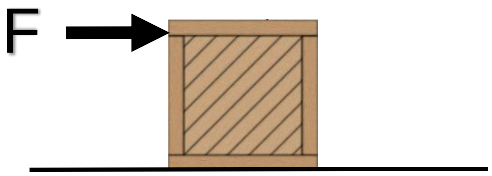
Physics 2111
Unit 20

Today's Concepts:

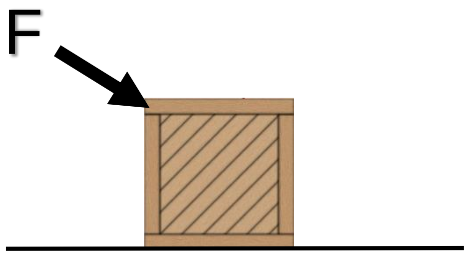
a) Static Equilibrium

b) Potential Energy & Stability

Question



Case 1



Case 1

Two boxes for equal mass are pushed by a force of equal magnitude. In Case 1, the force is horizontal. In Case 2, the force has some angle Θ with the horizontal. In both cases, the force of friction does not allow the box to move.

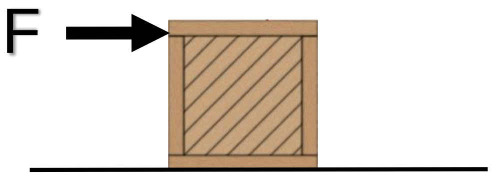
In which case is the normal force from the floor onto the box greater?

A. They have equal normal forces

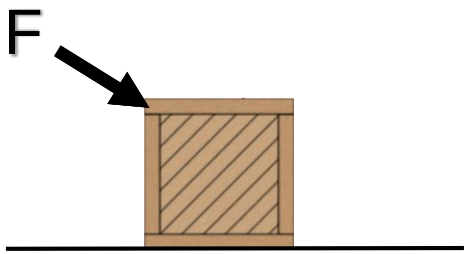
B. Case 1

C. Case 2

Question



Case 1



Case 1

Two boxes for equal mass are pushed by a force of equal magnitude. In Case 1, the force is horizontal. In Case 2, the force has some angle Θ with the horizontal. In both cases, the force of friction does not allow the box to move.

In which case is frictional force from the floor onto the box greater?

A. They have equal frictional forces

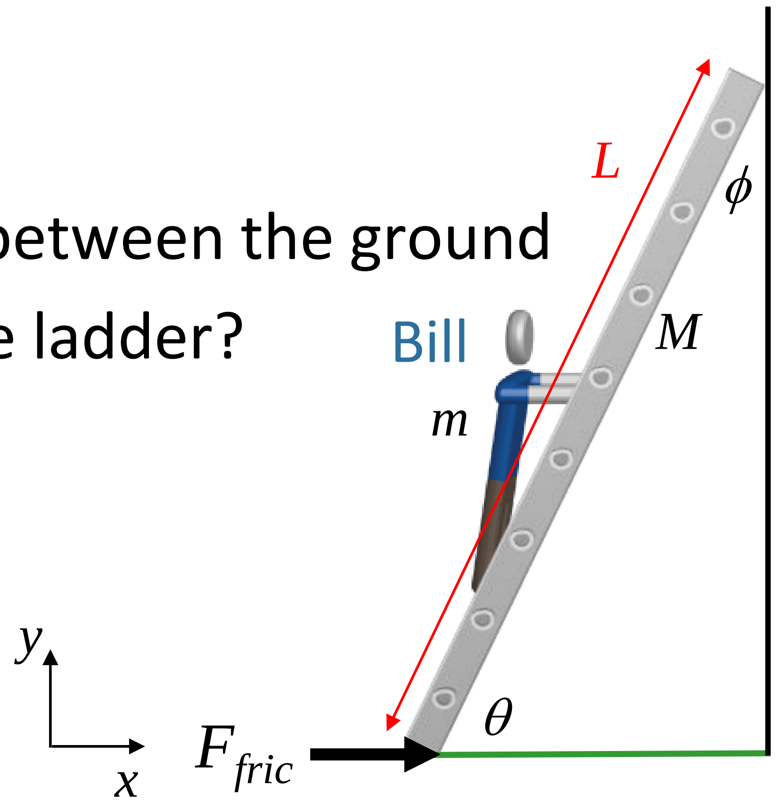
B. Case 1

C. Case 2

Example 20.1 (Painter on a Ladder)

Bill (mass m=75kg) is climbing a ladder (length L=2.5m, mass M=50kg) that leans against a smooth wall (no friction between wall and ladder). A frictional force F_{fric} between the ladder and the floor keeps it from slipping. The angle between the ladder and the ground is θ=70°.

