Practice Problem Set 8

1. Wolfson 14.59. (You will need to use the tension within a spring here. Make sure you understand where it comes from via Hooke's Law and symmetry.)

2. Standing Sound Waves in an Open-Open Tube

Consider a flute, which we will assume we can model as an air column with both ends open.

(a) With all holes covered, the flute has an effective length of 65cm. What is the fundamental frequency of the flute in this state?

(b) Suppose the flutist wants to play a G note (roughly 392 Hz). Describe how they could do this, and calculate the effective change in length.

(c) Now, suppose that the flutist is playing along with an organ, which can be viewed as a half-open tube. The organ player is also playing a G note. Are the effective lengths the same?

(d) Finally, the flutist wishes to match to the organ's third overtone. Some flutists are able to play a note by putting more relative weight on an overtone, done by using a technique called overblowing, which involves the manipulation of the supplied air. In this instance, might the flutist achieve their goal by doing this, or will they be forced to change their fingering? Explain.

3. Doppler Effect

A police car passes by you. As it approaches, the siren wails at a pitch of 1062 Hz, and after passing you, at a pitch of 945 Hz. What is the frequency emitted by the siren, and what is the speed of the car?