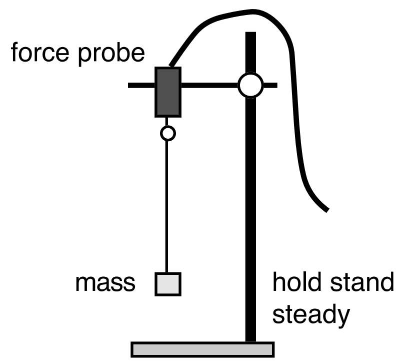
NAME: ________________

Lab 8-5: Vertical Circles

Purpose:
1. To predict the tension in the string of a pendulum when the pendulum is vertical.
2. To compare the prediction to reality.

Equipment: force probe, stand string mass meter stick

Procedure:



1. Hang the mass from the string and attach it to the force probe as shown. Make the string as long as possible, but make sure that the pendulum can swing freely. Also make sure that the force probe is vertical. *See diagram*.
2. Record the length of the pendulum you have just made, from the top point where it swings to the *middle* of the mass. With the mass simply hanging, record the tension in the string, which is simply the weight of the mass. Record the initial height of the 1 kg mass (from the table to the middle of the mass.)
3. Pull the mass back so that it makes a 30° to 45° angle. Measure the maximum height of the mass (from the table to the middle of the mass.)
4. Making sure that someone is holding the stand steady, start collecting data and let go of the mass. Record the tension in the string when the mass gets to its lowest point. (This will be the maximum force read by the force probe.)
5. Repeat steps 3 and 4 two more times. You can either drop the mass from the same height every time, or try it from different heights. It's up to you. Just make sure you record your data.

Data:

Radius of the pendulum: ___________ (m)

Tension when mass is stationary: ___________ (N)

		trial 1	*trial 2*	*trial 3*
Top height of mass	*(m)*			
Bottom height of mass	*(m)*			
Tension @ bottom	*(N)*			

Calculations:

For each of these calculations, show the equation you are using, and then show your work. You must do all these for each trial, but you only have to show your work for the first trial. Record your results in the table at the end of this section.

1. What is the potential energy "lost" by the swinging mass?

2. What is the kinetic energy of the mass at the bottom of its swing?

3. How fast is the mass going at the bottom of its swing?

4. What is the centripetal force needed so that the mass can be traveling is a circle with its calculated speed and radius?

5. What is the weight of the mass?

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6. Calculate the net force on the mass at the bottom of the swing.

Results of Calculations:

	trial 1	*trial 2*	*trial 3*
PE "lost " by mass *(J)*			
KE @ bottom of swing *(J)*			
speed @ bottom of swing *(m/s)*			
centripetal force needed *(N)*			
weight *(N)*			
tension in string @ bottom * *(N)*			
net force on mass @ bottom *(N)*			

* *Just copy this from your data on the other side*

Conclusions:

1. Compare the net force on the mass to the centripetal force needed. Explain why your results either make sense or don't make sense.

2. If the mass were just hanging without moving, the tension in the string would simply be equal to the weight of the mass. When the mass is swinging, however, the tension in the string will always be greater than the weight of the mass when the mass is at the bottom of its swing. Explain this.

3. Imagine you can get the mass going so fast that it just barely does a "loop-the-loop." Obviously, when the mass was at the bottom of its swing, the tension in the string would be greater than its weight. However, what would happen to the tension in the string when the mass got to its *highest* point? Explain your answer.