**Standing Waves**

AP Physics 1

Part I – waves on a string closed at each end

a) Draw the standing wave on the string for the indicated value of the harmonic number, *n*. The string is fixed at each end.

b) Assume that the string is 2 m long. Fill in the missing values for the frequency (*f*), wavelength (λ), and wave velocity (*v*).

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|  | n = 1  f = 10 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |  | n = 2  f = 10 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |
|  | n = 3  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 12 m/s |  | n = 4  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 12 m/s |
|  | n = 5  f = 20 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |  | n = 6  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 60 m/s |

Part II – waves in a pipe open at each end

a) Draw the standing wave in the pipe for the indicated value of the harmonic number, *n*. The pipe is open at each end.

b) Assume that the pipe is 1 m long. Fill in the missing values for the frequency (*f*), wavelength (λ), and wave velocity (*v*).

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|  | n = 1  f = 175 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |  | n = 2  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 350 m/s |
|  | n = 3  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 375 m/s |  | n = 4  f = 250 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |
|  | n = 5  f = 2000 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |  | n = 6  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 600 m/s |

Part III – waves on a string closed at one end and open at the other

a) Draw the standing wave on the string for the first three possible values of the harmonic number, *n*, starting with *n* = 1. The string is fixed at the left end and open at the right end

b) Assume that the string is 2 m long. Fill in the missing values for the frequency (*f*), wavelength (λ), and wave velocity (*v*).

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|  | n = 1  f = 10 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |  | n = \_\_\_\_\_\_\_\_  f = 10 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |
|  | n = \_\_\_\_\_\_\_\_  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 20 m/s |  |  |

Part IV – waves in a pipe open at one end and closed at the other

a) Draw the standing wave in the pipe for the first three possible values of the harmonic number, *n*, starting with *n* = 1. . The pipe is closed at the left end and open at the right end.

b) Assume that the pipe is 1 m long. Fill in the missing values for the frequency (*f*), wavelength (λ), and wave velocity (*v*).

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|  | n = 1  f = 175 Hz  λ = \_\_\_\_\_\_\_\_  v = \_\_\_\_\_\_\_\_ |  | n = \_\_\_\_\_\_\_\_  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 360 m/s |
|  | n = \_\_\_\_\_\_\_\_  f = \_\_\_\_\_\_\_\_  λ = \_\_\_\_\_\_\_\_  v = 360 m/s |  |  |