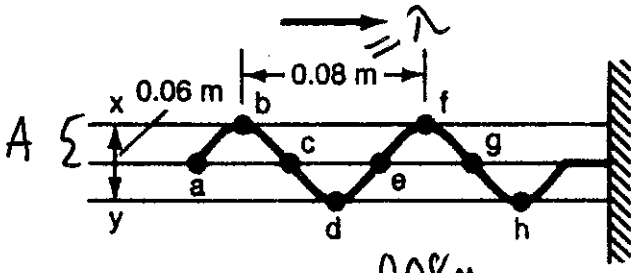
NAME KEY **WAVES & SOUND REVIEW SHEET**

WAVES

1. Base your answers to a.-e. on the diagram below which shows a periodic wave traveling to the right in a steel spring.



a. What is the wavelength of the wave? $\lambda =$ 0.08m

b. What is the amplitude of the wave? A = 0.03m

c. If a wave crest passes line XY every 0.4 sec, what is the frequency of the wave? f = 2.5Hz
(period)

d. What point is in phase with a? e
(= same spot on another wave)

e. What type of wave is shown by the diagram (longitudinal or transverse?)

2. Which diagram shows the shape of the medium when they are completely interfering?

Before Interference

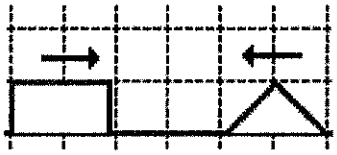


Diagram A

Diagram B

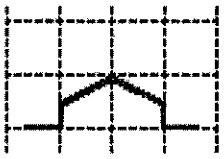
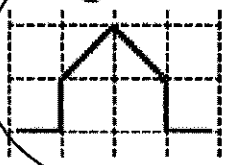


Diagram C

Diagram D



constructive interference

3. A sound wave of wavelength 0.90 m and velocity 330 m/s is produced for 2.0 s.

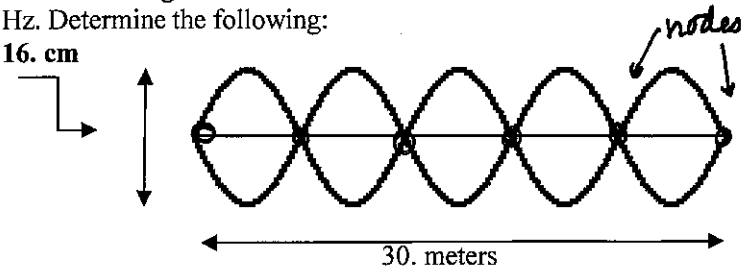
($\lambda =$, $= v$) ← 2 sig figs

a. What is the frequency of the wave? $f = \frac{v}{\lambda} = \frac{330\ m/s}{0.90\ m} = 367$ or 370 Hz

b. How many waves are emitted in 2.0 seconds? Recall, the definition of frequency...
#waves = freq × #seconds = 740 waves (#cycles/second)

c. After 2.0 s, what distance has the wave traveled from the source of the sound?
$d = ?$
$v = \frac{d}{t}$ $d = v \cdot t = 330\ m/s\ (2.0\ s) = 660\ m$

4. The standing wave shown below is the result of Stickman moving the rope (mechanical) with a frequency of 30. Hz. Determine the following:



dist. between nodes $= \frac{\lambda}{2}$

$T = f = \frac{1}{30} =$

a) Amplitude = 8.0cm b) Wavelength = 12 c) Period = .033 seconds

d) # nodes = 6 e) Type of wave? = MECHANICAL & TRANSVERSE

f) Velocity = ____ Show work here!

$v = \lambda \cdot f = (12m)(30Hz) = 360 \frac{m}{s}$

SOUND

D 5. Sound is both a _____ and _____ wave.
(a) mechanical & electromagnetic (b) electromagnetic & longitudinal
(c) mechanical & transverse (d) longitudinal & mechanical

D 6. Pitch is to frequency as loudness is to _____
(a) decibels (b) speed (c) period (d) amplitude

A 7. If a person speaks from the front of the room toward the back, the air molecules transmitting the sound oscillate = LONGIT. wave
(a) front to back to front (b) front to back only (c) back to front only

C 8. Audible range for humans is between the frequencies of _____ and _____ Hz.
(a) 20 and 30 (b) 330 and 660 (c) 20 and 20,000 (d) 0 and 20,000

C 9. A bat sends out a high frequency sound and receives a small amplitude lower frequency in return. What is true of the "insect" the sound bounced off of? little going away
a) The insect is large and stationary.
b) The insect is small and stationary.
c) The insect is small and moving away from the bat.
d) The insect is large and moving toward the bat.

