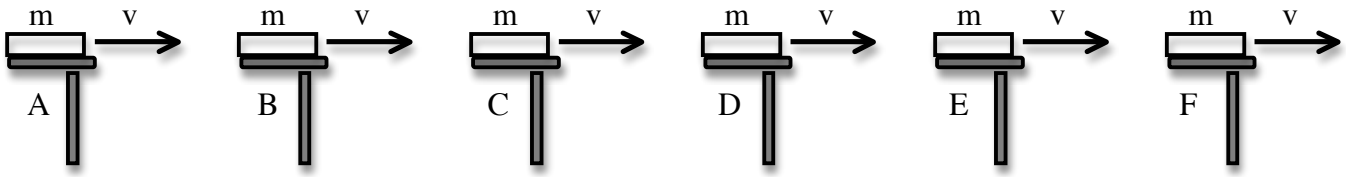
Name:_____ PC _____ _____ _____

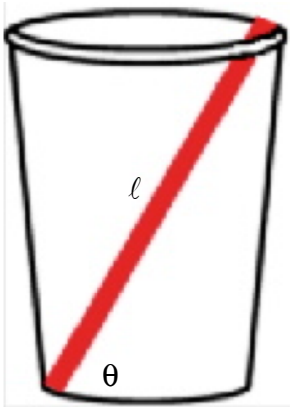
Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 10 points. You must show your work in a logical fashion starting with the correctly applied and clearly stated physical principles. The equations you need are on the equation sheet. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

1. Six different books slide off the edge of a table one at a time. The mass and speed along the table are given. Rank the books from greatest to least based upon (a)the time to hit the ground and (b)the horizontal distance from the edge of the table to the point where the book lands. You must explain your reasoning for full credit.



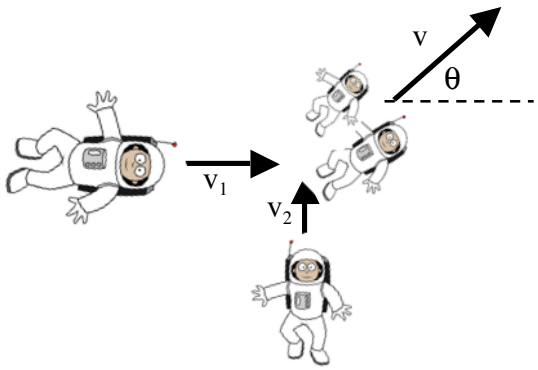
A	B	C	D	E	F
m = 1kg	m = 2kg	m = 1kg	m = 2kg	m = 1kg	m = 2kg
v = 1m/s	v = 1m/s	v = 2m/s	v = 2m/s	v = 3m/s	v = 3m/s

2. A 5.00g straw is just long enough to rest across a drinking glass. It is 12.0cm long and makes a 60˚ angle with the base of the cup. Assume the top of the glass is smooth and rounded. Find the horizontal and vertical components of the force that the bottom of the cup exerts on the straw.

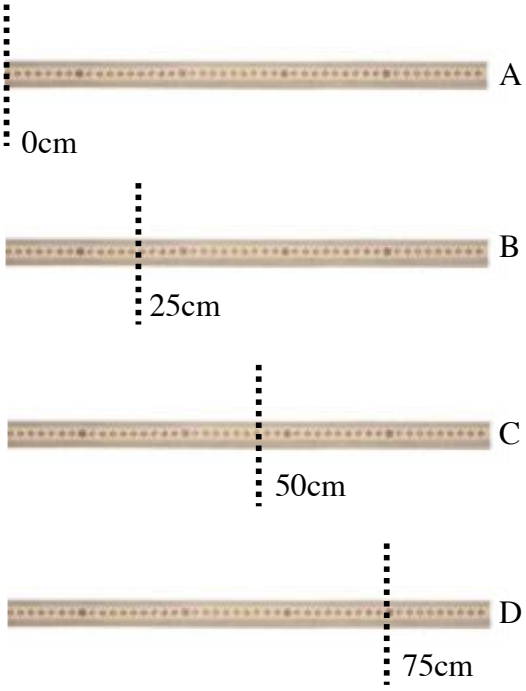


3. A 60.0kg bungee jumper steps off a 55.0m high bridge. The unstretched length of the cord is 30.0m and it stretches an additional 20.0m when the jumper is at the lowest point. Find the spring constant of the cord assuming both air resistance and the mass of the cord can be neglected.

4. A 110kg astronaut heading to the right collides with and holds on to an 80.0kg astronaut moving upward. After the collision, they move off together at 2.20m/s at an angle of 49° as shown. Find the speed of each astronaut before the collision.



5. A meterstick is rotated about an axis perpendicular to the stick. In each sketch, the axis is located at a different point along the stick as shown. The location is given. Rank these situations from greatest to least based upon the rotational inertia of the meterstick.



6. A baseball has a mass of 150g while a bat has a mass of 1.0kg and a rotational inertia of 0.45kg·m^2. A fastball heads toward the batter at 92mph (41m/s) and leaves the bat at 110mph (49m/s) in the opposite direction. The ball struck the bat at 75cm from the knob end when the bat is perpendicular to the velocity of the ball. Find (a)the initial angular momentum of the ball about the knob, (b)the final angular momentum of the ball about the knob, (c)the change in angular momentum of the ball, and (d)the change in angular momentum of the bat.

7. A 1.00m long string has a small 250g mass at the end. The mass is allowed to swing back and forth. Find the period.

8. We are now beginning to find many planets that orbit other stars. One such planet is found to have an orbital period of 3.00×10^7s and an orbital speed of 2.40×10^4m/s. Find (a)the radius of the planet's orbit, (b)the acceleration of the planet in its orbit, and(c)the mass of the star it orbits.

9. We have sent a space craft out of the solar system. Find the speed that such a craft would need starting at Earth so that it can escape the sun's gravitational field.

10. Explain how we know Dark Matter exists.