0.5 mm apart are placed halfway between the single slit and the screen so that interference fringes are obtained.

   If the spacing of five fringes is 10 mm calculate the wavelength of the light.

   What will be the effect on the fringes of

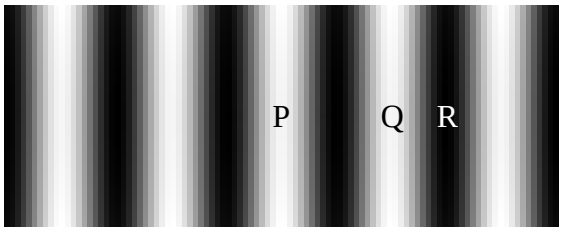
   (a) halving the distance between the double slit and the screen;

   (b) halving the slit separation;

   (c) covering one of the double slits;

   (d) using white light.

2. Red light, with wave length λ is incident on two slits. The light passing through the slits forms a fringe pattern on a screen which is a distance 2.2 m from the slits. The fringe pattern is shown on the right. The point P is at the center of the pattern directly opposite the slits. P and Q are maximum intensity and R is a minimum intensity fringe.



(a) Explain why there are dark and light fringes.

(b) What is the difference in path length from each of the two slits to the point P? The point Q? The point R? Express your answer in terms of the wavelength λ.

(c) If the distance between P and R is 1.6 mm, find the slit separation in terms of λ.

(d) Suppose the width of the slits on the right were decreased without changing the distance between the centers. Would the brightness of at Q increase,decrease or stay the same? What about R? Explain?