Read 5.1 - 5.6

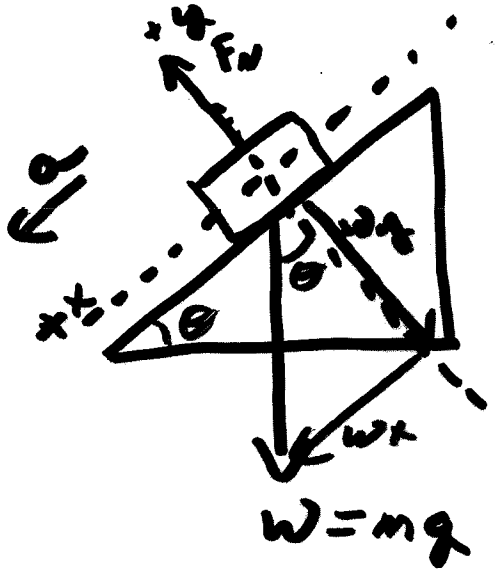
Grp 4 D2L

Next H.w available

Group problem on class web page

Exam prep on class web page

inclined plane no friction



axis in direction of acceleration

$w_x = w \sin\theta$

$w_y = w \cos\theta$

$y: \sum F_y = 0$ $\quad F_N - w\cos\theta = 0$

$$\boxed{F_N = mg\cos\theta}$$

$x: \sum F_x = ma$ $\quad mg\sin\theta = ma$

$$\boxed{a = g\sin\theta}$$

inclined plane
no friction

$F_N = mg\cos\theta$

$a = g\sin\theta$

check these by looking at 2 cases

1) 

$\theta = 0°$

know $F_N = mg$

$a = 0$

$\cos 0° = 1 \Rightarrow F_N = mg$ ✓

$\sin 0° = 0 \Rightarrow a = 0$ ✓

2) 

$\theta = 90°$

know $F_N = 0$

$a = g$

$\cos 90° = 0 \Rightarrow F_N = 0$ ✓

$\sin 90° = 1 \Rightarrow a = g$ ✓

Interactive Question

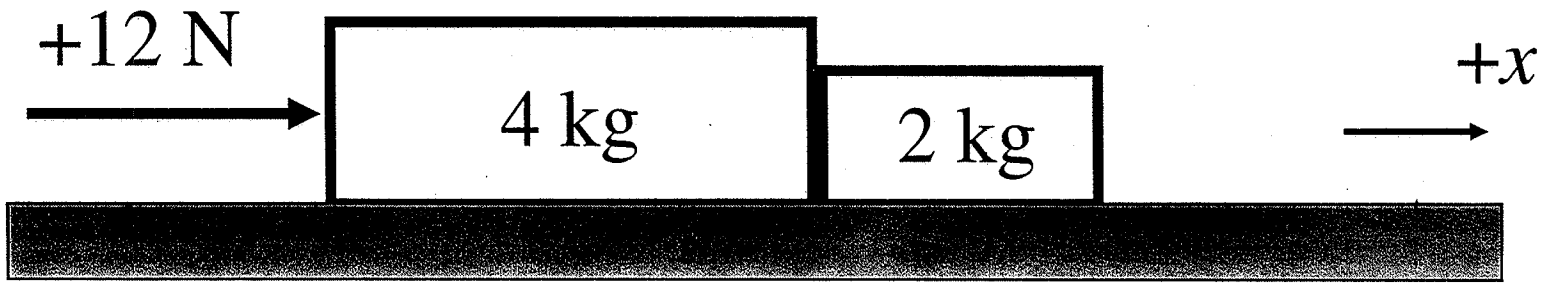
An object is held in place by friction on an inclined plane. The angle of the inclination is increased until the object starts moving. If the surface is kept at this angle, the object

A) slows down.
B) moves at uniform speed.
C) speeds up.
D) none of the above.

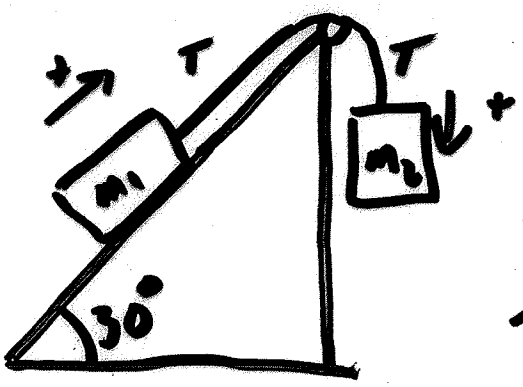
$\mu_k < \mu_s$

Interactive Question

A 4 kg block and a 2 kg block can move on a horizontal frictionless surface. The blocks are accelerated by a 12 N force in the positive x direction that pushes the larger block against the smaller one. Determine the force that the 2 kg block exerts on the 4 kg block.

