## PS 161 Final Exam Formulas

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$$\lambda = \frac{m}{L} \qquad \sigma = \frac{m}{A} \qquad \rho = \frac{m}{V} \tag{1}$$

$$p = \rho g h = \frac{F_1}{A_1} = \frac{F_1}{A_2}$$
 [Pa] (2)

$$F_{\text{pressure}} = pA$$
 (3)

$$F_{\text{buoyant}} = \rho g V \tag{4}$$

$$R = Av$$
 (flow rate) (5)

$$\rho_1 R_1 = \rho_2 R_2 \quad \text{(mass flux)} \tag{6}$$

$$\rho_1 = \rho_2 \text{ (incompressible)}$$
(7)

$$ME = p + \frac{1}{2}\rho v^2 + \rho gy \tag{8}$$

$$U_g = -\frac{GMm}{r} \tag{9}$$

$$F_g = -\frac{GMm}{r^2} \tag{10}$$

$$v_{\text{orbit}} = \sqrt{\frac{GM}{R}} \tag{11}$$

$$v_{\text{escape}} = v_{\text{orbit}} \sqrt{2}$$
 (12)

$$T = \frac{2\pi r}{v} = \frac{2\pi r^{1.5}}{\sqrt{GM}} \tag{13}$$

$$R_S = \frac{2GM}{c^2} \tag{14}$$

Simple Harmonic Motion (SHM):

$$x(t) = A\cos(\omega t + \phi) \ni \omega^2 = \frac{k}{m}$$
(15)

$$\omega = 2\pi f \tag{16}$$

$$E = \frac{mv^2 + kx^2}{2} \tag{17}$$

$$v = \pm \omega \sqrt{A^2 - x^2} \tag{18}$$

$$\theta(t) = \theta_0 \cos(\omega t + \phi) \tag{19}$$

Angular SHM: 
$$\omega^2 = \frac{\kappa}{I} \ni \kappa = \text{torsion constant}$$
 (20)

Small 
$$\theta$$
 Simple Pendulum:  $\omega^2 = \frac{g}{L}$  (21)

Physical Pendulum: 
$$\omega^2 = \frac{mgd}{I}$$
 (22)