Name: _____

Standing Waves in Air Columns

1. The range of human hearing is roughly 2.00×10^1 Hz to 2.00×10^4 Hz. Based on these limits, what are the lengths of the longest and shortest pipes (open at both ends) you would expect to find on a pipe organ?

Ans:

Ans:

2. A tube with a cap on one end, but open on the other end produces a standing wave whose fundamental frequency is 130.8 Hz. The speed of sound is 345.0 m/s. If the cap is removed, what is the new fundamental frequency and how long is the tube?

Ans:

Ans:

3. Aaron blows across the opening of a partially filled 20.0 cm high soft drink bottle and finds that the air vibrates with a fundamental frequency of 472 Hz. How high is the liquid in the bottle?

Ans:

4. Joyce, the church organist, is practicing on the organ and she finds that the 2nd and 3rd Harmonics of the 370 Hz pipe are 1110 Hz and 1850 Hz. Is the organ pipe closed at one end or open on both ends?

Ans:

5. A train passes through a tunnel that is 550 m long. What is the fundamental frequency of vibrating air in the tunnel? Is this in the range of human hearing?

Ans:

Ans:

6. In the physics lab, Sanjay finds that he can take a long glass tube and fill it with water, using the air space at the top to simulate a pipe closed at one end. If Sanjay holds a tuning fork of frequency 440 Hz over the mouth of the pipe and hears a fundamental resonance when the pipe is 0.19 m long, what is the speed of sound in the physics laboratory that day?

Ans:

7. A child has an ear canal that is 1.30 cm long. (The eardrum closes this "pipe" at one end.) What are the frequencies (in the human audible range) that form standing waves in the child's ear canal?

Ans:

8. A flute player hears four beats per second when she compares her note to a 512 Hz tuning fork. She can match the frequency of the tuning fork by pulling out the "tuning joint" to lengthen her flute slightly. What was her initial frequency?

Ans: