Name:_____

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 20 points. You must show your work in a logical fashion starting with the correctly applied physical principles shown on the last page. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

1. It turns out that neutrons are not stable particles. A neutron will decay into a proton and an electron. The mass of a proton is 1833 times the mass of an electron. Suppose a neutron, initially at rest, breaks apart into an electron and a proton. The total kinetic energy of the electron and proton together is K. Find (a)the net momentum of the electron and the proton as a system and (b)the kinetic energy of the proton by itself as a fraction of the total kinetic energy.

2. Find the torque that a pitcher must exert on a 150g baseball with a radius of 3.50cm to get it to go from rest to a spin rate of 2400rpm in the 0.200s it takes to "snap" their wrist.

3. A basketball player cannot balance a basketball on her fingertip unless the ball is spinning. Explain this in terms of the relevant principles of physics.

4. A 7.00g quarter (25¢ coin) has a radius of 1.20cm dropped into the slot of a vending machine rolls down a curved ramp 30.0cm high without slipping. At the bottom of the ramp find (a)the speed of its center of mass of the coin and (b)its angular speed about the center of mass.

5. The A end of bar AB rests on a frictionless horizontal surface while the B end is hinged. A horizontal 120N force is exerted on the A end. This force is so large that the weight of the bar can be ignored. Find (a)the horizontal component of the force exerted by the pivot and (b)the vertical component of the force exerted by the pivot.