PHYS 125 **Formula Sheet** Spring 2015

In showing work, these formulas may be used without derivation.

CONSTANTS

$v = 343\,\text{m/s}$ $\quad c = 2.998 \times 10^8\,\text{m/s}$

$\rho_{\text{air}} = 1.21\,\text{kg/m}^3$

MATH

sphere: $4\pi R^2$ $\quad \frac{4}{3}\pi R^3$

cylinder : $2\pi RL$ $\quad \pi R^2 L$

$$\frac{d}{dx}\sin(kx) = k\cos(kx)$$

WAVES

$$y(x,t) = y_m \sin(kx - \omega t + \phi_0)$$

$$k = \frac{2\pi}{\lambda} \qquad f = \frac{\omega}{2\pi} = \frac{1}{T}$$

$$v = \frac{\omega}{k} = \lambda f \qquad v = \sqrt{\frac{\tau}{\mu}}$$

$$P_{\text{avg}} = \frac{1}{2}\mu v \omega^2 y_m^2$$

$$\frac{\Delta\phi}{2\pi} = \frac{\Delta L}{\lambda} \qquad \frac{\Delta\phi}{2\pi} = \frac{\Delta t}{T}$$

$$\Delta\phi = 2m\pi \qquad \Delta\phi = (2m+1)\pi$$

$$y' = \left[2y_m \cos\left(\frac{\phi_0}{2}\right)\right] \sin\left(kx - \omega t + \frac{\phi_0}{2}\right)$$

$$y' = [2y_m \sin kx]\cos\omega t$$

$$f = \frac{v}{2L}n \qquad f = \frac{v}{4L}n$$

SOUND

$$v = \sqrt{\frac{B}{\rho}} \qquad \Delta p_m = (v\rho\omega)s_m$$

$$s = s_m \cos(kx - \omega t)$$

$$\Delta p = \Delta p_m \sin(kx - \omega t)$$

$$I = \frac{P}{A} \qquad I = \frac{P}{4\pi r^2} \qquad I = \frac{1}{2}\rho v \omega^2 s_m^2$$

$$\beta = (10\text{ dB})\log\frac{I}{I_0} \qquad I_0 = 10^{-12}\,\text{W/m}^2$$

$$f' = f\left(\frac{v \pm v_D}{v \pm v_S}\right)$$

LIGHT

$$v = \frac{c}{n} \qquad \lambda_n = \frac{\lambda}{n}$$

$$N_2 - N_1 = \frac{L}{\lambda}(n_2 - n_1) \qquad y_m = \frac{m\lambda D}{d}$$

$$d\sin\theta = m\lambda \qquad d\sin\theta = \left(m + \tfrac{1}{2}\right)\lambda$$

$$\frac{2L}{\lambda_n} = m \qquad \frac{2L}{\lambda_n} = m + \tfrac{1}{2}$$

NOT on the Formula Sheet

TO BE MEMORIZED unless otherwise indicated

CONSTANTS

metric prefixes G, M, k, c, m, μ

$n_{air} \approx 1.000$

MATH

circle: $2\pi R \quad \pi R^2$

right triangle: $C^2 = A^2 + B^2$

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$\frac{d}{dx}\cos(kx) = -k\sin(kx)$$

WAVES

transverse velocity from $u = \frac{dy}{dt}$

$$\mu = \frac{m}{L} \qquad \rho = \frac{m}{V}$$

$$f_{\text{beat}} = |f_1 - f_2|$$