PS 161 Final Exam Formulas

Daniel E. Janusch

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$$Y = \frac{\text{stress}}{\text{strain}} = \frac{F/A}{\Delta L/L_0} = \frac{FL_0}{A\Delta L} \text{ [Pa]}$$
 (1)

$$\lambda = \frac{m}{L} \qquad \sigma = \frac{m}{A} \qquad \rho = \frac{m}{V} \tag{2}$$

$$p = \rho g h = \frac{F_1}{A_1} = \frac{F_1}{A_2}$$
 [Pa] (3)

$$F_{\text{pressure}} = pA$$
 (4)

$$F_{\text{buoyant}} = \rho g V \tag{5}$$

$$R = Av$$
 (flow rate) (6)

$$\rho_1 R_1 = \rho_2 R_2 \quad \text{(mass flux)} \tag{7}$$

$$\rho_1 = \rho_2 \text{ (incompressible)}$$
(8)

$$ME = p + \frac{1}{2}\rho v^2 + \rho gy \tag{9}$$

$$U_g = -\frac{GMm}{r} \tag{10}$$

$$F_g = -\frac{GMm}{r^2} \tag{11}$$

$$v_{\text{orbit}} = \sqrt{\frac{GM}{R}} \tag{12}$$

$$v_{\text{escape}} = v_{\text{orbit}} \sqrt{2}$$
 (13)

$$T = \frac{2\pi r}{v} = \frac{2\pi r^{1.5}}{\sqrt{GM}} \tag{14}$$

$$R_S = \frac{2GM}{c^2} \tag{15}$$

Simple Harmonic Motion (SHM):

$$x(t) = A\cos(\omega t + \phi) \ni \omega^2 = \frac{k}{m}$$
(16)

$$\omega = 2\pi f \tag{17}$$

$$E = \frac{mv^2 + kx^2}{2} \tag{18}$$

$$v = \pm \omega \sqrt{A^2 - x^2} \tag{19}$$

$$\theta(t) = \theta_0 \cos(\omega t + \phi) \tag{20}$$

Angular SHM:
$$\omega^2 = \frac{\kappa}{I} \ni \kappa = \text{torsion constant}$$
 (21)

Small
$$\theta$$
 Simple Pendulum: $\omega^2 = \frac{g}{L}$ (22)

Physical Pendulum:
$$\omega^2 = \frac{mgd}{I}$$
 (23)