Formula Sheet

Percent uncertainty

%Unc= $\frac{SA}{A} x100\%$

SA= measured value

A= Expected Value

Kinematic Equations → Horizontal

x= x_0 + $\bar{v}t$

$\bar{v}$= $\frac{v_0 + v}{2}$

v= v_0 +at

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

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

Kinematic Equations → Free fall

y= y_0 + $\bar{v}t$

y= y_0 + v_0t +$\frac{1}{2}$gt^2

v^2= v_0^2 - 2g (y-y_0)

Gravity

- Whether the acceleration a should be taken as +g or -g is determined by your choice of coordinate system.
  - If you choose the upward direction as positive, a = - g = -9.80 m/s is negative.
  - In the opposite case, a = +g = 9.80 m/s- is positive.
- Since acceleration is constant, the kinematic equations above can be applied with the appropriate +g or - g substituted for a.

Maximum height

- $h = \frac{v^2_{0y}}{g}$

Maximum horizontal distance

- $R = \frac{v^2_0 sin2\Theta_0}{g}$

Force:

Fnet = ma

Units: Newtons (N)

Weight

$\bar{w}$ = mg

g = 9.8 m/s^2

Tension

T = $\bar{w}$ = mg

Uniform Circular Motion: motion in a circular path at a constant speed

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

Angular Velocity

- $\omega = \frac{\Delta\Theta}{t}$
  - Units: $\frac{rads}{s}$

The relationship between linear and angular velocity

- $v = \frac{\Delta s}{t} = \frac{r \bullet \Delta\theta}{r} = r\omega$

Centripetal acceleration: Center seeking

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

Centripetal Force: any net force causing uniform circular motion

- $F_c = m \cdot a_c = m\frac{v^2}{r} = m \cdot r \cdot \omega$

Magnitude of the gravitational constant

- $F = G\frac{mM}{r^2}$
  - $G = 6.674x10^{-11} \frac{N \cdot m^2}{kg^2}$

Acceleration due to gravity

- $g = G\frac{M}{r^2}$
  - Unit: $\frac{m}{s^2}$

Kinetic Energy

- K=$\frac{1}{2}mv^2$
  - Unit: Joules (J)

Potential Energy

- PE_g=mgh
- PE_{Spring}= $\frac{1}{2}kx^2$

Conservation of Energy

★ $KE_i+PE_i= KE_f+PE_f$

- $\frac{1}{2}mv_i + mgh_i = \frac{1}{2}mv_f + mgh_f$

Work

- w=Fdcosθ

Friction

- f=F_f= $\mu_k N=\mu_k mg$

Momentum

★ p=mv

★ Conservation of momentum

- P_{tot}=constant
- $P_{tot}=P'_{tot}$
- $p_1 + p_2 = p'_1 + p'_2$ (F_{net}=0)

Impulse

★ Change in momentum

★ $\Delta p = F_{net} \bullet \Delta t$

Torque

- $\boldsymbol{\tau}$=rFsinθ =$r_{\perp}$F