

PHY2053 Health, Summer C 2016

Quiz 6

Date: Thursday, July 20, 2016

Problem 1: Calculate the power emitted by a sound source, if a person at a distance of 10 m from it hears sounds at an intensity of 10 mW/m². Assume that the sound waves propagate uniformly in all directions.

$$I = \frac{\text{Power}}{\text{Area}} = \frac{P}{4\pi d^2}$$

$$P = I \times 4\pi d^2 \quad \text{where } d \text{ is distance}$$

not diameter.

$$P = 10 \times 10^{-3} \frac{\text{W}}{\text{m}^2} \times 4\pi \times (10 \text{ m})^2$$

$$\boxed{P = 4\pi W} \approx 12.57 \text{ W}$$

Problem 2: A cylindrical steel wire (density $\rho = 8000 \text{ kg/m}^3$) of diameter 1 mm is held taut horizontally with a tension of 200 N. Calculate the speed of transverse waves on this string. [Hint: Volume of a cylinder of radius r and length L is $\pi r^2 L$.]

$$v = \sqrt{\frac{T}{\mu}}$$

$$T = 200 \text{ N}$$

$$\mu = ?$$

$$\text{Volume of the string for length } L = \pi r^2 L$$

$$\text{Mass of the string for length } L = (\pi r^2 L) \rho$$

$$\mu = \frac{\text{mass for length } L}{L}$$

$$= \frac{\pi r^2 L \rho}{L} = \pi r^2 \rho$$

$$v = \sqrt{\frac{T}{\pi r^2 \rho}}$$

$$T = 200 \text{ N}$$

$$r = 0.5 \times 10^{-3} \text{ m}$$

$$\rho = 8000 \text{ kg/m}^3$$

$v = 178 \text{ m/s}$