C: Resonance and Standing Wave Patterns

You need a coiled spring, long measuring tape and a stopwatch.

1. Two people will generate a standing wave in the spring – one will drive it and the other holds their end fixed. A third person will measure the lengths and time the motion.

2. Create a standing wave with the lowest frequency you can manage. (More tension in the spring sometimes helps.) You've got the correct pattern if there is only one anti-node. Measure the length of the spring all the way up to the elbow of the person driving it. (That person's arm is like the last bit of the spring). Measure the frequency of the standing wave. Complete the first row in the chart below.

When a medium produces a standing wave it is in *resonance*. The medium *resonates* when it is driven at a *resonant frequency*. Most media have a set of resonant frequencies which form a *harmonic series*. We will learn more about this when we study sound. A system (like a spring) that is driven at a frequency near its resonant frequency experiences very large amplitudes. If it is driven at a slightly higher or lower frequency, the amplitudes are smaller and the pattern will not be regular.

3. Gradually increase the frequency driving the spring until you find the next standing wave pattern or oscillation mode. A new node should appear. Measure the frequency. Repeat this and complete the chart below.

Oscillation Mode	Number of Anti-Nodes	Number of Nodes	Number of λ	λ (m)	f(Hz)	Diagram
1						. .
2						. .
3						. .

4. Describe the patterns you see in each column when oscillation mode increases.

   Number of antinodes:

   Number of nodes:

   Number of λ:

   λ (m):

   f (Hz):

5. Predict the standing wave pattern for the 5^{th} mode. Sketch it below.