Name _____ Date _____ Class _____

Physics of Sound Worksheet Answer Key

Useful equations

$$f = \frac{v}{\lambda} \qquad f = \frac{1}{T} \qquad \beta(dB) = 10\log\left(\frac{I}{I_0}\right)$$

f = frequency λ = wavelength T = period

v = wave velocity $\beta(dB)$ = sound *i*ntensity

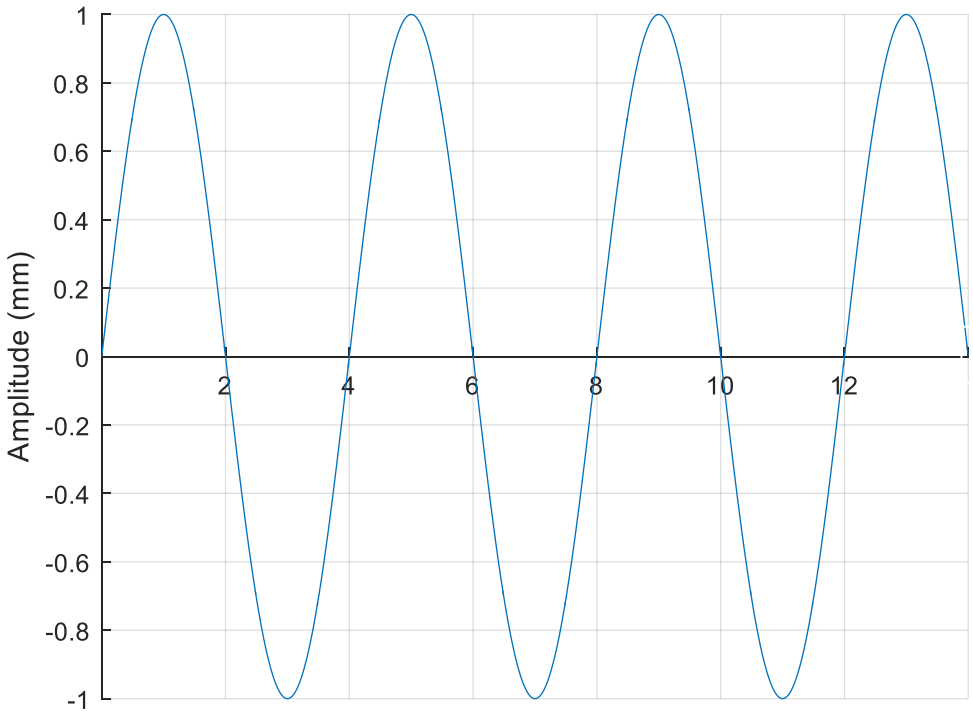
$I_0 = 10^{-12}\frac{watts}{m^2}$ I_0, reference intensity, is the standard threshold of hearing intensity

1. **How does sound move through different media?**
   Sound travels through media by vibrating molecules in the matter. Closely packed molecules, like in solids, transfer sound faster than loosely packed molecules, like in liquids and gases.

2. **Calculate the wave velocity of the given wave.**

   $\lambda = 4mm$

   $f = \frac{v}{\lambda}$ f = 1/4 seconds v = (1/4 seconds) x 4 mm = 1 mm/second



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3. **A soundwave hits a wall at a rate of 32.2 Hz.**
   a. **What is the period of the wave?**

      f = 1/t t= period 32.2 Hz = 32.2 $seconds^{-1}$

      period = 1/ 32.2 seconds = .031 seconds

   b. **Calculate the speed of the wave if the distance between wave crests is 12 meters.**

      $f = \frac{v}{\lambda}$ λ = 12 m v = 12 m x 32.2 Hz = 386.4 m/s

4. **The speed of sound at room temperature is 346 m/s.**
   a. **What is the frequency of a wave with a wavelength of 2.5 mm?**

      $f = \frac{v}{\lambda}$

      λ = 0.0025 m v = 346 m/s f = 346 m/s ÷ 0.0025 m = 138400 Hz

   b. **What is the period?**

      t = period f = 1/t t = 1/138400 Hz = 7.2 x 10^{-6} seconds

5. **A quiet library has a sound intensity of 1x10^{-8} W/m^2**
   a. **Calculate the sound intensity in dB.**

      $\beta(dB) = 10\log\left(\frac{I}{I_0}\right)$ $I_0 = 10^{-12}\,\frac{watts}{m^2}$

      β = 10 log (1x10^{-8} W/m^2 ÷ 1x10^{-12} W/m^2) = 40 dB

   b. **What is the threshold of pain?**

      140 dB