# Centripetal Force (Uniform Circular Motion)

Section#			Date				
1. Me	asurement of	Centripetal For	ce	Photo gate			Counter we
g (Gravitat	ional accel.) =		(m/s <sup>2</sup> )		Spring		<b>]</b> -
m (Mass of	bob) =			Bob Index pointe	m r		
r radius of orbit	T period	$v = 2\pi r/T$ tangential speed	$F_c = mv^2/r$ centripetal force	M hanging mass	Mg	$Mgr/v^2$	
			commpoun force				
							-

) ( )  $\Leftarrow$  write the unit

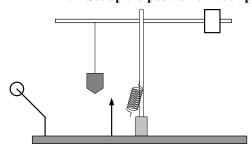
**Question 1:** What is the unit for the value of  $Mgr/v^2$ ?

 $\pm$ 

**Question 2:** Is this value agreed to the mass of the bob within the standard deviation?

## **Lab Procedure for Centripetal Motion**

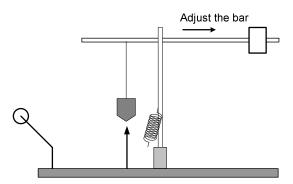
### 1. Set up the position of index point.



⇐ Take the spring off from the bob. Determine the radius of rotation with the index pointer.

### 2. Adjust the horizontal bar.

The bar has to be adjusted before rotation so that the pointed tip on the bottom of the bob is just over the index pointer as shown. The counter weight may be placed for a stable rotation, too.  $\Rightarrow$ 

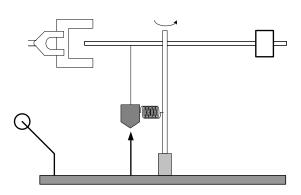


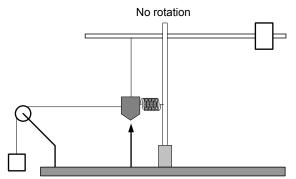
### 3. Hook up the spring.

← After hooking the spring, set up the photo gate as shown. Then, rotate the vertical bar.

### 4. Spin the bar and measure the period.

After the pointer and tip of the bob are lined up, make sure that the recorded period is stable. If needed, calculate the average with a few data.  $\Rightarrow$ 





### 5. Stop the rotation and hang a weight.

 $\Leftarrow$  To know the centripetal force, hang masses to the other side until the bob and pointer are lined up. The force will be the mass  $\times$  gravitational acceleration.

6. Repeat the above procedure after changing the position of pointer.

### Appendix: How to obtain average & standard deviation with Excel

	Α	В	
1		data	_
3		8.76	<u> </u>
3		8.55	
4		8.62	
5		8.8	
6		8.87	
7		8.73	
8			
9	Average		
10	Stdev		
11			
40			

1. Put the data and label as follows (to avoid mistakes).

2. For the average, go to the cell and press "=." (Note: it is the '=' sign on the keyboard.)  $\Rightarrow$ 

		<b>**</b>   (#)	G
	SUM	<b>▼ X √</b>	fx
	Α	В	
1		data	
2		8.76	
3		8.55	
4		8.62	
5		8.8	
6		8.87	
7		8.73	
8			
9	Average	=	Ī
10	Stdev		

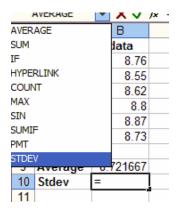
X V fx В SUM AVERAGE lata 8.76 HYPERLINK 8.55 COUNT 8.62 MAX 8.8 SIN 8.87 SUMIF 8.73 PMT STDEV 10 Stdev

3. Go to the "Function Box" and select "AVERAGE."

 $\Leftarrow$ 

AVERAGE data ? Function Arguments 2 8.55 AVERAGE 4 8.62 Number1 B2:B7 **1** = {8.76;8.55;8.62;8.8 5 8.8 Number2 <u>k</u> = 6 7 8.87 8.73 = 8.721666667 Returns the average (arithmetic mean) of its arguments, which can be numbers or names, arrays, or references that contain numbers. 9 Average =AVERAGE(B2:B7 10 Stdev 11 Number1: number1, number2,... are 1 to 30 numeric arguments for which you want 12 the average. 13 14 Formula result = 8.721666667 15 Help on this function OK Cancel 16

4. After "Function Arguments" popped up, select all the data with mouse pointer. Then click OK.  $\Rightarrow$ 



Α

Average

10 Stdev

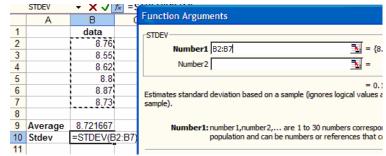
6

7

8 9 5. Do the same thing for the standard deviation. Press "=" and go to "Function Box." Then select "STDEV."

6. Select the data. Then click OK.  $\Rightarrow$ 

 $\Leftarrow$ 



7. Then, you will have following. 1 data  $\Leftarrow$ 2 8.76 3 8.55 4 8.62 5 8.8

8.87

8.73

8.721667

0.117884

В