Lecture 13
(Using Newton’s Laws)

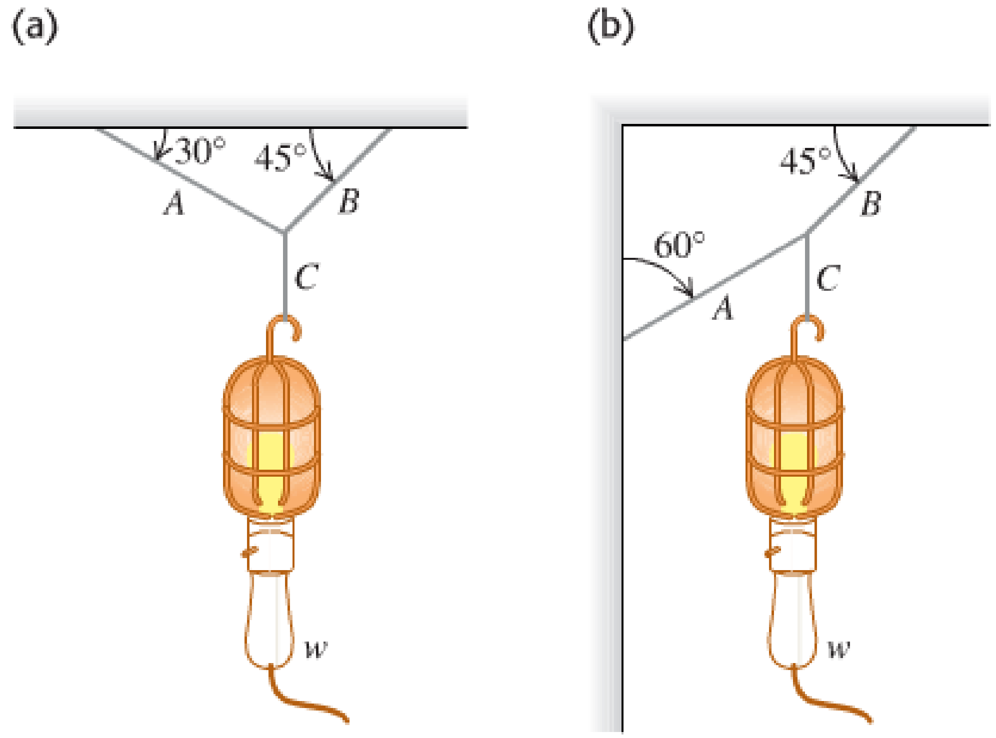
Physics 160-01 Fall 2012

Douglas Fields

Problem 5.9

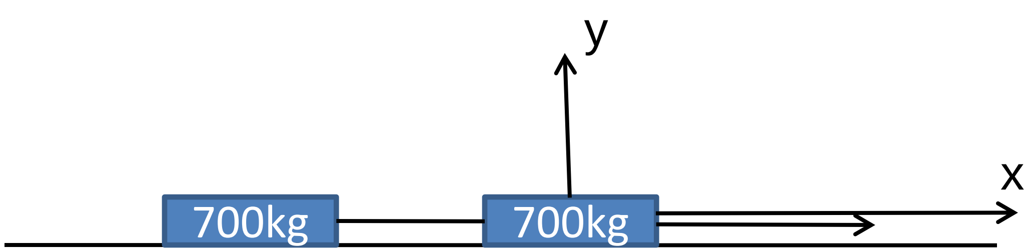
5.9. Find the tension in each cord in Fig. 5.44 if the weight of the suspended object is w.

Figure **5.44** Exercise 5.9.



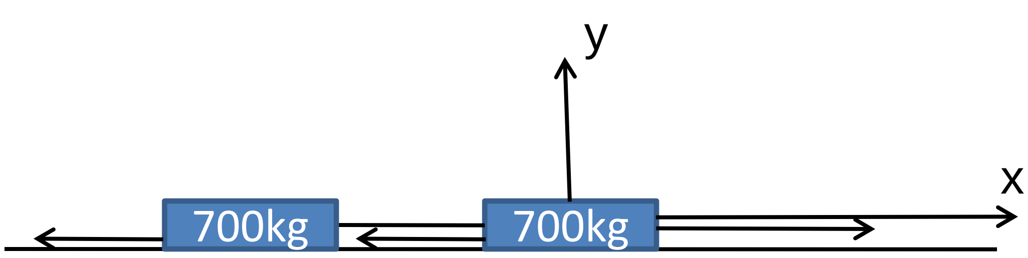
Problem 5.22

5.22. Runway Design. A transport plane takes off from a level landing field with two gliders in tow, one behind the other. The mass of each glider is 700 kg, and the total resistance (air drag plus friction with the runway) on each may be assumed constant and equal to 2500 N. The tension in the towrope between the transport plane and the first glider is not to exceed 12,000 N. (a) If a speed of 40 m/s is required for takeoff, what minimum length of runway is needed? (b) What is the tension in the towrope between the two gliders while they are accelerating for the takeoff?



