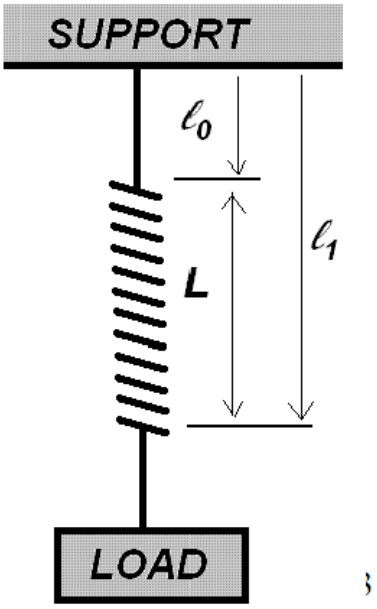
LECTURE 2. HOOCKE'S LAW

1. Purpose:

To measure the spring constant of a spring



2. Equipment

For this lab you will be using these equipments:

- 5 springs
- 1 Rod
- Masses hanger
- 1 meter stick.
- 1 Weight set

3. Background:

If a weight, $W = mg$, is hung from one end of an ordinary spring, causing it to stretch a distance x, then an equal and opposite force, F, is created in the spring which opposes the pull of the weight. If W is not so large as to permanently distort the spring, then this force, F, will restore the spring to its original length after the load is removed. The magnitude of this restoring force is directly proportional to the stretch,

$$F = -kx$$

The constant k is called the spring constant. To emphasize that x refers to the change in length of the spring we write

$$F = mg = - k \Delta l$$

In this form it is apparent that if a plot of F as a function of Δl has a linear portion, this provides confirmation that the spring follows Hooke's Law and enables us to find k.

4. Procedure:

1. Hang a spring from a horizontal metal rod.
2. Attach a mass hanger directly to the bottom of the hanging spring and record the position of the bottom of the mass hanger relative to a meter stick.
3. Add masses to the spring and record the position of the bottom of the mass hanger.

LECTURE 2. HOOCKE'S LAW

REPORTS

Name:…….

Class:……..

1. **Purpose:……**
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2. **Results.**

Table 1

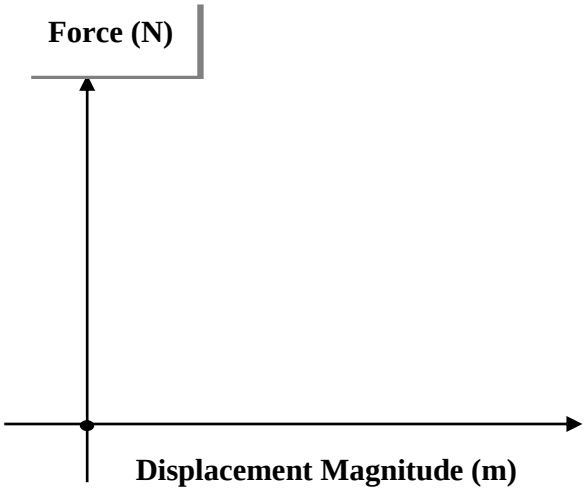
Position	Mass (g)	Location of the Mass Hanger Reference in cm		
		Trial 1	Trial 2	Trial 3
Reference				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Table 1

Force (N)	Displacement ($x10^{-2}$ m)				Constant spring (N/m)
	Trial 1	Trial 2	Trial 3	Average	

Average Spring Constant k =

Spring Constant k from Graph =



Caculation

1. Displacement: the length that the spring is stretched

x= Displacement = Location with Mass - Reference Location

x =

2. Uncertainty of displacement (Δ l): Propagation of error for addition and subtraction

$\Delta x = \sqrt{(\text{uncertainty in reference})^2 + (\text{uncertainty in location 1})^2}$

$\Delta x =$

3. Force on spring from the hanging mass

$F = mg =$

4. Standard Error for Average Displacement for 0.9811N force

Standard Error $= \sqrt{\frac{\sum (x_i - \bar{x})^2}{N(N-1)}} =$

5. Using Hooke's Law (F = - kx) to find the spring constant

$k = -\frac{F}{x} =$

6. Spring constant uncertainty: Propagation of error for multiplication and division

$$\Delta k = k\sqrt{(\Delta F / F)^2 + (\Delta x / x)^2} =$$

3. Discussion of results

$$\%difference = \left| \frac{M_{2theoretical} - M_{2experimental}}{M_{2theoretical}} \right| x100 =$$

……

$$\%difference = \left| \frac{\overline{M_{1experimental}} - \overline{M_{2experimental}}}{\overline{M_{1experimental}}} \right| x100 =$$

……

$$\%difference = \left| \frac{M_{1experimental} - M_{2experimental}}{M_{1experimental}} \right| x100 =$$

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