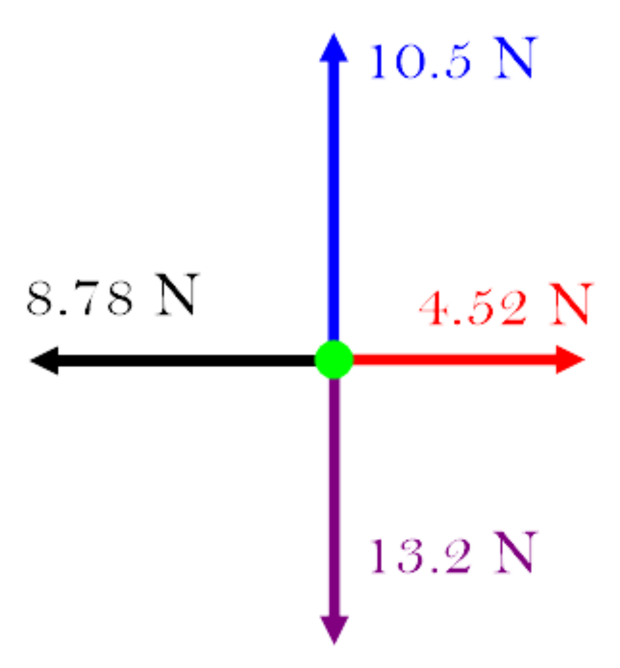
Test Review # 4

8/01/24 8:47 am

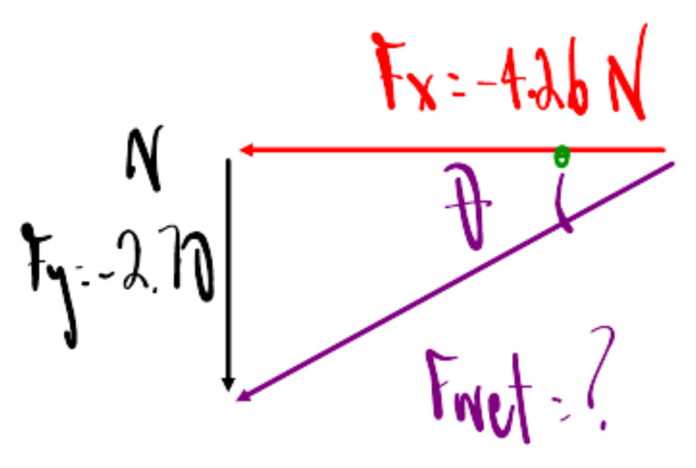


Force (Magnitude) = ?

Direction (Angle) = ?

$F_x = (4.52 - 8.78)\,N = -4.26\,N$ (West)

$F_y = (10.5 - 13.2)\,N = -2.70\,N$ (South)



