Physics First Honors
2012-13

Projectiles

Name _____
Period _____

Cannon Problems

1. Robin Hood shoots an arrow with a speed of 49.0 m/s at an angle of 30° with the horizontal. a) What are V_x and V_y?

$V_x = V\cos\theta = 49\cos 30^\circ = 42.4$ m/s

$V_y = V\sin\theta = 49\sin 30^\circ = 24.5$ m/s

	X	Y: To Top	Y: From Top
V_i	42.4	24.5	0
V_f	42.4	0	-24.5
d	dx	dy	dy
a	0	-9.8	-9.8
t	5.0	2.5	2.5

(b) How long after it is shot does the arrow reach the maximum height?

$V_f = V_i + at$

$0 = 24.5 - 9.8t$

$-24.5 = -9.8t$

$t = \frac{24.5}{9.8} = 2.5$ sec

(c) How high does the arrow go?

$d_y = \frac{1}{2}at^2$

$d_y = \frac{1}{2}(9.8)(2.5)^2 = 30.6$ m

(d) How long until the arrow reaches the ground (from the time it was shot)?

$t = 2t_{(up)} = 2(2.5) = 5.0$ Sec

(e) How far away from Robin Hood does it land?

$d_x = V_x \cdot t = 42.4(5) = 212$ m

Projectiles

2. In attempting a slam-dunk, Michael Jordan leaps into the air from the top of the key with a velocity of 7.62 m/s at an angle of 40^o above the floor.

	X	To Top	From Top
Vi	5.84	4.90	0
Vf	5.84	0	-4.90
d	dx	dy	dy
a	0	-9.8	-9.8
t			

a) What are V_x and V_{iy}?

$V_x = 7.62 \cos 40^\circ = 5.84$ m/s

$V_y = 7.62 \sin 40^\circ = 4.90$ m/s

b) How high are his feet at the top of his jump?

Tup → $V_f = V_i + at$

$0 = 4.9 - 9.8t$

$9.8t = 4.9$

$t = \frac{4.9}{9.8} = 0.5$

$d = \frac{1}{2}at^2$

$d = \frac{1}{2}(9.8)(.5)^2$

$d = 1.23$ m

c) What is his "hang time?"

$T_{Total} = 2(T_{up}) = 2(0.5) = 1.0$ Sec

d) How far from the top of the key does he land?

$dx = V_x \cdot t = 5.84(1) = 5.84$ m