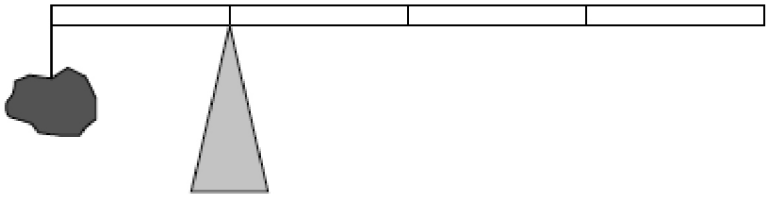
Static Equilibrium
Concept Questions

Question 1 A 1-kg rock is suspended by a massless string from one end of a 1-m measuring stick. What is the weight of the measuring stick if it is balanced by a support force at the 0.25-m mark?



1) 0.25 kg

2) 0.5 kg

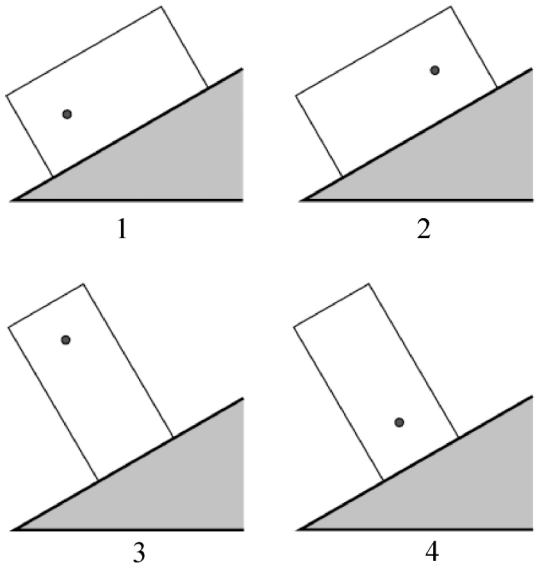
3) 1.0 kg

4) 2.0 kg

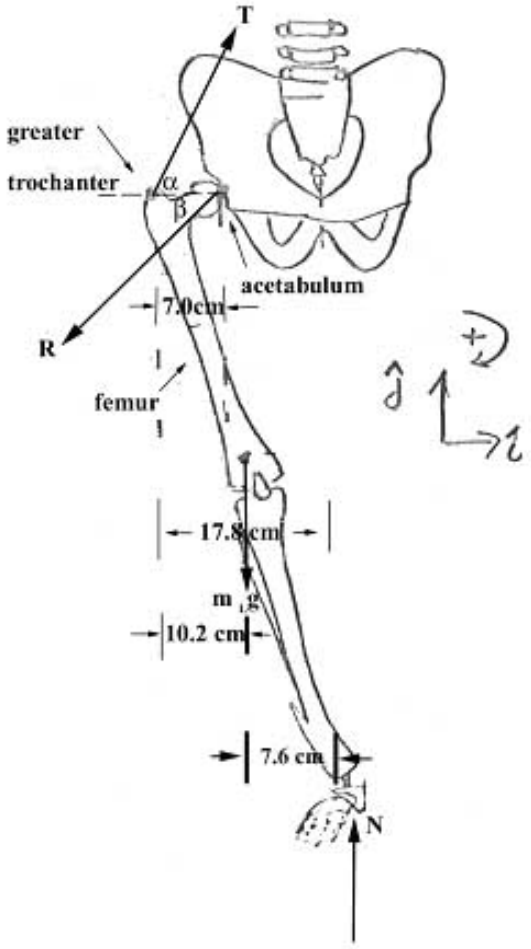
5) 4.0 kg

6) impossible to determine

Question 2 A box, with its center-of-mass off-center as indicated by the dot, is placed on an inclined plane. In which of the four orientations shown, if any, does the box tip over?



Question 3 Torque on the right leg We want to find the magnitude of the tension in the hip abductor muscles $\vec{\mathbf{T}}$ shown in the figure below.



The direction α is given. After drawing your free body diagram for the right leg, you are trying to decide what point to compute the torques about. Explain the disadvantages /advantages if you chose each of the points listed below.

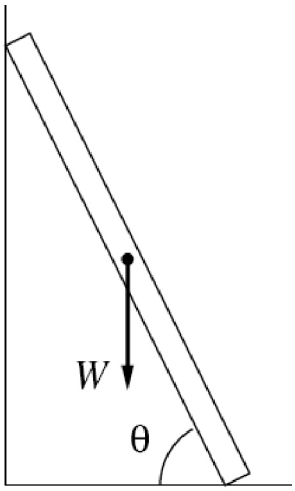
a) The center of mass of the leg where the gravitational force $m_l\vec{\mathbf{g}}$ acts

b) The contact point with the ground where the normal force $\vec{\mathbf{N}}$ acts

c) The point of contact between the acetabulum and the femur where the reaction force $\vec{\mathbf{R}}$ acts

d) The point where the tension in the hip abductor muscles $\vec{\mathbf{T}}$ act

Question 4 A uniform ladder (one whose center of mass is at its geometrical center) of weight W leans against a wall at an angle $\theta \approx 60^o$ up from the ground. The coefficient of friction between the ladder and the ground is μ_G, and between the ladder and the wall is μ_W. The magnitudes of these two coefficients are about equal. In order to keep the ladder from slipping:



1) The magnitude of the torque about the center of mass due to the normal force between the ground and the base of the ladder is greater than the magnitude of the torque about the center of mass due to the frictional force of the wall on the ladder.
2) The magnitude of the torque about the center of mass due to the normal force between the ground and the base of the ladder is equal to the magnitude of the torque about the center of mass due to the frictional force of the wall on the ladder.
3) The magnitude of the torque about the center of mass due to the normal force between the ground and the base of the ladder is less than the magnitude of the torque about the center of mass due to the frictional force of the wall on the ladder.

4) Not enough information is given to answer this problem.

Question 5 You are trying to open a door that is stuck by pulling on the doorknob in a direction perpendicular to the door. Assume the doorknob is at the same height as the center of mass of the door. If instead you tie a rope to the door and then pull perpendicularly with the same force, the torque about the center of mass of the door you exert is

1) increased
2) decreased
3) the same
4) unsure

8.01SC Physics I: Classical Mechanics