$F_{net}^2 = F_x^2 + F_y^2$

$F_{net} = \sqrt{4.26^2 + 2.70^2}$

$F_{net} = 5.04\,N$

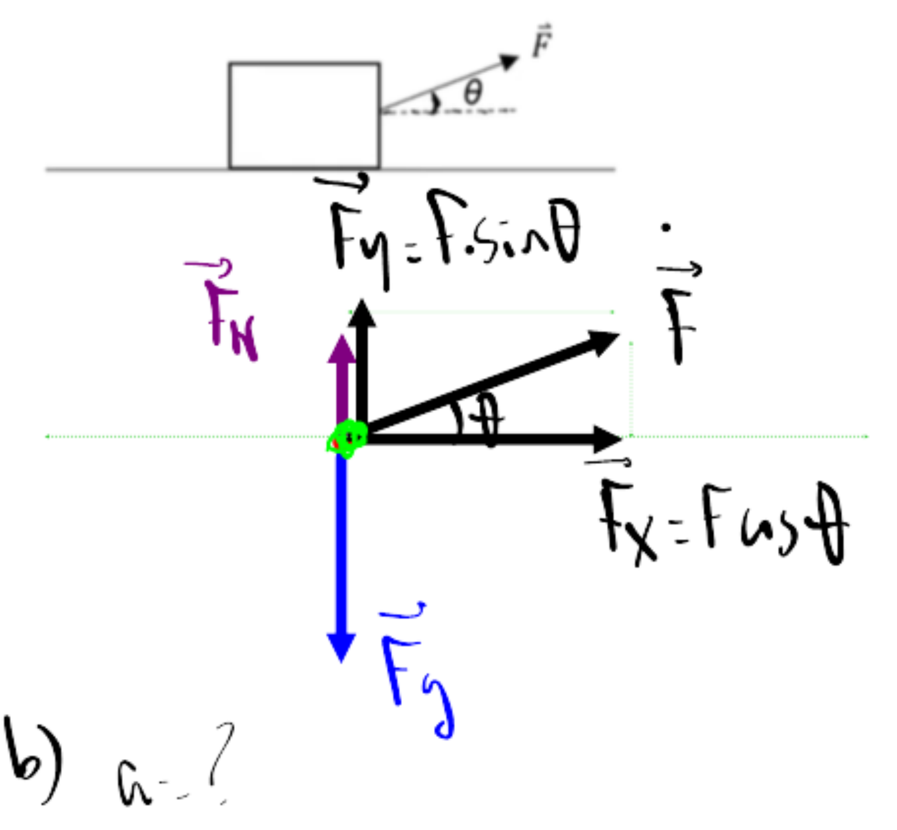
$\theta = ?$

$\tan\theta = \frac{opp.}{adj.} = \frac{-2.70}{-4.26}$

$\theta = \tan^{-1}\left(\frac{-2.70}{-4.26}\right) = 32.4^\circ$ S of W

Ex. A 10 kg box sliding to the right is pulled across a frictionless surface by an applied force of 40 N at an angle of 37° above the horizontal as shown below.

a) What is the normal force acting on the box?
b) What is the acceleration of the box?



a) $F_N = ?$

$\vec{F}_{net_y} = m \cdot \vec{a}_y$ → zero

$F_y + F_N - F_g = 0$

$F_N = F_g - F_y$

$F_N = m \cdot g - F\sin\theta$

$F_N = 10 \cdot 9.8 - 40 \cdot \sin(37^\circ)$

$F_N = 73.9\,N \approx 74\,N$

b) $a = ?$

$\vec{F}_{net_x} = m \cdot \vec{a}_x$

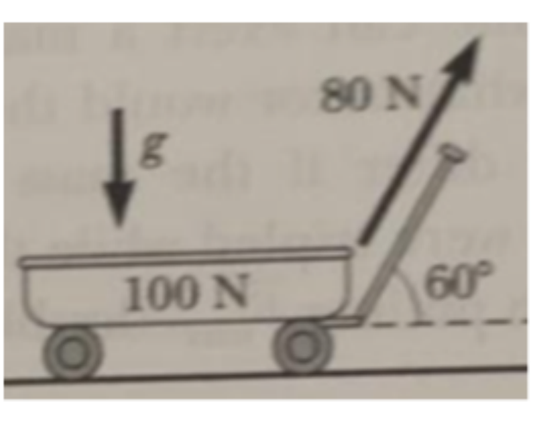
$F_x = m \cdot a$

$F \cdot \cos\theta = m \cdot a$

$40 \cdot \cos(37^\circ) = 10 \cdot a$

$\frac{40 \cdot \cos(37^\circ)}{10} = a = 3.2\,\frac{m}{s^2}$

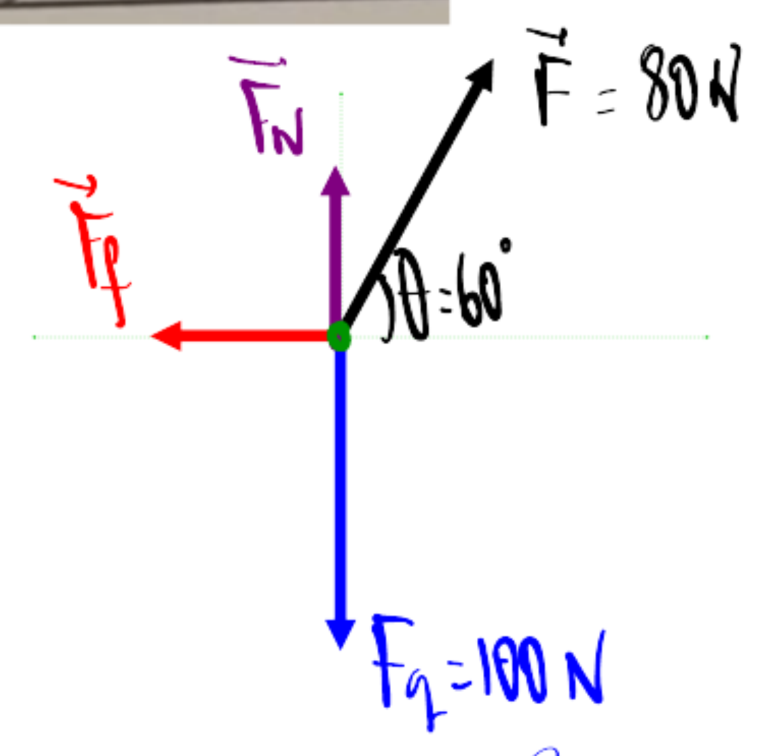
What is the magnitude of the friction force acting on a 100 N wagon if the wagon accelerates at 0.50 m/s^2 by pulling a force on its handle with 80.0 N of force at an angle of 60.0° from horizontal as shown here? Calculate the coefficient of kinetic friction.



