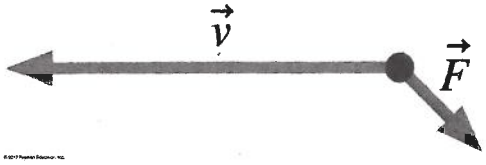
Physics 4A
Spring 2025

Name Answer Key

Lab: 8:00 am 11:10 am 2:30 pm (circle one)

Quiz #5: Dynamics I

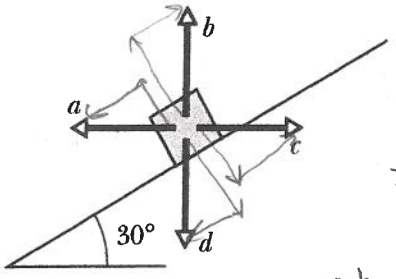
Problem 1 (1 point)
This force will cause the particle to



D

a) Speed up and curve upward.
b) Slow down and curve upward.
c) Speed up and curve downward.
(d) Slow down and curve downward.
e) None of the above.

Problem 2 (2 points)
The figure below shows four choices for the direction of a force of magnitude F to be applied to a block on an inclined plane. The directions are either horizontal or vertical. For choices *a* and *b*, the force is not enough to lift the block off the plane.



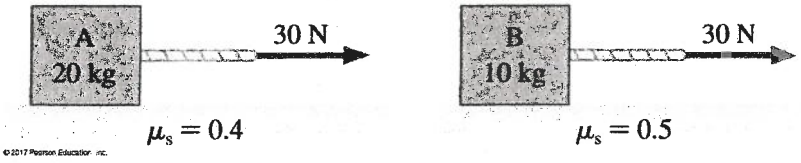
Which choice results in the greatest normal force? D

choice D has greatest component of force pushing down ⊥ to incline

Which choice results in the smallest normal force? B

choice B has the greatest component of force pulling up ⊥ to incline

Problem 3 (2 points)
Boxes A and B in the figure below both remain at rest as a 30 N force is applied. Is the friction force on box A larger than, smaller than, or equal to the friction force on box B? *Explain your answer.*

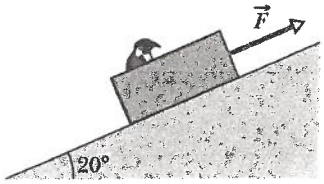


Force on Box A = Force on Box B

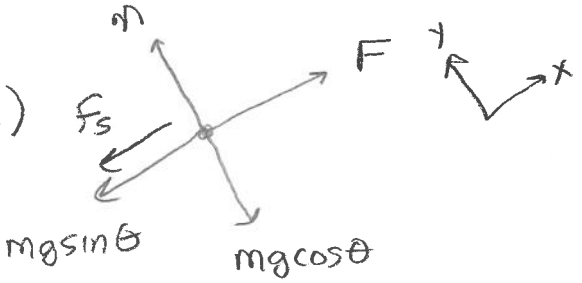
since boxes remain at rest, $\sum F_x = 0$ so $f_s = 30N$

Problem 4 (5 points)

A loaded penguin sled weighing 105 kg rests on a plane inclined at 20° to the horizontal (see the figure below). Between the sled and the plane, the coefficient of static friction is 0.32 and the coefficient of kinetic friction is 0.17. **(a)** What is the minimum magnitude F that will start the sled moving up the plane? **(b)** What value of F is required to move the sled up the plane at constant velocity?



(a)



$\sum F_y = ma_y = 0 \rightarrow n - mg\cos\theta = 0 \rightarrow n = mg\cos\theta$

$\sum F_x = ma_x = 0$ * to just start sled moving up incline, sled is on verge of slipping so $f_s = f_{s,max} = \mu_s n$

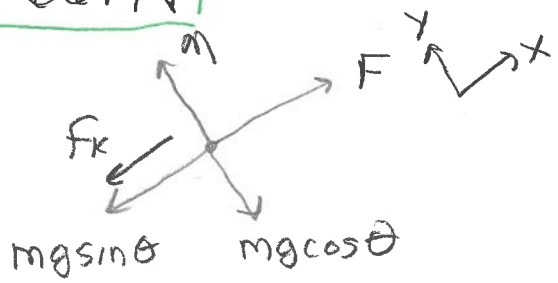
$F - mg\sin\theta - \mu_s n = 0$

$F = mg\sin\theta + \mu_s n = mg\sin\theta + \mu_s(mg\cos\theta)$

$F = (105\,kg)(9.80\,m/s^2)\sin 20° + (0.32)(105\,kg)(9.80\,m/s^2)\cos 20°$

$\boxed{F = 661\,N}$

(b)



$\sum F_y = ma_y = 0$

$n = mg\cos\theta$

$\sum F_x = ma_x = 0$

$F - mg\sin\theta - f_k = 0 \rightarrow F = mg\sin\theta + \mu_k n$

$F = mg\sin\theta + \mu_k(mg\cos\theta)$

$F = (105\,kg)(9.80\,m/s^2)\sin 20° + (0.17)(105\,kg)(9.80\,m/s^2)\cos 20°$

$= \boxed{516\,N}$