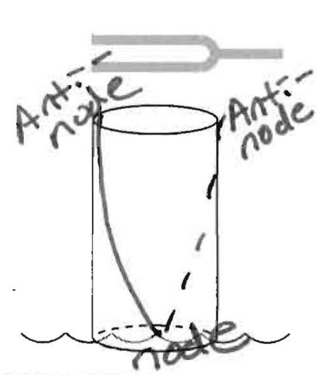
**Sound Unit Test Review** Name: *KEY* Date: __________ Pd: ____

1. A tuning fork of frequency 320 Hz is held above the open end of a tube immersed in water.
   a.) In the image to the right, label where the node(s) and antinode(s) will be located for the 1st standing wave pattern (mode 1).




   b.) What fraction of a complete wave does this represent?

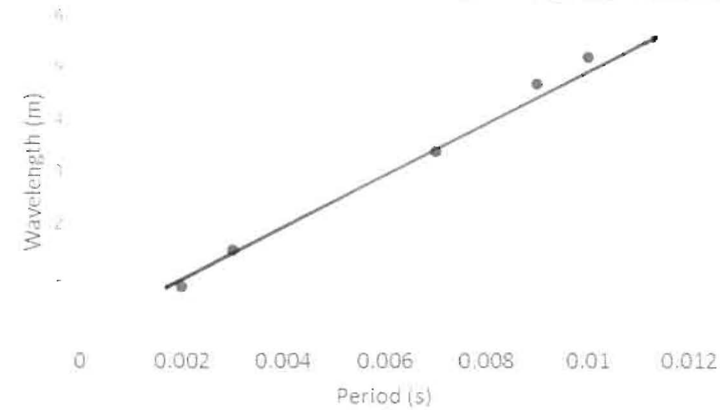
   *1/4*

   c.) If the speed of sound is 345 m/s, what is the length of the air column inside the tube when the first resonance (shortest possible tube length) occurs?

   $v = f\lambda \quad \lambda = \frac{v}{f} = \frac{345 \text{ m/s}}{320 \text{ Hz}} = 1.078 \text{ m}$

   tube $= \frac{1}{4}(1.078 \text{ m}) = \boxed{0.2695 \text{ m}}$

2. The same activity as in #1 is done outside on a hot summer day. Data collected is represented on the graph to the right.
   a.) Carefully and accurately draw a line of best fit.




   b.) If a tuning fork with a higher frequency (shorter period) is used, what will happen to the speed of sound? *stays the same (freq. does not affect speed)*

   c.) What was the speed of sound that day?

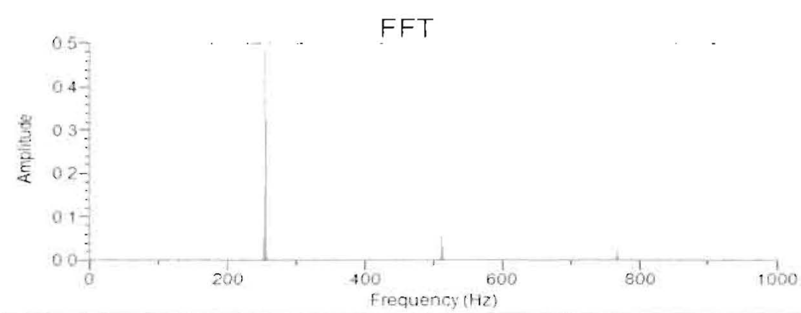
   *speed = slope = ~520 m/s (answers may vary slightly)*

3. Given the FFT graph to the right, what is the...
   a.) fundamental frequency? *~255Hz*

   b.) peak frequency? *~255Hz*

   c.) 2nd overtone? *~765Hz*

   d.) 2nd harmonic? *~510Hz*

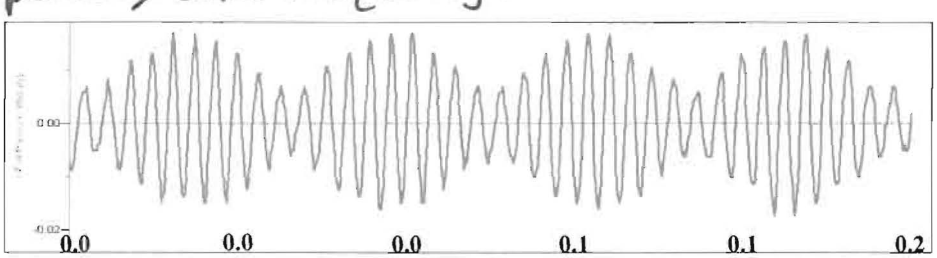



4. Was the FFT graph in #3 produced by a tuning fork? Explain why or why not.

   *No – it has more than one peak. Tuning forks only produce one peak/one frequency.*

