

NINE
UNIT 9 PROBLEMS

Name _____
Pd. _____

1. If a wave source produces 30 pulses every 5 seconds, calculate its period and frequency.

$$f = \frac{30 \text{ pulses}}{5 \text{ seconds}} = 6 \frac{\text{pulses}}{\text{sec}} = 6 \text{ Hz}$$

$$T = \frac{1}{f} = \frac{1}{6} \text{ sec}$$

$$x = .05 \text{ m} \quad f = 6 \text{ s}^{-1}$$

2. A wave tank produces a wave every 0.25 seconds with $\lambda = 5 \text{ cm}$. What is wave speed?

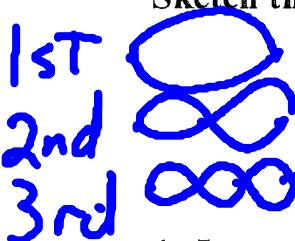
$$f = \frac{1}{T} = 4 \text{ Hz}$$

$$T = .25 \text{ s} = \frac{1}{4} \text{ s}$$

$$V = f\lambda = (4 \text{ s}^{-1})(.05 \text{ m}) = .20 \text{ m/s}$$

3. A 80 cm-long string fixed at both ends vibrates with a frequency of 440 Hz.

Sketch the first three harmonics and calculate the wave speeds of each.



$$\begin{aligned} 1^{\text{st}} & \cdot 8 \text{ m} = \frac{\lambda}{2} \quad \text{so} \quad \lambda = 1.6 \text{ m} \quad V = f\lambda = (440 \text{ Hz})(1.6 \text{ m}) = \\ 2^{\text{nd}} & \cdot 8 \text{ m} = \lambda \quad V = f\lambda = (440 \text{ Hz})(.8 \text{ m}) = 352 \text{ m/s} \\ 3^{\text{rd}} & \cdot 8 \text{ m} = \frac{3}{2} \lambda \quad \lambda = .53 \text{ m} \quad V = f\lambda = (440 \text{ Hz})(.53 \text{ m}) = 234.6 \text{ m/s} \end{aligned}$$

4. In an experiment to calculate the speed of sound, a 480 Hz tuning fork causes resonance in an 18 cm-long closed tube. Calculate the speed of sound.

$$.18 \text{ m} = \frac{\lambda}{4} \quad \therefore \lambda = .72 \text{ m}$$

$$V = f\lambda = (480 \text{ Hz})(.72 \text{ m}) \quad V = 345.6 \text{ m/s}$$

5. Calculate the fundamental frequency (1st harmonic) for an open tube of length 1.25 m. Use $v = 340 \text{ m/s}$.

$$1.25 \text{ m} = \frac{\lambda}{2} \quad \therefore \lambda = 2.50 \text{ m} \quad f = \frac{V}{\lambda} = \frac{340 \text{ m/s}}{2.5 \text{ m}}$$

$$f = 136 \text{ Hz}$$