What is the frictional force, F_{fric}, between the ground and the ladder if Bill is 0.5m up the ladder?



Question

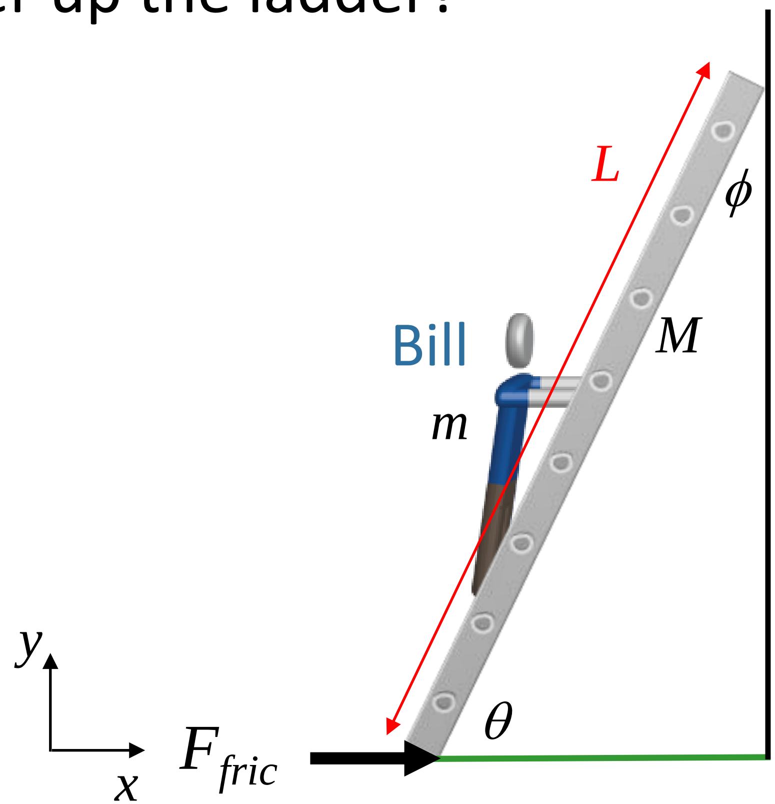
In the problem we just worked, Bill was 0.5m up the ladder.

What happens to F_{fric}, the frictional force between the ground and the ladder, as Bill climbs farther up the ladder?

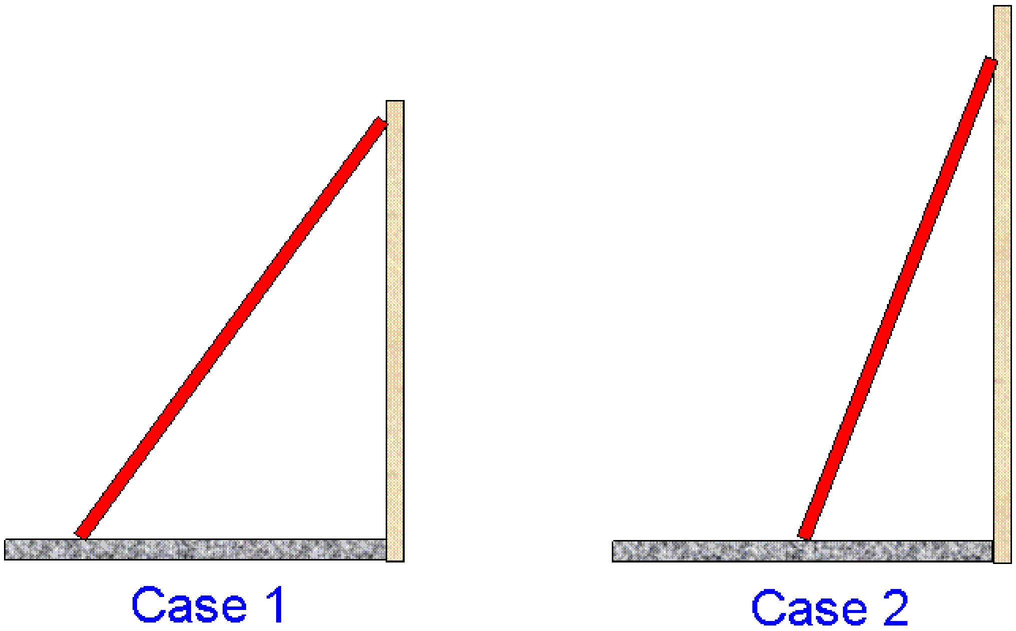
A. F_{fric} increases

B. F_{fric} decreases

C. F_{fric} remains the same.



Checkpoint



In the two cases shown identical ladders are leaning against frictionless walls and are not sliding.

