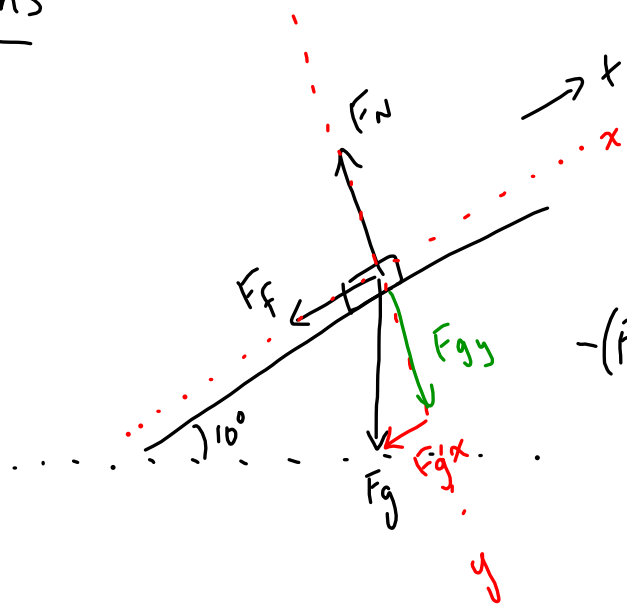
Incline Problems

PP/3



$\vec{F}_{net} = m\vec{a}$

$-(F_f + F_{gx}) = ma$

keep going

More Inclines

mp 471

$m = 84\,kg$

$\theta = 22^\circ$

$\mu_s = 0.47$

$\mu_k = 0.25$

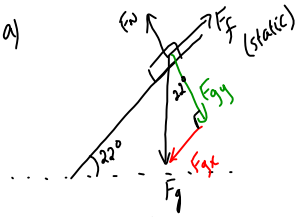
a) does it move?

b) if it does, $a = ?$

c) if it doesn't, $F_a = ?$

d) once moving, $a = ?$

a)



If the crate slides down the incline, then

$F_{gx} > F_{f(static)}$ (max)

$F_{gx} = F_g \sin\theta$

$F_{gx} = mg\sin\theta$

$F_{gx} = (84\,kg)(9.81\,m/s^2)\sin 22^\circ$

$F_{gx} = 308.69\,N$

$F_f = \mu F_N$

$F_f = \mu F_{gy}$

$F_f = \mu F_g \cos\theta$

$F_f = \mu mg\cos\theta$

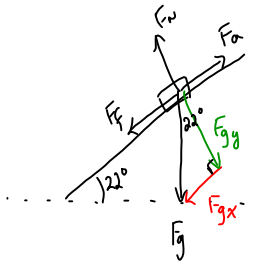
$F_f = (0.47)(84\,kg)(9.81\,m/s^2)\cos 22^\circ$

$F_f = 359.10\,N$ ← max static friction

Since $F_f > F_{gx}$ the crate does not slide down the incline.

b) N/A

c) What force (F_a) is needed to just start the crate moving uphill.



At the instant that the crate begins to move:

$F_a = F_{gx} + F_f$

$F_a = 308.69\,N + 359.10\,N$

$F_a = 667.79\,N$

$F_a = 6.7 \times 10^2\,N$

d) What is the acceleration if you continue pushing with the same force. The frictional force will now be the kinetic frictional force and will be less.

$F_f = \mu F_N$

$F_f = \mu mg\cos\theta$

$F_f = (0.25)(84\,kg)(9.81\,m/s^2)\cos 22^\circ$

$F_f = 191.01\,N$

(kinetic)

$\vec{F}_{net} = m\vec{a}$

$F_a - (F_{gx} + F_f) = ma$

$667.79 - (308.69N + 191.01N) = (84kg)a$

$667.79 - 499.70N = (84kg)a$

uphill downhill

$168.09\,N = (84\,kg)a$

$a = 2.0\,m/s^2$

TO DO

① PP 474 - 475

② Review: p528/23-25 & p626/33,34 & 36

③ Review: p117/19-29, p209/24-26,36, p212/34 & 35

TEST OUTLINE

Book: §3-2 Vectors in a Plane

§3-3 Relative Velocities

§5-2 Newton's Second Law
(forces in 2D - p172-175)

§10-1 Using Vector Components to Analyze Motion

You need to know:

- drawing vector diagrams (head to tail + resultant)
- components of vectors
- relative motion
- forces at angles
  - side on view
  - birds eye view
- incline problems
- subtraction of vectors

FBD, Newton's 2nd Law ($\vec{F}_{net} = m\vec{a}$)

an x-y chart is useful when adding 3 or more vectors.

What should you do to study:

1. Be sure all PP are done
2. recommended review questions
3. Look at previous NSEs
4. McGraw-Hill Quizzes.