Name:_____

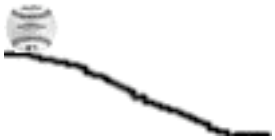
☐ Check here to have your grade posted on the class web site.

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 10 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. The pitcher throws a pitch from the mound toward home plate 18.4m away. The ball is released horizontally from a height of 2.00m with a velocity of 42.0m/s. Find (a)the time it takes for the ball to reach home plate and (b)the height above the ground when it gets there.

2. An 85.0kg base runner tries to steal second base. When he is 3.00m from the base he begins his slide at a speed of 9.00m/s. He comes to rest just as he touches the base. Find (a)his acceleration, (b)the average frictional force exerted by the ground on the sliding runner, and (c)the coefficient of friction between the runner and the ground.

3. A 150g baseball starts from rest and rolls without slipping down the 42.0cm high pitcher's mound. Find its speed at the bottom.



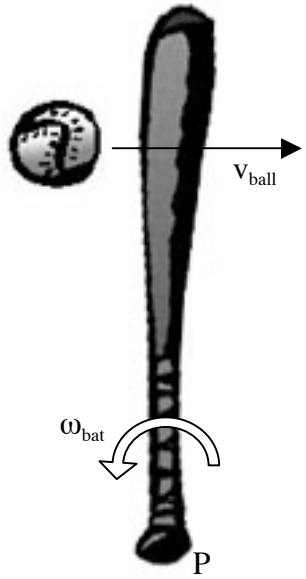
4. A 75.0kg shortstop jumps upward to catch the 150g baseball traveling horizontally at 55.0m/s. At the instant before the catch the shortstop is traveling upward at 0.250m/s. Find the velocity (magnitude and direction) of the shortstop and ball just after the catch.

5. A 1.00kg baseball bat 85.0cm long has a center of mass that is 20.0cm above the fat end. It leans against a wall smooth wall making a 60.0° angle with the ground. Find the magnitude of each force that acts on the bat and show its direction in the sketch below.

6. A sporting goods catalog lists the masses and lengths that are available in a given style of bat. Rank them according to their rotational inertia from smallest to largest. Be sure to explain your reasoning.

A		m = 900g	L = 75cm
B		m = 1000g	L = 80cm
C		m = 1100g	L = 85cm
D		m = 800g	L = 75cm
E		m = 900g	L = 80cm
F		m = 1000g	L = 85cm

7. A 1.00kg bat is rotating about the knob (P) at 600rpm as the 150g ball approaches with a speed of 40.0m/s. The rotational inertia of the bat about the knob end is 0.350kg·m^2 and the ball strikes the bat 60.0cm from the knob. Find (a)the angular momentum of the ball about P, (b)the angular momentum of the bat about P, and (c)the velocity of the ball after the collision assuming the rotation rate of the bat is 300rpm.



8. A 0.900±0.001kg baseball bat is 85.0±0.2cm long and its center of mass is 55.0 ±0.2cm from the knob end. When held at the knob end and allowed to oscillate, it is found to have a period of 1.60±0.05s. Find the rotational inertia of the bat about the knob end and find the uncertainty in this value.

9. A baseball announcer describing a long home run states that the batter "put that one in orbit." Find the speed that the ball would have to leave the bat in order to go into orbit just above the surface of the earth.

10. The Metrodome is a domed stadium in Minneapolis where the Minnesota Twins play baseball. The air inside the stadium, which has a density of 1.29kg/m, supports its roof almost entirely[3]. The mass of the roof is 2.640×10^5kg and is it $7.44 \times 10^4 m^2$ in area. Find (a)the pressure difference across the roof and (b)the speed that air would travel through an open door to the stadium. (c)Would the air move in or out?