Free Fall Notes

Galileo Galilei (1564-1642)

- determined that all objects fall at the same rate of acceleration

- he found that the distance depended on the square of the time & that the velocity increased as the ball moved down regardless of the mass of the ball

An object in Free fall is only subject to the Force of gravity.

Freely falling objects have constant acceleration if there is NO air resistance.

Free fall acceleration is denoted with the symbol g and is equal to $-9.81\ m/s^2$ on Earth.

Free fall acceleration is directed downward toward the center of the Earth

Acceleration due to gravity is negative since the downward direction is negative.

So... When in freefall, if there's no air resistance...

$$a = g = -9.81\ m/s^2$$

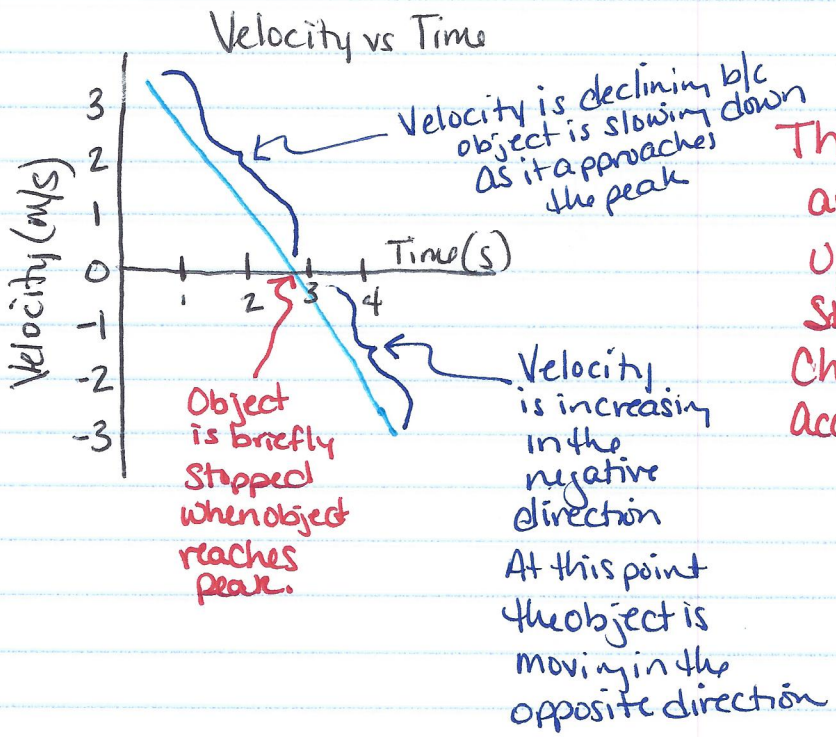
All objects, when thrown upwards will continue upwards for some time momentarily stop at the peak then change direction & begin to fall.

at the peak the Velocity = 0m/s

BUT...

$a_g = -9.8\ m/s^2$

a_g = acceleration due to gravity



This graph shows an object being thrown up. Stopping briefly then Changing directions & Accelerating

Terminal Velocity — The instant in time where the object stops accelerating.

If there is air resistance, the more massive object will accelerate longer before reaching terminal velocity.

Example

A tennis ball is thrown vertically upward with an initial velocity of 8 m/s. What is the ball's speed when it returns to the starting point? How long will it take?

$V_i = 8\ m/s$
$V_f = 0\ m/s$
$t = ?$
$a = -9.81\ m/s^2$

$V_f = at + V_i$

$0\ m/s = (-9.81\ m/s^2)(t) + (8\ m/s)$

$-8\ m/s \qquad\qquad -8\ m/s$

$$\frac{-8\ m/s}{-9.81\ m/s^2} = \frac{(-9.81\ m/s^2)(t)}{-9.81\ m/s^2}$$

$$\frac{-8\ m/s}{-9.81\ m/s^2} = t$$

$.82\ s = t$ ← This is the time it takes to go up. For total time, you need to double it.

$\boxed{t = 1.6\ s}$

Now... need to find V_f at the bottom.

$V_f = at + V_i$

$V_f = (-9.8\ m/s^2)(.82\ s) + 0$

$\boxed{V_f = -8\ m/s}$