Quiz No. 09 (2014 Summer)

PHYS 203A: College Physics

Date: 2014 Jul 28

(Name) (Signature)

1. (**20 points.**) Two children hang by their hands from the same tree branch. The branch is straight, and grows out from the tree trunk at an angle of 29.7° above the horizontal. One child, with a mass of 41.6 kg, is hanging 1.33 m along the branch from the tree trunk. The other child, with a mass of 33.3 kg, is hanging 2.17 m from the tree trunk. What is the magnitude of the net torque exerted on the branch by the children? Assume that the axis is located where the branch joins the tree trunk and is perpendicular to the plane formed by the branch and the trunk.

2. (**20 points.**) A uniform board is leaning against a smooth vertical wall. The board is at an angle θ above the horizontal ground. The coefficient of static friction between the ground and the lower end of the board is 0.363. Find the smallest value for the angle θ, such that the lower end of the board does not slide along the ground.

3. (**20 points.**) A hollow spherical shell ($I = \frac{2}{3}MR^2$) is rolling on a surface.

   (a) What fraction of its total kinetic energy is in the form of rotational kinetic energy about the center of mass?

   (b) What fraction of its total kinetic energy is in the form of translational kinetic energy?

4. (**20 points.**) Starting from rest, a basketball (that can be assumed to be a hollow spherical shell with $I = \frac{2}{3}MR^2$) rolls from the top of a hill to the bottom, reaching a translational speed of 5.46 m/s. Ignore frictional losses.

   (a) What is the height of the hill?

   (b) Released from rest at the same height, a can of frozen juice (that can be assumed to be a solid cylinder with $I = \frac{1}{2}MR^2$) rolls to the bottom of the same hill. What is the translational speed of the frozen juice can when it reaches the bottom?

5. (**20 points.**) Suppose the ice cap at the South Pole melted and the water was distributed uniformly over the earth's oceans. Would the earth's angular velocity increase, decrease, or remain the same? Justify your answer. Thus, would the length of day increase, decrease, or remain the same?