A string having of mass 10 g and length 2.0 m is under a tension of 80 N.

(a) How much power must be supplied to the rope to generate sinusoidal waves at a frequency of 60 Hz and an amplitude of 6.0 cm?

\[ P = \frac{1}{2} \rho v^2 \omega^2 y_m^2 \]

\[ \rho = \frac{m}{l} = \frac{10 \times 10^{-3}}{2} = 5 \times 10^{-3} \text{ kg/m} \]

\[ 2\pi f = 120\pi \text{ rad/s} \]

\[ \sqrt{\frac{T}{\rho}} = \sqrt{\frac{80}{5 \times 10^{-3}}} = 126.5 \text{ m/s} \]

\[ y_m = 6 \times 10^{-2} \text{ m} \]

\[ P = \frac{1}{2} (5 \times 10^{-3}) (126.5)(20\pi)^2 (0.06)^2 \approx 161.8 \text{ W} \]

(b) If the string's length is doubled, what would be the power delivered to the rope under the same experimental conditions as in part (a)?

If \( l_2 = 2l_1 \), \( P \) will not change since it is the same material \( \Rightarrow P \) remains the same.