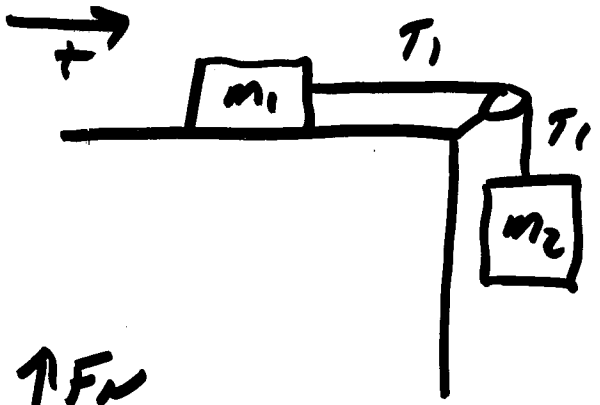
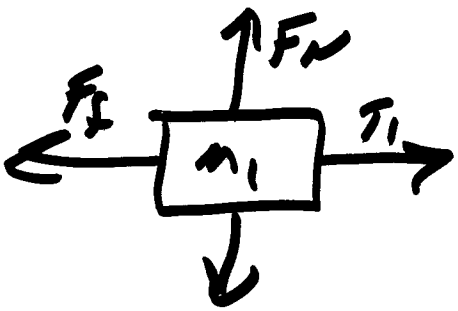


$m_1 = 50\,kg$

$m_2 = 100\,kg$

$\mu_k = 0.3$

Determine a



$w = m_1 g$

$m_2 g$

$F_N - w = 0$

$F_N = w = m_1 g$

$+T_1 - F_f = m_1 a$

$T_1 - \mu_k F_N = m_1 a$

$T_1 - \mu_k m_1 g = m_1 a$

$$T_1 = m_1 a + \mu_k m_1 g$$

$-T_1 + m_2 g = m_2 a$

$$T_1 = m_2 g - m_2 a$$

Set T_1 equal

$m_1 a + \mu_k m_1 g = m_2 g - m_2 a$

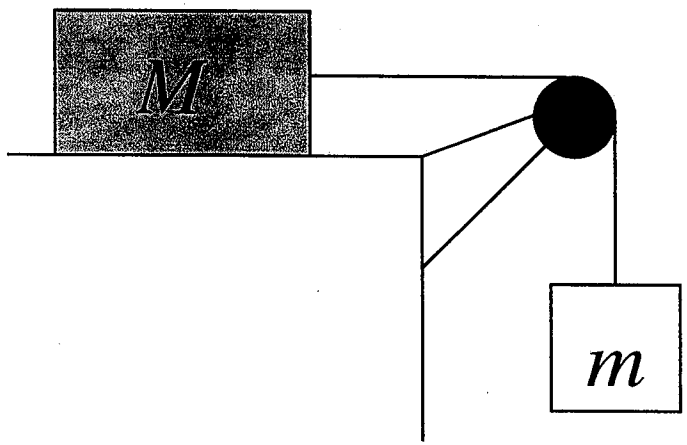
$$a = g\left(\frac{m_2 - \mu_k m_1}{m_1 + m_2}\right)$$

$a = \left(9.8\,m/s^2\right)\left(\frac{100\,kg - 0.3 \cdot 50\,kg}{100\,kg + 50\,kg}\right)$

$$a = 5.55\,m/s^2$$

Interactive Question Answer

A cart with mass M is placed on a frictionless track. One end of a cord is attached to the cart and the other end is attached to an object with mass m as shown. The pulley has no friction.



$a = g\left(\frac{m}{m+M}\right)$

When the system is released from rest, the cart has an acceleration given by a. If the mass of the cart is increased to $2M$, what happens to the acceleration?

A) It increases by 2
B) It decreases by $1/\sqrt{2}$
C) It decreases by 1/2
D) It decreases by 1/4
E) None of the above

Athlete releases a shot of mass 7.0kg with a speed of 13 m/s. The shot moved a total distance of 2.8 m while it was accelerated. What is the net force on the shot?

