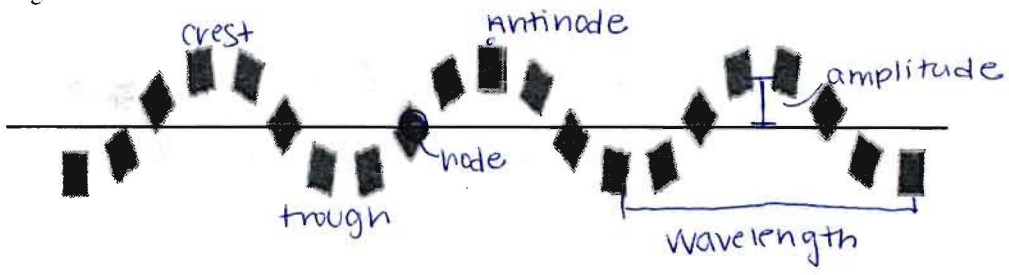
Physics 432 Name Katie Dau

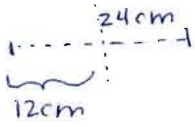
Review – Waves and Sound Date 2.4.08 Hour Key

This review sheet covers many of the important ideas covered in waves and sound. Do all the problems to get an idea of what can be on the test.

1. Identify all of the following on the sketch:
   1. Crest
   2. Trough
   3. Node
   4. Anti-node
   5. Wavelength
   6. Amplitude



2. If the young man shown, Phreddie Physics, moves his hand back and forth (moving a total of 24 cm left to right) twice a second, calculate the following:
   1. Amplitude : 12 cm
   2. Frequency : 2 Hz
   3. Period .5secs



3. The range of human hearing is 20 Hz-20,000Hz
How long is the longest wave we can hear (assuming a speed of sound of 335 m/s)?

$V = f\lambda$

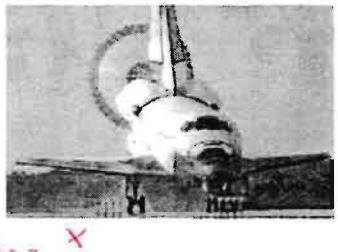
$335\,m/s = (20\,Hz)\lambda \qquad \lambda = 16.75\,m$

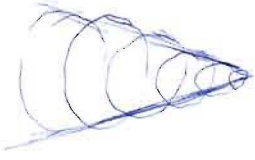
Use the above to find the length of the shortest wave we can hear.

$335\,m/s = (20{,}000\,Hz)\lambda$

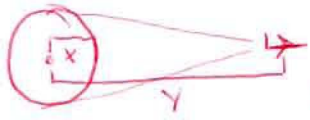
$\lambda = .01675\,m$

4. When the Space Shuttle is returning to earth it breaks the sound barrier. Draw a picture of what the sound waves must look like for this to be true.



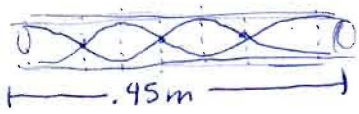


to find Mach



$Mach = \frac{x}{y}$

5. In a Saint Patty's Day Parade, the bagpipes are often heard. If the speed of sound is as listed above, and the length of a particular open pipe is .45 m, what are the frequencies of the fundamental and 3rd harmonic of a pipe?



$\frac{6}{4}\lambda = L$

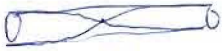
$\lambda = \frac{4}{6}L$

$\lambda = \frac{2}{3}(.45m)$

$= .3\,m$

$335\,m/s = f(.3\,m)$

$f = 1116.6\,Hz$



$\lambda = 2L$

$\lambda = .9\,m$

$V = f\lambda$

$335\,m/s = f(.9\,m)$

$f = 372.2\,Hz$

6. A piano is a stringed instrument. If middle C is 440 Hz, calculate the length of a string that would need to be struck in its fundamental mode to produce this sound. Assume the wave speed is 335m/s.

$V = f\lambda$

$335\ m/s = (440\ Hz)\lambda$

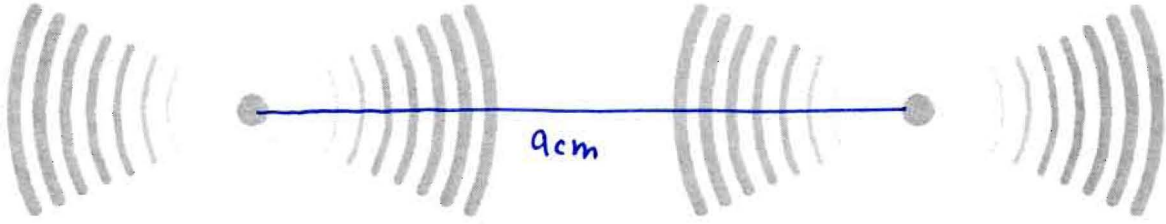
$\lambda = .7613\ m$

$\frac{1}{2}\lambda = L$

$\lambda = 2L$

$L = (.7613\ m)\frac{1}{2}$

$= .381\ m$



7. The two sources of sound shown are sending out 480 Hz waves. Using a ruler, measure their separation distance and determine how far loud spots would occur if this page was 5 m away from your ear. Assume the speed of sound is 335m/s.

$V = f\lambda$

$335\ m/s = 480\ Hz\ \lambda$

$\lambda = .6979\ m$

$\lambda = \frac{dx}{n\ell}$

$.6979m = \frac{(.09cm)\ x}{(1)(5m)}$

$x = 38.77\ m$

8. A pipe organ sends sound through some open and some closed pipes. One closed pipe is producing a sound of 666 Hz (A real devil of a sound). A second open pipe is then played and "beats" are heard. The beats occur once every 0.25 s. What is the length of each pipe assuming the closed pipe is operating in its fundamental while the open pipe is operating in its first overtone? Assume the speed of sound is 335m/s.

$f = 666\ Hz$

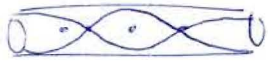
$\lambda = 4L$

$V = f\lambda$

$335\ m/s = (666\ Hz)\lambda$

$\lambda = .503\ m$

$L = .1257\ m$



$f = 666 \pm 4\ Hz$

$\lambda = L$

$335\ m/s = (670\ Hz)\lambda$

$\lambda = .5\ m$

$L = .5\ m$

$335\ m/s = (662\ Hz)\lambda$

$\lambda = .506\ m$

$\lambda = .506\ m$

If you got that one, you're ready for the test. Go enjoy some music!