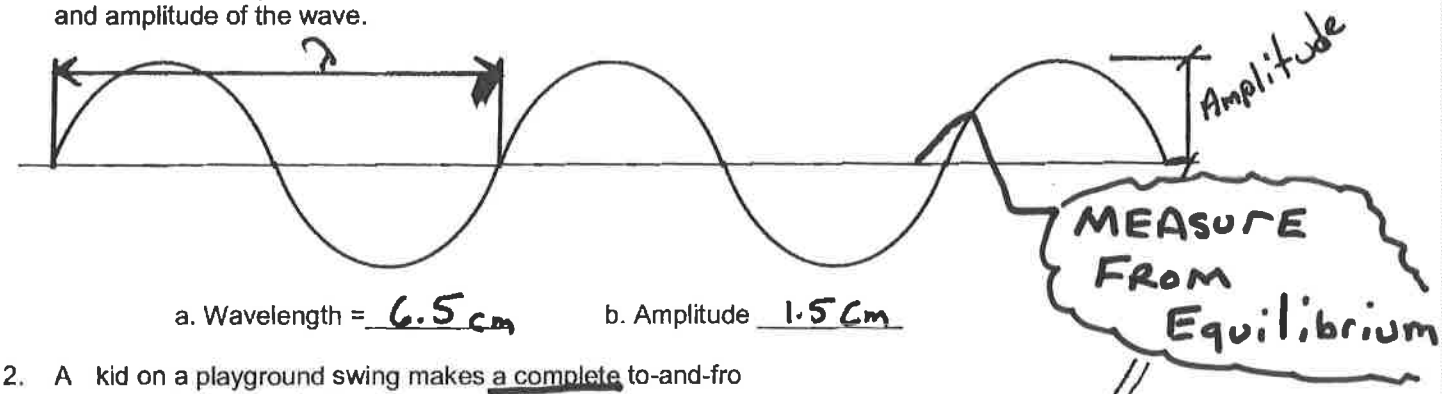
Name KEY 2017

Vibrations, Waves and Sound Review:

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 = 6.5 cm b. Amplitude 1.5 cm

2. A kid on a playground swing makes a complete to-and-fro swing each 2 seconds. The frequency of swing is

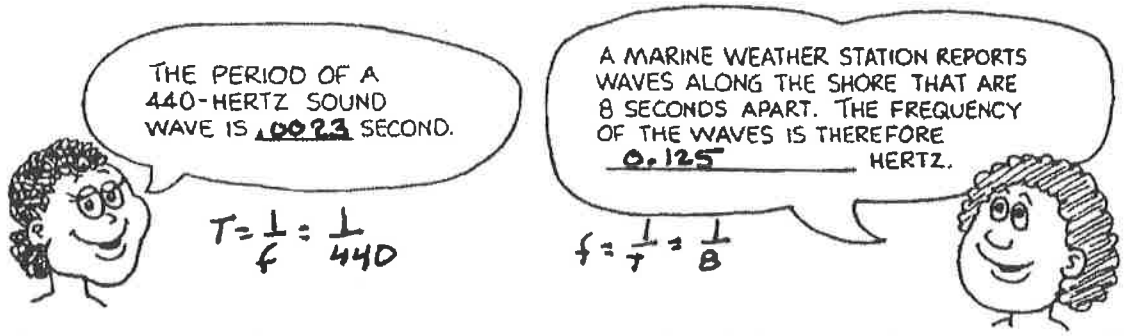
(0.5 hertz) (1 hertz) (2 hertz) $T = 2$, $f = 1/T = \frac{1}{2} = 0.5\,Hz$

and the period is

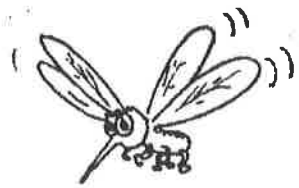
(0.5 second) (1 second) (2 seconds)

or $f = \frac{\text{cycles}}{\text{Time}} = 1/2$

3. Complete the statements.



4. The annoying sound from a mosquito is produced when it beats its wings at the average rate of 600 wingbeats per second. (v = 332 m/s)



a. What is the frequency of the sound wave?

600 Hz

b. What is the wavelength?

