HC Verma Solutions Some Mechanical Properties of Matter

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Some Mechanical Properties of Matter HC Verma Concepts of Physics Solutions
Some Mechanical Properties of Matter HC Verma Concepts of Physics Solutions Chapter 14

1. $F = mg$

   $\text{Stress} = \frac{F}{A}$

   $\text{Strain} = \frac{\Delta L}{L}$

   $Y = \frac{FL}{A\Delta L} \Rightarrow \frac{\Delta L}{L} = \frac{F}{YA}$
2. ρ = stress = mg/A
   e = strain = ρ/Y
   Compression $\Delta L = eL$
3. $y = \frac{F}{A}\frac{L}{\Delta L} \Rightarrow \Delta L = \frac{FL}{AY}$
4. $L_{steel} = L_{cu}$ and $A_{steel} = A_{cu}$

   a) $\frac{\text{Stress of cu}}{\text{Stress of st}} = \frac{F_{cu}}{A_{cu}}\frac{A_g}{F_g} = \frac{F_{cu}}{F_{st}} = 1$

   b) $\text{Strain} = \frac{\Delta Lst}{\Delta lcu} = \frac{F_{st}L_{st}}{A_{st}Y_{st}} \cdot \frac{A_{cu}Y_{cu}}{F_{cu}l_{cu}}$ $(\because L_{cu} = l_{st}\ ;\ A_{cu} = A_{st})$
5. $\left(\frac{\Delta L}{L}\right)_{st} = \frac{F}{AY_{st}}$

   $\left(\frac{\Delta L}{L}\right)_{cu} = \frac{F}{AY_{cu}}$

   $\frac{\text{strain steel wire}}{\text{Strain om copper wire}} = \frac{F}{AY_{st}} \times \frac{AY_{cu}}{F} (\because A_{cu} = A_{st}) = \frac{Y_{cu}}{Y_{st}}$
6. $\text{Stress in lower rod} = \frac{T_1}{A_1} \Rightarrow \frac{m_1 g + \omega g}{A_1} \Rightarrow w = 14\ kg$

Stress in upper rod = $\frac{T_2}{A_u} \Rightarrow \frac{m_2g + m_1g + wg}{A_u} \Rightarrow w = .18\ kg$

For same stress, the max load that can be put is 14 kg. If the load is increased the lower wire will break first.

$$\frac{T_1}{A_1} = \frac{m_1g + \omega g}{A_1} = 8 \times 10^8 \Rightarrow w = 14\ kg$$

$$\frac{T_2}{A_u} \Rightarrow \frac{m_2g + m_1g + \omega g}{A_u} = 8 \times 10^8 \Rightarrow \omega_0 = 2\ kg$$

The maximum load that can be put is 2 kg. Upper wire will break first if load is increased.

7. $Y = \frac{F}{A}\frac{L}{\Delta L}$

8. $Y = \frac{F}{A}\frac{L}{\Delta L} \Rightarrow F = \frac{YA\,\Delta L}{L}$

9. $m_2g - T = m_2a$ ...(1)
   and $T - F = m_1a$ ...(2)
   $\Rightarrow a = \frac{m_2g - F}{m_1 + m_2}$

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