definition of equlibrium: *the state of an object when the vector sum of all the forces acting on it is zero.*

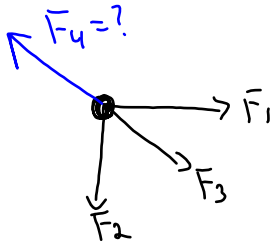
If an object is at ***rest*** and is in ***equilibrium***, then we say that it is in a state of "***static equilibrium***."

Equilibrant: is the one vector, when added to 2 or more other vectors produces a state of equilibrium. It is equal to the resultant but opposite in direction.

Three forces act simultaneously on point P. The firstforce is 10 N east. The second force is 15 N south. The third force is 28 N, E46°S. Find the equilibrant.(46N, W50°N)

$F_1 = 10$ [E] $F_3 = 28$ [E46°S]

$F_2 = 15$ [N] $F_4 = ?$



East-West

$F_{net} = \sum Forces = 0\ N.$

$0 = F_{1E} + F_{2E} + F_{3E} + F_{4E}$

$0 = 10 + 0 + 28\cos 46 + F_{4E}$

$-29.5\ N = F_{4E}$

North-South

$F_{net} = F_{1N} + F_{2N} + F_{3N} + F_{4N}$

$0 = 0 + (-15) + (-28\sin 46) + F_{4N}$

$35.1\ N = F_{4N}$

$$F_4 = \sqrt{(F_{4E})^2 + (F_{4N})^2}$$

$F_4 = 45.8\ N$

$\theta = \tan^{-1}\left|\frac{F_{4N}}{F_{4E}}\right|$

$\theta = 50°$

$F_4 = 46$ [W50°N]

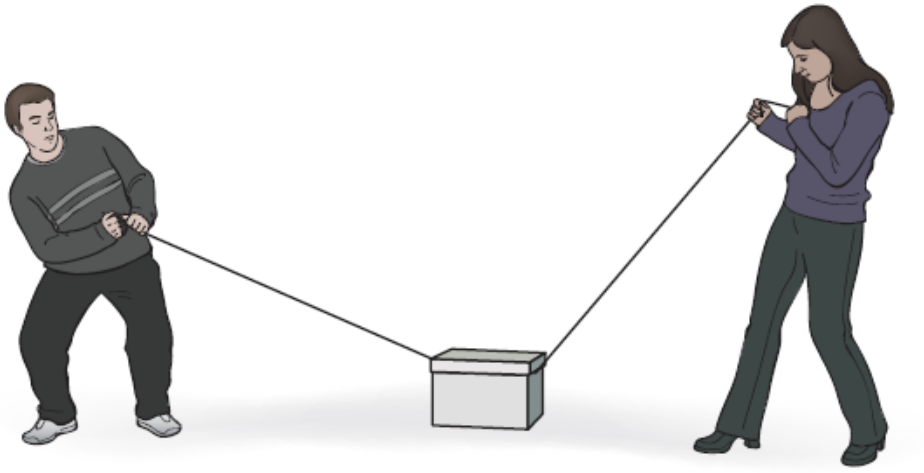
Pushing or Pulling at an Angle

Grade: 12

Subject: Physics 122

Date: 2014

Consider this diagram for the following questions:

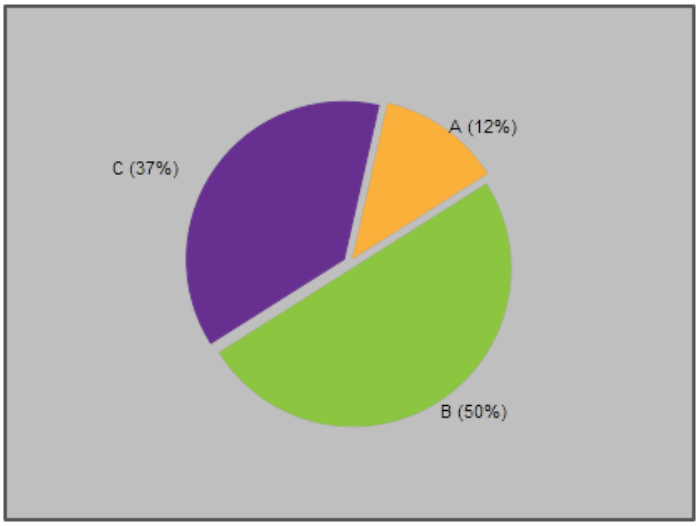


1 How does the normal force compare to the case where no one is pulling on the box?

A Normal force would be the same in either case.

