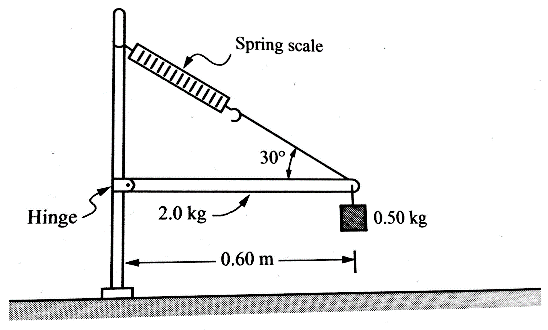
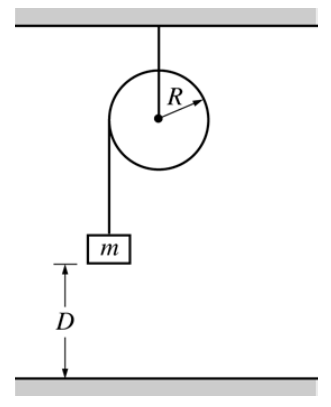
Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_

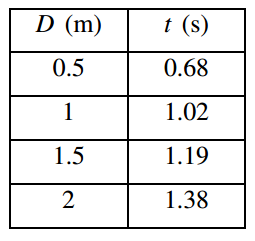
**AP Physics 1: Rotation AP Practice 2**



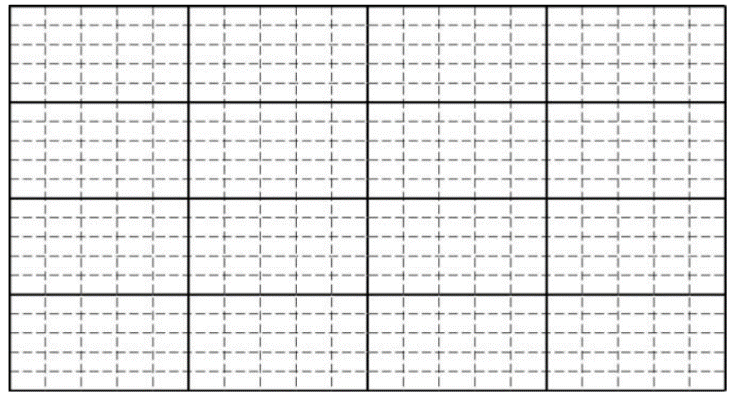
1. The horizontal uniform rod shown above has length 0.60 m and mass 2.0 kg. The left end of the rod is attached to a vertical support by a frictionless hinge that allows the rod to swing up or down. The right end of the rod is supported by a cord that makes an angle of 30° with the rod. A spring scale of negligible mass measures the tension in the cord. A 0.50 kg block is also attached to the right end of the rod.
2. On the diagram below, draw and label vectors to represent all the forces acting on the rod. Show each force as a vector originating at its point of application.
3. Calculate the reading on the spring scale, which represents the tension in the cord.
4. The cord that supports the rod is cut near the end of the rod and the block is removed from the rod before the rod is released and allowed to rotate about the hinge. Discuss whether the initial (linear) acceleration of the center of mass of the rod about the hinge is equal to *g*, greater than *g*, or less than *g*. Explain your answer. (The rotational inertia of the rod with the axis at the hinge is .)
5. Consider again the hinged rod (without cord or block attached).
   1. When the rod is released from a horizontal position, is the angular acceleration of the end of the rod greater than, less than, or equal to the angular acceleration of the center of mass of the rod? Explain your answer.
   2. When the rod is released from a horizontal position, is the linear acceleration of the end of the rod greater than, less than, or equal to the linear acceleration of the center of mass of the rod? Explain your answer.



1. A solid disk of unknown mass and known radius *R* is used as a pulley in a lab experiment, as shown above. A small block of mass *m* is attached to a string, the other end of which is attached to the pulley and wrapped around it several times. The block of mass *m* is released from rest and takes a time *t* to fall the distance *D* tothe floor. Provide all answers in terms of the given quantities (*R, m, t, D*) and fundamental constants.
2. Calculate the linear acceleration *a* of the falling block in terms of the given quantities.
3. The time *t* is measured for various heights *D* and the data are recorded in the following table.

