FREE-FALLING BODY

All bodies in free-fall close to the Earth's surface accelerate vertically downwards with the same acceleration: namely, $g = 9.81\ ms^2$.

$$\boldsymbol{v = gt}$$

$$\boldsymbol{h = \frac{1}{2}gt^2}$$

Note: From constant acceleration, initial velocity = 0, final velocity = V, s = h and a = g .

MOTION WITH VARIABLE ACCELERATION

When a varying force (force that either increases or decreases with time) then body will move with variable acceleration.

$$\boldsymbol{a = \frac{dv}{dt}}$$

$$\boldsymbol{v = \frac{ds}{dt}}$$

$$\boldsymbol{vdv = ads}$$

Where:

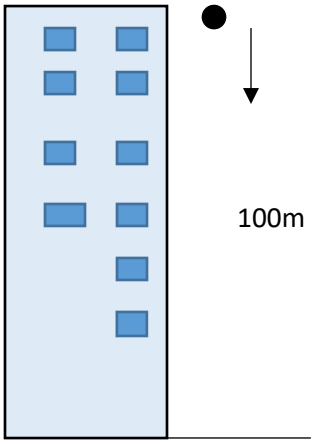
$s = distance$
$v = velocity$
$v_i = initial\ velocity$
$v_f = final\ velocity$
$a = acceleration$
$g = acceleration\ due\ to\ gravity$
$t = time$

Note:

- a is positive (+) if v is increasing (accelerate).
- a is negative (-) if v is decreasing (decelerate).
- g is positive (+) if the particle is moving downward.
- g is negative (-)if the particle is moving upward.

Problem 15.

A ball is dropped from a building 100 m high. If the mass of the ball is 10 gm after what time will the ball strike the earth?



Solution:

NOTE: since the ball is dropped the initial velocity is zero.

$h = \frac{1}{2}gt^2$

$100\ m = \frac{1}{2}\left(-9.81\frac{m}{s^2}\right)t^2$

$t = 4.52\ sec$ *answer.*