In which case is the force of friction between the ladder and the ground the biggest?

A. Case 1
B. Case 2
C. Same

Question

A (static) mobile hangs as shown below. The rods are massless and have lengths as indicated. The mass of the ball at the bottom right is 1 kg.

What is the total mass of the mobile?

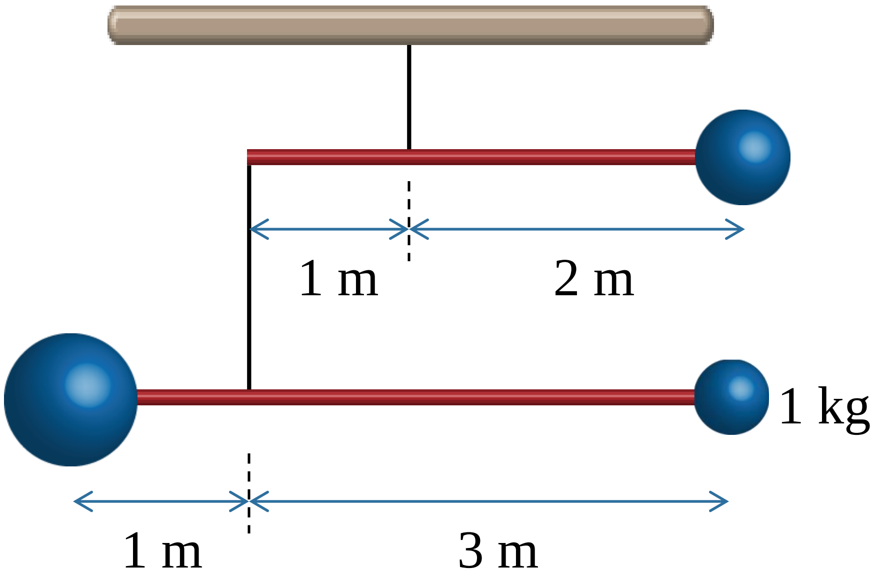
A) 4 kg

B) 5 kg

C) 6 kg

D) 7 kg

E) 8 kg



Question

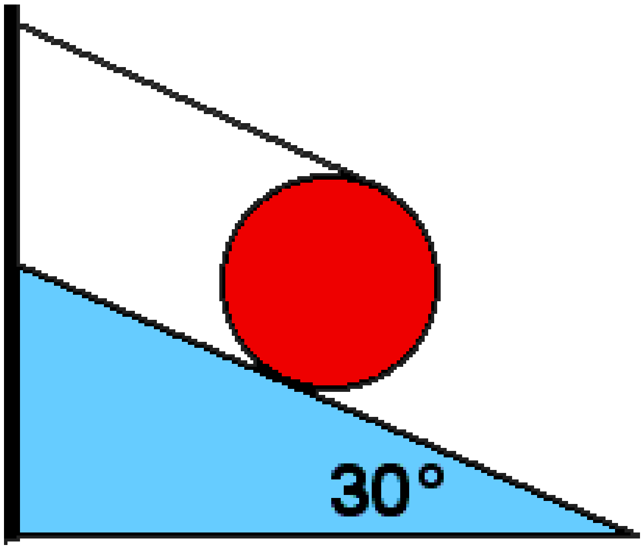
In a static situation, we can say that the sum of the torques is zero of any particular object. For that to be true, what point must we be summing the torques about?

