PHY 171 Formula Sheet

Fundamental SI Units

`Length`	meter (m)
`Mass`	kilogram (kg)
`Time`	second (s)
`Electric Current`	ampere (A)

Some Derived SI Units

`Force`	$\mathrm{N} = \mathrm{kg\ m/s^2}$
`Energy`	$\mathrm{J} = \mathrm{kg\ m^2/s^2}$
`Power`	$\mathrm{W} = \mathrm{J/s}$
`Pressure`	$\mathrm{Pa} = \mathrm{N/m^2}$

Some Important Constants

$G = 6.674 \times 10^{-11} \mathrm{N \cdot m^2/kg^2}$
$c = 3.00 \times 10^8 \mathrm{m/s}$
$N_A = 6.02 \times 10^{23}$
$k = 1.38 \times 10^{-23} \mathrm{J/K}$
$g = 9.80 \mathrm{m/2^2}$

Kinematics

`Displacement` $\Delta x = x_f - x_0$

`Velocity` $v = \frac{\Delta x}{\Delta t} = \frac{x_f - x_0}{t_f - t_0}$

`Acceleration` $a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_0}{t_f - t_0}$

constant a

$$x = x_0 + vt$$
$$v = v_0 + at$$
$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$
$$v^2 = v_0^2 + 2a(x - x_0)$$

freefall $a = -g$

$$v = v_0 - gt$$
$$y = y_0 + v_0 t - \tfrac{1}{2} g t^2$$
$$v^2 = v_0^2 - 2g(y - y_0)$$

projectile motion
horizontal motion $a_x = 0$

$$x = x_0 + v_x t$$
$$v_x = v_{0x} = v_x$$

vertical motion

$$y = y_0 + v_0 t - \tfrac{1}{2} g t^2$$
$$v_y - v_{0y} - gt$$
$$v_y^2 = v_{0y}^2 - 2g(y - y_0)$$

$$s = \sqrt{x^2 + y^2}$$
$$\theta = \tan^{-1}(y/x)$$
$$v = \sqrt{v_x^2 + v_y^2}$$
$$\theta_v = \tan^{-1}(v_y/v_x)$$

Maximum height and range

$$h = \frac{v_{0y}^2}{2g}$$
$$R = \frac{v_0^2 \sin 2\theta_0}{g}$$

Dynamics

$$a = \frac{F}{m}$$
$$F = ma$$
$$w = mg$$

friction

$$f_s \leq \mu_s N$$
$$f_k = \mu_k N$$

Uniform Circular Motion

$$\Delta\theta = \frac{\Delta s}{r}$$

2π rad $= 360^\circ = 1$ revolution

$$\omega = \frac{\Delta\theta}{\Delta t}$$
$$v = r\omega \text{ or } \omega = \frac{v}{r}$$

Centripetal Accelleration

$$a_c = \frac{v^2}{r} \ ; \ a_c = r\omega^2$$

Centripetal Force

$$F_c = ma_c$$
$$F_c = m\frac{v^2}{r}$$
$$F_c = mr\omega^2$$
$$\Delta L = \frac{F}{k}$$

Newton's Univeral Law of Gravitation

$$F = G\frac{mM}{r^2}$$

Work and Energy

$$W = Fd\cos\theta$$
$$KE = \tfrac{1}{2} m v^2$$
$$\Delta PE_g = mgh$$
$$P = \frac{W}{t}$$

Linear Momentum

$$p = mv$$
$$F = \frac{\Delta p}{\Delta t}$$
$$p_{\text{tot}} = \text{ constant}$$