Homework Solutions
11/5/2007

Conceptual

4. The wavelength of light in water decreases so the distance between bright spots would decrease they are directly proportional.

Problems

5. a.

$$d\sin\theta = m\lambda$$
$$v = f\lambda$$
$$\theta = \sin^{-1}\left(\frac{m\lambda}{d}\right) = \sin^{-1}\left(\frac{m\left(\frac{v}{f}\right)}{d}\right) = \sin^{-1}\left(\frac{1\left(\frac{343\frac{m}{s}}{2000Hz}\right)}{0.300m}\right) = 36.2°$$

b.

$$d\sin\theta = m\lambda$$
$$d = \frac{m\lambda}{\sin\theta} = \frac{1(3.00cm)}{\sin(36.2°)} = 5.08cm$$

c.

$$d\sin\theta = m\lambda$$
$$\lambda = \frac{d\sin\theta}{m}$$

$$\lambda = \frac{v}{f}$$

$$\frac{v}{f} = \frac{d\sin\theta}{m}$$

$$f = \frac{mv}{d\sin\theta} = \frac{1\left(3.0 \bullet 10^{8}\,\frac{m}{s}\right)}{(1.00 \bullet 10^{-6}\,m)\sin(36.2°)} = 5.08 \bullet 10^{14}\,Hz$$

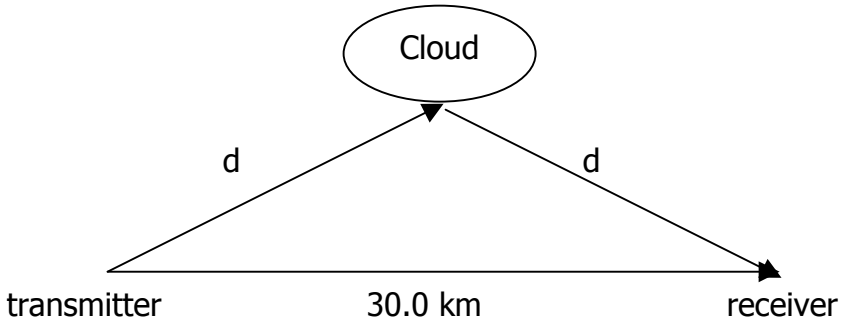
7. You can't use the small angle approximation because L and d and x are all similar in dimension.

11. a.

$$x_{\min ima} = \frac{\left(m + \frac{1}{2}\right)L\lambda}{d}$$

$$d = \frac{\left(m + \frac{1}{2}\right)L\lambda}{x} = \frac{(150m)(3.00m)}{2(20.0m)} = 11.3m$$

12.



$$\delta = pathdifferenc$$

$$\delta = \frac{\lambda}{2}$$

$$\delta = 2d - 30.0km$$

$$\frac{\lambda}{2} = 2d - 30.0km$$

$$d = \frac{\left(\frac{\lambda}{2} + 30.0km\right)}{2} = \frac{\left(\frac{0.400km}{2} + 30.0km\right)}{2} = 15.1km$$

$$h = \sqrt{(15.1km)^2 + (15.0km)^2} = 1.73km$$