**Mechanical Waves**
Supplemental Instruction
Iowa State University

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Equations:

\[
\begin{align*}
  \nu & = \frac{\lambda}{T} \\
  T & = \frac{1}{f} \\
  \nu & = \sqrt{\frac{F}{\mu}}; (\mu = \frac{m}{L}) \\
  n\left(\frac{\lambda}{2}\right) & = L
\end{align*}
\]

Conceptual Quiz:

1. Show the motion of a transverse wave vs. a longitudinal wave
2. Sketch the Different forms of waves: periodic, pulse and pulse train
3. If the particles of the medium are vibrating to and fro in the same direction of energy transport, then the wave is a ____ wave.
4. Unlike a transverse wave, a longitudinal wave has
   a. No amplitude
   b. No frequency
   c. No wavelength
   d. No speed
   e. All of the above
5. The speed of a wave is constant that depends only on the ____.
6. What is the SI unit for frequency?
7. If the frequency of a wave is doubled and if the speed remains constant, its wavelength is ____.
8. Two pulses are traveling in opposite directions along the same medium as shown in the diagram at the right. Which diagram below best depicts the appearance of the medium when each pulse meets in the middle?

![Diagram of pulses](image)

Options:
A. ![Option A](image)
B. ![Option B](image)
C. ![Option C](image)
D. ![Option D](image)

1. Find the period, frequency, amplitude, and the angular frequency for the following wave:

![Wave diagram](image)

2. Jerome and Claire are doing the Period of a Pendulum Lab. They observe that a pendulum makes exactly 10 complete back and forth cycles of motion in 21.8 seconds. Determine the period of the pendulum.
3. It is said that one can even observe the vibrational motion of the Sears Tower in Chicago on a windy day. As the Sears Tower vibrates back and forth, it makes about 8.6 vibrations in 60 seconds. Determine the frequency and the period of vibration of the Sears Tower.

4. A mechanical wave moves in a string with a speed of 125 m/s. If the frequency of the wave is 250 Hz, what is the wave length?

5. A 2 m long string with a mass of 0.10 kg is plucked with a tension force of 500 N.
   a. What is the linear density of the string?
   b. Find the velocity of the mechanical wave on the string
   c. Determine the frequency if the string has 8 nodes

6. The intro to “Nothing Else Matters” by Metallica consists fingerpicking open E, G, B, and e strings. Find the tension required for each string to produce the correct note if each string has a length of 66 cm.
   
   \[(E = 82.4 \text{ Hz} \ 4.5g, \ G = 196.0 \text{ Hz} \ 0.75g, \ B = 246 \text{ Hz} \ 0.47g, \ e = 329 \text{ Hz} \ 0.26g)\]