Physics Club
Mini Competition - Forces Basics
1/30/18

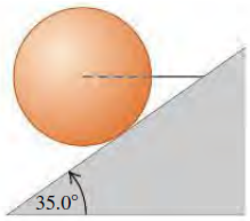
Team Name: _____

Instructions: This competition contains four questions, each is worth (at maximum) different amounts, depending on difficulty. Assume $g = 10\ \frac{m}{s^2}$. You do not have to go in order, and you may work in groups of 5 or less. Treat each object as a particle. Put your answers at the bottom of the page.

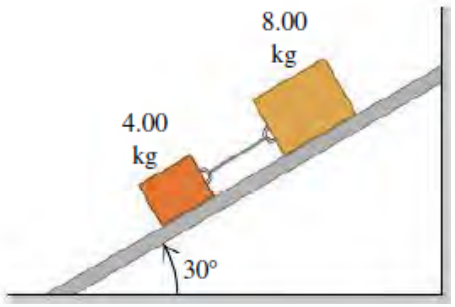
1. (10 points) A crate with mass 32.5 kg initially at rest on a warehouse floor is acted on by a net horizontal force of 14.0 N.
   (a) (2 points) What acceleration is produced?
   (b) (3 points) What is its speed at the end of 10.0 s?
   (c) (5 points) How far does the crate travel in 10.0 s?

2. (20 points) Boxes A and B are in contact on a horizontal, frictionless surface (A is to the left of B). You push on box A with a horizontal 100-N force. Box A weighs 150 N, and box B weighs 50 N. What force does A exert on B?

3. (40 points) A horizontal wire holds a solid uniform ball of mass 10kg in place on a tilted ramp that rises 35.0° above the horizontal. The surface of this ramp is perfectly smooth, and the wire is directed away from the center of the ball. Round your answers to the nearest tenth, including no trigonometric functions in your final answer.
   (a) (20 points) How hard does the surface of the ramp push on the ball?
   (b) (20 points) What is the tension in the wire?



4. (50 points) Two blocks, with masses 4.00 kg and 8.00 kg, are connected by a string and slide down a 30.0° inclined plane. The coefficient of kinetic friction between the 4.00-kg block and the plane is 0.25; that between the 8.00-kg block and the plane is 0.35. Calculate:
   (a) (25 points) the acceleration of each block and
   (b) (25 points) the tension in the string.



Answer Sheet:

1a)

1b)

1c)

2)

3a)

3b)

4a)

4b)

Challenge Problem

B, with mass 5.00 kg, rests on block A, with mass 8.00 kg, which in turn is on a horizontal tabletop. There is no friction between block A and the tabletop, but the coefficient of static friction between blocks A and 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.

a) 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?