Compare the following locations.

	Air Resistance	Gravity
Earth	✓	✓
Moon		✓
Deep Space		

Acceleration due to Gravity

1. symbol "g"
2. ~ 10 m/s/s
3. varies by location
4. varies by planet

Selected Values of "g"

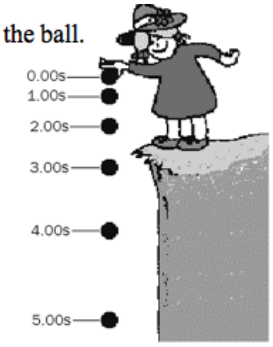
Eugene	$g = 9.81\ m/s^2$
Equator	$g = 9.75\ m/s^2$
North Pole	$g = 9.83\ m/s^2$
Moon	$g = 1.61\ m/s^2$
Mars	$g = 3.7\ m/s^2$

Complete the chart for the displacement, instantaneous velocity and acceleration of the ball.

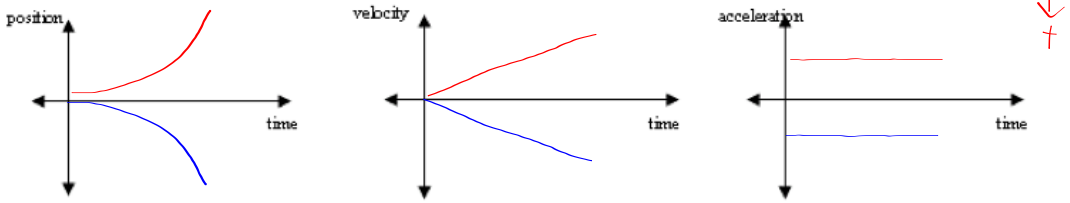
time (s)	d (m)	v (m/s)	a (m/s²)
0	0	0	10
1	−5	−10	−10
2	−20	−20	−10
3	−45	−30	−10
4	−80	−40	−10
5	−125	−50	−10

$\vec{v}_f = \vec{v}_0 + \vec{a}t$

$\vec{d} = v_0 t + \frac{1}{2}\vec{a}t^2$



Sketch the position, velocity and acceleration graphs for the falling ball. How would these change if distance and speed were graphed instead?



1. A ball is dropped down a shaft and hits the bottom in 3.2 seconds. Determine:

a) the depth of the shaft

$t = 3.2s$

$a = -9.8 m/s^2$

$V_0 = 0$

$\vec{d} = \vec{V_0}t + \frac{1}{2}\vec{a}t^2 = \frac{1}{2}(-9.8 m/s^2)(3.2s)^2 = -50.m$

b) how fast the ball is going when it hits the bottom

$\vec{V_f}^2 = V_0^2 + 2\vec{a}\vec{d}$

$\vec{V_f} = \sqrt{2\vec{a}\vec{d}}$

$-9.8 m/s^2 \quad -50.m$

$= -31 m/s$

2. A stunt man jumps off the Brooklyn Bridge which is 40. meters high. Determine:

a) the time it takes to hit the water

2.9s

b) his impact velocity

28 m/s

Throwing Up

A ball is thrown up into the air, as shown in the time-elapsed diagram. Each snapshot represents the position of the ball after one additional second of flight.

a) How long is it in the air? 6 s

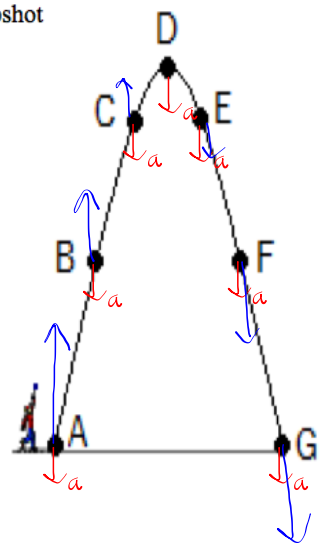
b) How long did it take to get to the top of its path? 3 s

c) How fast was it going when it left the ground? 30 m/s

d) Describe how its speed changes during the flight.
slows, stops, speeds up

e) Describe how its velocity changes during the flight.
constantly decreases

f) Describe how its acceleration changes during the flight.
constant



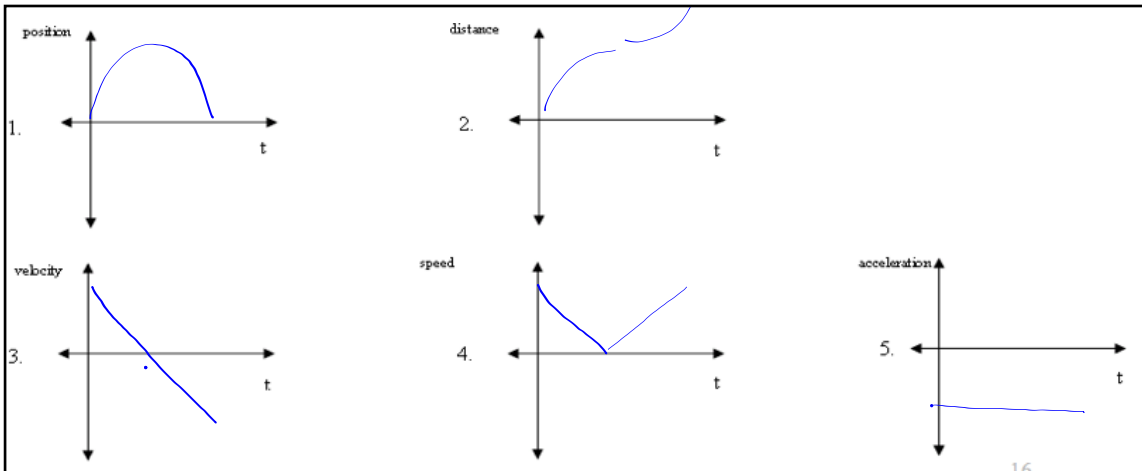
g) Sketch vectors on the diagram to indicate the velocity and acceleration of the ball at each instant.

h) Complete the chart at right for the ball.

i) Sketch the graphs below for the ball.

$\vec{d} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$

	Position (m)	Velocity (m/s)	Acceleration (m/s^2)
A	0	30	-10
B	25	20	-10
C	40	10	-10
D	45	0	-10
E	40	-10	-10
F	25	-20	-10
G	0	-30	-10



1. A football is punted straight up and remains airborne for 2.6 seconds. Determine:

a) the time it takes to get to the top of its flight

$t_{1/2} = 1.3\text{s}$

b) vertical launching velocity

$V_f = V_0 + at$ (V_f: 0, t: 1.3s)

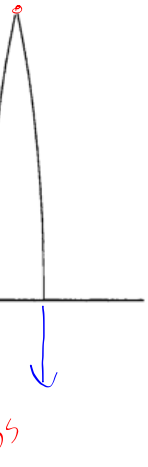
$V_f = V_0 + at$ (V_f: $-V_0$, t: 2.6s)

$= 13\text{ m/s}$

$d = v_0 t + \frac{1}{2}at^2$ (d: 0, t: 2.6s)

$0 = V_0 t + \frac{1}{2}at^2$

$0 = V_0 + \frac{1}{2}at$ (2.6s)



c) highest point reached

$d = v_0 t + \frac{1}{2}at^2 = 8.3\text{m}$

(v_0: 12.74 m/s, t: 1.3s, a: -9.8 m/s^2, t: 1.3s)

2. A ball is thrown straight up in the air with an initial velocity of 15 m/s. Determine:

a) the time it takes to get to the top of its flight

1.5s

b) highest point reached

11m

c) impact velocity

-15 m/s