0.553m

$V = \lambda \cdot f$
$332 = \lambda \cdot 600$
$\lambda = \frac{332}{600}$

10/sec = f

5. A machine gun fires 10 rounds per second. The speed of the bullets is 300 m/s.

a. What is the distance in the air between the flying bullets? $v = \lambda \cdot f$ $\lambda = \frac{v}{f} = \frac{300}{10} = 30\ m$

b. What happens to the distance between the bullets if the rate of fire is increased?

$v = \lambda \cdot f$ $f \uparrow \lambda \downarrow$

X Consider a wave generator that produces 10 pulses per second. The speed of the waves is 300 cm/s.

$v = \lambda \cdot f$ $\lambda = \frac{v}{f} = \frac{300}{10}$

SAME AS #5 a. What is the wavelength of the waves? 30 cm

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

$f \uparrow$ $\lambda \downarrow$

7. The bird at the right watches the wave crests. If 2 crests of the wave pass the pole each second, what is the speed of the wave? $f = 2\ Hz$ $v = \lambda \cdot f = 2 \cdot 1 = 2.0\ m/s$ $\lambda = 1\ m$

2.0 m/s

What is its period? 0.5 Sec $T = \frac{1}{f} = \frac{1}{2} = 0.5\ sec$

* If the distance between crests in the above question were 1.5 meters apart and 2 crests pass the pole each second, what would be the speed of the wave? $v = \lambda \cdot f = 1.5(2) = 3.0\ m/s$

Similar To 7 3.0 m/s

What is its period? ~~0.375~~ 0.5 Sec $T = \frac{1}{f} = \frac{1}{2} = 0.5$

9. When an automobile moves toward a listener, the sound of its horn seems relatively

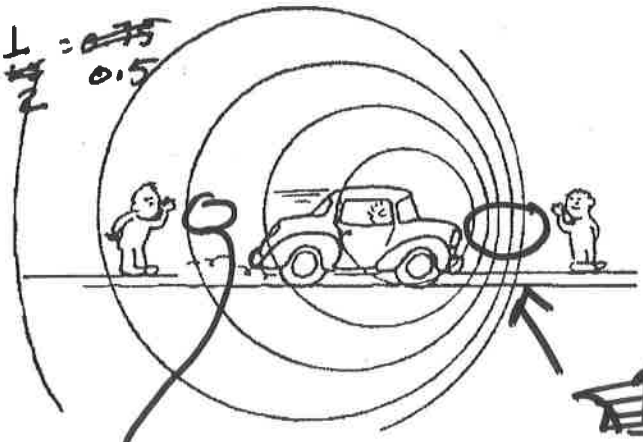
(low pitched) (normal)

(high pitched)

and when it moves away from the listener, its horn seems

(low pitched) (normal)

(high pitched)



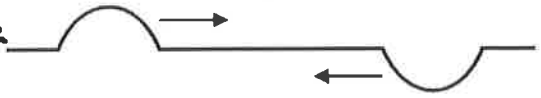
Velocity is constant

$\lambda \uparrow F \downarrow$

$\lambda \downarrow F \uparrow$

$v = \lambda \cdot f$

10. What type of interference would occur for the following diagram? (describe what would happen to the amplitude)



destructive Interference

Amplitude decreases

11. What type of interference would occur for the following diagram? (describe what would happen to the amplitude)

Constructive Interference

Amplitude Increases

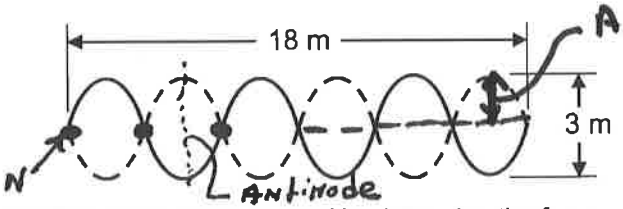
12. For the standing wave shown, determine the wavelength, amplitude, and the number of nodes. Label a node and an antinode.

Amp = 3/2 = 1.5m

Nodes = 7

1 Loop = 18/6 = 3m

λ = 2 Loops = 2(3) = 6m



a) If the frequency of vibration in the standing wave above is 256 Hz, determine the frequency of the second harmonic

Find f_1 First

$f_6 = 6f_1$

$f_1 = \frac{256}{6} = 42.7\ Hz$ $f_2 = 2f_1 = 2(42.7) = 85.3$

b) What is the speed of the wave?

