# PHYSICS LAB.

# ( 20147)

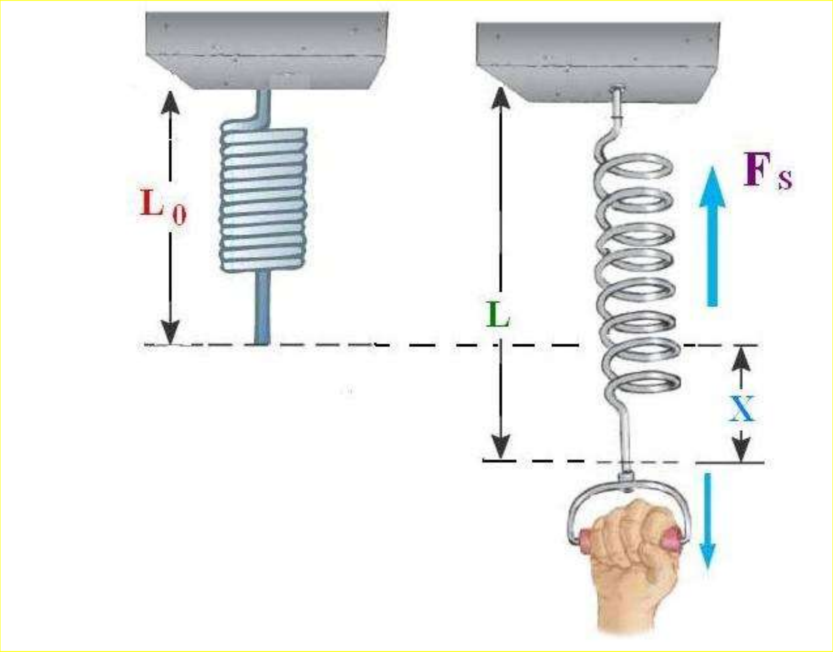
# Experiment No. 6

# Simple Harmonic Motion

## Single Spring

# Exp.no. 6 Simple Harmonic Motion
## Single Spring

- $L_0$ is the original length of the spring.
- L is the new length of the spring.
- X is the elongation of the spring.
- $F_s$ is the restoring force in the spring.
- $F_s$ is proportional to X , we write it as $F_s \ \alpha \ X$
- Or we can write it as $F_s = -k X$
- The quantity k is called " Force Constant " of the spring.
- k is measured by N / m .



# How to determine the force constant ( k ) experimentally

- **The force constant k depends on :**

The type of the material,

the number of turns of the spring,

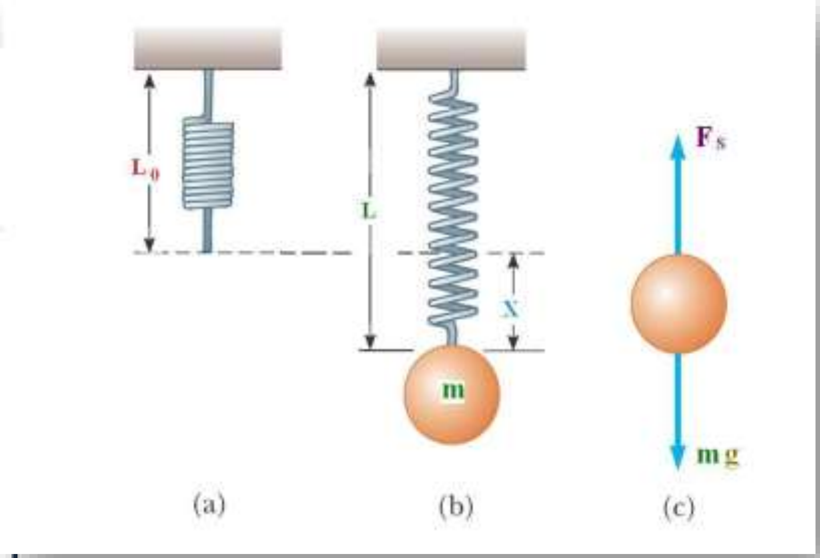
the spacing between.

- k can be found experimentally as follows:

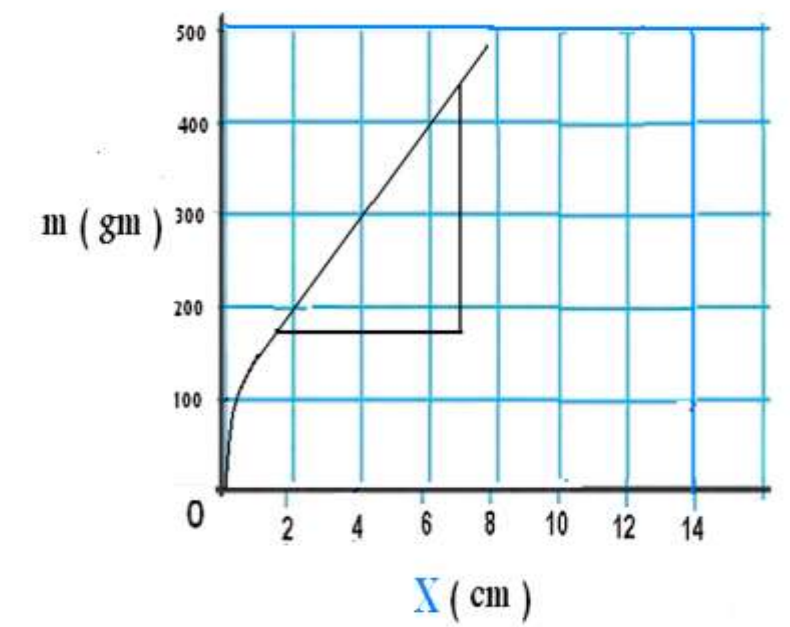
As the mass m in fig.( b ) is at equilibrium then $F_s = mg$, but

