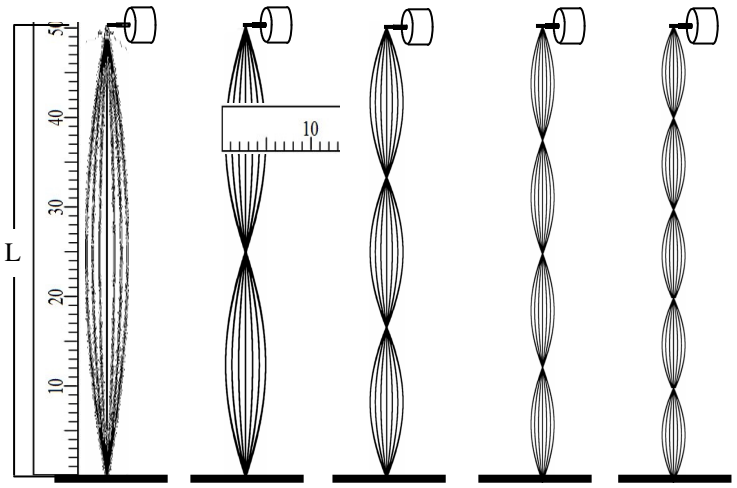
PreAP Harmonic Motion 8



Harm	1	2	3	4	5
Freq				36 Hz	
λ		*			
v	*				

1. A mechanical vibrator is attached to an elastic string. At particular frequencies it forms the given shapes.
   A. Since these are produced on the same string (without modification) these five shapes are known as:
   B. The first shape on the left has three names (see previous homework):
   C. * The wavelength of the first harmonic is <u>always</u> equal to:
   D. Fill in the chart. Again, notice the asterisks.
   E. Harmonic 5 has _____ antinodes and _____ nodes.
   F. Notice that each antinodes is completed by ____ nodes.
   G. The meterstick is turned to measure the distance the string moves from one side to the other. What is the amplitude of its motion?

For the next two questions, be sure to start with the formula. Put in the change, then follow the math.

2. On planet Xorgon the acceleration due to gravity is 1/2 that of the earth's.
   A. * By what factor would the <u>period</u> of a pendulum change on Xorgon?
   B. * By what factor would the period of a spring-mass system change on Xorgon?

3. A pendulum is moved to planet Pidronium where the acceleration due to gravity is 1/8 the strength of the earth's. (Careful!) What is the change in <u>frequency</u> of the pendulum?

4. In which materials is the speed of sound greater:
   A. Solids or gases? B. Dense or non-dense materials?
   C. Fast vibrating or slowly vibrating molecules?
   D. Hot air or cold air? E. Air at 273K or 20°C?

5. A string has a length of 0.8m.
   A. * What is the wavelength of the natural frequency (first harmonic) of this string?
   B. What are the wavelengths of the first 3 harmonics of the string?
   C. If the speed of the wave on the string is 24 m/s, what is the frequency of the fundamental?
   D. What are the frequencies for the first 3 harmonics of the string?

Q1C: 2L Table asterisks: $\lambda_2 = 0.5$ m; v = 9 m/s Q2A) put g/2 in denominator. Mult by reciprocal and the 2 goes next to the ℓ, which means T_{Xorgon} = square root of 2 times T_{Earth} or = $1.414T_{Earth}$.
Q2B) no change. g is not in the eq for a spring. Q4A) λ = 1m; Amp = −2m
Q4C) Net ampl = −2 + 1 = −1 m 5A) always = 2L, so 1.6 m