

1. Linear Motion; Constant Acceleration:

$$v = v_0 + at$$

$$x = x_0 + v_0t + \frac{1}{2}at^2$$

$$x = \frac{1}{2}(v_0 + v)t$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

2. Forces:

$$\Sigma \mathbf{F} = m\mathbf{a}$$

$$f_s^{MAX} = \mu_s n$$

$$f_k = \mu_k n$$

3. Work; Energy; Power:

$$W = F_{\parallel}s = (F \cos \theta)s$$

$$KE_{trans} = \frac{1}{2}mv^2$$

$$PE_{grav} = mgy$$

Linear ($F = -kx$) spring:

$$PE_{spring} = \frac{1}{2}kx^2$$

$$\bar{P} = W/\Delta t = F\bar{v}$$

4. Linear Momentum:

$$\mathbf{p} = m\mathbf{v}$$

$$\Sigma \mathbf{F} = \Delta \mathbf{p}/\Delta t$$

5. Gravitation

$$F_G = Gm_1m_2/R^2$$

$$\text{where } G = 6.672 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$$

At earth's surface:

$$F_G = mg \quad \text{where } g = 9.8 \text{ m/s}^2.$$

Kepler's Third Law: $T^2 = (4\pi^2/M_sG)R^3$

$$\text{Sun: } M_S = 2 \times 10^{30} \text{ kg}$$

$$\text{Earth: } M_E = 6 \times 10^{24} \text{ kg}$$

$$R_E = 6.37 \times 10^6 \text{ m}$$

$$\text{from sun} = 1.5 \times 10^{11} \text{ m}$$

$$\text{Moon: } M_M = 7.4 \times 10^{22} \text{ kg}$$

$$R_M = 1.74 \times 10^6 \text{ m}$$

$$\text{from earth} = 3.8 \times 10^8 \text{ m}$$

Gravitational PE: (above earth)

$$PE_g = -GM_E m/r$$

6. Circular Motion:

$$\omega = \omega_0 + \alpha t$$

$$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\theta = \frac{1}{2}(\omega_0 + \omega)t$$

$$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$

$$s = r\theta$$

$$v_T = r\omega$$

$$a_T = r\alpha$$

$$a_C = v_T^2/r = r\omega^2$$

$$\tau = Fd = F(r \sin \phi)$$