A. the COM of the object
B. the edge of the object
C. any point on the object
D. any point in space (anywhere)
E. None of the above

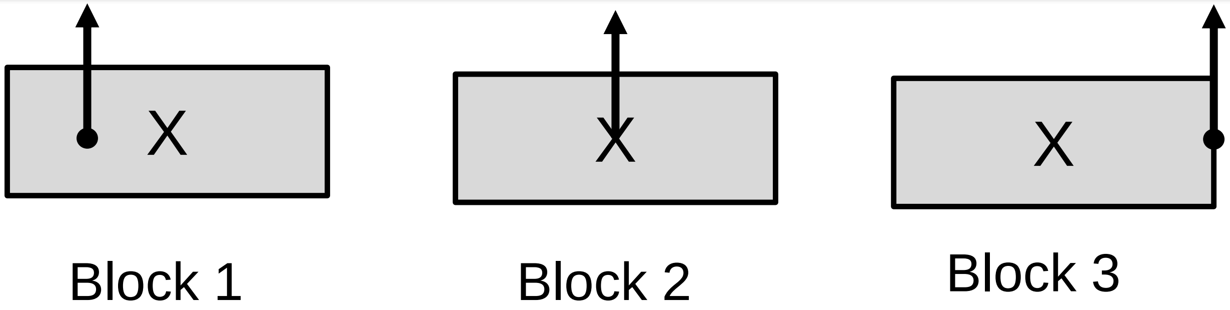
Question

A uniform disk with mass M and radius R sits at rest on an incline 30° to the horizontal. String is wound around disk and attached to top of incline as shown. The string is parallel to incline. The tension in the string is :

A. Mg
B. Mg/2
C. 2Mg/5
D. Mg/4
E. None of the above



Question

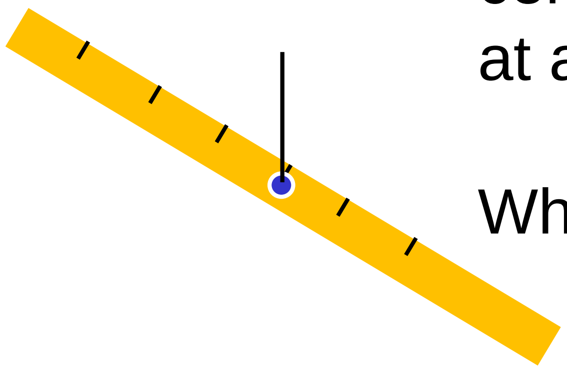


Three identical rectangular blocks are at rest on a horizontal, frictionless ice rink. A force of equal magnitude is exerted at different points on each block as shown in the above top view diagram. Each “X” represents the position of the block’s center of mass.

Rank the magnitudes of the accelerations of the center of mass of the blocks

A. $a_1 = a_2 = a_3$
B. $a_3 > a_2 > a_1$
C. $a_2 > a_1 = a_3$
D. $a_2 > a_1 > a_3$
E. $a_2 < a_1 < a_3$

Question

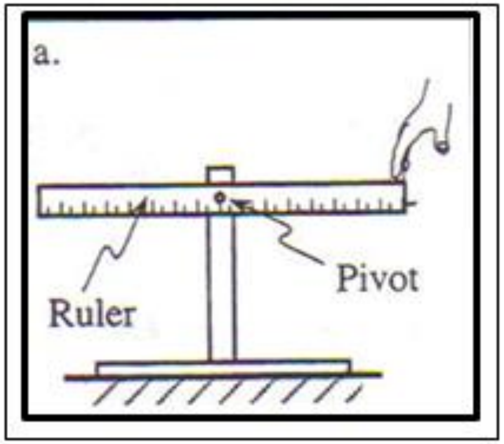


A ruler is on a frictionless pivot through its center of mass. The ruler is originally held at an angle and then released.

What will the ruler do?

a) Nothing, it will just stay in it's original position
b) Rotate back and forth
c) Move to a horizontal position

Question



A ruler is on a frictionless pivot through its center of mass. The ruler is at rest when a student briefly exerts a downwards force on the right end. The magnitude of the force exerted by the student is equal to one half the weight of the ruler. After the student stops pushing the ruler spins in clockwise a constant rate.

