Sphere

Volume

$$V = \frac{4}{3}\pi r^3$$

Vector components

$$v_{x_0} = v_0 \cos\theta$$

$$v_{y_0} = v_0 \sin\theta$$

Horizontal trajectory motion

Conditions are $a_x = 0, v_x = constant$

$$v_x = v_{x_0}$$

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

Vertical trajectory motion

Conditions are $a_y = -g = -9.81\ m.s^{-2} = constant$

$$v_y = v_{y_0} - gt$$

$$y = y_0 + v_{y_0} t - \frac{1}{2} gt^2$$

$$v_y^2 = v_{y_0}^2 - 2g(y - y_0)$$

Energy

Potential

$$E_P = mgh$$

Kinetic

$$E_K = \frac{1}{2} mv^2$$

Conservation

$$E = E_P + E_K$$

Rotational Motion

Radians vs. degrees

$$360° = 2\pi\ rad$$

Arc length

$\theta = \frac{l}{r}$ clockwise negative, anticlockwise positive.

Angular displacement

$\Delta\theta = \theta_2 - \theta_1$

Angular velocity

$\bar{w} = \frac{\Delta\theta}{\Delta t}$ (rad/s)

Angular acceleration

$\propto = \frac{\Delta w}{\Delta t}$ (rad/s^2)

Linear velocity

$v = r\,w$

Moment of inertia

$I = \sum m\,r^2$

Energy

Potential

$E_P = mgh$

Kinetic

$E_K = \frac{1}{2}mv^2 + Iw^2$