Physics 101
Written Homework 2

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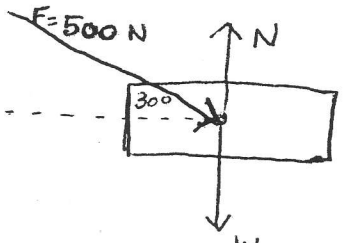
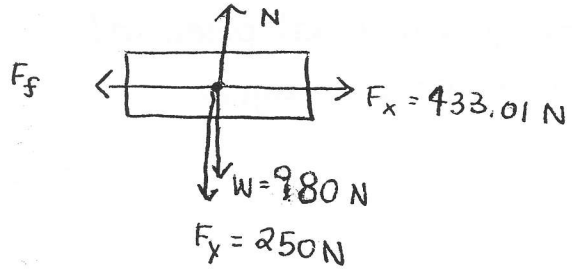


$F_x = 500\cos 30° = 433.01\ N$

$F_y = 500\sin 30° = 250\ N$

$W = mg = (100\,kg)(9.8\,m/s^2) = 980\ N$

b)



a) $\Sigma F_y = 0$ $\quad 0 = N - 980\ N - 250\ N$ $\quad \underline{N = 1230\ N}$

b) see above with $\underline{N = 1230\ N}$

$F_f = \mu_k N = (.2)(1230\ N) = \underline{246\ N}$

filled in

c) $W = Fd = F_x d_x = (433.01\ N)(2\ m) = \underline{866.02\ J}$

d) $W_f = F_f \cdot d = (-246\ N)(2\ m) = \underline{-492\ J}$

e) using the work-energy theorem $W_{total} = \Delta KE$

$(866.02 - 492)\ J = \frac{1}{2} m v_f^2 - \underbrace{0}_{KE_0 = 0 \text{ since } v_0 = 0\ m/s}$

$374.02\ J = \frac{1}{2}(100) v_f^2$

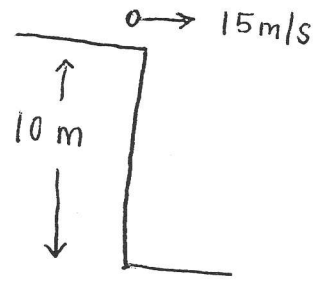
$\underline{v_f = 2.74\ m/s}$

can also use the kinematic equations: $\Sigma F_x = ma_x$ $\quad (433.01 - 246)\ N = (100) a_x$

$a_x = 1.87\ m/s^2$

$v_f^2 = v_0^2 + 2ad$ $\quad v_f = \sqrt{2(1.87)(2)} = 2.74\ m/s$

2)



a) $KE_0 = \frac{1}{2}mv_0^2 = \frac{1}{2}(.2\text{ kg})(15\text{ m/s})^2 = \underline{22.5\text{ J}}$

b) $U_{grav} = mgh = (.2\text{ kg})(9.8\text{ m/s}^2)(10\text{ m}) = \underline{19.6\text{ J}}$

c) when the ball hits the ground, all of its gravitational potential energy is turned into kinetic energy so $KE_f = KE_i + U_{grav}$

$KE_f = 22.5\text{ J} + 19.6\text{ J} = \underline{42.1\text{ J}}$

d) $KE_f = 42.1\text{ J}$

$\frac{1}{2}mv_f^2 = 42.1\text{ J}$

$\frac{1}{2}(.2\text{ kg})v_f^2 = 42.1\text{ J}$

$v_f = 20.52\text{ m/s}$

e) find the time the ball is in the air:

$= v_{oy}t + \frac{1}{2}a_y t^2 \qquad -10 = \frac{1}{2}(-9.8)t^2 \qquad t = 1.429\text{ s}$

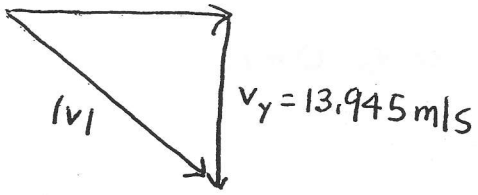
find the final y-velocity: $v_y = v_{oy} + a_y t = (-9.8\text{ m/s}^2)(1.429\text{ s})$

$= -13.945\text{ m/s}$

the final x-velocity is the same as the initial x-velocity

Since $a_x = 0$: $v_x = 15\text{ m/s}$

final velocity:



$|v| = \sqrt{15^2 + 13.945^2}$

$= 20.5\text{ m/s}$

Success!