Vibrations, Waves, and Sound

$T_P = 2\pi\sqrt{\frac{l}{g}}$ $T_{SHO} = 2\pi\sqrt{\frac{m}{k}}$ $f = \frac{1}{T}$

$v = \lambda \cdot f$ $f_B = |f_1 - f_2|$

Period = Time per cycle (sec)

Frequency = cycles per time (Hz)

Question 1

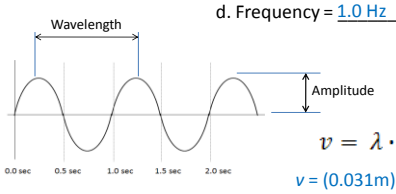
A sine curve that represents a transverse wave is drawn below. With a ruler, measure the wavelength and amplitude of the wave.

a. Wavelength = 3.1 cm (0.031m)

b. Amplitude = 1.3 cm

c. Period = 1.0 sec

d. Frequency = 1.0 Hz



$v = \lambda \cdot f$

v = (0.031m)(1.0/ sec)

v = 0.031 m/s

Question 2

A kid on a playground swing makes a complete to-and-fro swing each 4 seconds.

The frequency of swing is

Frequency = cycles / time = 1 cycle in 4 seconds = 0.25 Hz

or

$f = 1/T = ¼ = 0.25$ Hz

and the period is

Period = Time / cycle = 4 seconds

Question 3

The annoying sound from a mosquito is produced when it beats its wings at the average rate of 800 wingbeats per second. (v = 332 m/s)

a. What is the frequency of the sound wave?

Frequency = cycles / time = 800 cycles in 1 second = 800 Hz

b. What is the wavelength of the sound wave?

$v = \lambda \cdot f$

$332 = 800 \cdot \lambda$ $\lambda = 332/800 = 0.415$ m

Question 4

A record spins at a rate of 33.3 revolutions per minute. Calculate the period and frequency of the record.

Frequency = cycles / time = 33.3 cycles in 1 minute

f = 33.3 cycles / 60 seconds = 33.3/60 = 0.555Hz

Period = 1 / f = 1/0.555 = 1.8 sec

Question 5

The source of all waves is _____Vibrations_____

Question 6

All waves transfer _____Energy_____ from one point to another

Question

All mechanical waves travel through a medium by displacing the medium. A _____Transverse_____ wave occurs when the displacement of the medium is perpendicular to the direction the wave travels and a _____Longitudinal_____ wave occurs when the displacement of the medium is parallel to the direction the wave travels.

Question 7

Which of the following factors affect the period of a pendulum?
Amplitude, Mass, String Length, Color, acceleration due to gravity

Question 8

Which of the following factors affect the period of a spring oscillator?

Amplitude

Mass,

spring constant

Color

acceleration due to gravity

Question 9

Consider a wave generator that produces 10 pulses per second. The speed of the waves is 250 m/s.

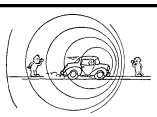
a. What is the wavelength of the waves? 25 m

$v = \lambda \cdot f$ 250 = λ·10

b. What happens to the wavelength if the frequency of pulses is increased?

Wavelength decreases (gets shorter)

Question 10



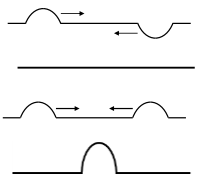
When an automobile moves toward a listener, the sound of its horn seems relatively… (lower) (normal) (higher) pitched

when it moves away from the listener, its horn seems (lower) (normal) (higher) pitched

The person in the car hears a (lower) (normal) (higher) pitch

Questions 11 & 12

What type of interference would occur for the following diagrams? (describe what would happen to the amplitude as the waves collide)

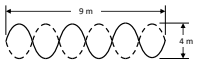


Destructive interference

Constructive interference

Question 13 & 14

For the standing wave shown, determine the wavelength, amplitude, and the number of nodes.



Wavelength 3 m
Amplitude 2 m
Nodes 7

If the frequency in the waveform shown above is 228 Hz, what is the speed of the wave?

$V = \lambda f = 3*228 = 684$ m/s

Question 15

A standing wave is in the 5th harmonic when its frequency is 190 Hz Which of the following frequencies does not belong in the harmonic series for the standing wave?

38 Hz, 76 Hz, 115 Hz, 152 Hz, 267 Hz, 342 Hz

The 1st harmonic is 38 Hz (190 / 5 = 38)

All the remaining harmonics must be multiples of 38

38, 76, 114, 152, 190, 228, 266, 304, 342

Question 16

A piano note creates a beat frequency of 6 Hz when played with a tuning fork of 384 Hz. What are the possible frequencies of the piano note?

$$f_B = |f_1 - f_2|$$

384 - 6 = 378 Hz

384 + 6 = 390 Hz

Question

If the piano tuner in the problem above tightens the string, the frequency of the sound wave produced by the string will _Increase_____.

Exit Waves & Sound