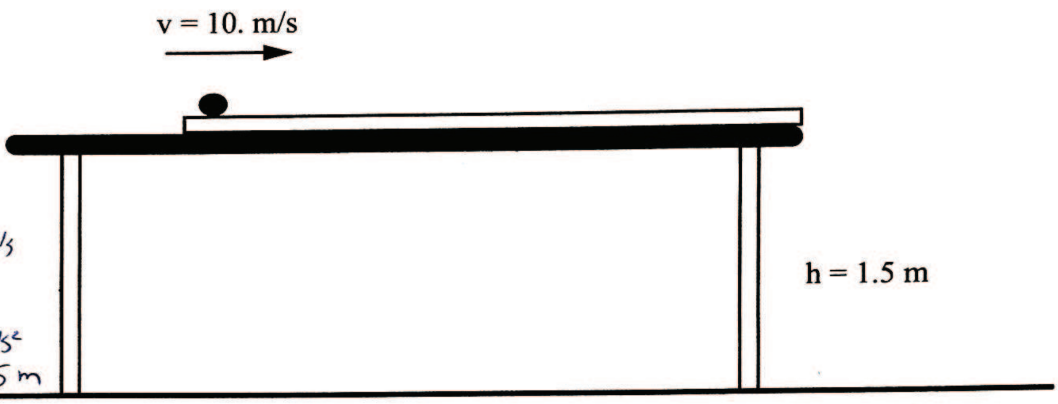
Name Answers!!

Date ________ Pd____

Worksheet 1

1. Given the following situation of a marble in motion on a rail with negligible F_{drag}:



x	y
t:	
$v = 10\,m/s$	$V_i = 0\,m/s$
$\Delta x = ?$	$V_f = ?$
	$a = -10\,m/s^2$
	$\Delta y = -1.5\,m$

Determine the horizontal range of the marble as it falls to the floor. Explain your method for solving this problem.

First find time! using "y" data

$\Delta y = \cancel{V_i t} + \frac{1}{2}at^2$

$\Delta y = \frac{1}{2}at^2$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-1.5m)}{-10\,m/s^2}} = .55s$

use time to find Δx

$\Delta x = V_x t$

$= (10\,m/s)(.55s)$

$= \boxed{5.5\,m}$

2. If the table in part one were 3.0 m high (so we have doubled the height), and sphere was traveling with a velocity of 10 m/s while on the table determine each of the following....

new data table

x	y
t:	
$V_x = 10\,m/s$	$V_i = 0\,m/s$ $\Delta y = -3\,m$
$\Delta x =$	$V_f = ?$
	$a = -10\,m/s^2$

a Determine the horizontal range of the marble as it falls to the floor. Explain your method for solving this problem.

once again, find time!

$\Delta y = \cancel{V_i t} + \frac{1}{2}at^2$

$\Delta y = \frac{1}{2}at^2$

$\frac{2\Delta y}{a} = \frac{at^2}{a}$

$\sqrt{\frac{2\Delta y}{a}} = \sqrt{t^2}$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-3m)}{-10\,m/s^2}} = .775$

use time to find Δx

$\Delta x = V_x t$

$= (10\,m/s)(.775)$

$= \boxed{7.7\,m}$

b. What effect did doubling the height have on range of the marble? What other factors affect the range of the sphere?

doubling the height increased the range of the ball by a factor of $\sqrt{2}$.

an increase in V_x would increase Δx

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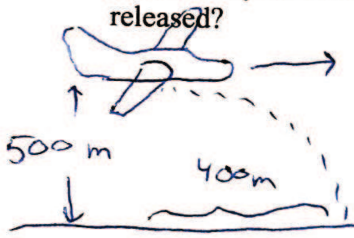
Worksheet 2

In all the problems below, draw a diagram to represent the situation. Identify the knowns and unknowns and label clearly.

Part I - use $g = 10 m/s^2$

1. The movie "The Gods Must Be Crazy" begins with a pilot dropping a bottle out of an airplane. It is recovered by a surprised native below, who thinks it is a message from the gods. If the plane from which the bottle was dropped was flying at a height of 500m, and the bottle lands 400m horizontally from the initial dropping point, how fast was the plane flying when the bottle was released?



$V_x = ?$

x | y

t =

V; $\Delta x = 400m$ | $d = -400m$, $a = -10 m/s^2$, $V_i = 0 m/s$, $V_f = X$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-400m)}{-10 m/s^2}} = \sqrt{100 m^2/s^2} = 10 s$

$V_x = \frac{\Delta x}{t} = \frac{400m}{10s} = \boxed{40 m/s}$

2. Suppose that an airplane flying 60 m/s, at a height of 300m, dropped a sack of flour. How far from the point of release would the sack have traveled when it struck the ground?

$V_x = 60 m/s$

x | y

t =

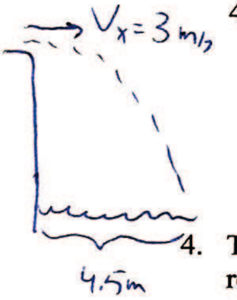
$\Delta x = ?$; $V_x = 60 m/s$ | $V_i = 0$, $V_f = ?$, $\Delta y = -300m$, $a = -10 m/s^2$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-300m)}{-10 m/s^2}}$

$\sqrt{60 s^2} = 7.7 s$

$\Delta x = V_x t = (60 m/s)(7.7 s) = \boxed{464.76 m}$

3. In many locations, old abandoned stone quarries have become filled with water once excavating has been completed. While standing on a quarry wall, a boy tosses a piece of granite into the water below. If he throws the ball horizontally with a velocity of 3.0 m/s, and it strikes the water 4.5 m away, how high above the water is the wall?



