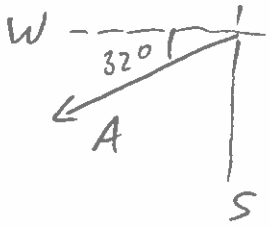
# Physics 10154 - Exam #1C

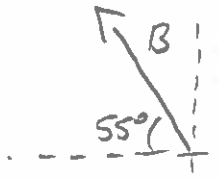
Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. (30 pts) Starting at the origin, a person walks 347 meters in a direction 32.0° South of West, then 565 meters in a direction 55.0° North of West. If the person now wishes to walk in a straight line back to the origin, what must be the magnitude and direction of the displacement?




$A_x = -347 \cos 32^\circ = -294.27$

$A_y = -347 \sin 32^\circ = -183.88$

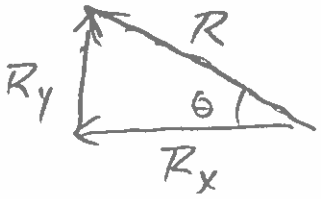



$B_x = -565 \cos 55^\circ = -324.07$

$B_y = 565 \sin 55^\circ = 462.82$

$R_x = -294.27 - 324.07 = -618.34$

$R_y = -183.88 + 462.82 = +278.94$




$|R| = \sqrt{R_x^2 + R_y^2} = 678\ m$

$\theta = \tan^{-1}\left(\frac{|R_y|}{|R_x|}\right) = 24.3^\circ N \text{ of } W$

To return to origin, travel a distance $|\vec{R}|$ in opposite direction.

**678 m, 24.3° S of E**

2. (35 pts) A 5.0-kg ball is dropped from rest. The ball reaches the halfway point between the starting point and the ground in 2.2 seconds.

a) What is the change in kinetic energy during the first half of the ball's motion?
b) What is the change in kinetic energy during the second half of the ball's motion?

a) 1st half

$\Delta y_1 = ?$
$v_{0y} = 0$
$v_y = ?$
$a_y = 9.8\ m/s^2$
$t = 2.2\ s$

$\Delta y_1 = 0 + \frac{1}{2}(9.8)(2.2)^2 = 23.7\ m$

$v_y = 0 + (9.8)(2.2)$

$= 21.56$

$\Delta K = \frac{1}{2}(5)(21.56)^2 - 0 = \boxed{1200\ J}$

b) Total

$\Delta y_t = 47.4$
$v_0 = 0$
$v = ?$
$a = 9.8$
$t = ?$

$\Delta y_{tot} = 2\Delta y_1 = 47.4\ m$

$v^2 = v_0^2 + 2a\Delta y_t$

$v^2 = 0^2 + 2(9.8)(47.4)$

$v = \pm 30.49\ m/s$, use $v = 30.49\ m/s$

$v_0 = v$ from (a) $= 21.56\ m/s$

$\Delta K = \frac{1}{2}(5)(30.49)^2 - \frac{1}{2}(5)(21.56)^2$

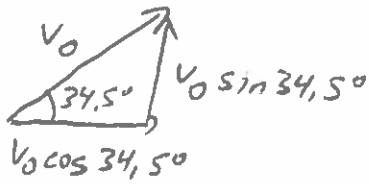
$= \boxed{1200\ J}$

3. (35 pts) A rock is launched toward a vertical brick wall with a speed of 14.0 m/s at an angle of 34.5° above the horizontal. If you want the rock to hit the highest possible point on the wall,

a) How far away from the wall (horizontally) must you launch the rock?

b) What is the speed of the rock when it hits the wall when launched from the place calculated in part (a)?

a) Find $t$ to reach max height, then use that $t$ to find $\Delta x$,




| X | Y |
|---|---|
| $\Delta x = ?$ | $\Delta y = ?$ |
| $V_{0x} = 11,54\ m/s$ | $V_{0y} = 7,93\ m/s$ |
| $V_x = 11,54\ m/s$ | $V_y = 0$ |
| $a_x = 0$ | $a_y = -9,8\ m/s^2$ |
| $t = ?$ | $t = ?$ |

$$0 = 7,93 - 9,8t$$

$$t = 0,809\ s$$

$$\Delta x = (11,54)(,809) = \boxed{9,34\ m}$$

b) At max height, $V_x = 11,54\ m/s$

$V_y = 0$

So $\boxed{V = 11,5\ m/s}$