<u>While the student is pushing on the ruler</u>, the net force on the ruler is:

a) Into the screen

b) Out of the screen

c) Down

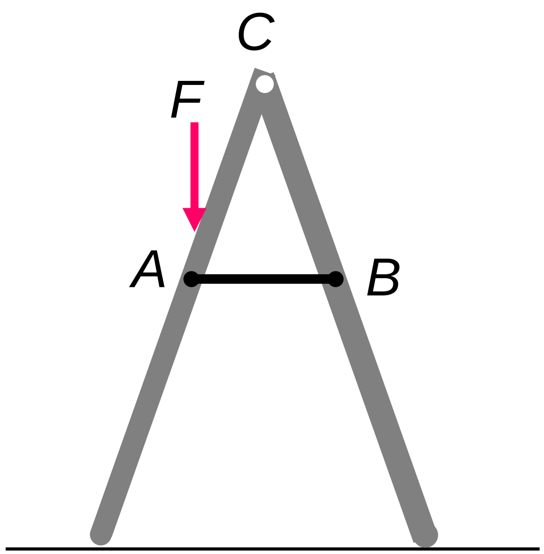
d) Up

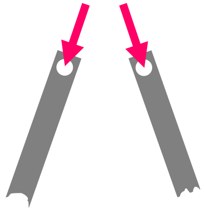
e) Zero

Question

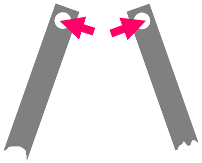
The ladder shown to the left has frictionless pins at points A,B and C. A vertical load F is placed at some point on the left leg. This is negligible friction between the legs of the ladder and the floor.

Which of the following could represent the forces exerted by the pin at point C on the two legs?