want $\vec{a}$

$$v^2 = v_0^2 + 2a(\underbrace{x - x_0}_{2.8\,m})$$

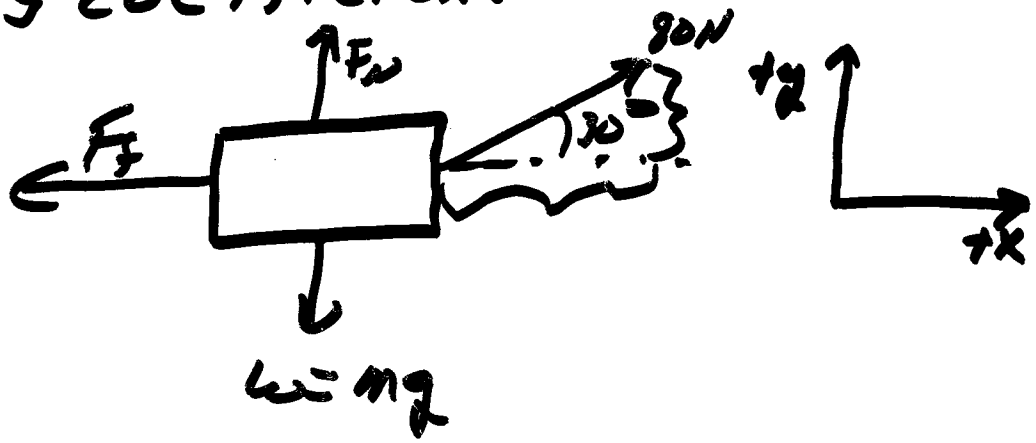
$v_0 = 0$ m/s

$$a = \frac{v^2}{2(x - x_0)} \qquad F = ma$$

$$F = \frac{mv^2}{2(x - x_0)} = \frac{7kg \cdot (13 m/s)^2}{2 \cdot 2.8 m}$$

$$= 210 N$$

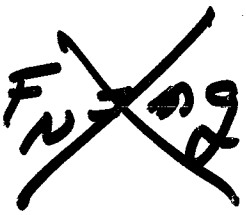
Ex) A 20kg box is being pulled across a surface at a constant velocity. A pulling force of magnitude 80 N is applied at 30° above horizontal. What is coefficient of kinetic friction



$y: +F_N - mg + 80 \sin 30^\circ = 0$

$x: -f_f + 80 \cos 30^\circ = 0$

$-F_N = mg - 80 \sin 30^\circ$



$F_f = 80 \cos 30^\circ$

$F_N = (20kg)(9.8 m/s^2) - 80 \sin 30^\circ$

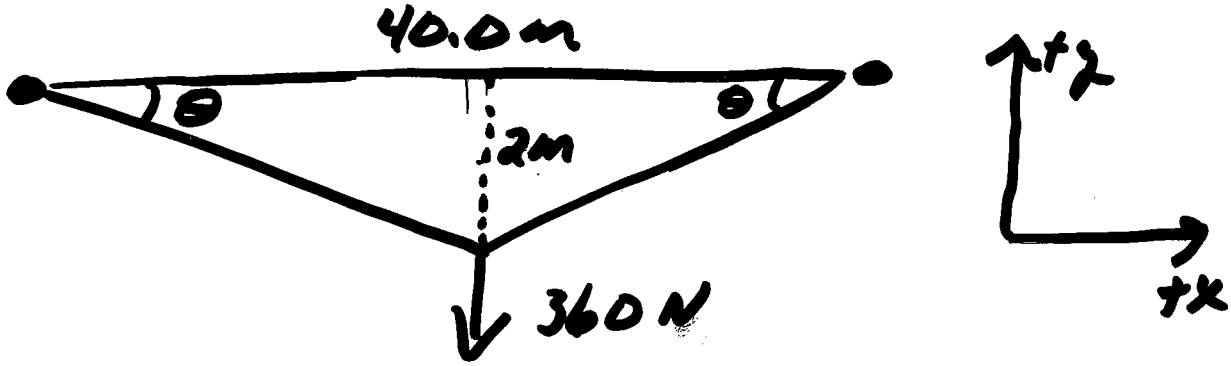
$\mu_K F_N = 80 \cos 30^\circ$

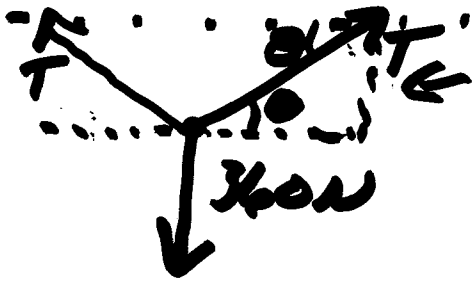
$F_N = 156 N$

$\mu_K = \frac{80 \cos 30^\circ}{F_N}$

$\mu_K = \frac{80 \cos 30^\circ}{156 N} = .44$

ex) A 40.0 m rope is tied between 2 trees. If the rope is pulled sideways with a force of 360.0 N at the midpoint of the rope, it has a 2.00 m displacement. What is the tension in the rope?





