PP/489

28.

$m_1 = 725\,g$

$m_2 = 595\,g$

$\mu_s = 0.47$

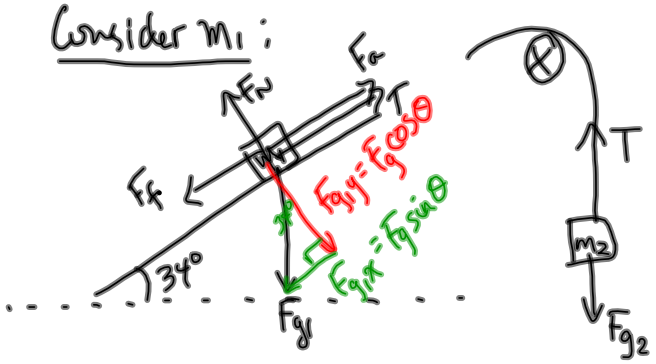
$\mu_k = 0.12$

$\theta = 34^\circ$

a) $F_a$ to start moving uphill

b) $a = ?$

c) $T = ?$




At the instant $m_1$ starts to move:

$$F_a + T = F_f + F_{g1x}$$

$T = F_{g_2}$ at instant system starts to move

$$F_a + F_{g_2} = F_f + F_{g1x}$$

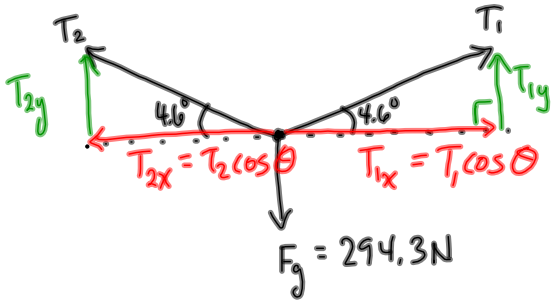
$$F_a = F_f + F_{g1x} - F_{g_2}$$

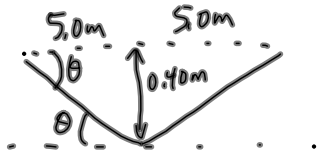
$$F_a = \mu F_N + F_g\sin\theta - m_2 g$$

$$F_a = \mu F_g\cos\theta + F_g\sin\theta - m_2 g$$

# Static Equilibrium in Small + Static Friction

**Example** A clothesline is attached to high poles 10.0m apart. A pulley, allowed to roll freely on the line, has a 30kg mass hanging from it. Find the tension in each half of the clothesline if the "sag" at its centre is 0.40m




$\tan\theta = \frac{0.40m}{5.0m}$

$\theta = 4.6°$

If this is in static equilibrium, there is no motion ant $\vec{F}_{net} = 0$

**Horizontally:**

$T_{1x} = T_{2x}$

$T_1\cos 4.6° = T_2\cos 4.6°$

$T_1 = T_2$ ← 2 eqn 2 unk.

* $T_1 = T_2$ ONLY because of the symmetry

**Vertically:**

$T_{1y} + T_{2y} = F_g$

$T_1\sin 4.6° + T_2\sin 4.6° = 294.3N$

$T_2\sin 4.6° + T_2\sin 4.6° = 294.3N$

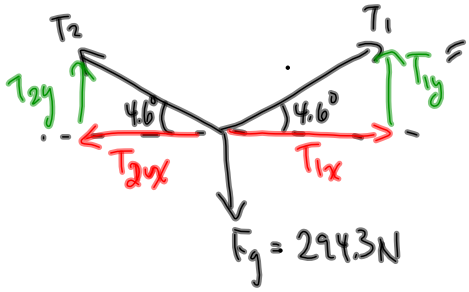
$2T_2\sin 4.6° = 294.3N$

$T_2 = \frac{294.3N}{2(\sin 4.6°)}$

$T_2 = 1.8\times10^3 N$

$\therefore T_1 = 1.8\times10^3 N$

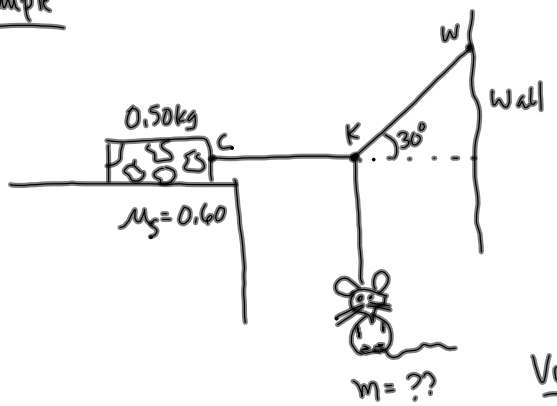
**A Shortcut:**



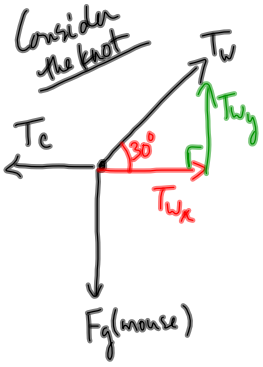

Because of the symmetry we know that

$T_{1y} = \frac{1}{2}(294.3N)$

Example




Consider the knot



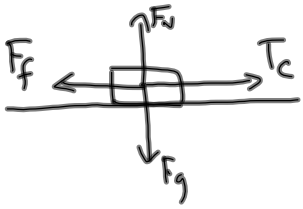

Vertically:

$F_g(mouse) = T_{Wy}$

Horizontally

$T_C = T_{Wx}$

Consider the cheese:




$T_C = F_f$

$T_C = \mu_s F_N$

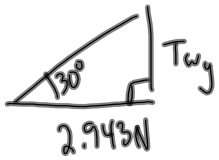
$T_C = \mu_s mg$

$T_C = 0.60(0.50kg)(9.81m/s^2)$

$T_C = 2.943N$

$T_{Wx} = T_C$

$\therefore T_{Wx} = 2.943N$




$\tan 30° = \frac{T_{Wy}}{2.943N}$

$T_{Wy} = 1.699N$

$\therefore F_g(mouse) = 1.699N$

$m(9.81m/s^2) = 1.699N$

$m = 0.17\ kg$

or 170 g mouse.

TO DO: ① FOP PP | Static Eq in Small Objects

② FOP PP | Static Friction.

HW for Monday

③ Monday: FOP | Review | 12 – 23

$\vec{F}_{net} = 0$