

## Answer on Question 61870, Physics, Mechanics

### Question:

3) Which of the following substances is ductile?

- a) glass
- b) high carbon steel
- c) copper
- d) brass

### Answer:

Ductile materials can be stretched without breaking and can be drawn into wire or rolled into sheets. Copper is an example of ductile material. Thus, the correct answer is c).

4) A solid cylindrical steel column is 4.0 m long and 9.0 cm in diameter. What will be its decrease in length when carrying a load of 80000 kg? Young's modulus for steel is  $E = 1.9 \cdot 10^{11} \text{ Nm}^{-2}$ .

- a) 5.2 mm
- b) 1.4 mm
- c) 3.7 mm
- d) 2.6 mm

### Solution:

Let's recall the definition of the Young's modulus. Young's modulus is the ratio of stress to strain:

$$E = \frac{\text{stress}}{\text{strain}} = \frac{F/A_0}{\Delta L/L_0},$$

here,  $E$  is the Young's modulus,  $F$  is the force exerted on the column under load,  $A_0$  is the cross-sectional area through which the force is applied,  $\Delta L$  is the amount by which the length of the column decreases,  $L_0$  is the original length of the column.

From this formula we can calculate  $\Delta L$ :

$$\Delta L = \frac{FL_0}{A_0 E} = \frac{80000 \text{ kg} \cdot 9.8 \text{ ms}^{-2} \cdot 4.0 \text{ m}}{\frac{\pi}{4} \cdot (0.09 \text{ m})^2 \cdot 1.9 \cdot 10^{11} \text{ Nm}^{-2}} = 0.00259 \text{ m} = 2.59 \text{ mm} \approx 2.6 \text{ mm}.$$

**Answer:**

d)  $\Delta L = 2.6 \text{ mm}.$