SUBJECT : PHYSICS

CLASS : LOWER-SIXTH SCIENCES

TOPICS : Solids.

Objectives : At the end of the chapter, the students should be able to :

- Master the arrangement of atoms in solids.
- Know the mechanical properties of solids.
- Understand and apply Hooke's law.

Introduction.

The mechanical properties of matter are concerned with the behaviour under the action of external forces. In this chapter we are going to study the following properties of solids.

1) Strength : This refers to the maximum force a material can withstand before breaking.

2) Stiffness: This is the opposition a material offers to a distorting force.

A is stiffer than B.
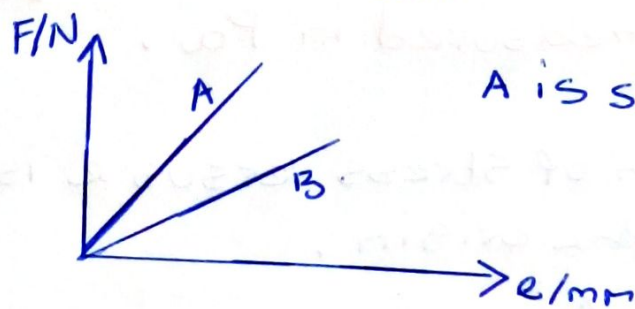
3. Ductility : This refers to the workability. A ductile material like copper or stell can be stretched, hammered into the desired shape.

4. A material is tough if it doesn't easily crack.

5. An elastic material is a material that can regain its shape when the distorting force has been removed. The elastic limit is the maxi-mum force beyond which the material will

regain it's original shape after been distorted.

6) **Tensile stress** : This is defined as the deforming force per unit area. It is similar to the pressure on the wire.

$$\text{Tensile stress} = \frac{\text{Force}}{\text{Area}}$$ Its SI unit is $\underline{\underline{Nm^{-2}}}$ or the Pascal (Pa).

7) **Tensile stiffness (Young's modulus E)**.
This is a measure of the resistance offered by the material to a lengthwise deformation.

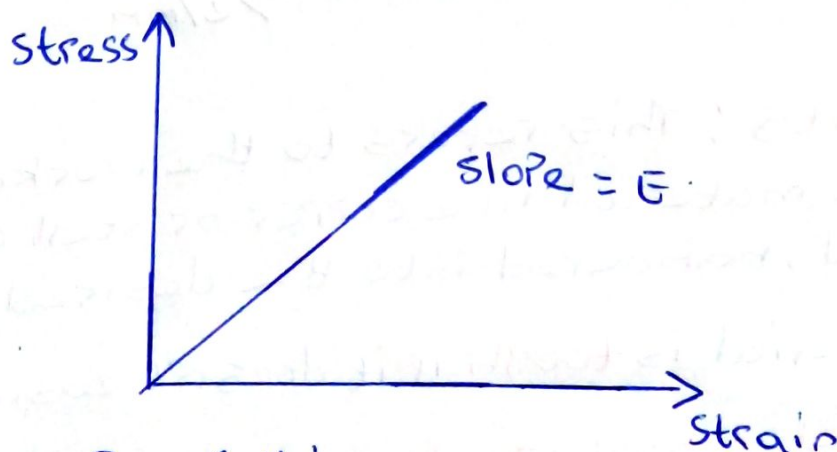8) **Tensile strain** : This is the extension of a material compared to its original length.

$$\text{Tensile strain} = \frac{\text{extension}}{\text{original length}} = \frac{e}{L_0}$$

It has no units.

N/B: Young's modulus $(E) = \frac{\text{stress}}{\text{strain}} = \frac{F/A}{e/L_0} = \underline{\underline{\frac{FL_0}{eA}}}$

It is measured in Pa.

A graph of stress versus e is a straight line through the origin.

The slope of this graph represents young modulus.