$F_s = kX$, then we have

$$k = \left(\frac{m}{X}\right) g$$



If we take several readings of m and the corresponding values of X, we can draw a graph as shown in the figure.




From the graph,

the slope = $\left(\frac{\Delta m}{\Delta X}\right)$

k = slope * g

Where g = 980 cm /s²

The unit of k is dyne / cm

# Vibrational motion of a mass attached to a spring

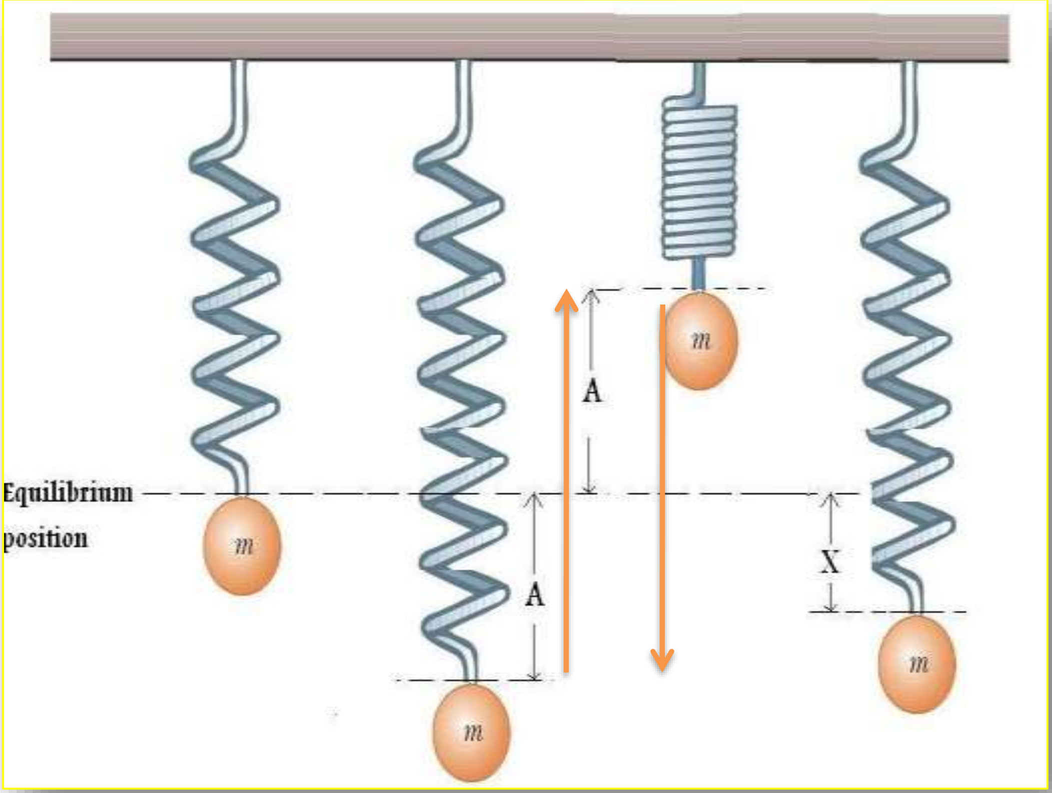
- **A** is the amplitude of the vibration, which is the maximum displacement from the equilibrium position.

- **T** is the period of one vibration. For mass less spring it is given by :

$$T = 2\pi\sqrt{\frac{m}{k}}$$

- **X** is the displacement of the mass from the equilibrium position at any time t during vibration. It is given by

$$X = A\cos\left(\frac{2\pi}{T}t\right)$$



## 3. Data :

### a) Complete the following table for the hard spring.

Original length of the spring $L_0$ = …………………….  cm

| No. | Mass M ( g ) | Length of spring L ( cm ) | Elongation of spring X ( cm ) |
|---|---|---|---|
| 1 | 100 | | |
| 2 | 200 | | |
| 3 | 300 | | |
| 4 | 400 | | |
| 5 | 500 | | |
| 6 | 600 | | |
| 7 | 700 | | |
| 8 | 800 | | |
| 9 | 900 | | |

## c) Complete the following table for the light spring.

Original length of the spring $L_0$ = …………………… cm

| No. | Mass M ( g ) | Length of spring L ( cm ) | Elongation of spring X ( cm ) |
|---|---|---|---|
| 1 | 20 | | |
| 2 | 30 | | |
| 3 | 40 | | |
| 4 | 50 | | |
| 5 | 60 | | |
| 6 | 70 | | |
| 7 | 80 | | |
| 8 | 90 | | |
| 9 | 100 | | |