$\tan\theta = \frac{2}{20} \Rightarrow \theta = 5.7^\circ$

$T_x = T\cos 5.7^\circ$

$T_y = T\sin 5.7^\circ$

x: $\sum F_x = 0$

y: $\sum F_y = 0$

x: $T\cos 5.7^\circ - T\cos 5.7^\circ = 0$

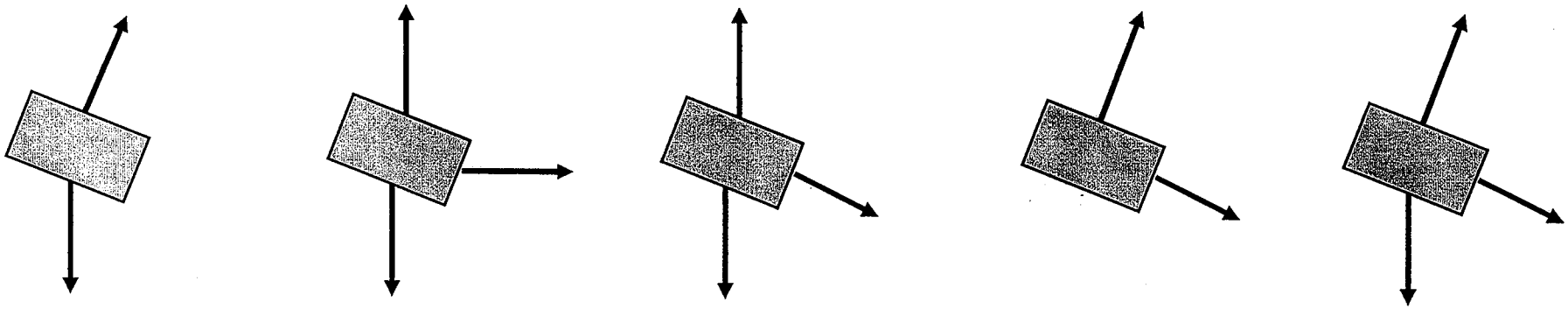
y: $T\sin 5.7^\circ + T\sin 5.7^\circ - 360\,N = 0$

$2T\sin 5.7^\circ = 360\,N$

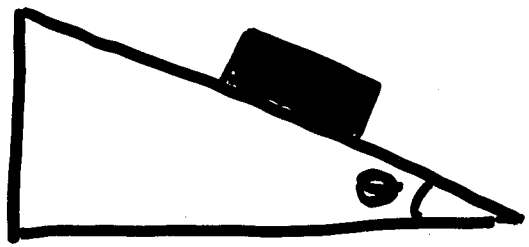
$T = \frac{360\,N}{2\sin 5.7^\circ} = \boxed{1810\,N}$

Interactive Question

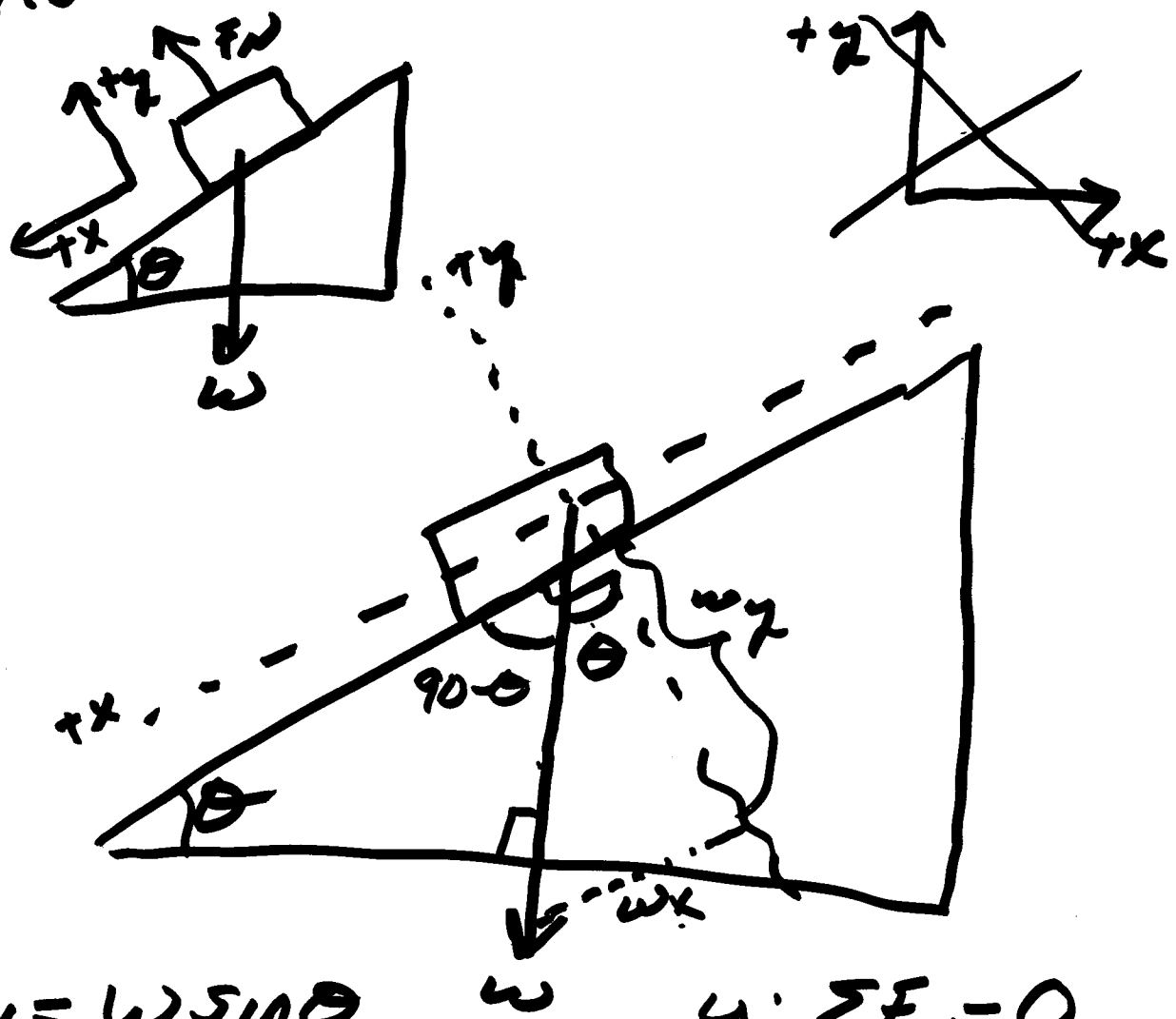
Which of the following is the correct free body diagram for an object sliding down a frictionless incline.