$\boxed{\vec{a} = \frac{\vec{F}_{net}}{m}}$

$\boxed{F_g = m \cdot g = W}$

$\boxed{F_f = \mu \cdot F_N}$



$m = ?$

$F_g = m \cdot g$

$100\,N = m \times 9.8\,\frac{m}{s^2}$

$\frac{100}{9.8} = m = 10.2\,Kg$

$\vec{F}_{net_x} = m \cdot \vec{a}_x$

$F_x - F_f = m \cdot a$

$F\cos\theta - F_f = m \cdot a$

$80 \cdot \cos(60^\circ) - F_f = 10.2 \times 0.5$

$80 \cdot \cos(60^\circ) - 5.1 = F_f$

$F_f = 35\,N$

b) $\mu = ?$

$F_f = \mu \cdot F_N$

yes

$F_N = ?$ (y-axis)

$\vec{F}_{net_y} = m \cdot \vec{a}_y$

$F_y + F_N - F_g = 0$

$F_N = F_g - F \cdot \sin\theta$

$F_N = 100 - 80 \cdot \sin(60^\circ)$

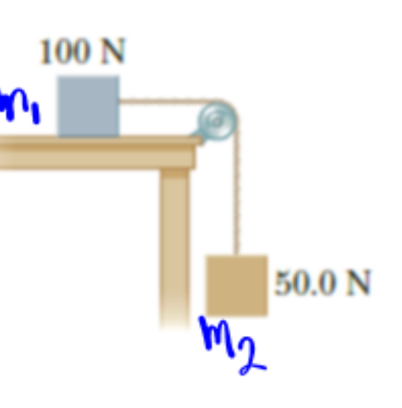
$F_N = 30.7\,N$

$\mu = \frac{F_f}{F_N} = \frac{34.9\,N}{30.7\,N}$

$\mu = 1.14$

To practice INDEPENDENTLY answer letter "C" we will answer next class

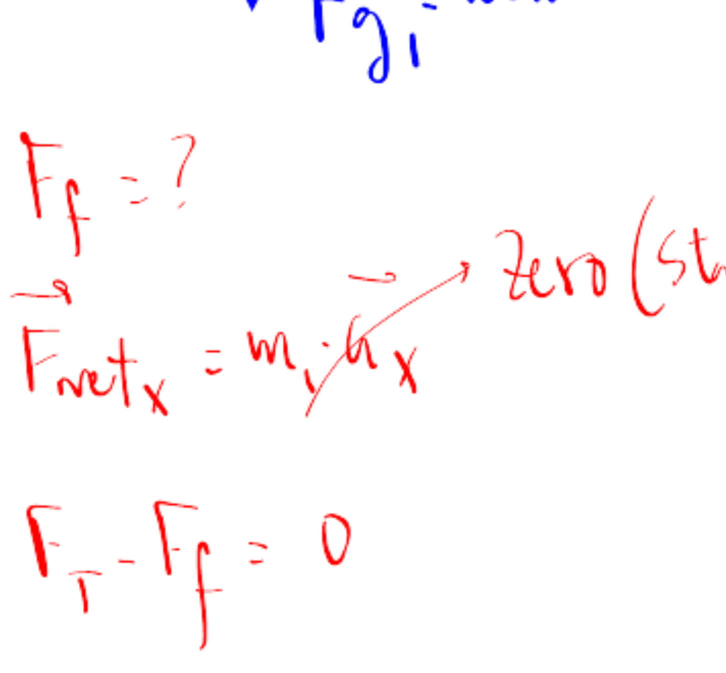
(a) What is the minimum force of friction required to hold the system of Figure P4.74 in equilibrium? (b) What coefficient of static friction between the 100.-N block and the table ensures equilibrium? (c) If the coefficient of kinetic friction between the 100.-N block and the table is 0.250, what hanging weight should replace the 50.0-N weight to allow the system to move at a constant speed once it is set in motion?



$\boxed{\vec{a} = \frac{\vec{F}_{net}}{m}}$

$\boxed{F_g = m \cdot g = W}$

$\boxed{F_f = \mu \cdot F_N}$



a) $F_f = ?$

$\vec{F}_{net_x} = m_1 \cdot \vec{a}_x$ → zero (static)

$F_T - F_f = 0$

$F_T = F_f$

$F_T = ?$

on m_2 (y-axis)

$\vec{F}_{net_y} = m_2 \cdot \vec{a}_y$ zero (static)

$F_T - F_{g_2} = 0$

$F_T = F_{g_2} = 50\,N$

$F_f = F_T = 50\,N$ (a)

b) $\mu = ?$

$F_f = \mu \cdot F_N$

$50\,N = \mu \cdot 100\,N$

$\mu = \frac{50}{100} = 0.5$