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**Harmonics WKST**

**Directions: Answer all the questions and show all of your work for full credit.**

1. Calculate the length of the pipe for a long organ that is closed on one end when the speed of sound is 352 m/s and the frequency is 440 Hz.
2. A flute is basically a pipe open on both ends. What is the length of the flute when a 260Hz note is played and the speed of sound is 340 m/s?
3. What is the length of the pipe when the speed of sound is 345 m/s and the note is 70.4 Hz for:
   1. Open Pipe Harmonic
   2. Closed Pipe Harmonic
4. A violin string is 0.50m long and has a frequency of 440Hz. What is the velocity of the wave on the string?
5. What are the lengths of string needed for a closed pipe harmonic when the speed of sound traveling on a guitar string are 115 m/s for:
   1. 82.1 Hz
   2. 115 Hz
   3. 144 Hz
6. The speed of sound on cold day is 330 m/s. What is the length of the open end pipe harmonic of a trumpet if the note played is 370 Hz?