**DATASHEET**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_

3 questions worth 1 point each, 6 questions worth 2 points each, 1 question worth 5 points, and 1 question worth 10 points; 30 points total

1. Draw a circle to represent the path of the rotating mass. Place a dot on the circle to represent the rotating stopper. Add a straight line from the dot to the center of the circle to represent the string. Draw arrows to indicate the direction of the tangential velocity, the centripetal acceleration, and the centripetal force. (1 point)
2. If you suddenly cut the string connected to the rotating stopper, what direction would the stopper’s velocity vector point? Draw a diagram showing the direction of motion of the stopper just cut from the string. (1 point)
3. What is the force sensor measuring? (1 point)

**Data**

1. Enter the data from the experiment in the table below. (10 points)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Radius (m) | *t* for 15 rev*(s)* | Measured period *Tm* (s) | Average period *Tm*(s) | Estimated period *Te (*s*)* | Percent difference | Force *F*(*N*) | Average force *F* (*N*) |
| 0.15  |  |  |  |  |  |  |  |
|  |  |  |
| 0.25  |  |  |  |  |  |  |  |
|  |  |  |
| 0.40 |  |  |  |  |  |  |  |
|  |  |  |

1. Paste the graph of your data below. (2 points)
2. Enter the measured mass of the stopper below. (2 points)
3. Use your data to calculate the average tangential velocity of the spinning stopper, the angular velocity, and the centripetal acceleration at each radius. (5 points)

|  |  |  |  |
| --- | --- | --- | --- |
| Radius (m) | *v* (m/s) | *ω* (rad/s) | *a* (m/s2) |
| 0.15 |  |  |  |
| 0.25 |  |  |  |
| 0.40 |  |  |  |

1. Write an expression that equates the average force measured by the sensor to the centripetal force acting on the rotating mass. Write your equation in terms of *m* (the mass of the stopper), *T* (the period), and *r* (the radius). (2 points)
2. Solve the equation that you wrote above for the period *T* in terms of *m*, *F*, and *r*. Plug in your radius values to find the estimated periods of rotation, and record them in the data table. (2 points)
3. Use the equations of rotational kinematics to calculate the angular acceleration needed to increase the angular velocity of the spinning stopper from 10 rad/s to 20 rad/s in a time of 8 seconds. How many revolutions would the stopper complete in that time? (2 points)
4. What are some of the sources of error in the experiment? (2 points)