Physics 2110
Autumn 1998
Sid Rudolph

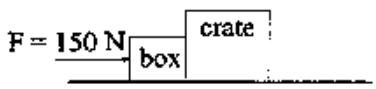
EXAM 2

3

Name:_____ Social Security #:_____

TA (circle one): Gary Samuelson Mitchell McKain Tarn Bereskin

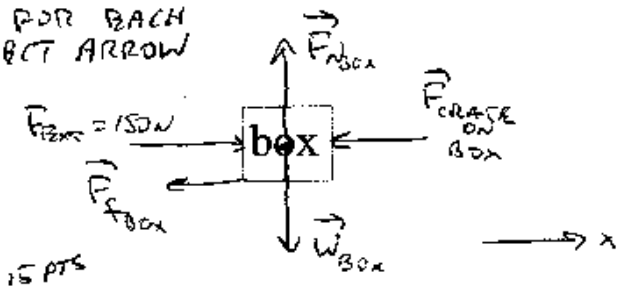
A 5.00 kg box is sitting next to a 12.0 kg crate on a horizontal surface. A 150 N force is applied horizontally on the 5.00 kg box. See figure. The coefficient of kinetic friction between each mass and the surface is $\mu_k = 0.600$.

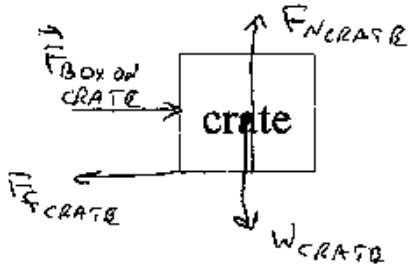


9 PTS

A. Construct a free body diagram for each mass using the objects shown below.

1 PT FOR EACH CORRECT ARROW





$\vec{F}_{f_{BOX}} = \mu_K \vec{F}_{N_{BOX}} = (0.600)(49N) = 29.4N$

$\vec{F}_{f_{CRATE}} = \mu_K \vec{F}_{N_{CRATE}} = (0.6)(117.6N) = 70.6N$

15 PTS

B. Determine the acceleration of the two mass system.

BOX $m_{BOX}\,a = F_{EXT} - F_{f_{BOX}} - F_{CRATE\ ON\ BOX}$

CRATE $m_{CRATE}\,a = F_{BOX\ ON\ CRATE} - F_{f_{CRATE}}$

ADD EQUATIONS

BUT $F_{BOX\ ON\ CRATE} = F_{CRATE\ ON\ BOX}$

$(m_{BOX} + m_{CRATE})\,a = F_{EXT} - F_{f_{BOX}} - F_{f_{CRATE}} = 150N - 100N = 50.0N$

$a = \frac{50.0N}{17.0kg} = \boxed{2.94 m/s^2}$

5 PTS FOR EACH CORRECT F=ma
1 PT " " " FRICTION
3 PTS FOR CORRECT SOLUTION

C. 6 PTS As the box and crate accelerate together, what is the force the right face of the box exerts on the left face of the crate?

$F_{BOX\ ON\ CRATE} = m_{CRATE}\,a + F_{f_{CRATE}} = (12.0kg)(2.94 m/s^2) + 70.6N$

$= 106N$ (TO THE RIGHT)

6 PTS

D. As the box and crate accelerate together, what is the magnitude of the force exerted by the left face of the crate on the right face of the box?

$\vec{F}_{CRATE\ ON\ BOX} = -\vec{F}_{BOX\ ON\ CRATE} = 106N$ (TO THE LEFT)