Be able to work the following problems:

1. Sammi the cat can hear frequencies approaching 64,000 Hz. What wavelength would correspond to these sounds? (assume the speed of sound is 340 m / s)

$f = 64{,}000\ Hz$ $\quad v = f\lambda$

$\lambda = ?$ $\quad \lambda = \frac{v}{f} = \frac{340}{64{,}000}$ $\quad \boxed{\lambda = 0.00531\ m}$

$v = 340\ m/s$

2. When sounded simultaneously, two tuning forks produce one beat every 0.3 seconds. A) By how much do the frequencies of the two tuning forks differ? $\frac{1}{0.3s} = \boxed{3.\overline{3}\ Hz}$

$\Delta f = 3.\overline{3}$

3. The shortest wavelength emitted by bats is about 3.3 mm. What is the corresponding frequency of these sounds? (Assume the speed of sound is 340 m / s)

$\lambda = 3.3mm = 0.0033m$ $\quad v = f \cdot \lambda$

$v = 340\ m/s$ $\quad f = \frac{v}{\lambda} = \frac{340}{0.0033} = \boxed{103{,}030\ Hz}$

$f = ?$

4. If the ear canal of a person can be considered to be acting like a pipe open at one end and closed at the other, then it will resonate when a wave of 3000 Hz is incident on it. What is the length of the ear canal if the speed of sound is 355 m/s?

$v = 355\ m/s$ $\quad v = f\lambda$

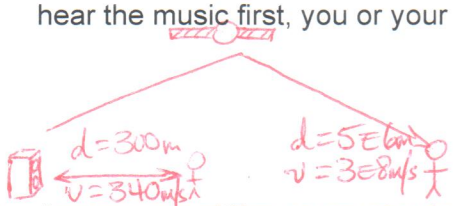
$f = 3{,}000\ Hz$ $\quad \frac{355}{3000} = \frac{(3{,}000)\lambda}{3000}$ $\quad \lambda = 0.11\overline{83}$

$\lambda = ?$ $\quad$ canal length $= \boxed{0.0296\ m}$

$\frac{1}{4}\lambda$

$f = 3{,}000\ Hz$

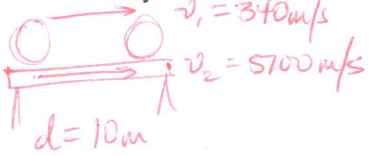
5. You are at a large outdoor concert seated 300 meters from the speaker system. The concert is also being broadcast via satellite. If your brother were 5000 km away and watching the concert on TV who would hear the music first, you or your brother? (assume the speed of sound is 340 m / s)



$v = \frac{d}{t}$ $\quad t_1 = \frac{300m}{340m/s}$ $\quad t_2 = \frac{5E6}{3E8}$

$t = \frac{d}{v}$ $\quad = 0.88s$ $\quad = 0.01\overline{6}\ s = \boxed{\text{your Brother}}$

6. Jeremy was sitting on an aluminum bench when he emitted an odd noise. If the speed of sound in the aluminum is 5100 m / s and the speed of sound in air is 340 m / s, how much time passed (no pun intended) between the time Miles "felt" the sound and heard it? Assume Jeremy and Austin are sitting 10 meters away from each other.



$\Delta t = ?$ $\quad \Delta t = 0.0294 - 0.00196$

$t_2 = \frac{d}{v_2}$ $\quad t_1 = \frac{d}{v_1}$ $\quad = \boxed{0.0275s}$

$= \frac{10}{5100} = 0.00196s$ $\quad = \frac{10}{340} = 0.0294s$

7. Immediately after seeing a lightning bolt you begin counting seconds. If 15 seconds pass before you hear the thunder, how far away is the storm?

$d = ?$ $\quad t = \frac{d}{v}$

$t_2 - t_1 = 15s$ $\quad -\frac{d}{v_l} + \frac{d}{v_s} = 15s$

$v_s = 340m/s$

$v_l = 3E8m/s$

$-\frac{d}{3E8} + \frac{d}{340} = 15$

$-(340)d + (3E8)d = (15)(3E8)(340)$

$d = \boxed{5100\ m}$

t for sound to travel is much higher than light. - assume t light = 0