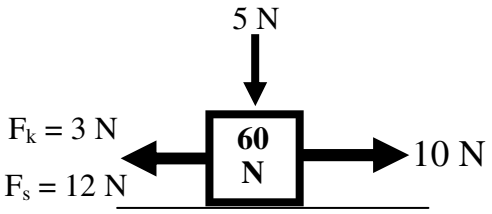
Due Mon., Oct 24

2011 PreAP Forces 5

1. An 60 N object is pulled by a 10 N force while a 5 N force pushes down on it. Friction is opposing the 10 N force. Imagine that the diagram is really two diagrams in one: it shows the object when the object both when it is moving and stationary.



A. *Is 60 N the mass or weight of the object?
B. After drawing a force diagram, calculate the normal force. (Use g = 10 m/s^2.)

C. How much force tries to keep the object from sliding?

D. How much force tries to stop the object from sliding (if already moving)?

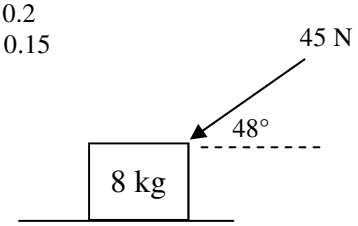
E. Is the 10 N force strong enough to move the object?
F. How much more force is necessary for it to break free?

G. * If the object is already sliding, calculate the acceleration of the object.

H. * Since $F_s = \mu_s F_N$ and $F_k = \mu_k F_N$, calculate the coefficients of friction for this surface (μ_s and μ_k).

2. * A 45 N force pushes on a 8 kg object an angle of 48°. The coefficients of friction are given. Start with a force diagram.

μ_s = 0.2
μ_k = 0.15



A. Noticing the direction of the 45 N force, which way does friction point?
B. Break up the 45 N force into its x and y components (draw and label it on the diagram, but not your force diagram).

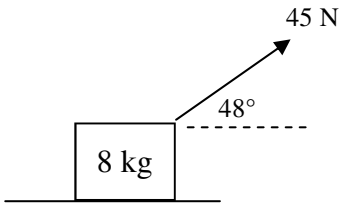
C. Calculate the normal force on the object.

D. Calculate static and kinetic friction on the object.
E. Will the object slide?
F. If the object doesn't slide, how much more force is necessary to get it to slide?

G. If it is sliding, calculate its acceleration.

3. The same object is on the same surface (so same coefficients of friction), but the force is now pulling up and to the right.

μ_s = 0.2
μ_k = 0.15



A. Break up the angled force into its components and label on the diagram.

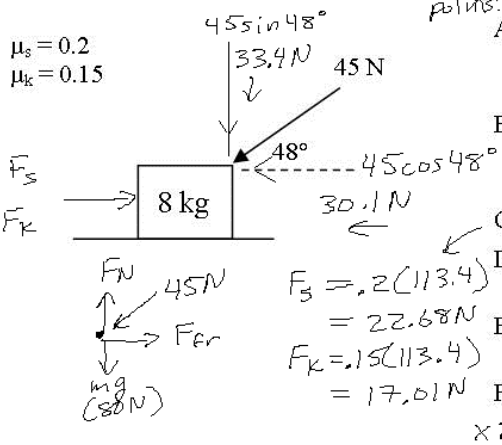
B. * After drawing a force diagram ("*Remember the dot*!"), calculate normal force acting on the object.

C. Calculate static and kinetic friction acting on the object.

D. * Decide if the object will slide or not. If it doesn't slide, decide how much more force would be necessary to move the object. If it does start to slide, calculate its acceleration.

1A) 60 N is the weight. 1G) a = 1.2 m/s^2 1H) μ_s = 0.18 (no units)
3B) 46.6 N 3C) Fs = 9.32 N 3D) 2.9 m/s^2

2. * A 45 N force pushes on a 15 kg object an angle of 48°. The coefficients of friction are given. Start with a force diagram.



points: Right

A. Break up the 45 N force into its x and y components (draw and label it on the diagram, but not your force diagram).
F_x=cos =30.1 N F_y = sin = 33.4 N

B. Calculate the normal force on the object.
y: $F_N - mg - 33.4 = m(0)$
$F_N = 33.4 + 80 = 113.4$ N

C. Calculate static and kinetic friction on the object.

D. Will the object slide? yes (30.1 > 22.68)

$F_s = .2(113.4)$
$= 22.68$N

E. If the object doesn't slide, how much more force is necessary to get it to slide?
N/A

$F_K = .15(113.4)$
$= 17.01$ N

F. If it is sliding, calculate its acceleration.
x: $-30.1 + 17.01 = 8(a)$
$-13.08 = 8a$
$a = -1.6$ m/s^2