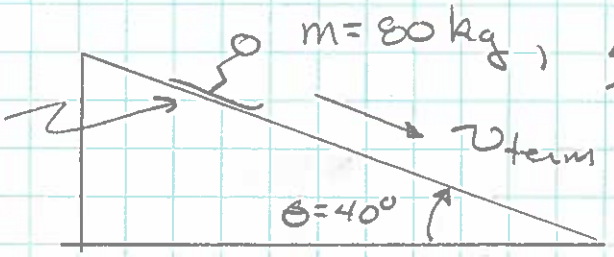
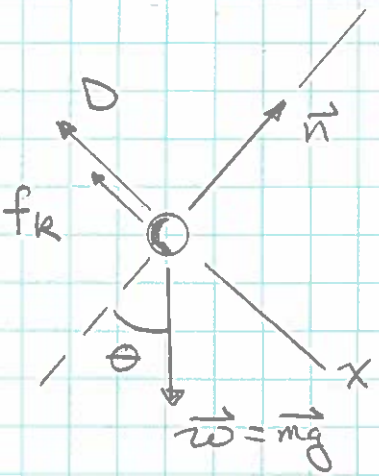
kinetic friction
$\mu_k = 0.06$
(wood on snow)



FBD

a.)



$\Sigma F_y = n - mg\cos\theta = ma_y = 0 \Rightarrow n = mg\cos\theta$

$\Sigma F_x = mg\sin\theta - f_k - D = ma_x = 0$; $a_x = 0$ for $v = v_{terminal}$ = const.

Now:

$f_k = \mu_k n = \mu_k mg\cos\theta$

$D = \frac{1}{2} C \rho A v^2$ C = Drag coeff., ρ = air density, A = area

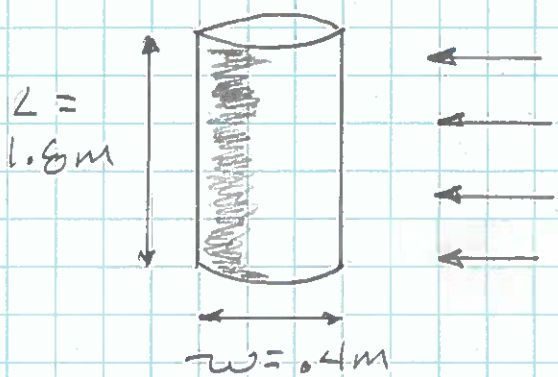
So:

$$mg\sin\theta - \mu_k mg\cos\theta - \frac{1}{2} C\rho A v^2 = 0$$

$$\therefore v = v_{term} = \left\{ \frac{2mg(\sin\theta - \mu_k\cos\theta)}{C\rho A} \right\}^{1/2}$$

Air density, $\rho = 1.2 \frac{kg}{m^2}$; $\mu_k = 0.06$

Case b: Standing up:



$A = Lw = 0.72\ m^2$

and the drag coeff is

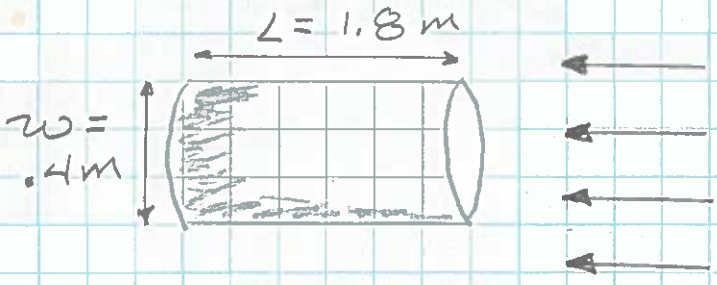
$C \approx 1.1$

So:

$$v_{term} = \left\{ \frac{2mg(\sin\theta - \mu_k \cos\theta)}{C\rho A} \right\}^{1/2}$$

$$= \underline{31.38\ m/s} \quad (70.3\ mph)$$

Case c: Tuck:



$A = \pi\left(\frac{w}{2}\right)^2 = 0.1257\ m^2$

and,

$C \approx 0.8$

So:

$$v_{term} = \left\{ \frac{2mg(\sin\theta - \mu_k \cos\theta)}{C\rho A} \right\}^{1/2}$$

$$= \underline{88.06\ \frac{m}{s}} \quad (197.2\ mph)$$