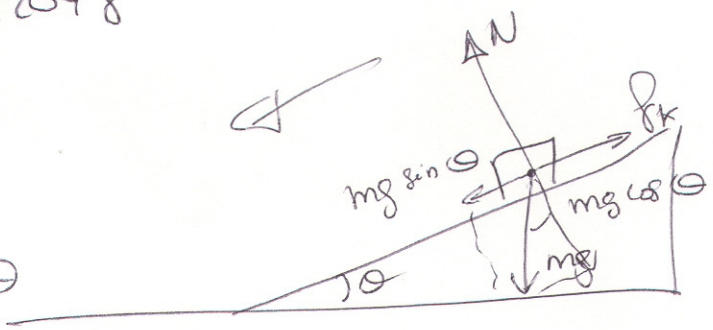
MIDTERM 2 — PH4204 8

1 $m = 0.2\ kg$

$\mu_k = 0.2$



$f_k = \mu_k \cdot N = \mu_k\, mg\cos\theta$

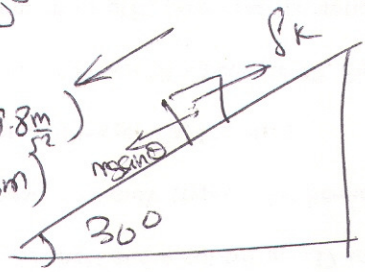
(a) $\sum_i F_i = ma = mg\sin\theta_{min} - f_k$

$0 = mg\sin\theta - \mu_k\, mg\cos\theta$

$\sin\theta = \mu_k \cdot \cos\theta \Rightarrow \tan\theta = \mu_k = 0.2 \rightarrow \boxed{\theta_{min} = 11.3°}$

(b) $W_{f_k} = \vec{f}_k \cdot \vec{d} = f_k \cdot d\cos 180°$

$W_{f_k} = -\mu_k\, mg\cos\theta\, d = -(0.2)(0.2)\left(9.8\frac{m}{s^2}\right) \cdot \cos 30° \cdot (3m)$

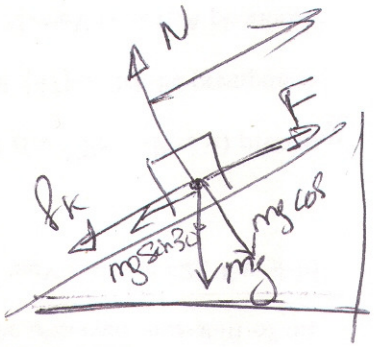


$\boxed{W_{f_k} = -1.02\ J}$ *

(c) $W_{mg} = +mg\sin\theta \cdot d = \boxed{2.94\ J}$

(d) $F - f_k = m \cdot a$

$F - \mu_k\, mg\cos 30° = mg\sin 30° = m \cdot 0$ (V = cte)

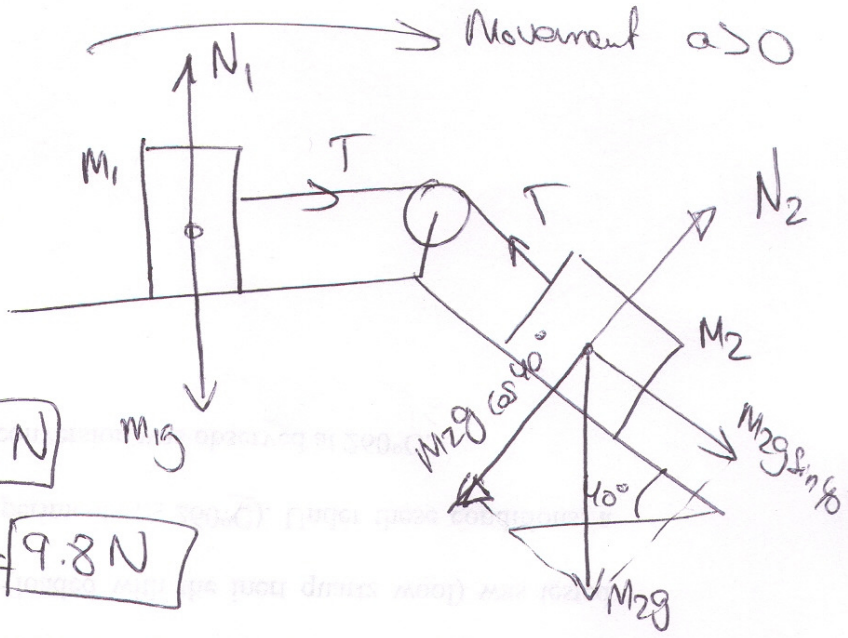


$F = \mu_k\, mg\cos 30° + mg\sin 30° = \boxed{1.32\ N}$

(2) $M_2 = 4kg$

$M_1 = 1kg$

No friction



(a)

