

Waves II - 1

Wave Superposition (1):

$$A \sin(kx - \omega t) + A \sin(kx - \omega t + \phi) = 2A \cos\left(\frac{\phi}{2}\right) \sin\left(kx - \omega t + \frac{\phi}{2}\right)$$

Guitar String (2):

$$f_n = n \frac{v}{2L} \quad n = 1, 2, 3, \dots, \quad v = \sqrt{\frac{F_T}{\mu}}$$

Harmonic Pipe (3):

$$f_n = n \frac{v}{4L} \quad n = 1, 3, 5, 7, \dots$$

See previous equation for odd numbers.

Standing Wave in a Pipe (4): See previous equation. Then,

$$H_{\text{water}} = L_0 - L_1.$$

Speed from Doppler Effect (5):

$$f_1 = f_0 \left(1 + \frac{u}{v} \right).$$

Solve for u .

Doppler Effect for a passing Train (6):

$$f_1 \left(1 - \frac{u}{v} \right) = f_0 \quad \text{and} \quad f_2 \left(1 + \frac{u}{v} \right) = f_0.$$

Solve for u .