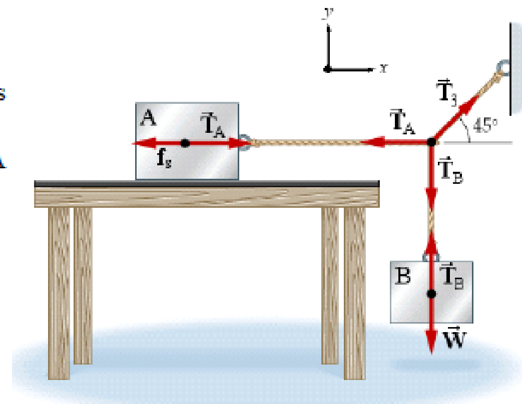
81. **Picture the Problem**: The force vectors acting on blocks A and B as well as the rope knot are shown in the diagram at right.



Strategy: Write Newton's Second Law for blocks A and B, as well as Newton's Second Law for the rope knot. In all cases the acceleration is zero. Combine the equations to solve for $\vec{f}_s$, which acts on block A and points toward the left. Let the x direction point to the right for block A and down for block B.

Solution: 1. (a) Write Newton's Second Law for block A:

$$\sum_{\text{Block A}} F_x = -f_s + T_A = 0$$

2. Write Newton's Second Law for block B:

$$\sum_{\text{Block B}} F_x = -T_B + m_B g = 0$$

3. Write Newton's Second Law for the rope knot:

$$\sum_{\text{knot}} F_x = -T_A + T_3 \cos 45° = 0$$

$$\sum_{\text{knot}} F_y = -T_B + T_3 \sin 45° = 0$$

4. Divide the y equation for the knot by the x equation:

$$\frac{T_3 \sin 45°}{T_3 \cos 45°} = \tan 45° = 1 = \frac{T_B}{T_A}$$

5. Substitute $T_A = T_B$ into the equation from step 2:

$$T_A = m_B g$$

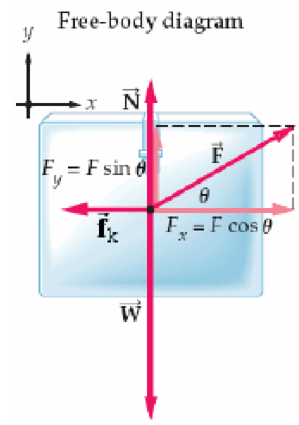
6. Substitute the result into the equation from step 1:

$$f_s = T_A = m_B g = (2.33 \text{ kg})(9.81 \text{ m/s}^2) = 22.9 \text{ N} = \boxed{23 \text{ N}}$$

7. (b) As long as mass A is heavy enough that $f_{s,\max} = \mu_s m_A g = (0.320)(8.82 \text{ kg})(9.81 \text{ m/s}^2) = 27.7 \text{ N} \geq 22.9 \text{ N}$, the friction force is not affected by changes in mass A. It will stay the same if the mass of block A is doubled.

Insight: The minimum mass of block A that will satisfy the criteria of step (b) is 7.29 kg. The answer to (a) is reported with only two significant figures because the angle 45° is only given to two significant figures.

90. **Picture the Problem**: The free-body diagram of the suitcase is depicted at right.



Strategy: Write Newton's Second Law in the vertical and horizontal directions. Because the velocity of the suitcase is constant, the acceleration is zero everywhere. This will produce two equations with two unknowns, the normal force and the strap tension. Use algebraic substitution to solve the two equations for the unknown variables.

Solution: 1. (a) Write Newton's Second Law in the vertical direction and determine the normal force on the suitcase:

$$\sum F_y = N + F\sin\theta - W = 0$$
$$N = mg - F\sin\theta$$

2. Write Newton's Second Law in the horizontal direction and solve for the strap force F:

$$\sum F_x = F\cos\theta - \mu_k N = 0$$
$$F = \frac{\mu_k N}{\cos\theta}$$

3. Substitute the expression for F into the equation from step 1:

$$N = mg - \left(\frac{\mu_k N}{\cos\theta}\right)\sin\theta$$
$$N(1 + \mu_k \tan\theta) = mg$$
$$N = \frac{mg}{1+\mu_k\tan\theta} = \frac{(18\text{ kg})(9.81\text{ m/s}^2)}{1+(0.38)\tan 45°}$$
$$= 128\text{ N} = \boxed{0.13\text{ kN}}$$

4. (b) Substitute the normal force into the expression for F from step 2:

$$F = \frac{\mu_k N}{\cos\theta} = \frac{(0.38)(128\text{ N})}{\cos 45°} = \boxed{69\text{ N}}$$

Insight: We bent the rules for significant figures slightly in step 4 in order to avoid rounding error. A larger coefficient of friction (say $\mu_k = 0.50$) would require a smaller N (118 N) but a larger F (83 N). The normal force is smaller because the larger F is pulling upward on the suitcase, supporting more of the weight than before.