M-6: Uniform Circular Motion **Name**_____
Lab Worksheet **Group member names**_____

This sheet is the lab document your TA will use to score your lab. It is to be turned in at the end of lab. To receive full credit you must use complete sentences and explain your reasoning clearly.

Follow all the instructions as given in the lab manual and the extra instructions given here. Mostly these extra instructions are about error analysis so review the notes from Lecture 10 and read pages 10-13 in your lab manual. The numbered items do correspond to the same numbered items in your lab manual. Only do the experiment for one bob, either brass or aluminum.

1) **Measure the mass.** Choose one of the bobs (either aluminum or brass – no need to do both). Have each member of your group measure the mass using the lab scale several times. Do you get the same exact value each time? Yes____No____ If your measurements differ then find the average, standard deviation, and the standard deviation of the mean. If they do not differ assume an uncertainty at the next decimal place beyond what you can measure with the lab scale.

Trial #	Measured m	Average m	Std. Dev. σ	Std. Dev of the Mean (error in the mean) σ_μ *or* assumed uncertainty
1				
2				
3				
4				
5				
6				
7				
8				
9				

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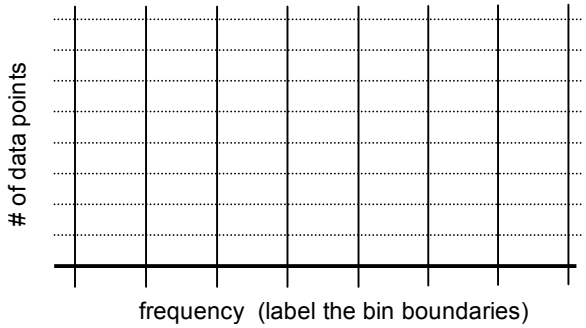
2) **Dynamic measurement of the force:** Record the rotation frequencies in the table below. Slowly increase the speed to the correct value, record the frequency, increase the speed further, slowly decrease the speed to the correct value, repeat until the table is filled. Try to take readings when the reflected light is half covered.

Trial #	*f* (Hz) Slowly increasing	*f* (Hz) Slowly decreasing	Average *f* (Hz) each pair	Average *f* (Hz)	Std. Dev. σ	Std. Dev. of the Mean (error in the mean) σ_μ
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

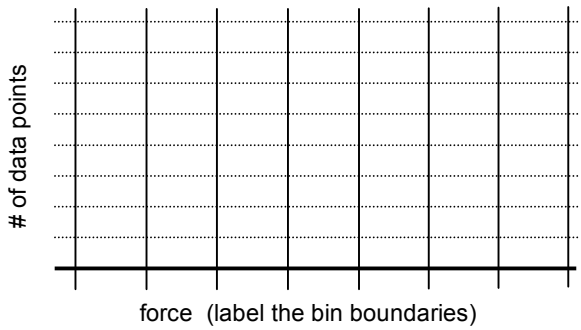
Fill in the histogram below using the data in the middle column above ("Average f(Hz) , each pair"). You will need to select (and label) an appropriate bin width so that the data is spread out across the histogram.



Sketch a curve through the data and estimate the half-width at half the maximum value by eye – for a normal (Gaussian) distribution the standard deviation is the halfwidth where the curve falls to 60 % of its peak value. Is this a normal distribution?

3) **Static measurement of the force:** Follow the instructions in the lab manual and fill in the table below. Make 10 **independent** measurements of the mass (and hence, the force), finding the average, the standard deviation, and the standard deviation of the mean. Enter your data in the table below and fill in the histogram at right. Sketch a curve through the data and estimate the standard deviation by eye . Is this a normal (Gaussian) distribution?

Trial #	Force = mg (N)	Average Force	Std. Dev. σ	Std. Dev. of the mean σ_μ
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



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4) **Measure the radius of the uniform circular motion.** In principle you could estimate the error in the radius by making repeated measurements, just as you have done already for the mass, the frequency, and the static force. But by now you probably get the point. To save time, have each group member make one measurement of the radius and then agree on its uncertainty, σ_r.

5) **Compute the centripetal force and its error**: Compute F_c and use the error propagation technique on page 13 of your lab manual and in your lecture notes to compute its error, σ_{Fc}, based on your measurements of m, r, and ω and their errors.

6) **Do the data support the theory?** Answer by comparing the calculated centripetal force and its error (part 5) to that of the measured static force and its error (part 3).