B Normal force is reduced based on the diagram.

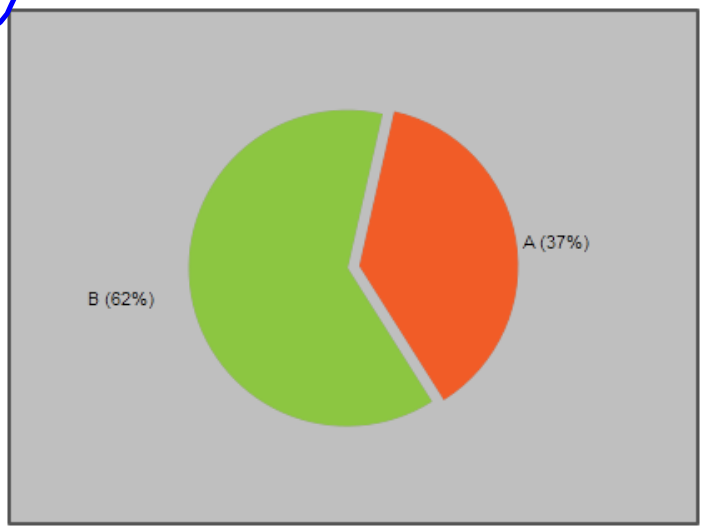
C Normal force is increased based on the diagram.



2 For this box not to have any horizontal motion, what condition must be met?

A Man applies more force than woman.

B Man applies less force than woman.

