Formula Sheet for Physics 1A03

Constants

$\rho_{air} = 1.29 \text{kg/m}^3$
$P_{atm} = 1.013 \times 10^5 \text{Pa}$
$g = 9.81 m/s^2$

Area and Volume

$A = \pi r^2,\ C = 2\pi R,\ A = 4\pi R^2$
$V = \frac{4}{3}\pi R^3, \qquad V = \pi R^2 h$

Other

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\sin\theta = \frac{opposite}{hypotenuse}$$

$$\cos\theta = \frac{adjacent}{hypotenuse}$$

$$\tan\theta = \frac{opposite}{adjacent}$$

$$\sin^2\theta + \cos^2\theta = 1$$

Kinematics

$v_f = v_i + at \qquad \Delta x = v_i t + \frac{1}{2}at^2$
$v_f^2 - v_i^2 = 2a\Delta \text{x}$
$\Delta x = \frac{(v_i + v_f)}{2}t$

Forces

$\sum \vec{F} = m\vec{a} \qquad \vec{F}_s = -k\vec{x}$
$f_\text{s} \leq \mu_s N \qquad f_\text{k} = \mu_k N$

Work and Energy

$K = \frac{1}{2}mv^2 \qquad U_g = mgy$
$W = \Delta K \qquad U_{el} = \frac{1}{2}kx^2$
$W = \vec{F} \cdot \Delta\vec{r} = F\Delta r \cos\theta = F_x\Delta x + F_y\Delta y$
$W_{cons} = -\Delta U$
$E = K + U_g + U_s$
$\Delta E = E_f - E_i = W_{non-cons}$
$P = \frac{\Delta E}{\Delta t} = \vec{F} \cdot \vec{v}$

Momentum

$\vec{p} = m\vec{v}$
$\vec{J} = \vec{F}_{ave}\Delta t = \triangle \vec{p}$
$\sum \vec{p}_i = \sum \vec{p}_f$

Waves, sound, light

$y(x,t) = A\cos(kx \pm \omega t)$
$y(x,t) = A\sin(kx \pm \omega t)$
$\omega = 2\pi f = 2\pi/T \qquad T = 1/f$
$k = 2\pi/\lambda \qquad c = f\lambda = \omega/k \qquad c = \sqrt{T/\mu}$
$P = \frac{\Delta E}{\Delta t} = \frac{1}{2}\mu\omega^2 A^2 c$

$\lambda_n = \frac{2L}{n},\ f_n = \frac{nc}{2L}, \qquad n = 1,2,3,\cdots$

$\lambda_n = \frac{4L}{n},\ f_n = \frac{nc}{4L}, \qquad n = 1,3,5,\cdots$

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

$c_n = c/n \qquad \lambda_n = \lambda/n \qquad n_2 \sin\theta_t = n_1 \sin\theta_i$

$$2d = \begin{cases} m\lambda_n \\ \left(m + \frac{1}{2}\right)\lambda_n \end{cases}$$

$$|r_2 - r_1| = d\sin\theta = \begin{cases} m\lambda \\ \left(m + \frac{1}{2}\right)\lambda \end{cases}$$

"low to high, phase shift of π"

Fluids

$F_g = mg = \rho Vg \qquad F_{buoy} = \rho_{liq} Vg$
$P = F/A \qquad \Delta P = P - P_0 = \rho gh$
$P_{abs} = P_{gauge} + P_{atm}$

End