Honors Physical Science – Projectile Motion – Practice Problems

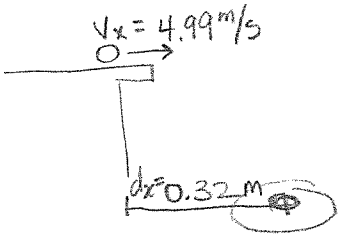
Name:_____ Period:_____

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, Kate rolls a 10g marble down a ramp and off the table with a horizontal velocity of 4.99 m/s. The marble falls on a bullseye 0.32 m from the table's edge. She gets an A.
   A) How high is the table?
   B) What is the vertical velocity (v_y) of the marble?



A) $d_y = ?$

$t = \frac{d_x}{v_x} = \frac{0.32\text{m}}{4.99\text{m/s}} = 0.064128\text{s}$

$d_y = \frac{1}{2} a t^2 = \frac{1}{2}(9.8\text{m/s}^2)(0.064128\text{s})^2$

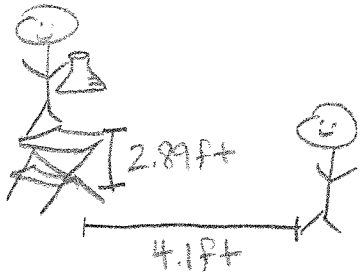
$d_y = 0.020\text{m}$

B) $v_y = at$

$= (9.8\text{m/s}^2)(0.064128\text{s})$

$= 0.63\text{m/s}$

2. David is standing on a step ladder grabbing glassware from the chemistry cabinet. As he takes down the Erlenmeyer flask, he throws it at Sam who is 2.89 feet below at a horizontal distance of 4.1 feet from David.
   A) How fast must David throw the flask horizontally (v_x) in order for them to reach Sam?
   B) What is the vertical velocity (v_y) of the glassware?



Conversions:

$\frac{2.89\text{ft}}{3.28\text{ft}} \left|\frac{1\text{m}}{}\right. = 0.881098\text{m}$

$\frac{4.1\text{ft}}{3.28\text{ft}} \left|\frac{1\text{m}}{}\right. = 1.25\text{m}$

A) $v_x = ?$

$t = ?$

$d_y = \frac{1}{2} a t^2$

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

$= \sqrt{\frac{2(0.881098\text{m})}{9.8}}$

$= 0.42405\text{s}$

$v_x = \frac{d_x}{t} = \frac{1.25\text{m}}{0.42405\text{s}} = 2.95\text{m/s} \approx 3.0\text{m/s}$

B) $v_y = at$

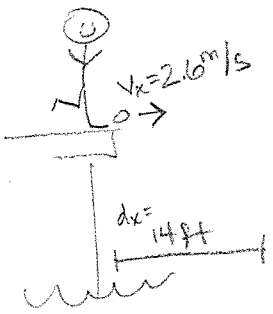
$= (9.8)(0.42405)$

$v_y = 4.2\text{m/s}$

3. Julie stands on the Memorial Bridge in Cleveland kicking stones in the water below. If Julie kicks a stone with horizontal velocity of 2.6 m/s and it lands in the water a horizontal distance of 14 feet from where Julie is standing.

A) What is the height of the bridge?

B) Assuming that we are on Earth, what is the velocity of the stone in the vertical direction?



Conversions

$$14\text{ft}\left|\frac{1\text{m}}{3.28\text{ft}}\right. = 4.268\text{m}$$

A) $d_y = ?$

$t = ?$

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

$$t = \frac{d_x}{v_x} = \frac{4.268}{2.6} = 1.64165\text{s}$$

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

$$= \frac{1}{2}(9.8)(1.64165)^2$$

$$d_y = 13.2 \approx 13\text{m}$$

B) $v_y = at$

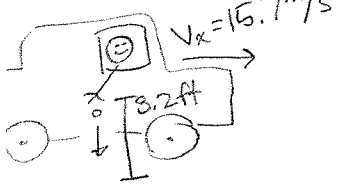
$$= (9.8)(1.64165)$$

$$v_y = 16\text{ m/s}$$

4. Lauren drops a wad of gum out the car window 3.2 feet above the ground while traveling down the road at 15.7 m/s.

A) How far, horizontally, from the initial dropping point will the gum hit the ground?

B) What is the vertical velocity of the gum?



Conversion:

$$3.2\text{ft}\left|\frac{1\text{m}}{3.28\text{ft}}\right. = 0.9756\text{m}$$

A) $d_x = ?$

$t = ?$

$$t = \sqrt{\frac{2d_y}{a}} = \sqrt{\frac{2(0.9756)}{9.8}}$$

$$= 0.4462$$

$$d_x = v_x t$$

$$= (15.7)(0.4462)$$

$$d_x = 7.0\text{m}$$

B) $v_y = at$

$$= (9.8)(0.4462)$$

$$v_y = 4.4\text{ m/s}$$