Name:_____

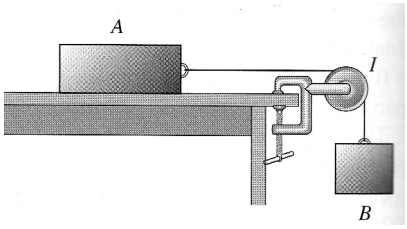
Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 20 points. You must show your work in a logical fashion starting with the correctly applied physical principles. The equations you need are on the equation sheet. Your score will be maximized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

1. Three equally massive and equally strong astronauts are outside their ship in outer space. Two of them get the bright idea to play a game of catch by throwing the third one back and forth. Suppose the game begins with the first astronaut throwing the third astronaut toward the second astronaut at a speed v_o. Describe the rest of the game. This means that you must find the velocity of each astronaut after each catch and after each throw. Sketches of the game at each stage might be the best way to explain your answer. Be sure to state the principle or principles you use.

2. A 100g bat (the animal) flying northward at 0.800m/s gulps down a 20.0g moth heading eastward at 3.50m/s. Find the speed and direction of the bat and its full belly just after his meal.

3. A basketball has a mass of 0.450kg, a radius of 12.0cm, and is hollow. The basketball player shown at the right wants to get the basketball spinning by exerting an average torque of 0.0300N·m for 3.00s. Find (a)the rotational inertia of the ball and (b)the rate at which it will be spinning.

4. The system shown below starts from rest. Block A slides across a frictionless table and has a mass of 2.00kg. The pulley has a mass of 1.00kg and a radius of 5.00cm. Block B has a mass of 5.00kg. Find the speed of block B after it has fallen 1.00m.



5. The slope of a pitcher's mound makes a 20.0° angle with the horizontal. A 15.0N – 90.0cm baseball bat rests on the mound in such a way that only the ends are actually in contact with the mound. The center of mass of the bat is 60.0cm from the skinny end. Find the magnitudes of each of the normal forces and the total frictional force that the ground exerts on the bat.