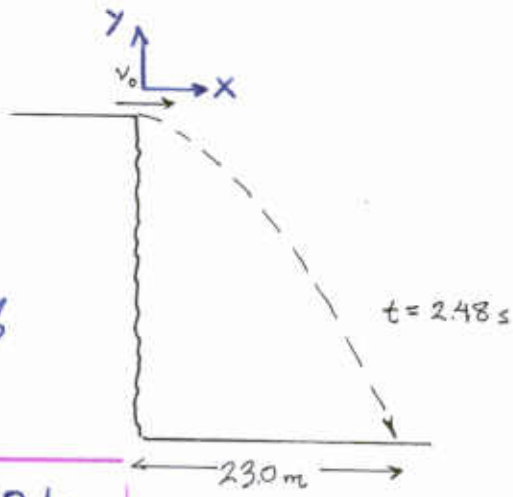
Name_____

Phys 121
Quiz #2



1. A rock is thrown horizontally from the top of a cliff. 2.48 s later it strikes the ground below at a distance of 23.0 m. from the base of the cliff.

a) What is the height of the cliff?

Since $v_{oy} = 0$ at $t = 2.48$ s the y-coord of the rock is

$$y = v_{oy}t + \tfrac{1}{2}a_y t^2 = 0 + \tfrac{1}{2}(-9.8\ m/s^2)(2.48\ s)^2$$

$$= -30.1\ m \rightarrow \text{Height of cliff is } \boxed{30.1\ m.}$$

b) What was the initial speed of the rock?

We don't know v_{ox} but at $t = 2.48$ s, $x = 23.0$ m.

Since $x = v_{ox}t$, then

$a_x = 0$!

$$23.0\ m = v_{ox}(2.48\ s) \rightarrow v_{ox} = 9.27\ m/s$$

since $v_{oy} = 0$, $v_o = v_{ox} = \boxed{9.27\ m/s}$

c) Find the speed of the rock at impact.

Since $a_x = 0$, $v_x = 9.27$ m/s at impact

At $t = 2.48$ s,

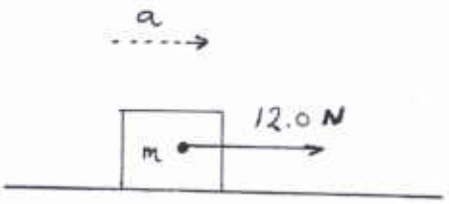
$$v_y = v_{oy} + a_y t = 0 + (-9.8\ m/s^2)(2.48\ s) = -24.3\ m/s$$

and the speed is

$$= \sqrt{v_x^2 + v_y^2} = \sqrt{(9.27\ m/s)^2 + (-24.3\ m/s)^2} = \boxed{26.0\ m/s}$$

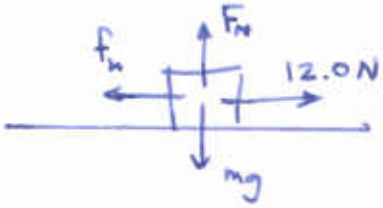
2. A 2.0 kg block is pulled by a horizontal applied force of 12.0 N across a rough horizontal surface. As this occurs, the acceleration of the mass is $3.36 \frac{m}{s^2}$.

Find the coefficent of kinetic friction for the block sliding on this surface.



$a = 3.36 \frac{m}{s^2}$

$m = 2.0$ kg



$\Sigma F_y = 0$ So $F_N = mg$

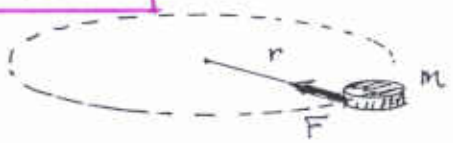
$\Sigma F_x = 12.0\,N - f_k = ma_x$

So $f_k = 12.0\,N - (2.0\,kg)(3.36 \frac{m}{s^2}) = 5.28\,N$

But $f_k = \mu F_N = \mu mg = 5.28\,N$ ✓

So $\mu = \frac{5.28\,N}{mg} = \frac{5.28\,N}{(2.0\,kg)(9.8 \frac{m}{s^2})} =$ **0.269**

3. An 0.65 kg – mass is undergoing uniform circular motion in a circle of radius 0.750 m because of a (net) centripetal force of 14.2 N applied to it.



$F = 14.2$ N

$m = 0.65$ kg

$r = 0.750$ m

a) What is the magnitude and direction of the acceleration of the mass?

$a_{centrip} = \frac{F_{centrip}}{m} = \frac{14.2\,N}{0.65\,kg} =$ **$21.8 \frac{m}{s^2}$**

Accel. always points **toward the center of the circle.**

b) What is the speed of the mass?

$a_{centrip} = \frac{v^2}{r} = 21.8 \frac{m}{s^2}$ $\quad v^2 = (21.8 \frac{m}{s^2})(0.750\,m) = 16.4 \frac{m^2}{s^2}$

$\Rightarrow$ **$v = 4.05 \frac{m}{s}$**

You must show all your work!

$v_x = v_{0x} + a_x t \qquad x = v_{0x} t + \frac{1}{2} a_x t^2 \qquad v_x^2 = v_{0x}^2 + 2a_x x \qquad x = \frac{1}{2}(v_x + v_{0x})t$

$v_y = v_{0y} + a_y t \qquad y = v_{0y} t + \frac{1}{2} a_y t^2 \qquad v_y^2 = v_{0y}^2 + 2a_y y \qquad y = \frac{1}{2}(v_y + v_{0y})t$

$\mathbf{F}_{net} = m\mathbf{a} \qquad F_{grav} = G\frac{m_1 m_2}{r^2} \qquad f_{stat}^{Max} = \mu_s F_N \qquad f_{kin} = \mu_{kin} F_N$

Ignore air resistance on all projectile problems.

$g = 9.8 \frac{m}{s^2} \qquad a_{centrip} = \frac{v^2}{r} \qquad F_{centrip} = \frac{mv^2}{r}$