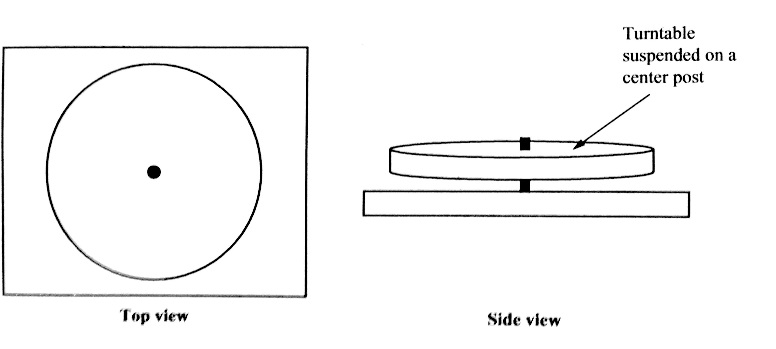


1. How could the variables used in part (a) be graphed in order to determine the acceleration of the block, using a best-fit line?
2. On the grid below, plot the measured quantities for the variables listed in the table in the manner described in part i. Label the axes, and draw the best‑fit line to the data.

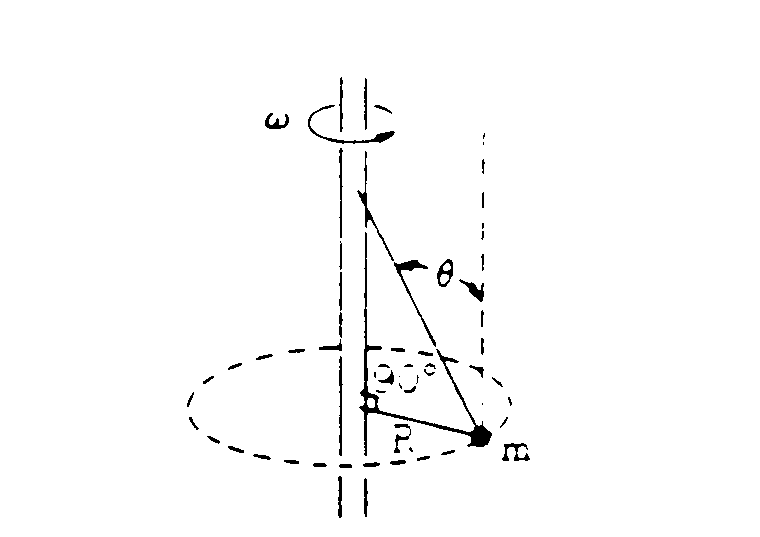


1. Use your graph to calculate the magnitude of the acceleration.
2. The value of acceleration found in part (b)iii, along with numerical values for the given quantities, is used to determine the rotational inertia of the pulley:

The pulley is removed from its support and its rotational inertia is found to be greater than the value calculated from the experimental data. Give one explanation for this discrepancy.



1. A very light low-friction cylindrical turntable is mounted on a sturdy base. Although the turntable is well balanced, its density might not be uniform. Design an experimental method to gather data that can be used to determine the rotational inertia of the turntable. In each part, provide the explanations and/or diagrams necessary to support your response.
   1. First, list all equipment you will use and describe what measurements you will take and how you will take them, in enough detail so that another student could carry out your experiment. Use diagrams to clarify your experimental setup.
   2. Explain how you will use your measurements to determine the rotational inertia. Again, provide enough details that another student could carry out the calculations and/or produce the representations (e. g., graphs) that you discuss.
   3. Now you will consider the uncertainty in the rotational inertia.
   4. Which measurement might contribute most to that uncertainty, and why?
   5. In doing or redoing the experiment, how could you reduce the uncertainty stemming from the measurement you selected in part i?



1. A ball of mass m is attached by two strings to a vertical rod. as shown above. The entire system rotates at constant angular velocity ω about the axis of the rod.
   1. Assuming ω is large enough to keep both strings taut, find the force each string exerts on the ball in terms of ω, m, g, R, and θ.
   2. Find the minimum angular velocity, ωmin for which the lower string barely remains taut.