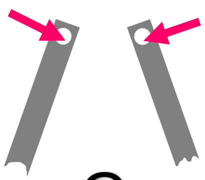




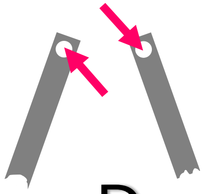
A



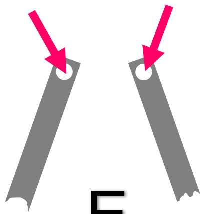
B



C

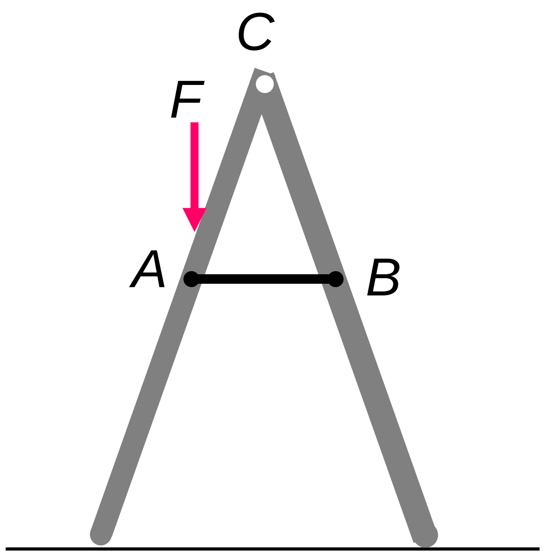


D



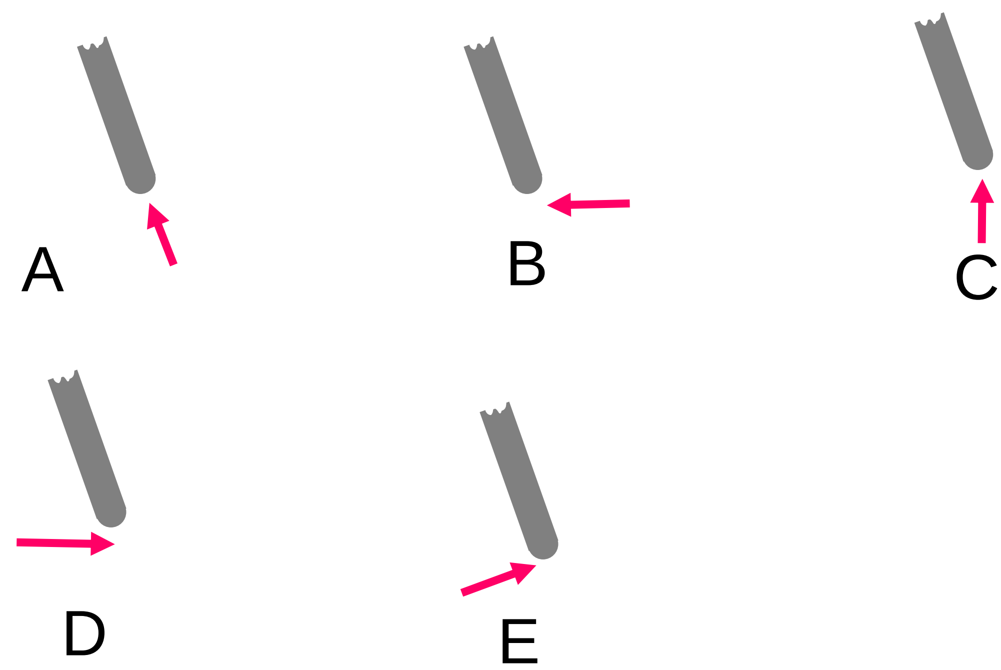
E

Question

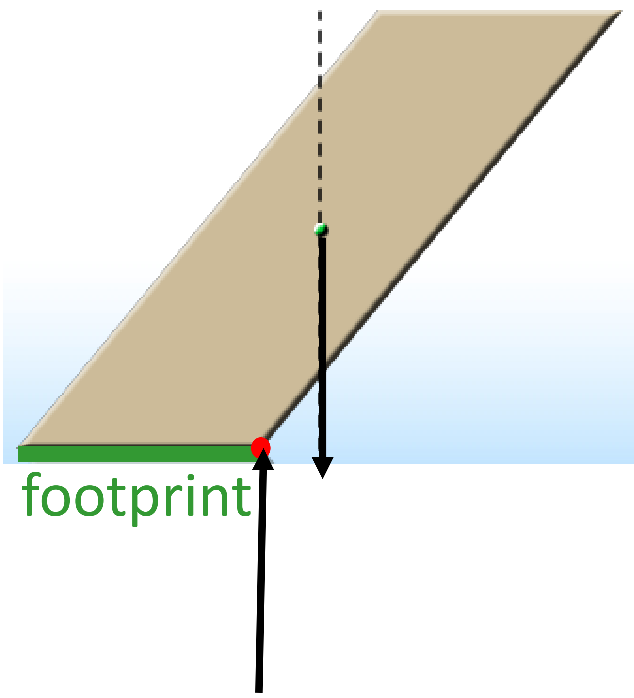


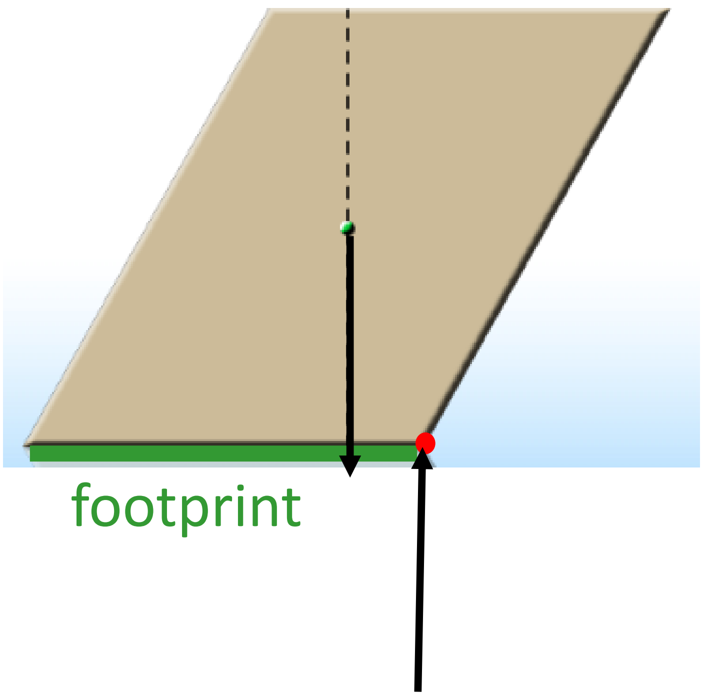
The ladder shown to the left has frictionless pins at points A,B and C. A vertical load F is placed at some point on the left leg. This is negiligible friction between the legs of the ladder and the floor.

Which of the following could represent the force exerted by the floor on the right leg?

