

# PHYS 211X

## General Physics I

## Formulas

Position:

$$x, y, s, \text{ or } p = \vec{v}\Delta t = \int \vec{v}dt \quad (1)$$

$$x = \left( \frac{v_0 + v_f}{2} \right) \Delta t \quad (2)$$

$$x = v_0 t + \left( \frac{1}{2} \right) \vec{a}t^2 \quad (3)$$

Velocity:

$$\vec{v} = \vec{a}\Delta t = \frac{d}{dt}[p] = \int (\vec{a})dt \quad (4)$$

$$\vec{v} = v_0 + \vec{a}t \quad (5)$$

$$\vec{v}_f^2 = v_0^2 + 2\vec{a}\Delta x \quad (6)$$

Acceleration

$$\vec{a} = \frac{d}{dt}[\vec{v}] \quad (7)$$

Projectile Motion:

$$y_f = y_0 + v_0(\Delta t) + \frac{1}{2}a(\Delta t^2) \quad (8)$$

Force:

$$\vec{F} = m\vec{a} \quad (9)$$

Friction:

$$f = \mu N \quad (10)$$

Drag:

$$\vec{F}_D \text{ or } D = \frac{1}{2}\rho C_D A v^2 \quad (11)$$

Circular Motion:

$$\vec{v} = r \quad (12)$$

$$a_{cent} = \frac{m\vec{v}^2}{r} \quad (13)$$

$$f = \mu n \quad (14)$$

$$v_{cent/crit} = \sqrt{gr} \quad (15)$$

$$N = mr\omega^2 \quad (16)$$

$$N = 3mg \quad (17)$$

$$\omega = \frac{\Delta\theta}{\Delta t} \quad (18)$$

Total Energy:

$$E = K + U \quad (19)$$

$$KE_i + U_i = KE_f + U_f \quad (20)$$

$$\frac{1}{2}mv_i^2 + mgy_i = \frac{1}{2}mv_f^2 + mgy_f \quad (21)$$

PE of a spring:

$$U = 1/2kx^2 \quad (22)$$

$$U_p = \frac{1}{2}k(x - L_0) \quad (23)$$

Potential Energy:

$$(24)$$

Work:

$$W_{int} = -\frac{F_x}{\Delta} \quad (25)$$

$$F_x = -\frac{dU}{dx} \quad (26)$$

Momentum:

$$\rho = mv$$

## Key

$v$	= velocity, meters/second
$y$	= height, meters
$x$	= distance, meters
$t$	= time, seconds
$m$	= mass, kilograms
$a$	= acceleration, meters/second <sup>2</sup>
$\theta$	= angle, degrees
$g$	= gravity: 9.8 meters/second <sup>2</sup>
$\omega$	= angular velocity, radians or degrees/second, counter-clockwise
$F$	= force, Newtons, kilogram · meters/second <sup>2</sup>
$\mu$	= coefficient of friction
$N$	= normal force, Newtons
$A$	= area, meters <sup>2</sup>
$\rho$	= volumetric mass density, kilograms/meters <sup>3</sup>
$C_D$	= drag coefficient (geometry dependant)
$K$	= kinetic energy
$U$	= potential energy