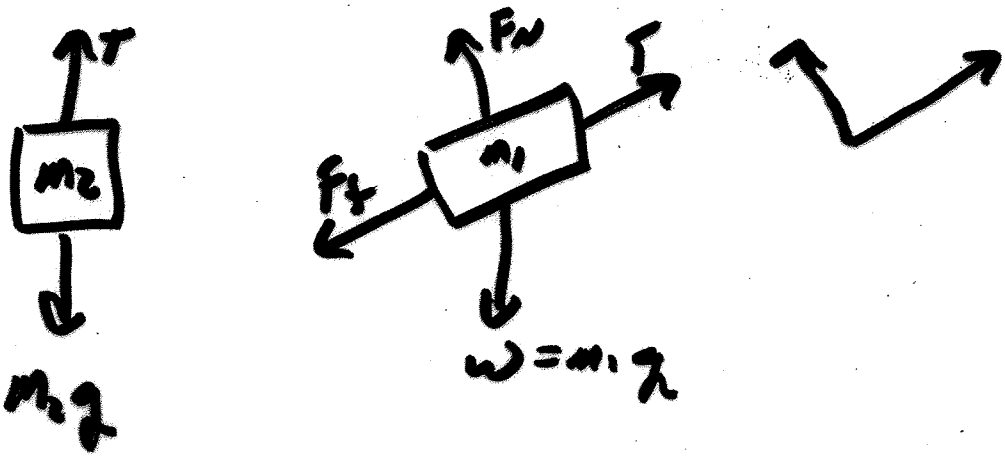


A) zero
B) –4 N
C) +4 N
D) +8 N
E) -12 N



$m_1 = 1kg$ $m_2 = 2kg$

$\mu_k = 0.5$ find a



① $m_2 g - T = m_2 a$

② y: $F_N - m_1 g \cos\theta = 0$

③ x: $T - F_f - m_1 g \sin\theta = m_1 a$

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① $T = m_2 g - m_2 a$

③ $T = m_1 a + F_f + m_1 g \sin\theta$

$m_2 g - m_2 a = m_1 a + F_f + m_1 g \sin\theta$

↳ $\mu_k F_N$

② $F_N = m_1 g \cos\theta$

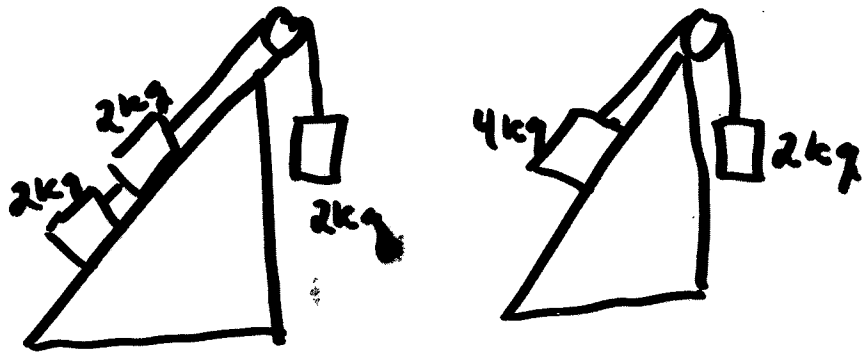
$$m_2 g - m_2 a = m_1 a + \mu_k m_1 g \cos\theta + m_1 g \sin\theta$$