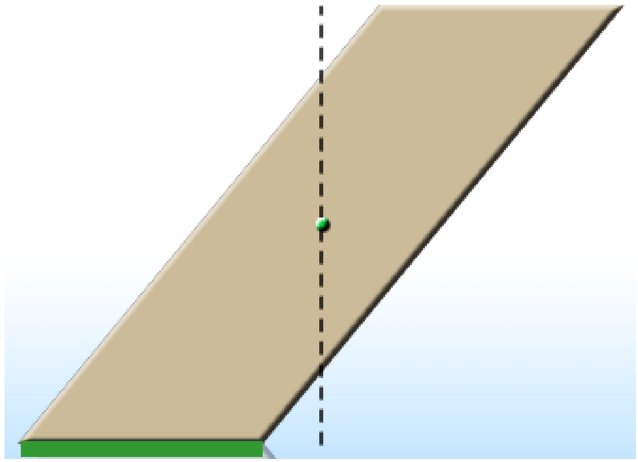


Stability and torques

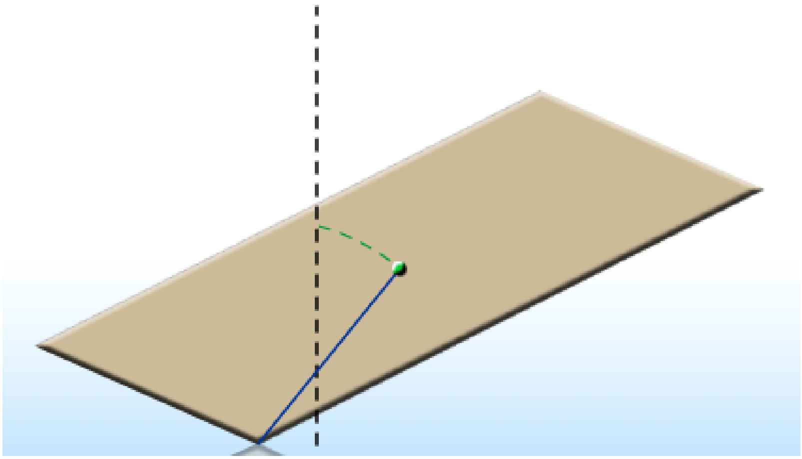


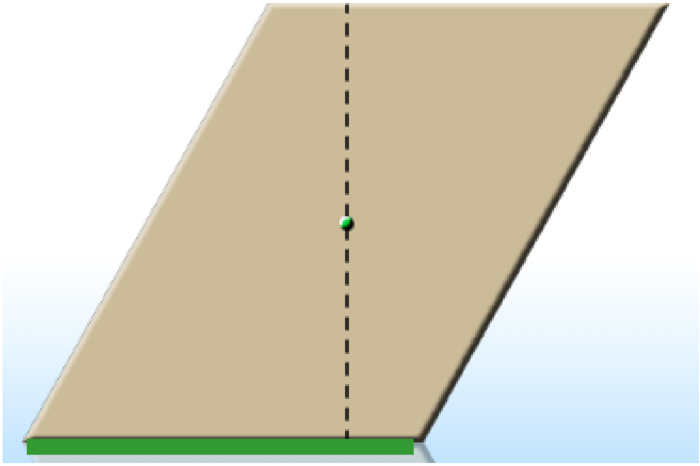


Stability & Potential Energy



footprint





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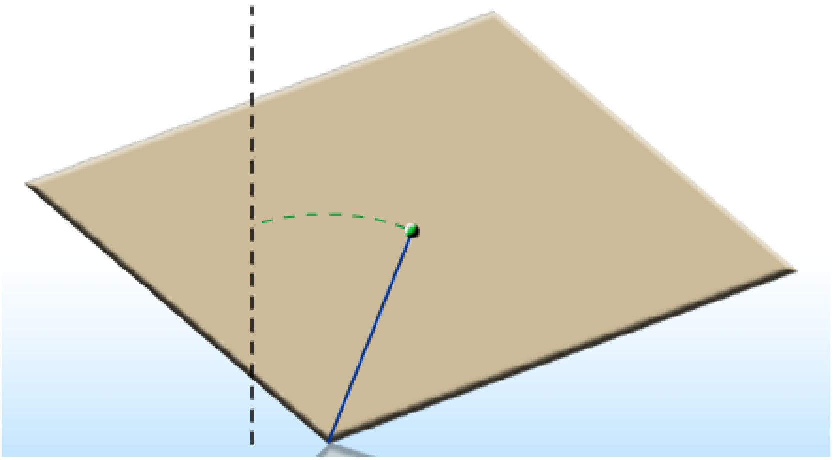

CheckPoint

Suppose you hang one end of a beam from the ceiling by a rope and the bottom of the beam rests on a frictionless sheet of ice. The center of mass of the beam is marked with an black spot. Which of the following configurations best represents the equilibrium condition of this setup?