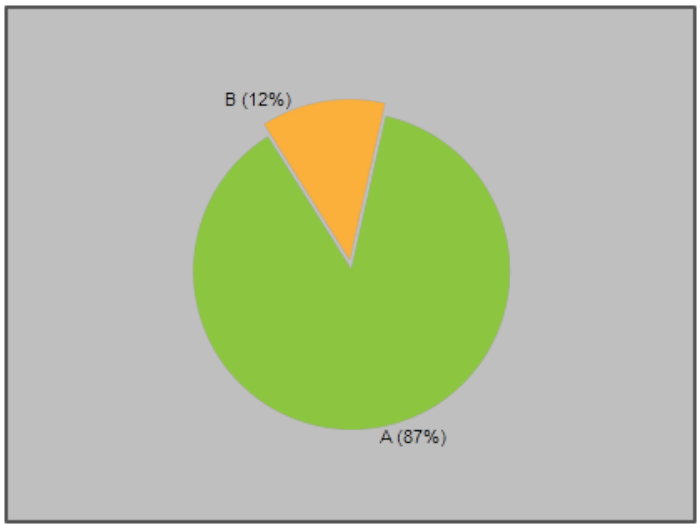


3 How does the vertical component of the applied force change when the angle is increased?

A Increased

B Decreased

C Remains the same

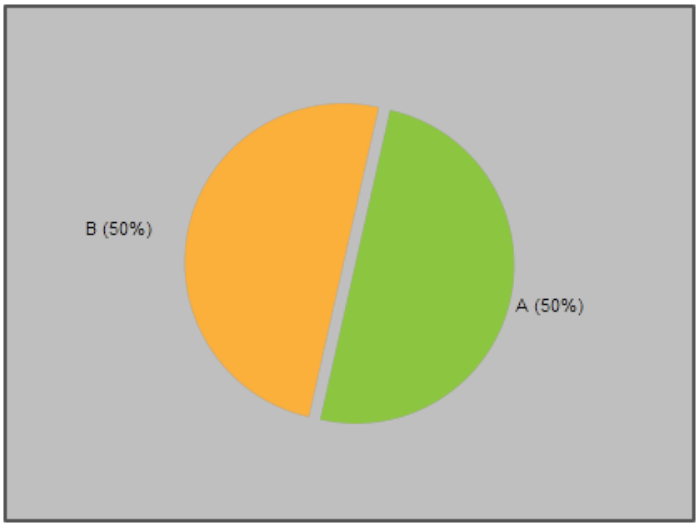


4 If the woman doubles her applied force then the horizontal component will _____.

A double

B be halved

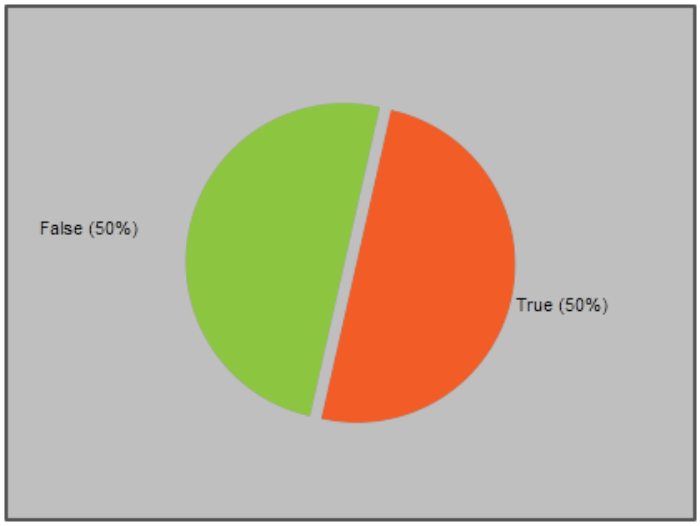
C remain the same



5 If the man doubles the angle of the applied force (without changing F_a) it will double the vertical component of F_a.

True

False

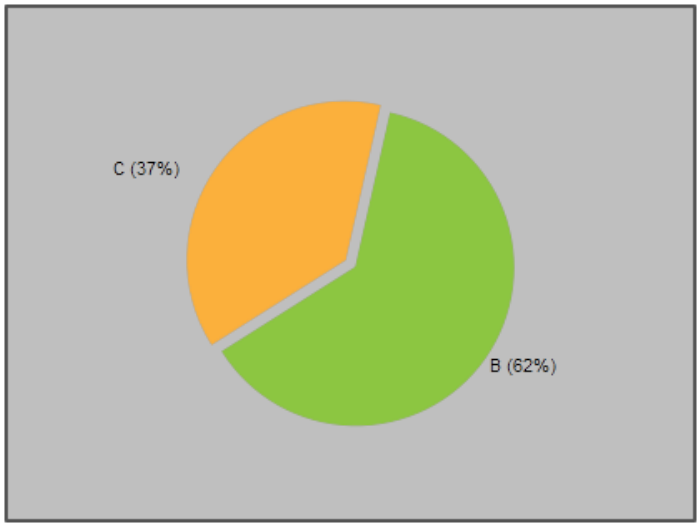


6 If both people increase their angles then the force of friction will _____.

A increase

B decrease

C remain the same

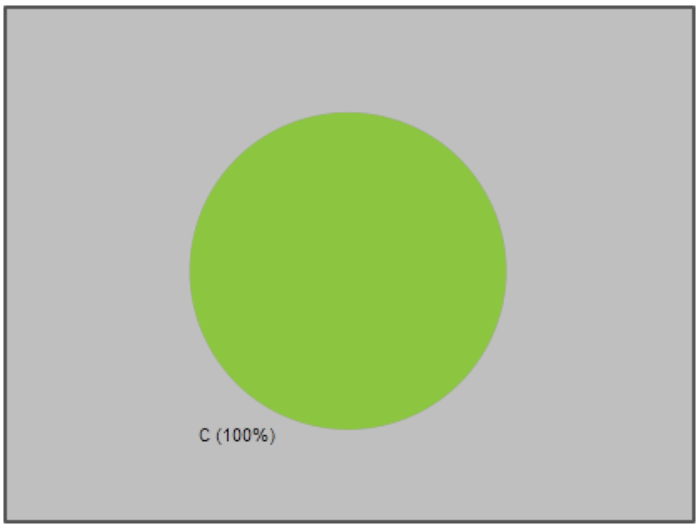


7 If both people reduce their pulling angles the force of gravity on the box will ___.

A increase

B decrease

C remain the same

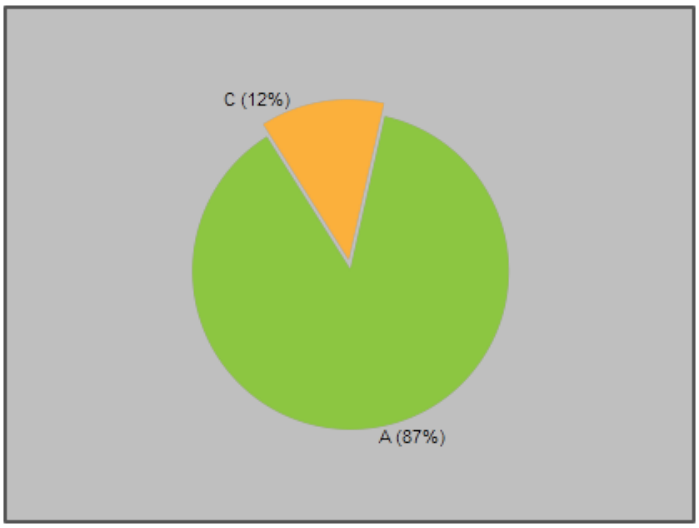


