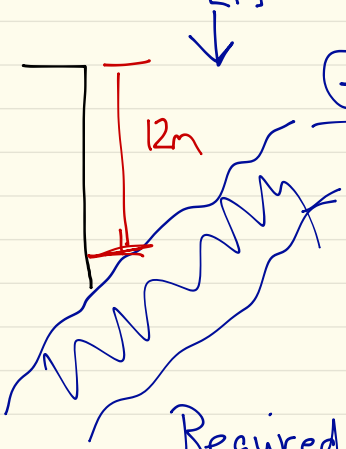
UNIT #1 KINEMATICS

Projectile Motion

Pg. 42 #2



Given: $\vec{v}_1 = 3.0\ m/s\ [\downarrow]$

$\vec{a} = 9.8\ m/s^2\ [\downarrow]$

$\vec{\Delta d} = 12\ m\ [\downarrow]$

Required: $\vec{v}_2$ = velocity at instant it hits the water

Analysis: $\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\,\vec{\Delta d}$

$= \left(3.0\ \frac{m}{s}\right)^2 + 2\left(9.8\ \frac{m}{s^2}\right)(12\ m)$

$\vec{v}_2^{\,2} = 9\ \frac{m^2}{s^2} + 235.2\ \frac{m^2}{s^2}$

$\vec{v}_2^{\,2} = 244.2\ \frac{m^2}{s^2}$

$\vec{v}_2 = \sqrt{244.2\ m^2/s^2}$

$\vec{v}_2 = 15.6\ m/s$

$\therefore \vec{v}_2 = 16\ \frac{m}{s}\ [\downarrow]$

Projectiles

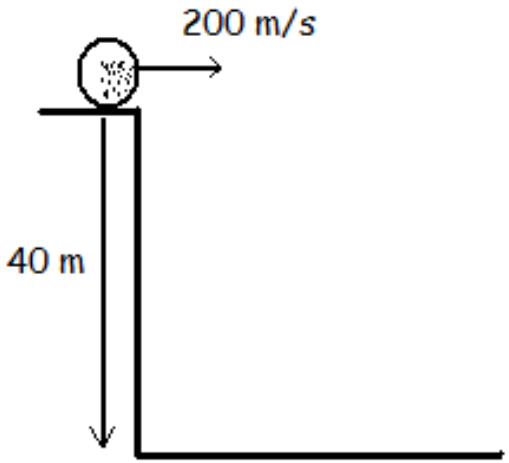
- any object upon which the only force is gravity
- horizontal and vertical motion are INDEPENDENT

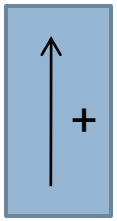
Vertical	Horizontal
•acceleration due to gravity •use the “big 5” equations	•no horizontal forces acting on projectile, so... •NO horizontal acceleration (uniform motion v=d/t)

Example #1

Assume 2 sig figs

Find the horizontal distance travelled by the projectile shown.





→ +

VERTICAL	HORIZONTAL
$a = -9.8\ m/s^2$	$d_h =$
$d_y = -40\ m$	$v_h = 200\ m/s$
$v_{1y} = 0\ m/s$	$t = 2.86\ s$
$v_{2y} = X$	
$t = 2.86\ s$	

Steps $v_1 = 0$

$\vec{\Delta d} = v_1 \Delta t + \frac{1}{2} a \Delta t^2$

Analysis: $\vec{\Delta d} = \vec{V}_1 \Delta t + \frac{1}{2} \vec{a} \Delta t^2$

(Quadratic) - unless $v_1 = 0$

$\Delta d = \frac{1}{2} a \Delta t^2$

$-40m = \frac{1}{2}\left(-9.8 \frac{m}{s^2}\right)\Delta t^2$

$-40m = -4.9 \frac{m}{s^2}\left(\Delta t\right)^2$

$\Delta t^2 = \frac{-40\ m}{-4.9\ m/s^2}$

$\Delta t^2 = 8.16\ s^2$

$\Delta t = \sqrt{8.16 s^2}$

$\Delta t = 2.86 s$ → keep 3 sig digs

HW

pg. 43

#4, 5

Pg. 39

practice

#1, 2

Horizontal: $V = 200\ m/s\ [\rightarrow]$ +

$t = 2.86 s$

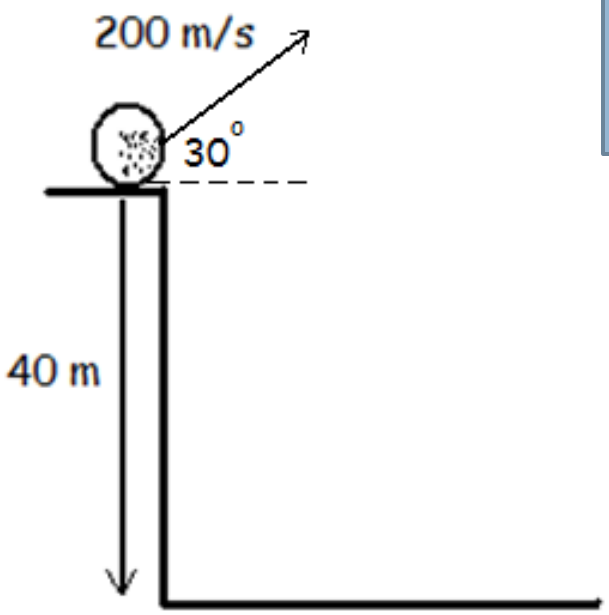
$v = d/t \quad \therefore \quad d = vt$

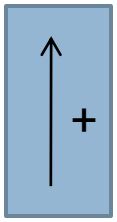
$= 200 \frac{m}{s}[\rightarrow]\ (2.86 s)$

$d = 570\ m\ [\rightarrow]$

Example #2

a)Find the horizontal distance travelled by the projectile shown.





VERTICAL

$a =$

$d_y =$

$v_{1y} =$

$v_{2y} =$

$t =$

HORIZONTAL

$d_h =$

$v_h =$

$t =$

b)Find the impact velocity

Example #3

A plane flying horizontally at 75 m/s drops a supply box when it is directly over a tower 250m below.

a) How far from the tower does the box land?
b) What is its velocity when it hits the ground?