

**Massachusetts Institute of Technology  
Physics Department**

**8.01X**

**Fall 2002**

**PROBLEM FOR EXPERIMENT CF: CENTRIPETAL FORCE**

**Handed out: October 7. Due: October 18 at 5 pm in 4-339B.**

- a) Make measurements of the radius,  $r$ , of the circular orbit for the spinning nut for rotational frequencies  $f$  of 10 Hz, 12 Hz, 15 Hz, and 20 Hz. Record your results in Table 1.
- b) Make measurements of the number of pennies,  $n_p$ , required to stretch the rubber band for the range of lengths corresponding to the radii of the circular orbits you measured in part 1. Record your results in Table 2.
- c) Calculate the hanging weight,  $F = n_p m_p g + m_{\text{cup+clip}} g$ , due to the weight of the pennies, cup and paper clip you used in part 2. Add your results to Table 2.
- d) Make a graph of the hanging weight vs. the length of the rubber band. Make a best-fit straight line and calculate the slope.
- e) For each of your measured values of the radius of the circular orbit of the nut in part a), use your calibration of the rubber band in part d) to determine the centripetal force necessary to keep the nut spinning. Add your results to Table 1.
- f) For each of the rotational frequencies in part a), calculate the centripetal acceleration  $|a_r| = r 4\pi^2 f^2$  of the nut. Add these results to your Table 1.
- g) Using your results from part f, multiply the centripetal acceleration by the mass of the nut,  $0.92 \pm 0.01 g$ . Add these results to your Table 1.
- h) Compare your results in part e) and part g). How closely did you come to verifying Newton's Second Law for circular motion?
- i) What is the major source of error in your experiment? Estimate the effect that this error has on your results.

