PHYSICS 534

ANSWERS

EXERCISE-18 **Elasticity**

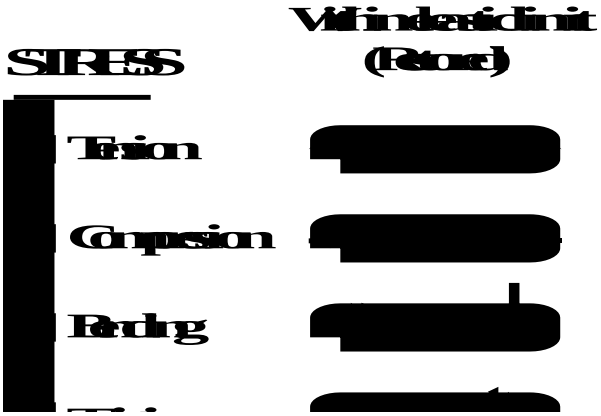
Max von Laue received the Nobel prize for physics in 1914 for his work with crystal diffraction in X-rays.

von LAUE

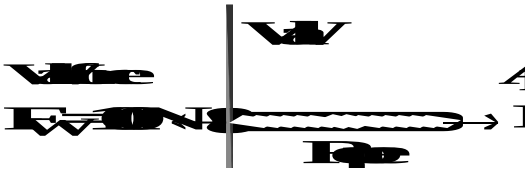
Two equal but opposite applied forces acting in parallel produce what is called a "stress".

A stress can be considered as a force "inside" a solid material produced by two parallel forces acting on the material. If the stress is ***within*** the "elastic limit" of the material, the material will return to its original shape when the stress is removed. If the stress causes the material to deform ***beyond*** its elastic limit, the material will be permanently deformed when the stress is removed.

Strain refers to the ***deformation*** a material undergoes due to a stress acting on it. The strain can be temporary when the stress acts ***within*** the elastic limit, or permanent when the stress acts ***beyond*** the elastic limit. Strain is simply the ***shape*** of the deformation.



↳ ***Note***: A wire (or string or rope) is under "tension" when pulled and has two ***equal*** but ***opposite*** forces acting on it. The ***tension*** is equal to the applied force pulling the wire (even though the resultant force is zero). In the illustration on the right, a rope is attached to a wall and is pulled with an applied force F_A equal to 100 N.



1. Define ***elasticity***.

The ability of a material to be stretched.

2. Explain the difference between a perfectly ***elastic*** and a perfectly ***inelastic*** material.

In a perfectly elastic material, there is no energy loss.
In a perfectly inelastic material, there is total energy loss.

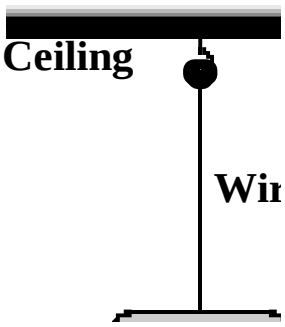
3. Define ***stress***.

Two equal but opposite forces acting in parallel.

4. Define ***strain***.

The deformation that an object undergoes due to a stress.

5. A 20 kg object is suspended from a ceiling by a wire. What is the tension in the wire?

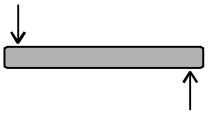


Since the object is at rest, $F_R = 0$.

Thus, $\Sigma F_{UP} = \Sigma F_{DOWN}$

$\therefore \quad F_{UP} = (20\text{ kg})(10\text{ m/s}^2) = 200\text{ N}$

6. List the ***five*** types of stress, draw the forces corresponding to the stresses acting on an object (under **FORCES**), and state the strain associated with each stress:

	Write the **STRESS**	Draw the **FORCES**	Write the **STRAIN**
a)	**Tension**		**Stretched**
b)	**Compression**		**Shortened**
c)	**Bending**		**Bent**
d)	**Twisting**		**Twisted**
e)	**Shearing**		**Warped**