

## FlexiPrep: Downloaded from flexiprep.com

For solved question bank visit [doorsteptutor.com](http://doorsteptutor.com) and for free video lectures visit  
Examrace YouTube Channel

# NCERT Physics Class 11 Exemplar Ch 9 Mechanical Properties of Solids Part 4 (For CBSE, ICSE, IAS, NET, NRA 2022)

Doorsteptutor material for IMO Class-11 is prepared by world's top subject experts:  
[fully solved questions with step-by-step explanation](#)- practice your way to success.

### One and More Than One Answer

Q. 21 To what depth must a rubber ball be taken in deep sea so that its volume is decreased by 0.1%. (The bulk modulus of rubber is  $9.8 \times 10^8 \text{ Nm}^{-2}$  ; and the density of sea water is  $10^3 \text{ kg m}^{-3}$ .)

Answer:

Q. 22 A truck is pulling a car out of a ditch by means of a steel cable that is  $9.1 \text{ m}$  long and has a radius of  $5 \text{ mm}$ . When the car just begins to move, the tension in the cable is  $800 \text{ N}$  . How much has the cable stretched? (Young's modulus for steel is  $2 \times 10^{11} \text{ Nm}^{-2}$  .)

Answer: Let the increase in length be  $\Delta l$  , then

$$\frac{800}{(\pi \times 25 \times 10^{-6}) / (\Delta l / 9.1)} = 2 \times 10^{11}$$

$$\therefore \Delta l = \frac{9.1 \times 800}{\pi \times 25 \times 10^{-6} \times 2 \times 10^{11}} \text{ m}$$

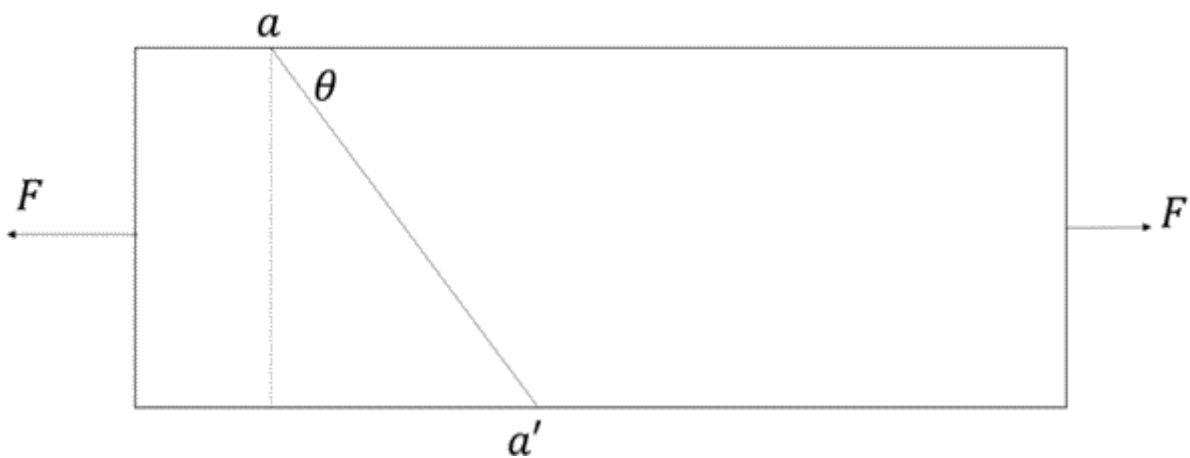
$$\cong 0.5 \times 10^{-3} \text{ m}$$

Q. 23 Two identical solid balls, one of ivory and the other of wet-clay, are dropped from the same height on the floor. Which one will rise to a greater height after striking the floor and why?

Answer: As the ivory ball is more elastic than the wet-clay ball, it will tend to retain its shape instantaneously after the collision. Hence, there will be a large energy and momentum transfer compared to the wet clay ball. Thus, the ivory ball will rise higher after the collision.

### Long Question

Q. 24 Consider a long steel bar under a tensile stress due to forces  $F$  acting at the edges along the length of the bar (Fig. 9.5) . Consider a plane making an angle  $\theta$  with the length. What are the tensile and shearing stresses on this plane?



©FlexiPrep. Report @violations @<https://tips.fbi.gov/>

(a) For what angle is the tensile stress a maximum?

(b) For what angle is the shearing stress a maximum?

Answer: Let the cross-sectional area of the bar be  $A$ . Consider the equilibrium of the plane  $aa'$ . A force  $F$  must be acting on this plane making an angle  $\frac{\pi}{2} - \theta$  with the normal  $ON$ . Resolving  $F$  into components, along the plane and normal to the plane

$$F_p = F \cos \theta$$

$$F_N = F \sin \theta$$

Let the area of the face  $aa'$  be  $A'$ , then

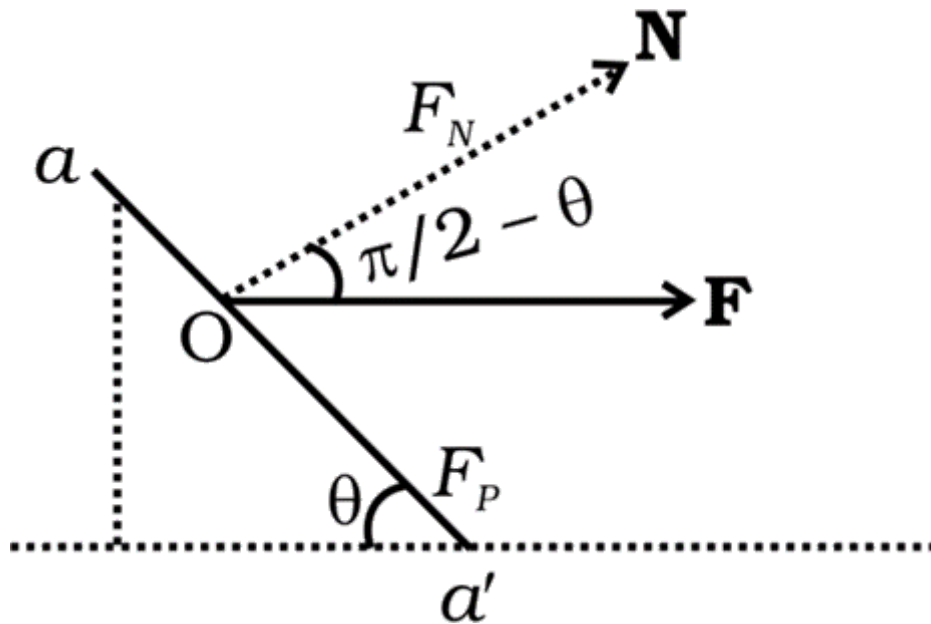
$$\frac{A}{A'} = \sin \theta$$

$$\therefore A' = \frac{A}{\sin \theta}$$

The tensile stress  $T = \frac{F \sin \theta}{A'} = \frac{F}{A} \sin^2 \theta$  and the shearing stress

$$Z = \frac{F \cos \theta}{A'} = \frac{F}{A} \cos \theta \sin \theta = \frac{F \sin 2\theta}{2A}. \text{ Maximum tensile stress is when } \theta = \frac{\pi}{2} \text{ and}$$

maximum shearing stress when  $2\theta = \frac{\pi}{2}$  or  $\theta = \frac{\pi}{4}$ .



©FlexiPrep. Report ©violations @<https://tips.fbi.gov/>

Developed by: [Mindsprite Solutions](#)