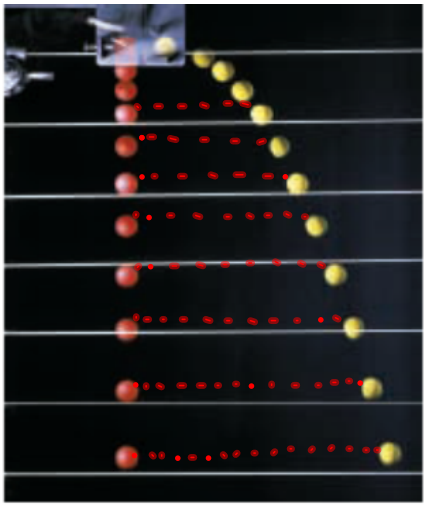
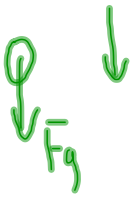
§11-1 Projectile Motion



red ball is accelerating due gravity.

yellow ball is accelerating due to gravity



Horizontally

- no force acting on the object (neglecting air resist.)
- the velocity is constant

$$v = \frac{\Delta d}{\Delta t}$$

Vertically

- the force of gravity is acting on the object

therefore the acceleration is $-9.81 m/s^2$ (+ up, - down)

- constant acceleration

$$a = \frac{\Delta v}{\Delta t}$$ ← vertical

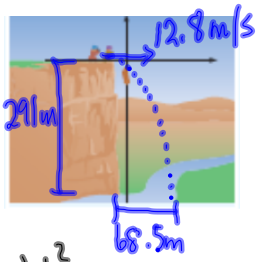
$$v_{ave} = \frac{\Delta d}{\Delta t}$$ ← vertical

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

$$\Delta d = v_2 t - \frac{1}{2} a t^2$$

$$v_2^2 = v_1^2 + 2a\Delta d$$

MP 153#4



Vertically (acc)

$v_i = 0$ m/s
$a = -9.81\ m/s^2$
$\Delta d = -291$ m
$\Delta t = ??$

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

$-291\text{m} = \frac{1}{2}(-9.81\ m/s^2)t^2$

$\frac{2(-291\text{m})}{-9.81\ m/s^2} = t^2$

$t = 7.70$ s

Horizontally (constant v)

$v = 12.8$ m/s
$\Delta t = 7.70$ s
$\Delta d = ?$

$v = \frac{\Delta d}{\Delta t}$

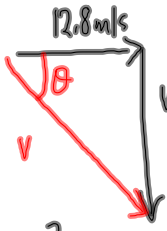
$\Delta d = v\Delta t$

$\Delta d = (12.8\ m/s)(7.70\ s)$

$\Delta d = 98.6$ m

a) Since $\Delta d > 68.5$m, the rock lands on the other side of the river.

b) When the rock hits the ground:



$c^2 = a^2 + b^2$

$v^2 = (12.8\ m/s)^2 + (75.6\ m/s)^2$

$v = 76.6$ m/s

$\tan\theta = \frac{75.6\ m/s}{12.8\ m/s}$

$\theta = 80.4°$

Vertically

$v_i = 0$
$a = -9.81\ m/s^2$
$\Delta d = -291$ m
$\Delta t = 7.07$ s
$v_2 = ??$

$a = \frac{\Delta v}{\Delta t}$

$a = \frac{v_2 - v_1}{\Delta t}$

$v_2 = v_1 + a\Delta t$ ($v_1 = 0$)

$v_2 = a\Delta t$

$v_2 = (-9.81\ m/s^2)(7.07\ s)$

$v_2 = -75.6$ m/s

$\vec{v_2} = 75.6$ m/s [down]

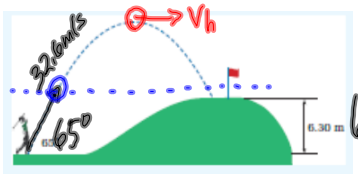
The velocity of the rock when it hits the ground is 76.6 m/s [80.4° below the horiz]

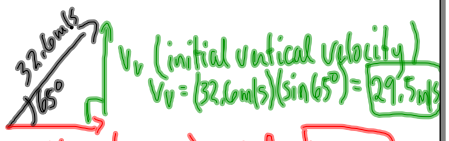
MP|539

a) $\Delta t = ?$

b) $\Delta d_h = ?$

c) V@impact = ??





a) Vertically

$V_i = 29.5\text{m/s}$

$a = -9.81\text{m/s}^2$

$\Delta d = +6.30\text{m}$

$\Delta t = ??$

$\Delta d = v_i t + \frac{1}{2}at^2$

$6.30 = (29.5)t - \frac{9.81}{2}t^2$

$\frac{9.81}{2}t^2 - 29.5t + 6.30 = 0$

a b c

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{29.5 \pm \sqrt{(29.5)^2 - 4\left(\frac{9.81}{2}\right)(6.30)}}{9.81}$$

$$x = \frac{29.5 \pm 27.3}{9.81}$$

$x = \frac{29.5 + 27.3}{9.81}$ or $x = \frac{29.5 - 27.3}{9.81}$

$x = 5.79\text{s}$

$x = 0.224\text{s}$

← when the ball is @ 6.30m on the way up

b) Horizontally (v is constant)

$V = 13.8\text{m/s}$

$\Delta t = 5.79\text{s}$

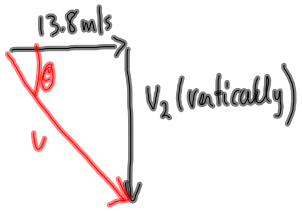
$\Delta d = ?$

$\Delta d = v\Delta t$

$\Delta d = (13.8\text{m/s})(5.79\text{s})$

$\Delta d = 79.9\text{m}$

c) v at impact:



① find v_2 (vertical)
② find v
③ find θ
④ put it all together.

TO DO

① PP|536-537 ← for sure!

③ PP|543 ← not necessary for Mon.

Nov 18-10:11 AM