

# Frictional Forces

1)  $m = 16 \text{ kg}$

$a = g = -9.8 \text{ m/s}^2$

$F_g = ma = 156.8 \text{ N} = F_N$

$F_f = \mu_k \cdot F_N = 56.5 \text{ N}$

$\Sigma f = 0 \text{ N}$      $F_{\text{pull}} = 56.5 \text{ N}$

2)  $\Sigma f_1 = 0 \text{ N}$      $m = 16 \text{ kg}$      $a = 9.8 \text{ m/s}^2$      $\theta = 25^\circ$

$F_{g1} = F_g \sin \theta = 66.27 \text{ N} = F_f$      $F_N = F_g \cos \theta = 142 \text{ N}$   
 $\mu = 0.47$

3)  $m = 23 \text{ kg}$      $\mu_s = 0.24$      $\mu_k = 0.15$      $a = -9.8 \text{ m/s}^2$

a)  $F_{\text{pull}} = F_N \cdot \mu_s \cdot a = 23 \text{ kg} \cdot 0.24 \cdot 9.8 \text{ m/s}^2 = 54.1 \text{ N}$

b)  $F_{\text{push}} = F_N \cdot \mu_k \cdot a = 23 \text{ kg} \cdot 0.15 \cdot 9.8 \text{ m/s}^2 = 33.8 \text{ N}$

4)  $F_t = 250 \text{ N}$      $m = 35 \text{ kg}$      $\mu_k = 0.42$      $F_t = 250 \text{ N}$

$F_N = mg = 35 \text{ kg} \cdot 9.8 \text{ m/s}^2 = 343 \text{ N}$

$F_f = F_N \cdot \mu_k = 144 \text{ N}$

$\Sigma F_x = 250 \text{ N} - 144 \text{ N} = 106$

$a = \frac{\Sigma F_x}{m} = 3.03 \text{ m/s}^2$

5)  $m = 40 \text{ kg}$      $\theta = 40^\circ$      $\mu_k = 0.22$

$F_g = 40 \text{ kg} \cdot 9.8 \text{ m/s}^2 = 392 \text{ N}$

$F_f = F_N \cdot \mu_k = 66 \text{ N}$

$F_{s1} = F_g \sin \theta = 252 \text{ N}$

$F_{s2} = F_N = F_g \cos \theta = 300 \text{ N}$

$\Sigma F_1 = 252 \text{ N} - 66 \text{ N} = 186 \text{ N}$

$a_1 = \frac{\Sigma F_1}{m} = \frac{186 \text{ N}}{40 \text{ kg}} = 4.65 \text{ m/s}^2$

6)  $m = 25 \text{ kg}$      $F_{\text{pull}} = 100 \text{ N}$      $\theta = 20^\circ$      $\mu_k = 0.37$

$F_g = 25 \text{ kg} \cdot 9.8 \text{ m/s}^2 = 245 \text{ N}$

$F_{\text{pull}x} = F_{\text{pull}} \cdot \cos \theta = 100 \text{ N} \cdot \cos 20^\circ = 94 \text{ N}$

$F_{\text{pull}y} = F_{\text{pull}} \cdot \sin \theta = 100 \text{ N} \cdot \sin 20^\circ = 34.2 \text{ N}$

$F_N = F_g - F_{\text{pull}y} = 210.8 \text{ N}$

$F_f = F_N \cdot \mu_k = 78 \text{ N}$

$\Sigma f_x = F_{\text{pull}x} - F_f = 16 \text{ N}$

$a_x = \frac{\Sigma F_x}{m} = 0.64 \text{ m/s}^2$