x | y

t =

$V = 3 m/s$; $\Delta x = 4.5m$ | $V_i = 0 m/s$, $V_f = 0$, $\Delta y = ?$, $a = -10 m/s^2$

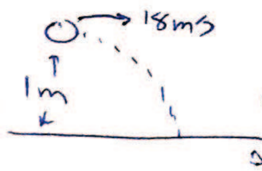
Find time

$t = \frac{\Delta x}{V} = \frac{4.5 m}{3 m/s} = 1.5 s$

$\Delta y = V_i t + \frac{1}{2} a t^2 = \frac{1}{2}(-10 m/s^2)(1.5 s)^2$

+11.25 m Pos. ans ok here

4. Tad drops his bowling ball out the car window 1.0 m above the ground while traveling down the road at 18 m/s. How far, horizontally, from the initial dropping point will the ball hit the ground? If the car continues to travel at the same speed, where will the car be in relation to the ball when it lands?



x | y

t =

$V = 18 m/s$; $\Delta x = ?$ | $V_i = 0 m/s$, $V_f = ?$, $a = -10 m/s^2$, $\Delta y = -1m$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-1m)}{-10 m/s^2}} = .45 s$

$d = V_x t = (18 m/s)(.45 s) = \boxed{8 m}$

ignoring air resistance, the car and ball will have traveled the same horizontal distance

Part II

5. A student finds that it takes 0.20s for a ball to pass through photogates placed 30 cm apart on a level ramp. The end of the ramp is 92 cm above the floor. Where should a coin be placed so that the ball strikes it directly on impact with the ground?

$V_x = d/t = .3/.2s = 1.5 m/s$

x | y
t =
V = 1.5 m/s | Δy = -.92 m
Δx = ? | a = -10 m/s²
V_i = 0 m/s
t = ?

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-.92m)}{-10 m/s^2}} = \sqrt{.184 s^2} = .43s$

$\Delta x = V_x t = (1.5 m/s)(.43s) = \boxed{.645 m}$

6. Suppose now that the same ball, released from the same ramp (92 cm high) struck a coin placed 25 cm from the end of the ramp.
   a) What was the ball's horizontal velocity?
   b) How long did it take for the ball to pass through the photogates? (a)

x | y
t =
V = ? | V_i = 0
Δx = .25 | V_f = ?
a = -10 m/s²
Δy = -.92 m

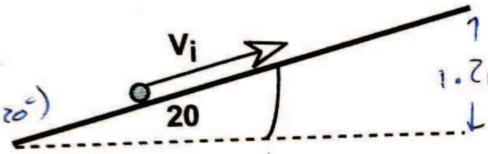
time is the same as #5!! = .43s

so $V_x = \frac{\Delta x}{t} = \frac{.25 m}{.43 s} = \boxed{.58 m/s}$

(b) $t = \frac{\Delta x}{V} = \frac{.3 m}{.58 m/s} = \boxed{.52 s}$

(These next 2 are a little tougher!)

7. Suppose a metal sphere is launched up a ramp with V_i = 1.5 m/s. The end of the ramp is 1.20 m above the floor. Calculate the range of the sphere.



$V_{ix} = V_i \cos\theta = 1.5(\cos 20°) = 1.41 m/s$

$V_{iy} = V_i \sin\theta = 1.5 m/s(\sin 20°) = .51 m/s$

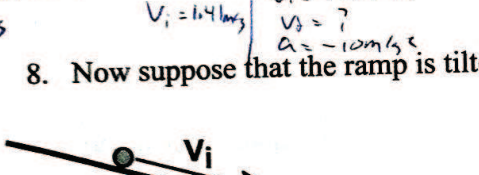
x | y
t =
Δx = ? | Δy = 1.2m
V_i = 1.41 m/s | V_i = +.51 m/s
V_f = ?
a = -10 m/s²

Find t
(you can use $\Delta y = V_i t + \frac{1}{2}at^2$) and then use quadratic
or
find V_{fy} then find t
$V_f^2 = V_i^2 + 2a\Delta y$
$= \sqrt{(.51 m/s)^2 + 2(-10 m/s^2)(-1.2m)}$
$= 4.9 m/s$ (negative)

Find time
$t = \frac{\Delta V}{a} = \frac{V_f - V_i}{a} = \frac{-4.9 m/s - (.51 m/s)}{-10 m/s^2} = .541$

finally, find range
$\Delta x = V_x t = (1.41 m/s)(.541) = \boxed{.76 m}$

8. Now suppose that the ramp is tilted downwards as shown below.



$V_{xi} = V_i \cos\theta = 1.5 m/s \cos 15 = 1.45 m/s$

$V_{yi} = V_i \sin\theta = (1.5 m/s)(\sin 15) = -.39$ (Negative because it's m/s going down ramp)

Suppose that the sphere leaves the ramp at 1.5 m/s. The bottom of the ramp is 0.90 m above the floor. Calculate the range of the sphere.

x | y
t
Δx = ? | Δy = -.9m
V_x = 1.45 m/s | V_i = -.39 m/s
V_f = ?
a = -10 m/s²

$V_f^2 = V_i^2 + 2a\Delta y$
$V_f = \sqrt{(-.39 m/s)^2 + 2(-10)(-.9m)} = \sqrt{18.15 m^2/s^2} = -4.26 m/s$

$t = \frac{\Delta V}{a} = \frac{V_f - V_i}{a} = \frac{-4.26 m/s - (-.39 m/s)}{10 m/s^2} = .47s$

$\Delta x = V_x t = (1.45 m/s)(.47s) = \boxed{.67 m}$