

PHYS-1200 PHYSICS II
HOMEWORK #16 SOLUTIONS

26.) Sample Problem 17-5 shows that a decibel difference $\Delta\beta$ is directly related to an intensity ratio (which we write as $R = I' / I$). Thus,

$$\Delta\beta = 10 \log(R) \Rightarrow R = 10^{\Delta\beta/10} = 10^{0.1} = 1.26.$$

35.) (a) The intensity is

$$I = \frac{P}{4\pi r^2} = \frac{30.0 \text{ W}}{(4\pi)(200 \text{ m})^2} = 5.97 \times 10^{-5} \text{ W/m}^2.$$

(b) Let $A (= 0.750 \text{ cm}^2)$ be the cross-sectional area of the microphone. Then the power intercepted by the microphone is

$$P' = IA = (6.0 \times 10^{-5} \text{ W/m}^2)(0.750 \text{ cm}^2)(10^{-4} \text{ m}^2 / \text{cm}^2) = 4.48 \times 10^{-9} \text{ W}.$$

12.) The intensity of the signal at Proxima Centauri is

$$I = \frac{P}{4\pi r^2} = \frac{1.0 \times 10^6 \text{ W}}{4\pi[(4.3 \text{ ly})(9.46 \times 10^{15} \text{ m/ly})]^2} = 4.8 \times 10^{-29} \text{ W/m}^2.$$

24. (a) We note that the cross section area of the beam is $\pi d^2/4$, where d is the diameter of the spot ($d = 2.00\lambda$). The beam intensity is

$$I = \frac{P}{\pi d^2 / 4} = \frac{5.00 \times 10^{-3} \text{ W}}{\pi [(2.00)(633 \times 10^{-9} \text{ m})]^2 / 4} = 3.97 \times 10^9 \text{ W / m}^2.$$

(b) The radiation pressure is

$$p_r = \frac{I}{c} = \frac{3.97 \times 10^9 \text{ W / m}^2}{2.998 \times 10^8 \text{ m / s}} = 13.2 \text{ Pa}.$$

(c) In computing the corresponding force, we can use the power and intensity to eliminate the area (mentioned in part (a)). We obtain

$$F_r = \left(\frac{\pi d^2}{4} \right) p_r = \left(\frac{P}{I} \right) p_r = \frac{(5.00 \times 10^{-3} \text{ W})(13.2 \text{ Pa})}{3.97 \times 10^9 \text{ W / m}^2} = 1.67 \times 10^{-11} \text{ N}.$$

(d) The acceleration of the sphere is

$$a = \frac{F_r}{m} = \frac{F_r}{\rho(\pi d^3 / 6)} = \frac{6(1.67 \times 10^{-11} \text{ N})}{\pi(5.00 \times 10^3 \text{ kg / m}^3)[(2.00)(633 \times 10^{-9} \text{ m})]^3} \\ = 3.14 \times 10^3 \text{ m / s}^2.$$

Q35.04) a. ΔL increases b. by 1λ from one bright fringe to the next. (see FIG. 35-12)

Q35.06) b. ΔL is equal to 300nm b.) So the rays are exactly out of phase since that is half the wavelength of 600nm