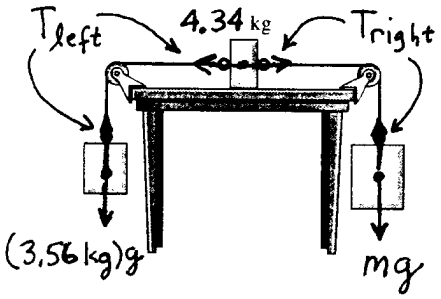
PHY 140Y – FOUNDATIONS OF PHYSICS
2001-2002
Tutorial Questions #6
October 22/23

Note: As requested, answers are given in brackets. Try getting full solutions before the tutorials!

More on Newton's Laws of Motion without Friction

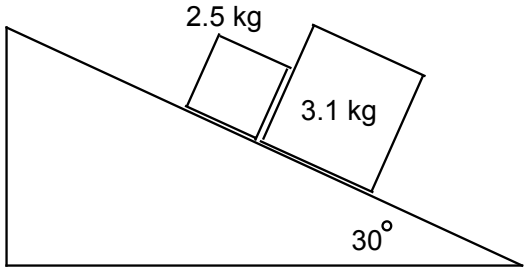
1. What downward force is exerted on the air by the blades of a 4300-kg helicopter when it is (a) hovering at constant altitude *[42kN]*; (b) dropping at 21 m/s with speed decreasing at 3.2 m/s^2 *[56 kN]*; (c) rising at 17 m/s with speed increasing at 3.2 m/s^2 *[56 kN]*; (d) rising at a steady 15 m/s *[42 kN]*; (e) rising at 15 m/s with speed decreasing at 3.2 m/s^2 *[28 kN]*?

2. In a setup like that shown in in the figure, but with different masses, a 4.34-kg block starts from rest on the left edge of a frictionless tabletop 1.25 m wide. It accelerates to the right, and reaches the right edge in 2.84 s. If the mass of the block hanging from the left side is 3.56 kg, what is the mass hanging from the right side? *[3.93 kg]*



Applying Newton's Laws of Motion with Friction

3. A 2.5-kg and a 3.1-kg block slide down a 30° incline as shown. The coefficient of kinetic friction between the 2.5-kg block and the slope is 0.23, and the coefficient of kinetic friction between the 3.1-kg block and the slope is 0.51. Determine (a) the acceleration of the pair *[1.6 m/s^2]*, and (b) the force that the lighter block exerts on the heavier block *[3.3 N]*.



4. A box of mass m sits on a rough horizontal surface. The coefficient of static friction is μ_s. The box is pulled by a massless rope as shown below.
   (a) What is the magnitude of force T so that the box will just start moving horizontally? *[an eqn!]*
   (b) At what angle θ_{min} is the force required to move the box a minimum value? *[$\tan^{-1}\mu_s$]*
   (c) Why, physically, is there a minimum value? *[discuss]*