30. A wire fixed at the upper end stretches by length ℓ by applying a force F. The work done in stretching is [2004]

(a) $2F\ell$ (b) $F\ell$ (c) $\dfrac{F}{2\ell}$ (d) $\dfrac{F\ell}{2}$

30. **(d)** Let A and L be the area and length of the wire.

Work done by constant force in displacing the wire by a distance ℓ.

= change in potential energy

$$= \frac{1}{2} \times \text{stress} \times \text{strain} \times \text{volume}$$

$$= \frac{1}{2} \times \frac{F}{A} \times \frac{\ell}{L} \times A \times L = \frac{F\ell}{2}$$