$$m_1 a + m_2 a = m_2 g - \mu_k m_1 g \cos\theta - m_1 g \sin\theta$$

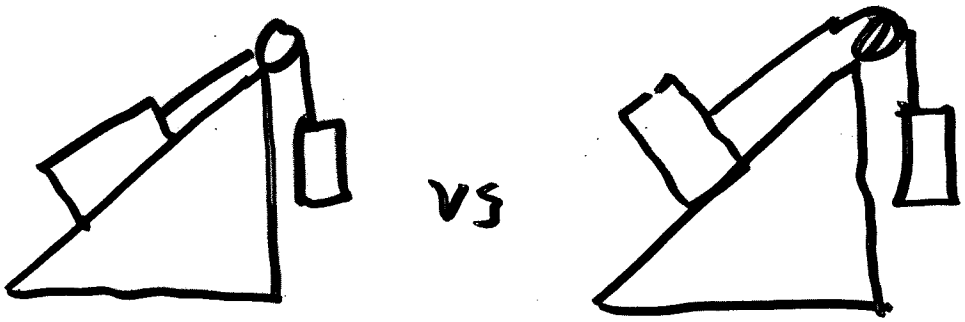
$$a(m_1 + m_2) =$$

$$a = g\,\frac{(m_2 - \mu_k m_1 \cos\theta - m_1 \sin\theta)}{(m_1 + m_2)}$$

$$a = 5.5\ m/s^2$$

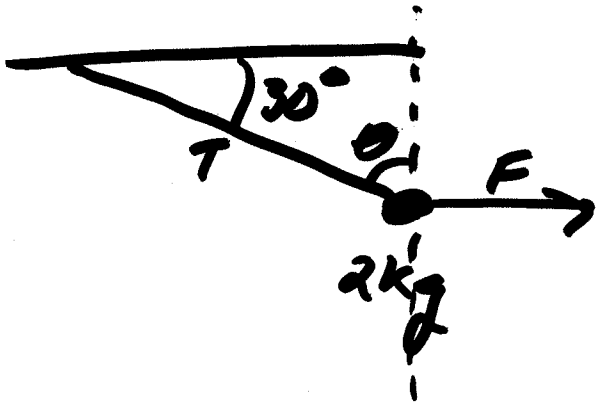


same



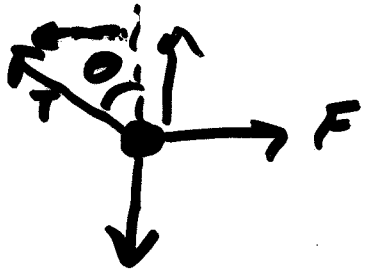
If uniform block, doesn't matter

If one side smoother than other does matter



Find F

Find Tension in rope



$\theta = 60°$

$x: F - T\sin 60° = 0$

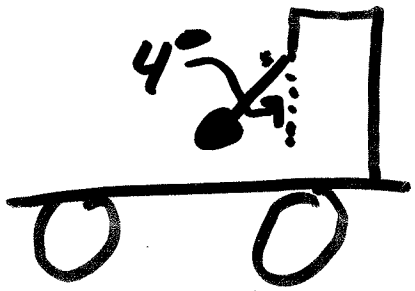
$y: T\cos 60° - mg = 0$

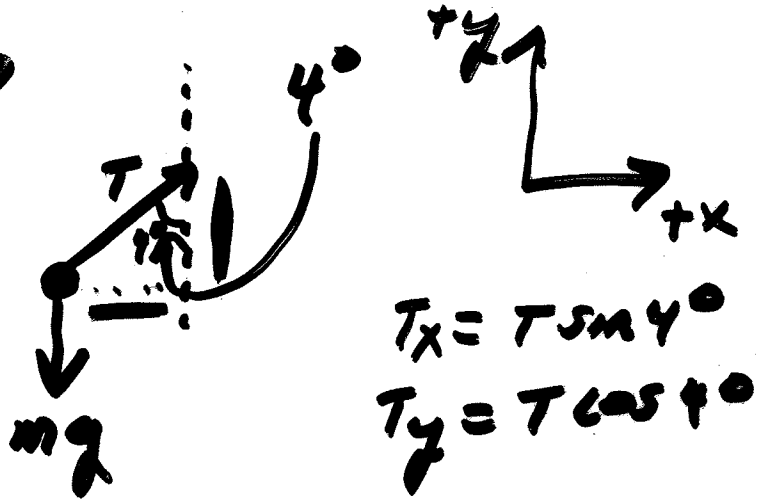
$T = \frac{mg}{\cos 60°} = \boxed{37.2\,N}$

$x: F - (37.2\,N)\sin 60° = 0$

$\boxed{F = 34\,N}$

A 3kg mass hangs in a car which accelerates to right. The mass makes an angle of 4° with the vertical. Find the car's acceleration





$y: T\cos 4° - mg = 0$

$x: T\sin 4° = ma$

$T\cos 4° = mg$

$T\sin 4° = ma$

$$\frac{\cos 4°}{\sin 4°} = \frac{g}{a}$$

$$a = g\frac{\sin 4°}{\cos 4°} = g\tan 4°$$

$$a = g\tan 4° = \boxed{.69\ m/s^2}$$