NAME__________

Gravity and constant acceleration

If an object is thrown up and falls down then:

Time up = Time down = half entire time.
Dis at bottom is 0.
V at top = 0
Vi up = -Vf down

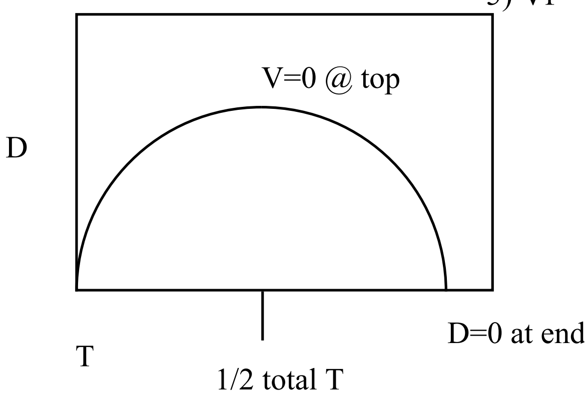
1) $D = \frac{(Vi+Vf)}{2} * T$

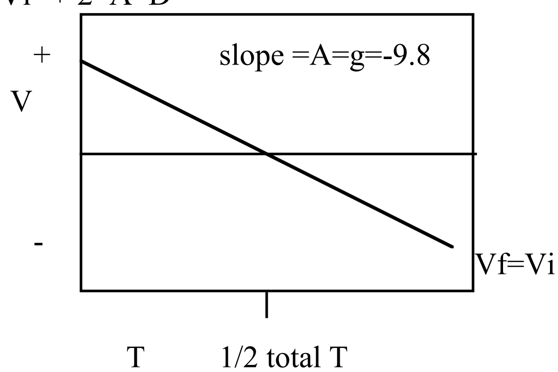
2) $Vavg = \frac{(Vi+Vf)}{2}$

3) $Vf = Vi + A*T$

4) $D = Vi*T + ½*A*T^2$

5) $Vf^2 = Vi^2 + 2*A*D$





G Problems:

1) If I throw up a baseball straight into the air at 8 m/s, (assume g=-9.8)

a)what is its velocity at the top of its journey?

Vf = 0 at top

b) How much time does it take to go all the way up?

Vf=0, Vi=8, A = -9.8

Vf=Vi+AT   0=8-9.8T   9.8T=8   T=8/9.8=.81632 seconds

c) How much time does it take to go down?

Same amount of time T= .81632 seconds

Total time up and down, D=0, Vi=8, A=-9.8

$D=ViT + ½*AT^2$

$0=8T+ ½*-9.8\ T^2$

0=8-4.9T   T=8/4.9 =1.632 seconds for whole trip, ½ = .81632 seconds

d) What is its final velocity when it hits the ground?

Vf=Vi+AT

Vf=8+(-9.8)(1.632) = 8-16 = -8 m/s

***Or** $Vf^2=Vi^2+2AD$*
$= 8^2+2(-9.8)(0)$
so Vf=+/- 8 m/s

2) A pebble is dropped down a well and hits the ground 1.5 seconds later. What is the displacement from the edge of the well to the waters surface?

Vi=0 (dropped)
A= -9.8
T=1.5
D=???

$D=ViT + ½*AT^2$
$D=0*1.5+ ½*-9.8\ 1.5^2$
D= -4.9*2.25 = -11.025 m (downwards)

3) A gymnast is practicing a dismount from the high bar that is 4 meters off the ground, and swings up with a velocity of + 4 m/s . How fast will she be going when she hits the ground?

Vi=4, A = -9.8 , D= -4 m (because up is positive, and she's ending up below the start)

$Vf^2=Vi^2+2AD$
$Vf^2= 4^2+2(-9.8)(-4)$
$Vf^2=16+78.4=94.4$
so Vf=+/- 9.7 m/s or -9.7 m/s downwards

4) I drop a meterstick and catch it at the 32 cm mark. What is my reaction time?

Vi=0, A = - 9.8 , D = -32 cm = - .32 m, T= ???
$D= ½*g*T^2$
$.32 = ½*9.8*T^2$
T= SQRT (2*.32/9.8) = SQRT (.0653) = .256 seconds

5) I jump straight up and hit the ground 3 seconds later.
How fast was I going when I started?

Vi=????, T=3, D=0 (hit ground), A = -9.8
$D=ViT + ½*AT^2$
$0=Vi*3+ ½*-9.8\ 3^2$
0=3Vi -4.9 * 9
44.1 = 3Vi Vi=14.7 m/s, Vf = -14.7 m/s

or at top of journey, Vf=0, T=1/2 total t= 1.5, A = -9.8

Vf=Vi + A T 0=Vi -9.8*1.5 Vi= 14.7 m/s

What is the total DISTANCE I traveled (not displacement)

Total distance equals distance up plus distance down, or twice distance down.

Starting at top T =1.5, Vi=0, A = -9.8, D=??

$D=ViT + ½*AT^2$

$D=0T+ ½*-9.8*1.5^2$

D=11.025m so total distance = 22.05 m

Or use #5 for first half of journey, Vi=14.7, Vf=0, A= -9.8, T=1.5

$0^2=14.7^2 +2(-9.8)D$

$0^2= 216.09+ - 19.6D$

216.09=19.6D D=11.025m up, so total D is 2*11.025 = 22.05 m

6) A robot probe drops a camera off the rim of a 24 km deep crater on Mars, where the free fall acceration is -3.7 m/s^2 .

Find the time required for the camera to reach the crater floor and the velocity with which it hits.

D= -24 km = -24000 m, Vi=0, A = - 3.7 T =???

$D=ViT + ½*AT^2$

$-24000=0T+ ½*-3.7*T^2$

$-24000= -1.85\ T^2$

T^2 ***= 24000/1.85 so T= 113 seconds or 1.89 minutes***

$Vf^2=0^2 +2(-3.7)(-24000)$

$Vf^2=177600$

Vf=421.4 m/s

Sketch the distance time and velocity time graph as compared to Earth.