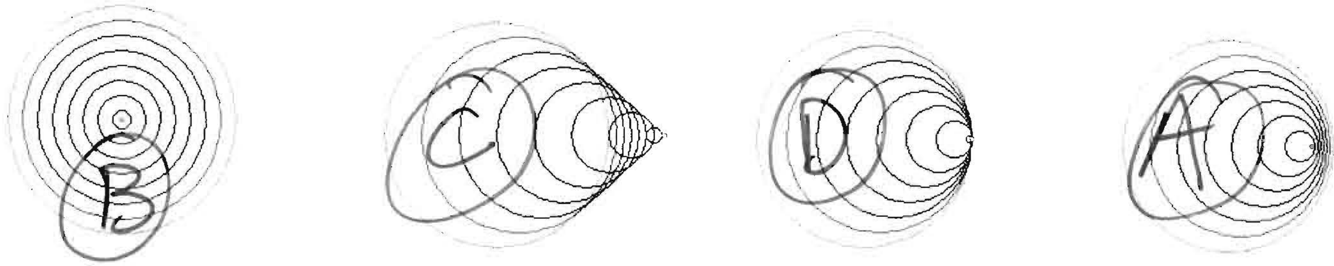
5. Based on the graph to the right, what is the beat frequency?

   $f = \frac{\text{beats}}{\text{sec}} = \frac{4 \text{ beats}}{0.2 \text{ s}} = 20 \text{ Hz}$



6. Label the following Doppler effect wave simulations using the following choices (use each once):

A. The object is moving slower than the speed of the waves
B. The object is not moving
C. The object is moving faster than the speed of the waves
D. The object is moving at the same speed as the waves




7. A car is blaring its horn and traveling with a speed of 32.0 m/s. Its horn emits a frequency of 525 Hz. (Use $v_{sound\ waves}$ = 345 m/s). What frequency does a stationary observer hear as the car approaches?

$$f' = 525\,Hz\left(\frac{345\frac{m}{s} + 0}{345\frac{m}{s} - 32\frac{m}{s}}\right) = \boxed{579\,Hz}$$

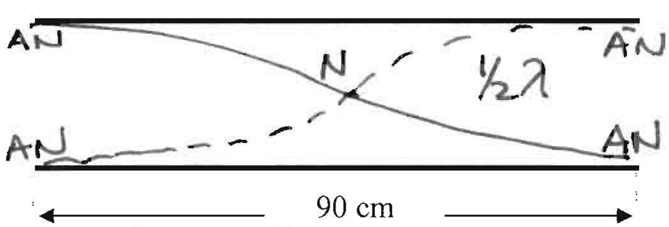
*May be useful...*

$$f' = f \cdot \left(\frac{v_w + v_o}{v_w - v_s}\right)$$

8. A fire truck is traveling at 27.0 m/s. Its siren emits a frequency of 700 Hz. (Use $v_{sound\ waves}$ = 345 m/s). If a driver is traveling toward the fire truck at 24 m/s on the other side of the highway, what frequency will the driver hear?

$$f' = 700\,Hz\left(\frac{345\frac{m}{s} + 24\,m/s}{345\frac{m}{s} - 27\,m/s}\right) = \boxed{812\,Hz}$$

9. The tube below is open at both ends. A standing wave is created inside of it. Sketch the fundamental frequency. Label all nodes with an "N" and all antinodes with "AN".




$90\,cm = \frac{1}{2}\lambda$

Calculate the wavelength:

$90\,cm = \frac{1}{2}\lambda$

$\lambda = \frac{90\,cm}{(1/2)} = 180\,cm = \boxed{1.80\,m}$

10. Using a speed of sound of 345 m/s, calculate the frequency for the above wave.

$v = f\lambda$

$f = \frac{v}{\lambda} = \frac{345\,m/s}{1.80\,m} = \boxed{192\,Hz}$

11. What would be the frequency for the 2nd mode? 3rd mode? (hint: you can do this without drawing the waves)

2nd mode = 2x fundamental = 2x 192 Hz = 384 Hz

3rd mode = 3x fundamental = 3x 192 Hz = 576 Hz