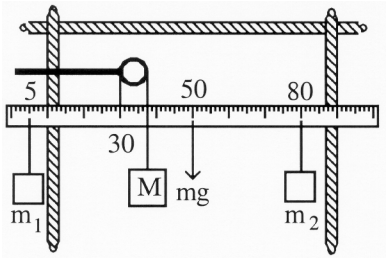
Name:_____ Posting Code ____ ____ ____
(only if you want your grade posted on the web.)

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 shown on the last page. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

1. A helicopter flying horizontally at 30.0m/s is 80.0m above the ground and plans to drop supplies to tsunami victims below. Find (a)the time before they are directly overhead that they must release the supplies so that they land near these victims and (b)the horizontal distance from where they release them to the point where they land.

2. A 150g meterstick is suspended horizontally from a string at the 30cm mark that is wrapped over a pulley supporting a mass M. Two weights hang from the stick. One has a mass of 100g at the 80cm mark and the other is at the 5cm mark. Find the weight at the 5cm mark and the mass M needed to keep the meterstick in equilibrium.

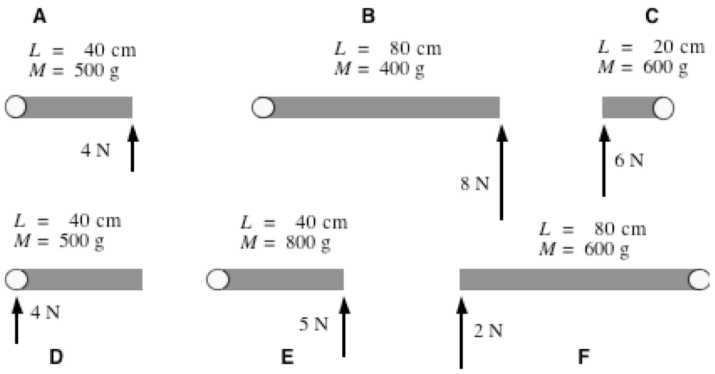


3. The US military has a 200kg satellite that orbits Earth at an altitude of 300km. Earth exerts a gravitational force on the satellite to keep it in orbit. You claim that this means that the satellite exerts a gravitational force on Earth. Your friend says that this is ridiculous because the satellite is so small compared to Earth that it can't affect Earth at all. Explain as clearly as you can to your friend why you are correct and be sure to compare the size of the force exerted on the satellite with the size of the force exerted on Earth.

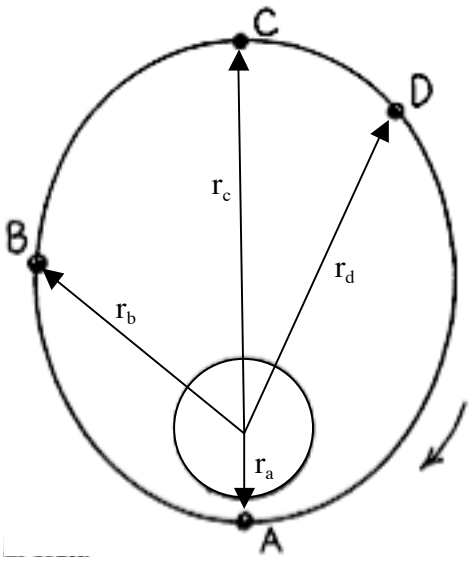
4. Find the period of orbit of the satellite in the previous problem.

5. A 60.0kg astronaut is on a space walk to repair a communications satellite. She realizes that she needs to consult the repair manual, which her colleague tosses toward her at 4.00m/s relative to the spaceship. If she was at rest relative to the ship before she catches the 3.00kg manual. Find her speed after she catches it.

6. Shown at the right in a top view are six uniform rods that vary in mass (M) and length (L) as indicated. The circles represent the vertical axis around which the rods are going to be rotated in a horizontal plane. Arrows show the forces acting to rotate the rods. The forces change direction in order to always act perpendicular to the rods and the magnitudes of the forces are given in each figure. Rank these rods from greatest to least, on the basis of (a)their rotational inertia, (b)the torque they feel, and (c)their change in angular momentum in 1.00s. Explain your reasoning for full credit.

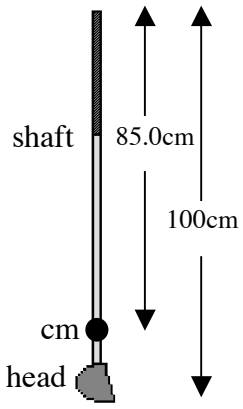


7. A comet of mass 3.50×10^5kg orbits the sun. At closest approach (A) it has a speed of 75.0km/s. The distance from the sun to point C is four times the distance from the sun to point A. Find its speed at point C.



8. As the comet in problem 7 goes from point A to point C, (a)find the change in kinetic energy, (b)the change in potential energy, and (c)the radii r_a and r_c.

9. The golf club shown at the right is 1.00m long. The head has a mass of 700g and the shaft has a mass of 200g. The center of mass is 85.0cm below the top of the shaft. A bored golfer decides to let the club gently swing back and forth while she chats with her partners. The period of oscillation is 2.00s. Find the rotational inertia of the club about the end of the shaft.



10. A block of metal has a mass of 200g in air, but the same scale only reads 175g when the block is submerged in water. Find the density of the metal.