OBJECTS IN FREE-FALL

Def: *An object in free-fall is any object that is moving freely under the influence of gravity alone, regardless of its initial position and velocity.*

$\boxed{g = 9.8\ m/s^2}$ Acceleration of Gravity
Near Earth'sSurface

- The direction of 'g' is toward center of earth.

Small variations of 'g' due to:

1. altitude
2. latitude (g is smaller at equator)
3. local earth density

Since an object in free-fall moves with constant acceleration near earth, we may use the kinematic equations to describe its motion.

Convention *– reserve x-axis for horizontal motion and y-axis for vertical motion.*

To obtain the free-fall equations we will simply replace *x* by *y* in the kinematic equations:

Free-Fall Equations

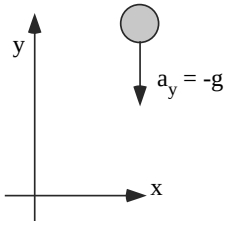
$$v = v_{oy} + a_y t$$

$$y = y_o + v_{oy} t + \frac{1}{2} a_y t^2$$

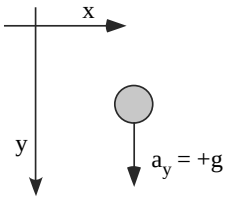
$$v^2 = v_{oy}^2 + 2a_y (y - y_o)$$

$$y = y_o + \frac{1}{2}\ v_{oy} + v\ t$$

Object in Free-Fall



Object in Free-Fall



Where $a_y = \pm g$ depending on the coordinate system used.