

Honors Physics – P221

Exam II

Distributed on Friday, October 25, 2002
and due at 1:25 pm on Monday, October 28, 2002

Guidelines:

- (1) This exam consists of four problems, each worth 25 points. Please show all your work in the blue books provided.
- (2) You can use your text, notes and computer – but you may not consult with anyone while taking this exam.
- (3) If you have a question about any of these problems please send me an e-mail. I will post answers to questions to the entire class.
- (4) Please take the time to write your solutions neatly and clearly. Be sure to specify units.

Thank you,



Alex R. Dzierba

Please print your name below and also sign your name. By so doing you are stating your understanding of the rules under which this exam is given and that you followed these rules.

Problem 1 (25 points)

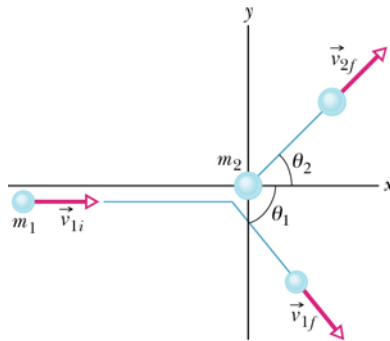
A solid sphere of radius R and mass M has a mass density (mass per volume) that depends only on r , the distance from the center from the sphere. That density is given by:

$$\rho(r) = \rho_0 \cdot r$$

where ρ_0 is a constant.

- (a) What are the units for ρ_0 ?
- (b) Determine ρ_0 in terms of R and M ?
- (c) Find the moment of inertia of this sphere.

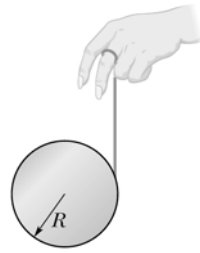
Problem 2 (25 points)



In the above collision the mass of ball 2 is twice the mass of ball 1. The initial velocity of ball 1 is 10 m/s and the final velocity vector of ball 1 makes an angle of 30 degrees. We do *not* know whether the collision is elastic or not.

- (a) What is the final speed of ball 2 in terms of the final speed of ball 1?
- (b) Plot this function.
- (c) What is the largest possible final speed for ball 1?

Problem 3 (25 points)

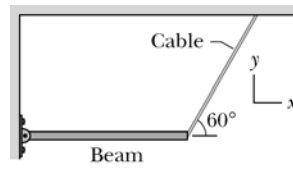


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In the above figure a spool of thread of moment of inertia I , radius R and mass M falls as the thread unwraps around its circumference. A hand holds the upper end of the string.

- (a) What is the magnitude of the linear acceleration of the spool's center of mass if the hand is stationary?
- (b) What upward acceleration must the hand give the thread if the spool's center of mass is not to fall?

Problem 4 (25 points)



In the figure the beam is uniform and has a mass of 53 kg. The hinge (on the wall) and the cable attached to the ceiling support the beam. What are the x and y components of the force of the hinge on the beam?