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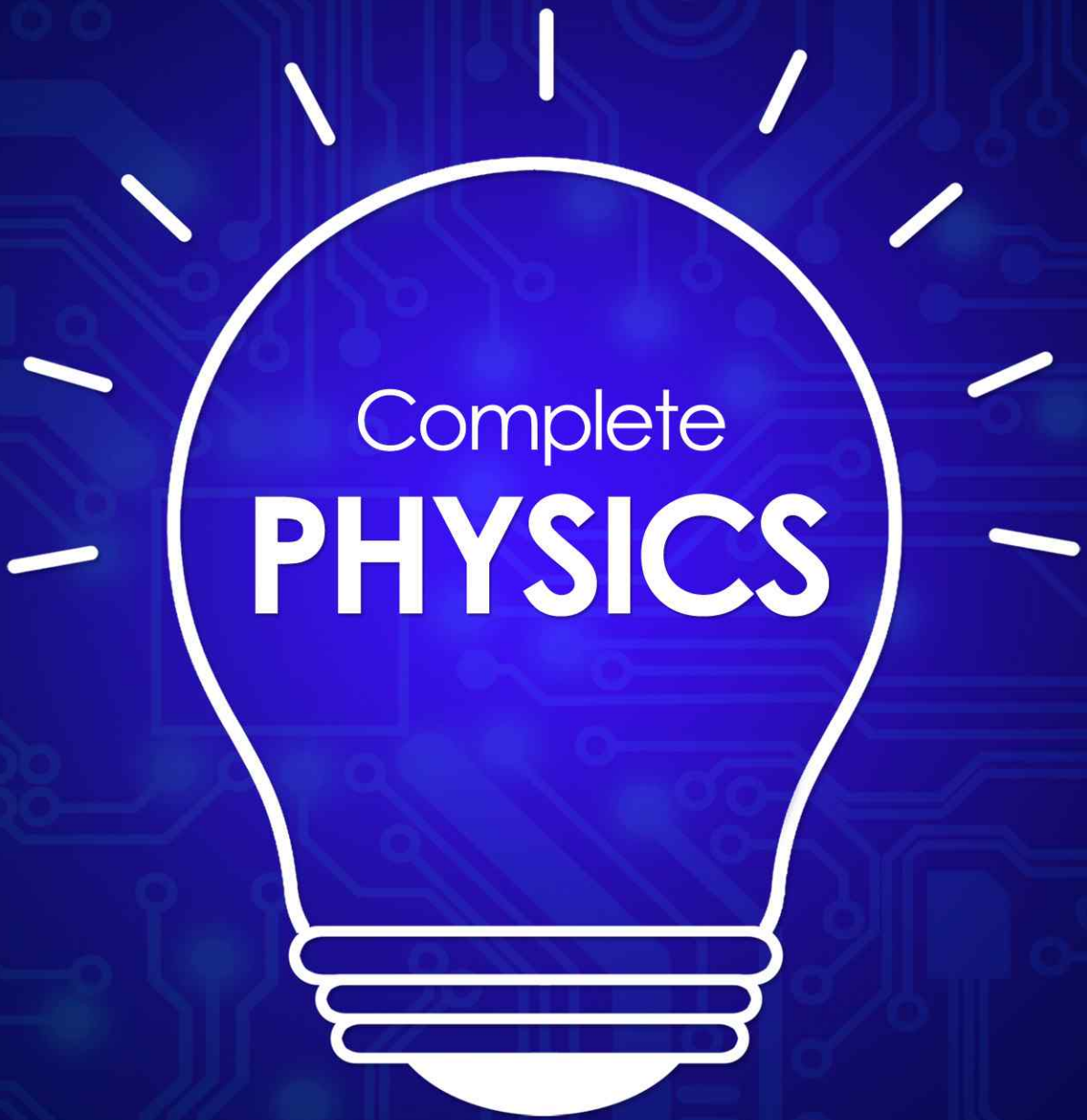

Complete PHYSICS

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CLASS 11th

Properties of Matter

01. Elastic And Plastic Behaviours of Solids

Sometimes, a force acting on a body, instead of producing a change in its state of rest or of uniform motion, produces a change in the shape of the body. Such a force is called ***deforming force***

A rigid body can be noticeably stretched, compressed, bent or twisted by applying a suitable force. That a body can be deformed by a force, can be easily shown by stretching a rubber band or by loading a spring. Delicate measurements indicate that deformations do take place, even when small forces are applied to the rigid bodies.

Elastic Body

A body that returns to its original shape and size on the removal of the deforming force (when deformed within elastic limit), is called an elastic body.

Actually, this concept of an elastic body is an idealisation and no materials behave as perfectly elastic body. Thus, all bodies are elastic ; the difference lies only in degree.

Elasticity

The property of matter by virtue of which it regains its original shape and size, when the deforming forces have been removed is called elasticity.

Contrary to the concept of elasticity in daily life ; in physics, elasticity stands for opposition to change. Qualitatively, more rigid a body, more elastic it is said to be. for this reason, steel is more elastic than rubber.

Plastic body

A body that does not return to its original shape and size on the removal of deforming force, however small the magnitude of deforming force may be, is called a plastic body.

02. Hooke's Law

It is the basic law in elasticity. It states that *the extension produced in a wire is directly proportional to the load attached to it.*

Thus, according to Hooke's law,

$$\text{extension} \propto \text{load}$$

However, this proportionality holds good upto certain limit, called the ***elastic limit.***

Hooke's law can be easily verified by suspending a long metallic wire of uniform area of cross-section from a rigid support and noting the extension (increase in its length) on loading it. The extension is always directly proportional to the load.

In 1807, English physicist Thomas Young pointed out that the load and the extension are more scientifically described in terms of stress and strain respectively. Thus, Hooke's law may be stated that *stress is directly proportional to strain.*

According to the modified form of Hooke's law,

$$\text{stress} \propto \text{strain}$$

or $$\text{stress} = \text{constant} \times \text{strain}$$

or $$\frac{\text{stress}}{\text{strain}} = \text{constant} \qquad \text{...(i)}$$

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