Problem 5.22

- First, think of the two planes as one load on the tether line…
- Then, use Newton's 2^{nd} Law to calculate the maximum acceleration that the tether rope will stand.
- From that acceleration, find the minimum runway distance.



Analyzing Forces

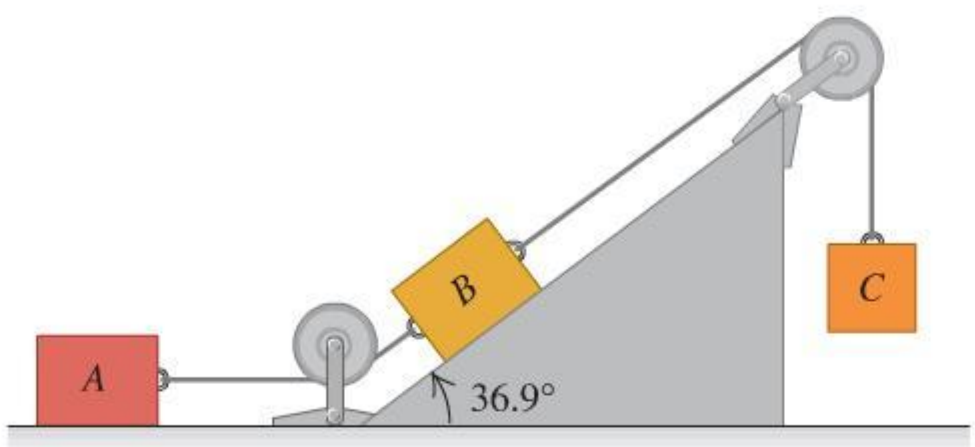
- Equilibrium in an inertial frame
- Acceleration in an inertial frame
- Equilibrium in a non-inertial frame

Problem 5.45

- Equilibrium in an inertial frame

5.45. Blocks A, B, and C are placed as in Fig. 5.56 and connected by ropes of negligible mass. Both A and B weigh 25.0 N each, and the coefficient of kinetic friction between each block and the surface is 0.35. Block C descends with constant velocity. (a) Draw two separate free-body diagrams showing the forces acting on A and on B. (b) Find the tension in the rope connecting blocks A and B. (c) What is the weight of block C? (d) If the rope connecting A and B were cut, what would be the acceleration of C?

Figure 5.56 Exercise 5.45.

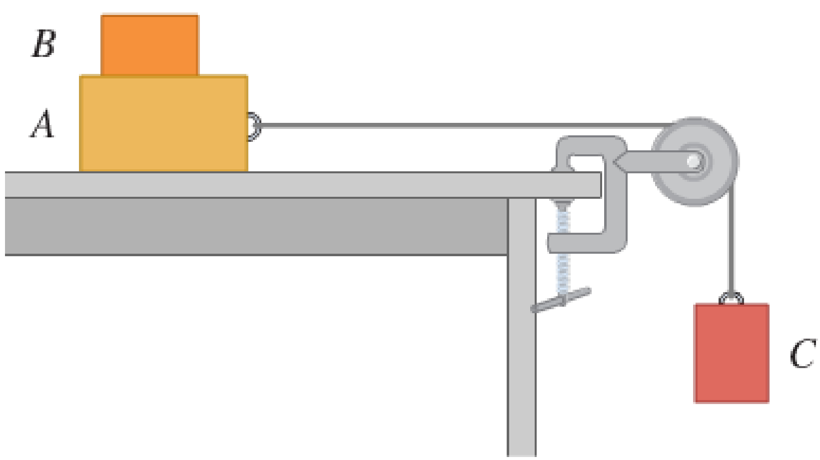


Problem 5.88

- Acceleration in an inertial frame

5.88. Block *B*, with mass 5.00 kg, rests on block *A*, with mass 8.00 kg, which in turn is on a horizontal tabletop (Fig. 5.72). There is no friction between block *A* and the tabletop, but the coefficient of static friction between block *A* and block *B* is 0.750. A light string attached to block *A* passes over a frictionless, massless pulley, and block *C* is suspended from the other end of the string. What is the largest mass that block *C* can have so that blocks *A* and *B* still slide together when the system is released from rest?

Figure 5.72 Problem 5.88.



Problem 5.91

- Equilibrium in a non-inertial frame

5.91. A block is placed against the vertical front of a cart as shown in Fig. 5.73. What acceleration must the cart have so that block *A* does not fall? The coefficient of static friction between the block and the cart is μ_s. How would an observer on the cart describe the behavior of the block?

Figure 5.73 Problem 5.91.