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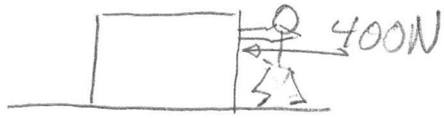
Dr. Bob

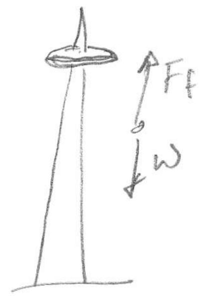
1. a)



The block doesn't move so the friction force must balance the pushing force

$F_f = 400N$ to the right

b)



Since the velocity is constant, the forces must balance each other.

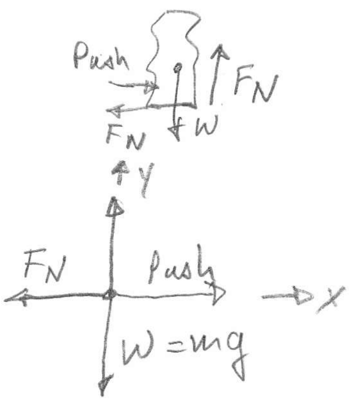
$W = mg = (2.35 \times 10^{-3} kg)(9.8 m/s^2)$

$m = 2.35 \times 10^{-3} kg$

$W = 0.0230 N$ downwards

$F_f = 0.0230$ upwards.

2. $F_{f\,max} = \mu_s F_N$



Since the object isn't moving, the forces must balance in the horizontal (x) direction & separately in the vertical direction.

$F_N + W = 0$

$F_N - mg = 0 \qquad F_N = mg$

$F_f = \mu_s F_N$

a) $m = 0.345 kg \qquad \mu_s = 0.5$

$F_N = (0.345 kg)(9.8 m/s^2) = 3.381 N$

$F_{f\,max} = \mu_s F_N = (0.5)(3.381N)$

$F_f = 1.69 N$

2(cont'd).

b) $m = 125\,kg$ $\mu_s = 1.0$

$F_N = (125\,kg)(9.8\,m/s^2) = 1,225\,N$

$F_f = \mu_s F_N = (1.0)(1,225\,N)$

$$\boxed{F_{f\,max} = 1225\,N}$$

c) $m = 8 \times 10^{-4}\,kg$ $\mu_s = 0.41$ (assume steel on steel)

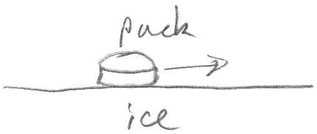
$F_N = (8 \times 10^{-4}\,kg)(9.8\,m/s^2) = 7.84 \times 10^{-3}\,N$

$F_{f\,max} = \mu_s F_N = (0.41)(7.84 \times 10^{-3}\,N)$

$$\boxed{F_{f\,max} = 3.21 \times 10^{-3}\,N}$$

3. The normal force presses the surfaces together causing the variations in the surfaces interlock. The harder they are pressed together (greater normal force) the harder it is to move the objects.

4.



$m = 0.160\,kg$ $\mu_s = 0.006$ $\mu_k = 0.005$

$F_N = (0.160\,kg)(9.8\,m/s^2) = 1.568\,N$

a) $F_f = (1.568\,N)(0.005)$

$F_{fk} = 7.84 \times 10^{-3}\,N$

b) $F_{f\,max} = (1.568\,N)(0.006)$

$$\boxed{F_{f\,max} = 9.41 \times 10^{-3}\,N}$$

5.

$m = 1200 kg$ $\mu_s = 0.006$ $\mu_k = 0.005$

$F_N = (1200 kg)(9.8 m/s^2) = 11,760 N$

Start moving

$F_f = \mu_s F_N = (0.006)(11,760 N)$

$$\boxed{F_f = 70.6 N}$$

Keep moving

$F_f = (0.005)(11,760 N)$

$$\boxed{F_f = 58.8 N}$$

6.

$M = 415 kg$ $\mu_s = 0.7$

$F_N = (415 kg)(9.8 N) = 4,067 N$

$F_f = (0.7)(4,067 N) = 2,847 N$

So the max force generated in the pull was 2,847 N

Now, on a dry surface, this pull could move what mass?

$F_f = \mu_s F_N = \mu_s m g$ $\mu_s = 1.0$

$$m = \frac{F_f}{\mu_s g} = \frac{2847 N}{(1.0)(9.8 m/s^2)} = 291 kg$$

$$\boxed{m = 291 kg}$$