SI Workshop Problems #4: Forces in Equilibrium

Be Aware! How many objects are in the problem? How many Force Analysis need to be done?

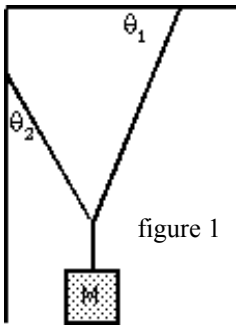

figure 1

1. Find the tensions in the two strings in figure 1 if the mass is 10 kg and the angles are:

a. $\theta_1 = 60°$; $\theta_2 = 60°$

b. $\theta_1 = 53°$; $\theta_2 = 45°$ [$T_1 = 69.9N$; $T_2 = 79.0N$]

c. $\theta_1 = 45°$; $\theta_2 = 60°$ [$T_1 = 88.0N$; $T_2 = 71.7N$]

2. For figure 2, find the tensions in the three strings and one of the two masses if:

a. $\theta_1 = 60°$, $\theta_2 = 37°$, $M_1 = 5$ kg, $M_2 = ?$

b. $\theta_1 = 53°$, $\theta_2 = 45°$, $M_1 = ?$, $M_2 = 5$ kg

[$T_1 = 61.1N$; $T_2 = 48.9N$; $T_3 = 69.1N$, $M_1 = 3.7kg$]

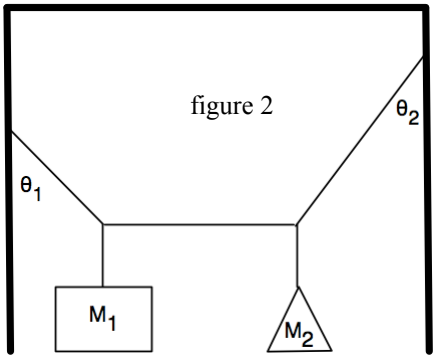

figure 2

3. If the three blocks shown in figure 3 are moving at constant speed and the coefficient of kinetic friction is 0.3, what are the tensions in the strings? (the masses shown are in kilograms).

[$T_3 = 14.7N$; $T_2 = 44.1N$; $T_1 = 73.5N$]

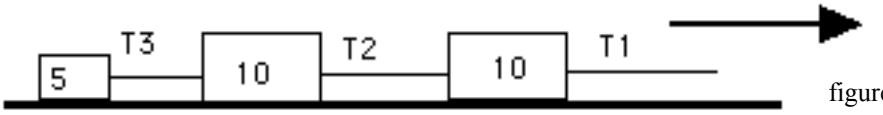

figure 3

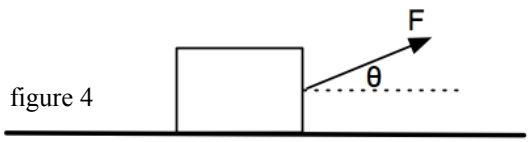

figure 4

4. For figure 4, solve for F if the block is moving at constant velocity, M = 10 kg, $\theta = 30°$, and $\mu_k = 0.2$. [F = 20.3N]

5. For figure 4, solve for μ if the block is moving at constant velocity, M = 10 kg, $\theta = 37°$, and F = 6 N. [$\mu = 0.051$]

6. For figure 4, solve for M if the block is moving at constant velocity, F = 8 N, $\theta = 45°$, and $\mu_k = 0.25$.

[M=2.88 kg]

7. If $W_A = 15$ lb and $W_B = 6$ lb, as shown in figure 5, what is the coefficient of kinetic friction that will allow block B to move down at constant velocity? [$\mu = 0.20$]

8. For figure 5, if $M_A = 15$ kg and $\mu_k = 0.35$, what is W_B that will allow block B to move down at constant velocity? [$W_B = 51.4N$]

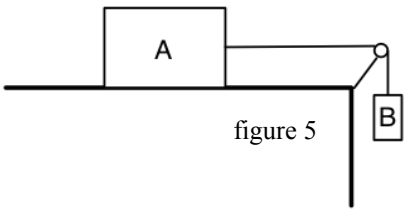

figure 5

9. For figure 5, if $M_B = 10$ kg. and $\mu_k = 0.45$, what is M_A that will allow block B to move down at constant velocity? [$M_A = 22.2$Kg]

10. In figure 6, how much must block A weigh if it slides down the incline and pulls the 5 lb block B <u>up</u> at constant speed?

($\mu_k = 0.5$ and $\theta = 37°$)

[$W_A = 25.0$ lb]

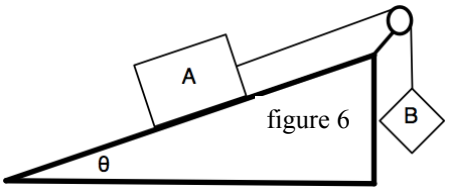

figure 6