$V = \lambda \cdot f = 6(256) = 1536\ m/s$

13. Which type of interference occurs at nodes and at antinodes?

destructive @ Nodes & Constructive @ antinodes

14. A piano note creates a beat frequency of 3 Hz when played with a tuning fork of 256 Hz. What are the possible frequencies of the piano note?

$f_B = |f_1 - f_2|$ $3 = |f_1 - 256|$ $f_1 = 253$ or $259\ Hz$

15. If someone spins a tuning fork in a vertical circle, when will you hear a higher pitch and when will you hear a lower pitch?

You will hear a higher pitch when it is moving toward you & a Lower Pitch as it moves away.

16. How do you change the wave speed of waves in a slinky or for that matter any wave?

Change the medium through which it travels (tension)

If someone talks in a loud, high pitch voice; describe the sound waves' amplitude, wavelength, wavespeed, frequency, and period versus talking normally.

A ↑, λ ↓, V same, f ↑, T ↓

18. What happens if you force something to vibrate at its natural frequency?

It will Resonate causing the Amplitude to magnify

duplicate

Sitting on the dock of the bay, you are counting waves. If ten waves go by in 5 seconds, determine the period of the waves. If the distance from one wave to the next is 2 meters, determine the speed of the waves.

$T = \frac{Time}{Wave} = \frac{5}{10} = 0.5\ Sec.$ $f = \frac{1}{T} = \frac{1}{0.5} = 2.0$ $V = \lambda \cdot f = 2(2) = 4.0\ m/s$

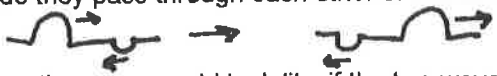
duplicates

20. The moon is describes as a "silent planet." Explain why.
There Is No Air So there is nothing for Sound to travel through.

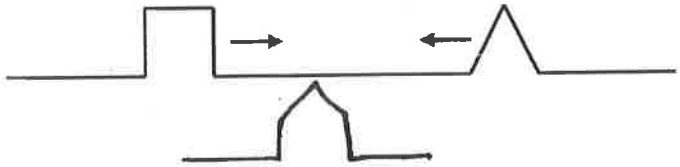
~~X~~ Sound travels at a speed of 343 m/s in air at 20°C. The wavelength of a sound wave is 1.31 m. Find the period of the wave.
$V = \lambda \cdot f$ $f = \frac{V}{\lambda} = \frac{343}{1.31} = 262\ Hz$ $T = \frac{1}{f} = \frac{1}{262} = 0.0038$

~~X~~ The magnetic tape of a cassette deck moves with a speed of 0.048 m/s. The recording head records a 15,000 Hz tone on the tape. What is the wavelength of the magnetized regions?
$V = \lambda \cdot f$ $\lambda = \frac{V}{f} = \frac{0.048}{15000} = 3.2 \times 10^{-6}\ m$

23. Classify the following as longitudinal or transverse waves, a) sound b) light c) ocean wave d) stadium crowd waves e) traffic slowing because of an accident.
Sound → L, Light → T, Ocean → T, Stadium → T, Traffic → L

~~X~~ When waves hit each other do they pass through each other or bounce off? Explain how you know.
Pass through 

25. Use superposition to determine the wave would look like if the two waves below passed through each other.



No Calculations for these!

~~X~~ What is the period of a pendulum with a length of 0.75m?
$T = 2\pi\sqrt{l/g} = 2\pi\sqrt{.75/9.8} = 1.74\ sec$

~~X~~ A student sets up a pendulum in the classroom with a period of 1.35 seconds. What is the length required in order to obtain the period of 1.35 second?
$1.35 = 2\pi\sqrt{l/g} \Rightarrow \sqrt{\frac{l}{g}} = \frac{1.35}{2\pi} = 0.215 \Rightarrow \frac{l}{9.8} = (0.215)^2 = 0.0462$
$l = 9.8 \times .0462 = 0.45m$

~~X~~ A. By what factor must you increase the length of the string of a pendulum in order to triple the period?
9

~~X~~ B. A student sets up a simple harmonic oscillator (SHO) with a mass of 0.55 kg and a spring constant of 165 N/m. What is the period of this oscillator?
$T = 2\pi\sqrt{m/k} = 2\pi\sqrt{\frac{.55}{165}} = 0.363\ sec$

What is the frequency?
$f = \frac{1}{T} = \frac{1}{0.363} = 2.76\ Hz$