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General Physics I, Quiz 5
PHYS10400, Class year 99
12-23-2010

SN:_____, Name:_____

Chapter 18-20, Serway; ABSOLUTELY NO CHEATING!
Please write the answers on the blank space or on the back of this paper to save resources.

1.

$y = (1.50\ \text{m})\sin(0.400x)\cos(200t) = 2A_0 \sin kx \cos\omega t$

Compare corresponding parts:

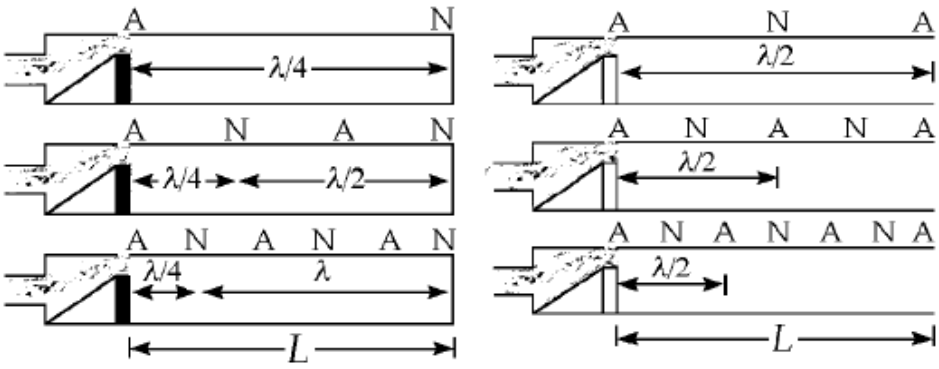
(a) $k = \dfrac{2\pi}{\lambda} = 0.400\ \text{rad/m}$ $\quad \lambda = \dfrac{2\pi}{0.400\ \text{rad/m}} = \boxed{15.7\ \text{m}}$

(b) $\omega = 2\pi f$ so $f = \dfrac{\omega}{2\pi} = \dfrac{200\ \text{rad/s}}{2\pi\ \text{rad}} = \boxed{31.8\ \text{Hz}}$

(c) The speed of waves in the medium is $v = \lambda f = \dfrac{\lambda}{2\pi} 2\pi kf = \dfrac{\omega}{k} = \dfrac{200\ \text{rad/s}}{0.400\ \text{rad/m}} = \boxed{500\ \text{m/s}}$

2.

(a)



ANS FIG. P18.35

The wavelength is $\lambda = \frac{v}{f} = \frac{343\ \text{m/s}}{261.6/\text{s}} = 1.31\ \text{m}$

so the length of the open pipe vibrating in its simplest (A-N-A) mode is

$$d_{\text{A to A}} = \frac{1}{2}\lambda = \boxed{0.656\ \text{m}}$$

(b) A closed pipe has (N-A) for its simplest resonance, (N-A-N-A) for the second, and (N-A-N-A-N-A) for the third, equal to 5/4 wavelengths.

Here, the pipe length is $5d_{\text{N to A}} = \frac{5\lambda}{4} = \frac{5}{4}(1.31\ \text{m}) = \boxed{1.64\ \text{m}}$

3.

(a) $PV = nRT$

$$n = \frac{PV}{RT} = \frac{(1.013\times10^5\ \text{Pa})(1.00\ \text{m}^3)}{(8.314\ \text{J/mol}\cdot\text{K})(293\ \text{K})} = \boxed{41.6\ \text{mol}}$$

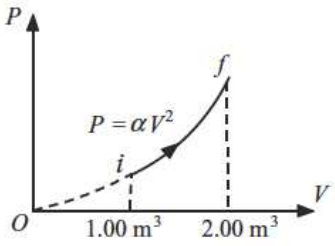
(b) $m = nM = (41.6\ \text{mol})(28.9\ \text{g/mol}) = \boxed{1.20\ \text{kg}}$

(c) **This value agrees with the tabulated density** of 1.20 kg/m^3 at 20.0°C.

4.

$$W = -\int_i^f P\,dV$$

The work done on the gas is the negative of the area under the curve $P = \alpha V^2$ between V_i and V_f.



ANS FIG. P20.23

$$W = -\int_i^f \alpha V^2\,dV = -\frac{1}{3}\alpha\left(V_f^3 - V_i^3\right)$$

$$V_f = 2V_i = 2(1.00\ \text{m}^3) = 2.00\ \text{m}^3$$

$$W = -\frac{1}{3}\left[(5.00\ \text{atm/m}^6)(1.013\times10^5\ \text{Pa/atm})\right]\left[(2.00\ \text{m}^3)^3 - (1.00\ \text{m}^3)^3\right] = \boxed{-1.18\ \text{MJ}}$$