Standing Waves Problems

Name: _____ Date: _____

1. Two people are holding the ends of a slinky. They set the slinky in motion vibrating it at 4 Hz. The speed of the waves in the slinky is 8 m/s. If the people are 4 metres apart, state the harmonic that the wave is vibrating at. Include a well-labelled diagram.

2. A guitar string is tightened so that it resonates at its first harmonic (fundamental frequency) of 600 Hz. The guitar string is 0.56 m in length.
   a) Calculate the wavelength of the wave using a well labelled diagram.
   b) Calculate the speed of the waves in the string.

3. A power line is connected to two poles 35m apart. The wind causes the wire to vibrate at its 4^{th} harmonic.
   a) Sketch the situation and from your diagram calculate the wavelength.
   b) A student watching this unique phenomenon notices that the wire vibrates 20 times in 37 seconds. What is the speed of the waves in the wire (in km/h)?

4. A standing wave is produced in a vibrating car antenna as the car moves along a slightly rough highway. The wave has two nodes in a distance of 30 cm.
   a) Calculate the wavelength of the standing wave – include a neat, well labelled sketch.
   b) Assume that the wave's frequency is 20 Hz. Calculate the velocity of the wave.

5. A student hangs a slinky over the edge of a stairwell. The slinky is stretched so that it is just above the ground. The student sends a pulse down the slinking and measures the speed to be 18m/s. The student then vibrates the slinky with a frequency of 4.5 Hz and notices that 4 nodes produced. How high is the stairwell? [***hint:*** The end near the floor is an open end and the end where the student his holding the slinking is a fixed end.]

   a) Calculate the wavelength of the slinky.
   b) Draw a well labelled diagram of the situation.
   c) Calculate the height of the stairwell.