Doppler Effect

would remain higher in pitch

10. An ambulance races toward an observer at a constant high speed with its siren blaring. What would be true of the frequency heard as the siren approaches and then departs?
a) ~~It remains constant in pitch (frequency) the entire time.~~
b) It will appear constantly at a higher pitch and then at a lower pitch after passing.
c) The pitch will vary continuously from high to low.
d) The pitch will vary continuously from low to high.

$f = \frac{v}{\lambda}$ so high f means short λ...

B 11. Which of the following tubes would resonate at the highest frequency (smallest wavelength)?
(a) a 20 cm closed tube (b) a 20 cm open tube (c) an 80 cm closed tube (d) an 80 cm open tube
λ=80cm λ=40cm λ=320cm λ=160cm

Doppler Effect

12. A bug at rest in a pool begins swimming in the water toward a swimmer. What is true of the length of the waves compared to their wavelength when the bug was not moving but still making circular waves-? What is true of these λ's after the bug passes?

As the bug swims TOWARD the observer, the freq. of the waves is higher & wavelength shorter. The opposite is true after it passes.

OPEN - $\lambda = 2 \cdot L$

CLOSED - $\lambda = 4 \cdot L$

TRUE or FALSE

T 13. When a source of sound moves, its frequency will appear different depending on whether or not the source is approaching or departing. DOPPLER

T 14. The speed of sound is faster in a solid than in a gas. sound needs molecules to deliver message so tightly spaced molecules are quicker for sound.

F 15. Infrasonic refers to objects traveling at a speed slower than the speed of sound. frequencies < 20Hz (nothing to do with speed)

T 16. A loud sound has a higher amplitude than a soft sound. amplitude ∝ energy

17. One **closed** organ pipe has a length of 2.40 m. assume 343 m/s as the speed of sound.

a) What is the fundamental frequency of the note played by this pipe? What is the first overtone of this pipe? $v = \lambda f$, $\lambda = 4L$

$$f = \frac{v}{\lambda} = \frac{343\ m/s}{4(2.40\ m)} = 35.7\ Hz$$

b) Determine the fundamental frequency played by the same size **open** tube. $\lambda = 2 \cdot L$

$$f = \frac{v}{\lambda} = \frac{343\ m/s}{2(2.40\ m)} = 71.4\ Hz$$

18. A police car sends out a radio wave of frequency 6.0×10^7 Hz toward an approaching car and measures the reflecting wave to be 6.5×10^7 Hz. How fast was the approaching car traveling?

$$f' = f\left(1 + \frac{v_{object}}{v_{sound}}\right)$$

f = actual frequency; f' = observer's detect. freq.; use speed @ STP!

$$6.5 \times 10^7\ Hz = 6.0 \times 10^7\ Hz \left(1 + \frac{v_{object}}{330\ m/s}\right)$$

$$v_{object} = 28\ m/s$$

19. A particular sound is measured to be 20 decibels louder than the reference sound. **How many times louder** is this sound than the reference? Recall, the decibel scale is logarithmic meaning a 30 decibel difference is a 10^3 or 1000x difference.

30db = 10^3 louder
20db = 10^2 " = 100x
10db = 10^1 "

40db = 10^4 louder
etc. -

20. Two notes are played in a band, one of frequency = 250 Hz and another of unknown frequency. A **beat frequency** of 6 Hz is heard. What are the possibilities for the unknown frequency?

$$\#\ BEATS = |f_2 - f_1| \quad \leftarrow \text{absolute value}$$

$$6\ Hz = 250\ Hz - f_1$$

So f_1 must be 6Hz higher or lower than 250Hz.

256Hz or 244 Hz

21. What is meant by the term **RESONANCE**? Why is it said that a "singing wineglass" is said to resonate?

causing molecules in a substance to vibrate at their NATURAL FREQUENCY. When you rub your finger on the wineglass rim, it is as though you are tapping it ("SLIP & STICK").