VERIFY HOOKE'S LAW AND DETERMINE THE EXTENSION PER UNIT MASS OF ADDED LOAD

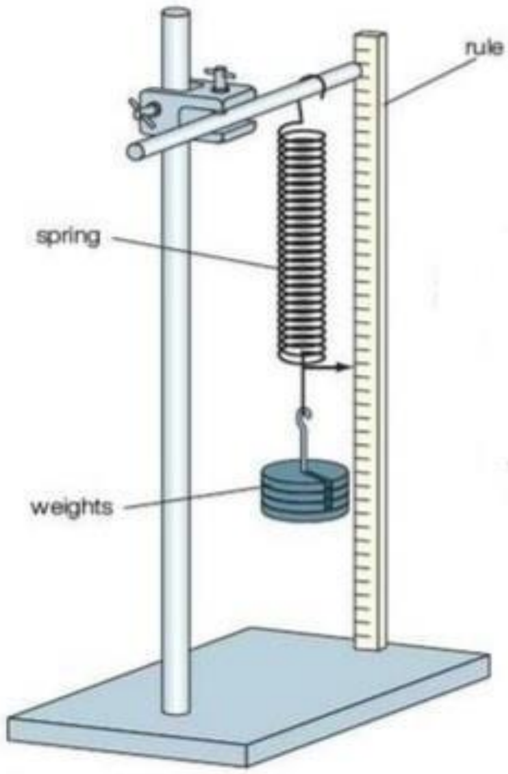
Apparatus:

1-Spiral spring.

2-Stand and clamps.

3- Slotted weights and hanger.

4-Ruler



Method:

1- Setup apparatus as diagram.
2-Measure natural length of spring (with no load) using mm ruler.
3-Add one mass at a time; allow spring to come to rest and measure extension (CHANGE IN LENGTH from original to stretch).
4-Do this six times for enough measurements.
5-Repeat experiment for reliability and calculate average value for each weight.

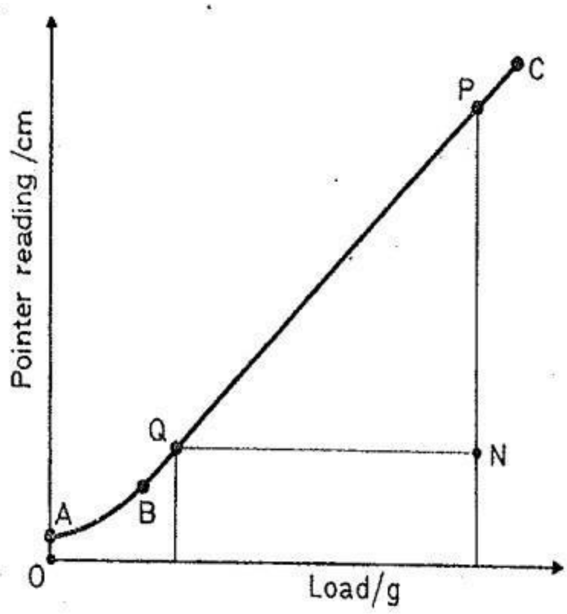
Readings and tabulate data:

Load/g	Pointer readings/mm		
	Load increasing	Load decreasing	Mean reading
1			
2			
3			

Draw graph between load on y-axis & pointer reading at X-axis

Theory and Calculations:

The graph will probably be of the shape shown in the diagram. The first conclusion to be drawn is that though most of the points lie on a straight line, not all of them do. Therefore the total extension of the spring is not proportional to the total load producing it. However, for the straight - line portion of the graph it is seen that any increase QN in the load is proportional to the extension PN it produces, which is Hooke's law.



The extension per unit additional load λ:

$$= \frac{PN\ cm}{QN\ g} = \frac{PN \times 10^{-2} m}{QN \times 10^{-3} kg} = 10 \times \frac{PN}{QN} m kg^{-1}$$

The initial curved portion of the graph is probably due to the fact that in the early stages of the experiment some of the turns of the spring are pressing against each other.

Medical Applications:

Most restorative materials must withstand forces during either fabrication or mastication. Mechanical properties are therefore important in understanding and predicting a material's behavior under load. Because no single mechanical property can give a true measure of quality, it is essential to understand the principals involved in a variety of mechanical properties to obtain the maximum service in a material. Quantities of force, stress, strain, strength, toughness, hardness, friction, and wear can help identify the properties of a material. In general, the stability of a solid under applied load is determined by the nature and strength of atomic binding forces Because of this we study mechanical properties as medical applications for this experiment as following:

Brittleness: Relative inability of a material to deform plastically before it fractures.

Stress: Force per unit area within a structure subjected to a force.

Compressive stress: Compressive force per unit area perpendicular to the direction of applied force.

Compressive strength: Compressive stress at fracture.

Flexural stress (bending stress): Flexural force per unit area of a material that is subjected to flexural loading.

Flexural strength (bending strength or modulus of rupture): Flexural stress at fracture in a test specimen subjected to flexural loading.

Shear stress: occurs when the component of force vector parallel to the material cross section.

Shear strength: Shear stress at the point of fracture.

Ductility: Relative ability of a material to elongate plastically under a tensile stress. This property is reported quantitatively as **percent elongation**.

Elastic strain: Amount of deformation that is recovered instantaneously when an externally applied force or pressure is reduced or eliminated.

Elastic modulus (also modulus of elasticity and Young's modulus): Stiffness of a material that is calculated as the ratio of elastic stress to elastic strain.

Fracture toughness: The critical stress intensity factor at the point of rapid crack propagation in a solid containing a crack of known shape and size.

Hardness: Resistance of a material to plastic deformation.

Malleability: Ability to be hammered or compressed plastically into thin sheets without fracture.

Plastic strain: Irreversible deformation that remains when the externally applied force is reduced or eliminated.

Pressure: Force per unit area acting on the surface of a material (compare with Stress).

Proportional limit: Magnitude of elastic stress above which plastic deformation occurs.

Stress concentration: Area or point of significantly higher stress that occurs because of a structural discontinuity such as a crack or pore or a marked change in dimension.

Strain: Change in dimension per unit initial dimension. For tensile and compressive strain, a change in length is measured relative to the initial reference length.

Stress intensity (stress intensity factor): Relative increase in stress at the tip of a crack of given shape and size when the crack surfaces are displaced in the opening mode (also Fracture Toughness).

Strain rate: Change in strain per unit time during loading of a structure.

Strength :(1) Maximum stress that a structure can withstand without sustaining a specific amount of **plastic strain (yield strength);** (2) stress at the point of fracture (ultimate strength).

The End