Physics 20 Formula Sheet

Kinematics

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$$

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\left(\vec{v}_f - \vec{v}_i\right)}{\Delta t}$$

$$v_f = v_i + at$$

$$\Delta \vec{d} = \vec{v}_i t + \tfrac{1}{2}\vec{a}t^2$$

$$\Delta \vec{d} = \vec{v}_f t - \tfrac{1}{2}\vec{a}t^2$$

$$\Delta d = \left(\frac{v_i + v_f}{2}\right)t$$

$$v_f^2 = v_i^2 + 2ad$$

$$a = \frac{v_f^2 - v_i^2}{2d}$$

Dynamics

$$\vec{F}_{Net} = m\vec{a}$$

$$\vec{F}_g = mg$$

$$\vec{F}_f = \mu \cdot \vec{F}_N$$

$$\vec{F}_g = \frac{Gm_1m_2}{r^2}$$

$$g = \frac{GM}{r^2}$$

$$F_{net} = F_{app} + F_{opposed}$$

Circular Motion

$$v = \frac{2\pi r}{T}$$

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

$$F_c = \frac{mv^2}{r} = \frac{4\pi^2 rm}{T^2}$$

$$K = \frac{T_a^2}{r_a^3}$$

$$\frac{T_a^2}{R_a^3} = \frac{T_b^2}{R_b^3}$$

$$f = 1/T$$

$$v_s = \sqrt{\frac{GM}{R}}$$

$$T_s = 2\pi\sqrt{\frac{r^3}{GM_e}} \text{ or } T_s = \frac{2\pi R}{v}$$

$$T_s = \frac{2\pi R^{3/2}}{\sqrt{GM}}$$

Work and Energy

$$W = \vec{F} \cdot \vec{d}$$

$$W = \Delta E$$

$$F_s = kx$$

$$W = \left|\vec{F}\right|\left|\vec{d}\right|\cos\theta$$

$$E_p = mgh$$

$$E_k = \tfrac{1}{2}mv^2$$

$$E_s = \tfrac{1}{2}kx^2$$

$$W = E_m = E_p + E_k$$

$$P = \frac{\Delta E}{\Delta t} = \frac{W}{\Delta t}$$

Oscillatory Motion

$$F_s = -kx \qquad v_{\max} = A\sqrt{\frac{k}{m}}$$

$$T = 2\pi\sqrt{\frac{m}{k}} \qquad T = 2\pi\sqrt{\frac{l}{g}}$$

$$E_p = \frac{1}{2}kx^2 \qquad F_r = F_g \sin\theta$$

Mechanical Waves

$$l = v\Delta t \qquad v = f\lambda \qquad f = 1/T$$

$$L_c = \tfrac{1}{4}\lambda \qquad L_o = \tfrac{1}{2}\lambda$$

$$f_d = f_s\left(\frac{v_w}{v_w \pm v_s}\right)$$

Vector Components

$$\sin\theta = \frac{opp}{hyp} \qquad \cos\theta = \frac{adj}{hyp} \qquad \tan\theta = \frac{opp}{adj}$$

$$x = r\cdot\cos\vartheta \qquad y = r\cdot\sin\vartheta$$

$$x^2 + y^2 = r^2 \qquad \tan\vartheta = y/x$$

<u>Constants</u>

Acceleration due to gravity Earth surface	a = - 9.81 m/s^2
Gravitational field, Earth's surface	g = 9.81 N/kg
Universal Gravitational Constant	G = 6.67 x 10^{-11} Nm^2/kg^2
Earth Mass	M_E = 5.97 x 10^{24} kg
Earth Equatorial Radius	R_E = 6.37 x 10^6 m
Speed of sound, 20°C	v = 343 m/s

Use for scrap paper if you wish.