8 Suppose the box in the diagram is replaced with one that is more massive (that is the only change). The normal force will ___.

A increase

B decrease

C remain the same

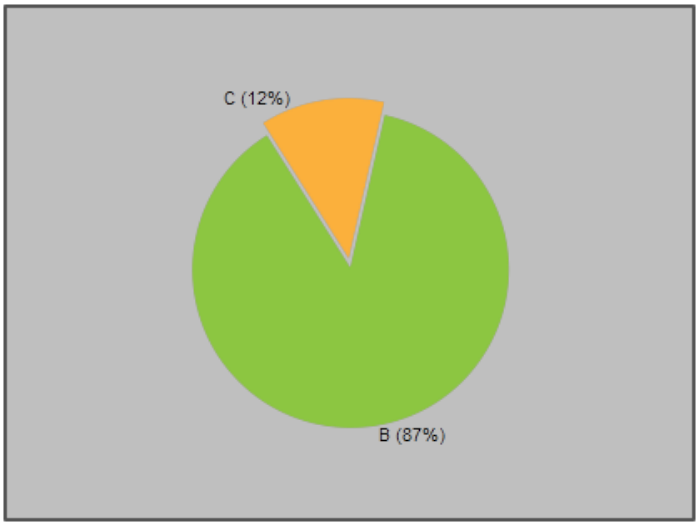


9 Suppose in this situation the box accelerates to the left. How could the woman compensate without changing her applied force?

A increase the angle of her applied force

B decrease the angle of her applied force

C it is not possible to compensate



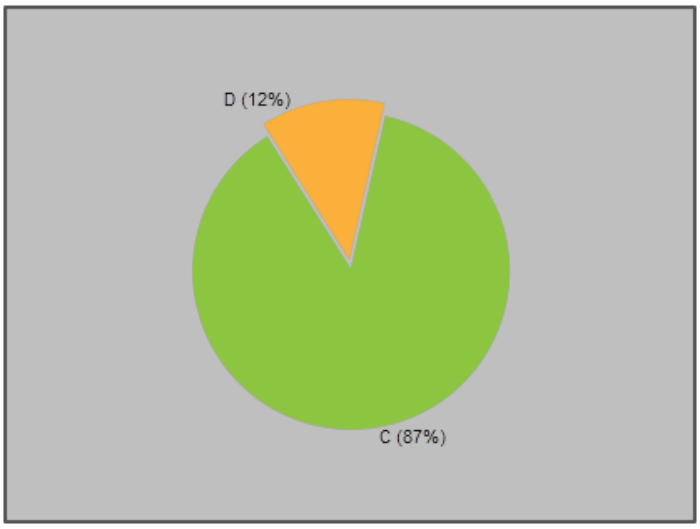
10 Suppose the box is in static equilibrium when a third person attaches a rope to the front side of the box and pulls (so this applied force would be out of your screen - in the 3rd dimension). What will happen to the box? (neglect friction)

A The box will remain in static equilibrium.

B The box will accelerate away from the third person.

C The box will accelerate toward the third person.

D The box will move at a constant velocity towards the third person.



Attachments

ramp-forces-and-motion_en.jar