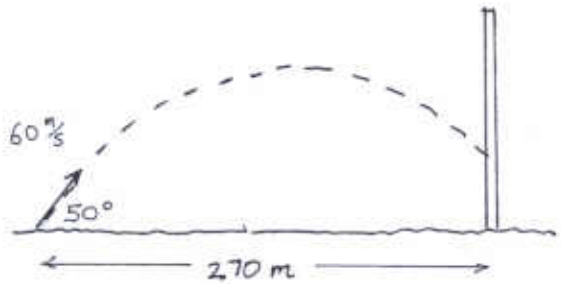
Name_____

Phys 121
Quiz #2



1. A projectile is fired from ground level with an initial speed of $60\frac{m}{s}$ at an angle of 50° above the horizontal toward a vertical wall 270 m from the launch point.

a) What is the $x-$ component of the velocity when the projectile strikes the wall?

v_x does not change since $a_x = 0$

$v_x = v_{ox} = 60\ \frac{m}{s} \cdot \cos 50^\circ = \boxed{38.6\ \frac{m}{s}}$

b) At what time (after launching) does the projectile strike the wall?

When does $x = 270$ m ?

$x = v_{ox} t = (38.6\ \frac{m}{s})\, t$

$270\text{ m} = (38.6\ \frac{m}{s})\, t \qquad t = \frac{270\text{ m}}{38.6\ \frac{m}{s}} = \boxed{7.00\text{ s}}$

c) What is the initial $y-$ component of the projectile's velocity?

$v_{oy} = 60\ \frac{m}{s} \sin 50^\circ = \boxed{46.0\ \frac{m}{s}}$

d) At what height does the projectile strike the wall?

At $t = 7.00$ s,

$y = v_{oy} t + \frac{1}{2} a_y t^2$

$= (46.0\ \frac{m}{s})(7.00\text{ s}) + \frac{1}{2}(-9.8\ \frac{m}{s^2})(7.00\text{ s})^2$

$= \boxed{81.6\text{ m}}$

e) What is the speed of the projectile when it strikes the wall?

At $t = 7.00\,s$,

$v_y = v_{0y} + a_y t$

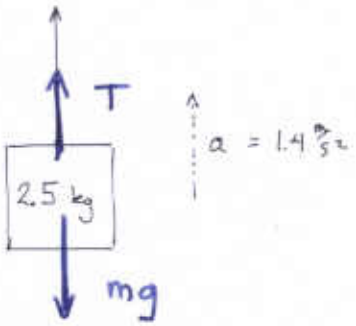
$= 46.0\,\frac{m}{s} + (-9.8\,\frac{m}{s^2})(7.00\,s)$

$= -22.6\,\frac{m}{s}$

and $v_x = 38.6\,\frac{m}{s}$

So $v = \sqrt{(38.6\,\frac{m}{s})^2 + (-22.6\,\frac{m}{s})^2} = \boxed{44.7\,\frac{m}{s}}$

2. A 2.5-kg mass is pulled vertically upward by a string, such that it is given a constant upward acceleration of $1.4\,\frac{m}{s^2}$. What is the tension in the string?



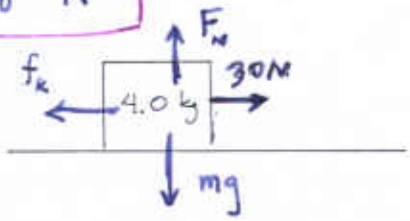
Forces are as shown.

$T - mg = ma$

$T = mg + ma = m(g + a)$

$= (2.5\,kg)(9.8\,\frac{m}{s^2} + 1.4\,\frac{m}{s^2}) = \boxed{28\ N}$

3. A 4.0 − kg mass is dragged over a rough surface with a coefficient of kinetic friction 0.25 by a horizontal force of 30 N what is its acceleration?



Here, $F_N = mg$.

The x-forces give:

$30\,N - f_k = ma$

$30\,N - \mu_k F_N = 30\,N - \mu_k mg = 30\,N - (0.25)(4.0\,kg)(9.8\,\frac{m}{s^2}) = 20.2\,N$

$= ma$

$a = \frac{20.2\,N}{4.0\,kg} = \boxed{5.05\,\frac{m}{s^2}}$

You must show all your work!

$A_x = A\cos\theta \quad A_y = A\sin\theta \quad A = \sqrt{A_x^2 + A_y^2} \quad \theta = \tan^{-1}\frac{A_y}{A_x}$

$v = v_{0x} + a_x t \quad v = v_{0x} + a_x t \quad x = v_{0x}t + \frac{1}{2}a_x t^2 \quad x = v_{0x}t + \frac{1}{2}a_x t^2$

$v_x^2 = v_{0x}^2 + 2a_x x \quad v_x^2 = v_{0x}^2 + 2a_x x \quad v_x^2 = v_{0x}^2 + 2a_x x \quad v_x^2 = v_{0x}^2 + 2a_x x$

$\mathbf{F} = m\mathbf{a} \quad f_s^{max} = \mu_s F_N \quad f_k = \mu_k F_N \quad g = 9.8\,\frac{m}{s^2} \quad \text{Weight} = mg$