Key

HORIZONTAL PROJECTILES- NOTES!!!!

Formulas: $d=\frac{1}{2}at^2$ $a=\frac{V_f-V_i}{t}$ $v=d/t$

1) A ball is thrown from a 22 m high cliff horizontally at 16 m/s.

a. How much time will it take for the ball to reach the ground?

$\vec{V_x}$ | $\uparrow V_y$

$V_x = 16\ m/s$ | $V_y =$

$t_x =$ | $d_y = 22\ m$

$$t = \sqrt{\frac{2d}{a}}$$

$$= \sqrt{\frac{44}{9.8}}$$

$$t = 2.11\ s$$

b. How far from the base of the cliff will it land?

$$d_x = (16\ m/s)(2.11\ s)$$

$$= 33.9\ m$$

2) The same ball in problem #1 is thrown on the moon, where g = 1.67 m/s^2.

a. How much time will it take to hit the ground now?

$\vec{V_x}$ | $\uparrow V_y$

$V_x = 16\ m/s$ | $V_y =$

$d_x =$ | $d_y = 22\ m$

$t =$

$$22 = \frac{1}{2}(1.67)t^2$$

$$\sqrt{26.35} = t$$

$$5.13\ s = t$$

b. How far away will it land?

$$d_x = V_x t$$

$$= (16)(5.13) = 82.1\ m$$

3) A cannon is fired horizontally at 150 m/s from a castle wall that is 7.2 m high. How far away will the cannonball land?

V	H
$V_y =$	$V_x = 150$
$d_y = 7.2$	$d_x =$

$$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2(7.2)}{9.8}} = 1.21\,s$$

$$d_x = (150)(1.21) = \boxed{181.8\,m}$$

4) A rock is thrown horizontally at 24 m/s from a cliff. It lands 56 m from the base. How high is the cliff?

$V_x = 24\,m/s$

$d_x = 56m$

$$t = \frac{56}{24} = 2.33\,s$$

$$d_y = \frac{1}{2}(9.8)(2.33)^2$$

$$\boxed{d_y = 26.60m}$$

Honors Physical Science – Projectile Motion – Practice Problems

Name:_____ Period:_____

~~Equations~~

$d = \frac{1}{2} at^2$ $d = [(v_i + v_f)/2]\, t$ $d = v_i t + \frac{1}{2} at^2$ $2ad = v_f^2 - v_i^2$ $v_f = v_i + at$

$v = d/t$ (uniform or constant velocity) $d = vt$

1. In her physics lab, Melanie rolls a 10g marble down a ramp and off the table with a horizontal velocity of 1.2 m/s. The marble falls in a cup placed 0.51 m from the table's edge.
   A) How high is the table?
   B) What is the vertical velocity (v_y) of the marble?

H
$v_x = 1.2\ m/s$
$d_x = 0.51\ m$
$t = ?$

V
$v_y =$
$d_y = 0.89\ m$

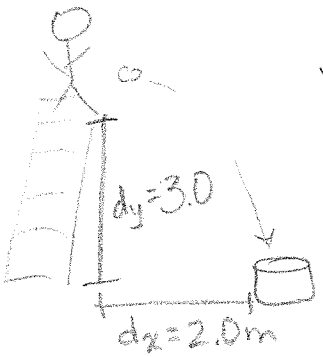
(A) $v = \frac{d}{t}$
$1.2t = 0.51$
$t = 0.425\ s$

$d = \frac{1}{2}(9.8)(0.425)^2$
$= 0.89\ m$

(B) $v_f = v_i + at$
$= 0 + (9.8)(0.425)$
$= 4.2\ m/s$

$t_x = t_y$

2. Bert is standing on a ladder picking apples in his grandfather's orchard. As he pulls each apple off the tree, he tosses it into a basket that sits on the ground 3.0 m below at a horizontal distance of 2.0 m from Bert.
   A) How fast must Bert throw the apples horizontally (v_x) in order for them to land in the basket?
   B) What is the vertical velocity (v_y) of the apples?



x
$v_x =$
$d_x = 2.0m$

y
$v_y =$
$d_y = 3.0m$

$t =$

$3 = \frac{1}{2}(9.8)t^2$
$0.782s = t$

(A) $v_x = \frac{d_x}{t} = \frac{2.0}{0.782}$
$v_x = 2.55\ m/s$

(B) $v_f = (0) + (9.8)(0.782)$
$v_y = 7.66\ m/s$

3. Billy-Joe stands on the Talahatchee Bridge kicking stones in the water below. If Billy-Joe kicks a stone with horizontal velocity of 3.50 m/s and it lands in the water a horizontal distance of 5.40 m from where Billy-Joe is standing.
   A) What is the height of the bridge?
   B) If the stone had been kicked harder, how would this affect the time it would take to fall?
   C) Assuming that the stone accelerates vertically at 9.8 m/s², what is the velocity of the stone in the vertical direction?

H
$V_x = 3.50$
$d_x = 5.40$

V

$t = \frac{d_x}{V_x}$

$t = \frac{5.4}{3.5}$

$t = 1.543\,s$

(A) $d = \frac{1}{2}(9.8)(1.543)^2$

$d_y = 11.67\,m$

(B) It wouldn't

(C) $V_f = (0) + (9.8)(1.543)$

$V_y = 15.1\,m/s$

4. Tad drops a cherry pit out the car window 1.0 m above the ground while traveling down the road at 18 m/s.
   A) How far, horizontally, from the initial dropping point will the pit hit the ground?
   B) What is the vertical velocity of the cherry pit?

$V_x = 18\,m/s$ $d_y = 1.0\,m$

$d_x =$ $V_y =$

$1.0 = \frac{1}{2}(9.8)t^2$

$\sqrt{\frac{2}{9.8}} = t$

$0.452\,s = t$

(A) $d_x = V_x t$

$= (18)(0.452)$

$= 8.13\,m$

(B) $V_f = V_i + at$

$= 0 + (9.8)(0.452)$

$= 4.43\,m/s$