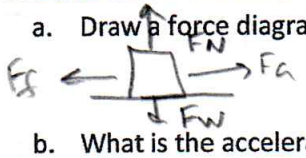
Materials	μ_s	μ_k
Steel on steel	0.74	0.57
Aluminum on steel	0.61	0.47
Copper on steel	0.53	0.36
Rubber on concrete (dry)	1.0	0.8
Rubber on concrete (wet)	0.3	0.25
Wood on wood	0.25-0.5	0.2
Glass on glass	0.94	0.4
Teflon on Teflon	0.04	0.04
Teflon on steel	0.04	0.04
Waxed wood on wet snow	0.14	0.1
Waxed wood on dry snow	0.10	0.04
Metal on metal (lubricated)	0.15	0.06
Ice on ice	0.1	0.03
Synovial joints in humans	0.01	0.003
Very rough surfaces		1.5

1. A copper block with a mass of of 82kg is pulled along a steel floor for a distance of 91.44m. The force exerted on the cable is 600. N. The block is then released and allowed to slide.

   a. Draw a force diagram on the block before and after the cable is released



   b. What is the acceleration of the metal block?

$F_f = 82 \cdot 10 \cdot (.36) = 295\ N$

$a = \frac{\Sigma F}{m} = \frac{F_a - F_f}{m} \quad \frac{600-295}{82} = 3.7\ m/s^2$

   c. What is the amount of work done by the cable?

$600 \cdot 91.44m = 54864J$

   d. What is the work done by friction?

$TE = m \cdot g \cdot u \cdot d \quad 82 \cdot 10 \cdot .36 \cdot 91.44 = 26993J$

   e. What is the blocks speed at the 91.44m mark?

$E - TE = \_\_\_\_$

$54864 - 26993 = 27870 = \frac{1}{2}mv^2 \quad v = 26m/s$

   f. What is the power output of the cable at the 91.44m mark?

$\text{Energy/time} = \frac{54864}{7.0} = 7837W$

   g. How far will the block slide

$KE = TE$ ← solve

$27870 = m \cdot g \cdot u \cdot d$

$82 \cdot 10 \cdot .36 \cdot d \quad d = 94m$

→ Need time

$X_f = X_i + V_i t + \frac{1}{2}at^2$

$91.44 = 0 + 0 + \frac{1}{2}(3.7)t^2$

$t = 7.0\ sec$

2. A rubber block with a mass of 90kg is being dragged 50m by a rope across a concrete floor. The rope is pulling the box with 750N at an angle of 25 degrees with the horizontal.

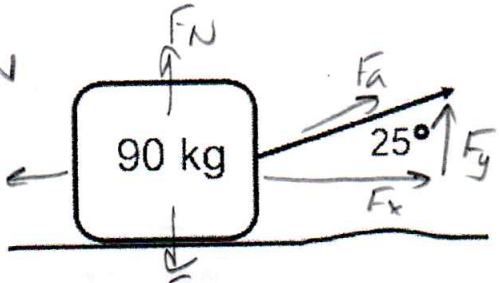
a. Draw a force diagram on the block before and after the cable is released

F_f; $F_N + F_y = F_g$

$F_N = F_g - F_y = 900N - 316N = 583N$

$583 \cdot .8$

$F_N \cdot \mu = 466N$



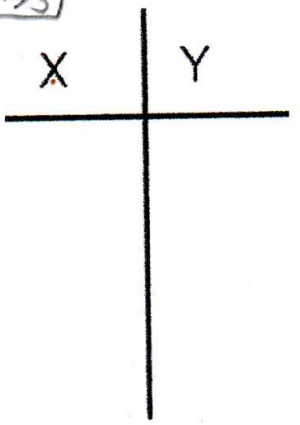
b. Determine the force components in the X and Y direction.

X $\cos 25 \cdot 750 = 679\ N$

Y $\sin 25 \cdot 750 = 316N$

c. What is the acceleration of the metal block?

$a = \frac{\Sigma F}{m} = \frac{F_a - F_f}{m}$ $\frac{679N - 466N}{90} = 2.36 m/s$



d. What is the amount of work done by the cable? on the Box

$679 \cdot 50 = 33950J$

e. What is the work done by friction?

$F_N \cdot \mu \cdot d$

$466 \cdot .8 \cdot 50 = 18640$

f. What is the blocks speed at the 91.44m mark?

$33950 - 18640 = 15310J = \frac{1}{2} m v^2$ $= \frac{90 \cdot v^2}{2}$ $v = 18.4 m/s$

g. What is the power output of the cable at the 91.44m mark?

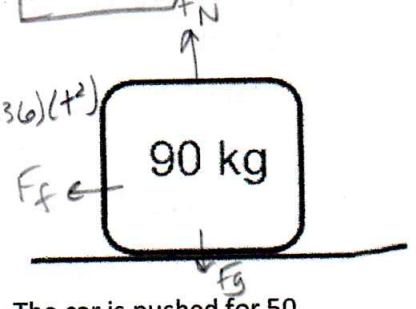
total $\frac{\text{Energy}}{\text{time}} = \frac{18640}{6.5}$

$X_f = X_i + v_i t + \frac{1}{2} a t^2$

$50 = 0 + 0 + \frac{1}{2}(2.36)(t^2)$

$t = 6.5 sec$

$2867W$



h. How far will the block slide

KE → TE

$15310 = mgud$ $\frac{15310}{90 \cdot 10 \cdot 0.8} = 21.2m$

3. A car is pushed through a school parking lot with a force 100Newtons. The car is pushed for 50 meters. The Uk is 0.02 for tires and pavement. The force is causing an acceleration of $0.03 m/s^2$.

$\Sigma F = ma$ $ma = \Sigma F = F_a - F_f = ma$

a. What is the mass of the car?

$m = \frac{100}{.03 + (10 \cdot .02)} = 434 kg$

$F_a - mg\mu = ma$ "solve for m"

$F_a = m_c a_c + m_c g \mu$

$F_a = m_c (a_c + g\mu)$

$m_c = \frac{F_a}{(a_c + g\mu)}$

b. How fast is the car moving at 50m?

Use energy if you want

$X_f = X_i + v_i t + \frac{1}{2} a t^2$

$50 = 0 + 0 + \frac{1}{2}(.03) t^2$

$t = 57 sec$

$v_s = v_i + at$

$= 0 + .03 \cdot 57$

$1.7 m/s$

c. How far will the car roll after it stops being pushed?

KE = TE

$\frac{1}{2} m v^2 = mgud$ $\frac{v^2}{2g\mu} = d = 7.2m$