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Common Exam 3 Phys 105

Spring 2009

Physics 105 Formula Sheet:

$$W = mg \quad g = 9.8 \text{ m/s}^2 \quad \text{centi}=\text{c}=0.01 \quad \text{kilo}=\text{k}=1,000 \quad \text{mega}=\text{M}=1,000,000$$

$$\text{For constant a:} \quad v = v_0 + at \quad x - x_0 = v_0t + \frac{1}{2}at^2 \quad v^2 - v_0^2 = 2a \cdot (x - x_0) \quad x - x_0 = \frac{1}{2}(v + v_0)t$$

$$F_{\text{net}} = ma \quad \Sigma \mathbf{F} = m\mathbf{a} \quad F_{\text{st,max}} = \mu_s N \quad F_k = \mu_k N$$

$$\text{Gravitational force:} \quad F_g = mg$$

$$\text{Force of static friction:} \quad f_{s,\text{max}} = \mu_s N$$

$$\text{Force of kinetic friction:} \quad f_k = \mu_k N$$

$$\text{Centripetal acceleration for circular motion:} \quad a_c = \frac{v^2}{r}$$

$$\text{Centripetal force for circular motion:} \quad F_c = m \frac{v^2}{r}$$

$$\text{Work: } W = \vec{F} \cdot \vec{d} = |\vec{F}| |\vec{d}| \cos \theta_{F,d}, \quad W_{\text{grav}} = -mg \cdot (y - y_0), \quad W_{\text{spring}} = -1/2k(x^2 - x_0^2), \quad W_{\text{frict}} = -F_k d,$$

$$\text{Work-Energy Theorem: } W_{\text{tot}} = K_f - K_i$$

$$\text{Kinetic Energy: } K = 1/2mv^2, \quad \text{Power: } P = W/\Delta t = \mathbf{F} \cdot \mathbf{V}$$

$$\text{Potential Energy for gravity } U_g = mg \cdot (y - y_0), \quad \Delta U_g = -W_g$$

$$\text{Potential Energy for spring: } F = -kx, \quad U_s = \frac{1}{2}kx^2, \quad \Delta U_s = -W_s$$

$$\text{Mechanical Energy: } E_m = U + K.$$

Conservation of mechanical energy: $\Delta E_m = \Delta U + \Delta K = 0$ if conservative forces are the only forces that do work on the system.

$$\text{Work done by non-conservative forces: } W_{\text{nc}} = E_{m,f} - E_{m,i}$$

$$\text{Vectors: Components: } a_x = a \cdot \cos(\theta) \quad a_y = a \cdot \sin(\theta) \quad \mathbf{a} = a_x \mathbf{i} + a_y \mathbf{j} \quad |a| = \sqrt{a_x^2 + a_y^2} \quad \theta = \tan^{-1}(a_y/a_x)$$

$$\text{Addition: } \mathbf{a} + \mathbf{b} = \mathbf{c} \quad \text{implies } c_x = a_x + b_x, \quad c_y = a_y + b_y$$

$$\text{Dot product: } \mathbf{a} \cdot \mathbf{b} = a \cdot b \cdot \cos(\phi) = a_x b_x + a_y b_y + a_z b_z \quad \text{unit vectors: } \mathbf{i} \cdot \mathbf{i} = \mathbf{j} \cdot \mathbf{j} = \mathbf{k} \cdot \mathbf{k} = 1; \quad \mathbf{i} \cdot \mathbf{j} = \mathbf{i} \cdot \mathbf{k} = \mathbf{j} \cdot \mathbf{k} = 0$$

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