(1) $T = M_1 \cdot a = 1kg \cdot a = \boxed{5N}$

$N_1 = m_1 g = (1kg)(9.8 \frac{m}{s^2}) = \boxed{9.8N}$

(2) $M_2 g \sin 40° - T = m_2 a$

$N_2 = m_2 g \cos 40° = (4kg)(9.8 m/s^2)\cos 40° = \boxed{30\ N}$

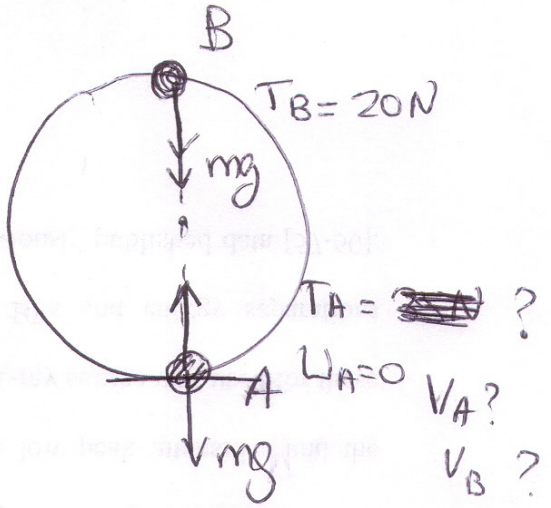
$T = a$ (1)

$+ \quad 25.2 - T = 4a$ (2)

$25.2 = 5a \rightarrow \boxed{a = 5\ m/s^2}$

(3) $m = 1.5\ kg$

$R = 2m$



$$F_c = m\frac{V_B^2}{R} = T_B + mg \quad (1)$$

$$F_c = m\frac{V_A^2}{R} = T_A - mg \quad (2)$$

(1) $0.75\,V_B^2 = 20 + 14.7 = 34.7 \rightarrow V_B = \sqrt{\frac{34.7}{0.75}} = 6.8\frac{m}{s}$

(2) $0.75\,V_A^2 = T_A - 14.7$

(3) $\Delta E = 0 = \Delta K + \Delta U = K_B - K_A + U_B - U_A$

$$0 = \frac{1}{2}m(V_B^2 - V_A^2) + mg2R$$

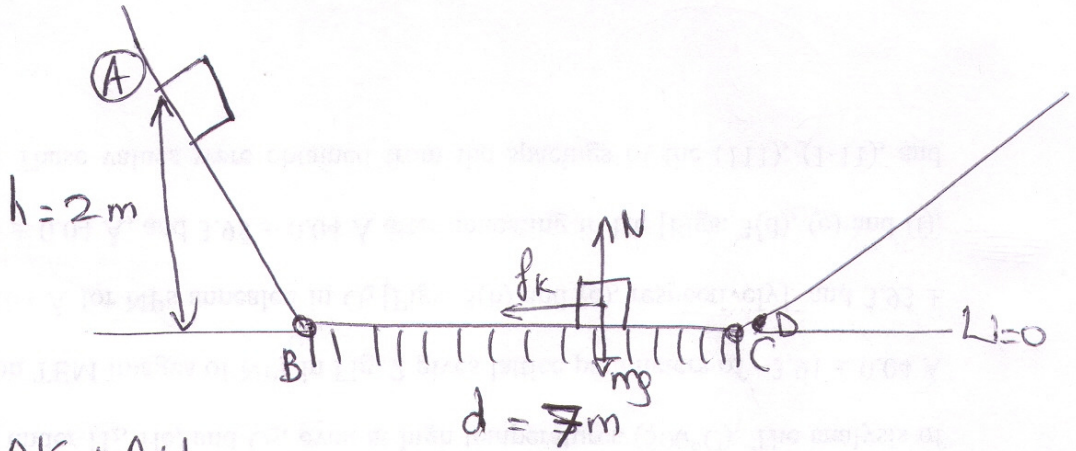
(3) $0 = 0.75\,V_B^2 - 0.75\,V_A^2 + 58.8 \rightarrow 0 = 93.5 - 0.75\,V_A^2$

$$V_A = \sqrt{\frac{93.5}{0.75}}$$

(2) $0.75\,V_A^2 = T_A - 14.7$

(2) $T_A = 14.7 + 0.75V_A^2 = 14.7 + 0.75(11.16)^2 = 108.2N = 11.16\,m/s$

(4) $\mu_K = 0.4$



V_B ?

(a) $\Delta E = 0 = \Delta K + \Delta U_g$

A-B $\quad 0 = K_B - K_A + U_B - U_A \Rightarrow K_B = U_A$

$\frac{1}{2} m v_B^2 = mgh \Rightarrow v_B = \sqrt{2gh} = \boxed{6.26\ m/s}$

(b) Does block reach C ? NO (L)

Let's assume YES ⇒ See how far the block can travel on region with friction. If $L > d$ ⇒ yes, block reach C

$\Delta E = 0 = \Delta K + \Delta U_g + \Delta E_{th}$ $\quad \mu_K \cdot N$

$0 = K_D - K_B + U_D - U_B + f_K \cdot L \Rightarrow K_B = f_K \cdot L = \mu_K \cdot mg\, L$

$\frac{K_B}{m} = \frac{1}{2} v_B^2 = \mu_K g L \Rightarrow 19.59 = 3.92\, L \Rightarrow L \approx 5m$

Max distance the block can travel ⇒ Block does not make it to C