(A) (B) (C) (D) (E)



Block slides down an inclined plane with no friction. What is its acceleration?



$w_x = w\sin\theta$

$w_y = w\cos\theta$

$y: \Sigma F_y = 0$

$x: \Sigma F_x = ma$

$: +F_N - w\cos\theta = 0$

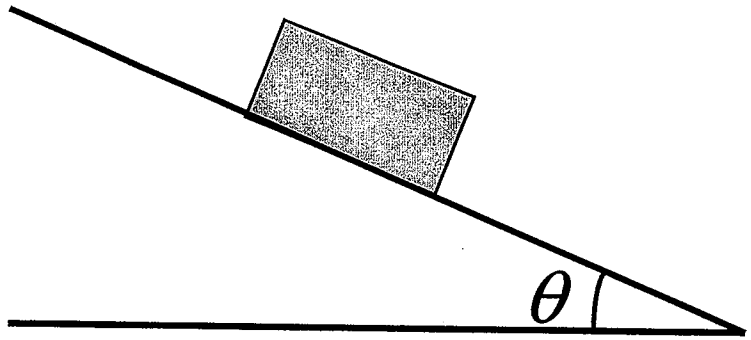
$F_N = w\cos\theta$

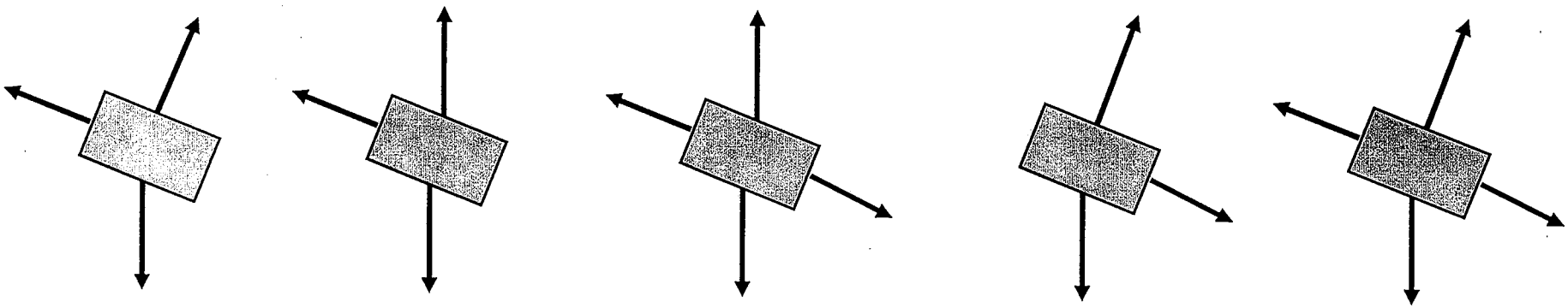
$: w\sin\theta = ma$

$mg\sin\theta = ma \Rightarrow \boxed{a = g\sin\theta}$

Interactive Question

Which is the correct free body diagram for an object sliding down an inclined surface? Don't neglect friction.





(A) (B) (C) (D) (E)