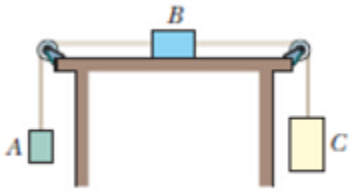
Physics 1A: Physics for Scientists and Engineers: Mechanics **Winter 2015**

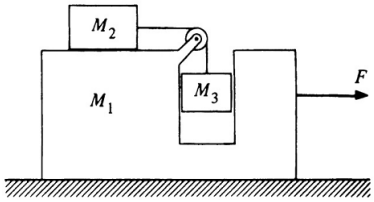
Discussion 3: Week 4

Exercise 1 A hot-air balloon consists of a basket, one passenger, and some cargo. Let the total mass be M. Even though there is an upward lisft force on the balloon, the balloon is initially accelerating downward at a rate of $g/3$. (a) Draw a free-body diagram for the descending balloon. (b) Find the upward lift force in terms of the initial total weight Mg . (c) The passenger notices that he is heading straight for a waterfall and decides he needs to go up. What fraction of the total weight must he drop overboard so that the balloon accelerates upward at a rate of $g/2$? Assume that the upward lift force remains the same.

Exercise 2 The following figure shows three blocks attached by cords that loop over frictionless pulleys. Block B lies on a frictionless table; the masses are $m_A = 6.00$ kg, $m_B = 8.00$ kg, and $m_C = 10.0$ kg. When the blocks are released, what is the tension in the cord at the right?



Exercise 3 A 'pedagogical machine' is illustrated in the sketch. All surfaces are frictionless. What force F must be applied to M_1 to keep M_3 from rising or falling? (Hint: for equal masses $F = 3Mg$)



Exercise 4: Challenging Problem A painter weighing 630 N working from a Bosuns chair hung down the side of a tall building desires to move in a hurry. He pulls down on the fall rope with such a force that he presses against the chair with only a force of 350 N. The chair itself weights 105 N. (a) What is the acceleration of the painter and the chair? (b) What is the total force supported by the pulley?