

Surface Tension:-

Cohesive and Adhesive Force:-

- ↳ The force of attraction between similar molecules is called Cohesive Force. e.g. $\Rightarrow$ force between water molecules.
- ↳ The force of attraction between dissimilar molecules is called adhesive force. e.g. $\Rightarrow$ force between water & glass molecules.

Surface Tension:-

- ↳ The property by virtue of which liquid surface behaves as stretched membrane and tends to occupy the minimum surface area is called Surface tension.

Mathematically,

Surface tension is the force per unit length of an imaginary line drawn in the plane of liquid surface acting at right angle of this line.

If 'F' be the force acting on the imaginary line of length 'l', Then;

$$T = \frac{F}{l}$$

Note:-

① In case of an object:

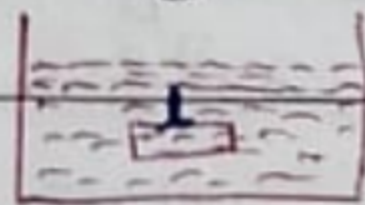
- i) When the object 'l' is on the surface of liquid;

$$T = \frac{F}{l}$$



- ii) When an object of length 'l' is inside the liquid;

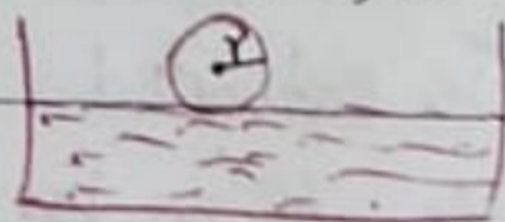
$$T = \frac{F}{2l}$$



② In case of ring:

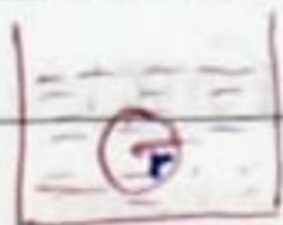
- i) When a ring of perimeter '2 πr ', on the surface of liquid;

$$T = \frac{F}{2\pi r}$$



i) When a ring of '2r' inside the liquid;

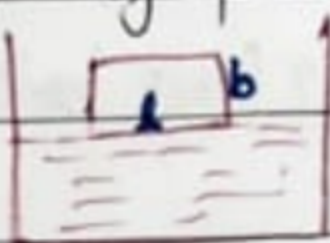
$$T = \frac{F}{4\pi r}$$



© In Case of rectangle:-

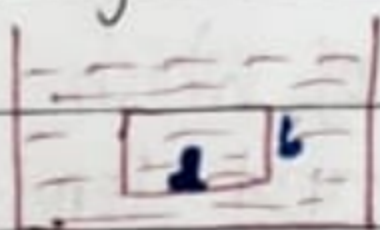
i) When the rectangle of perimeter '2(l+b)' on the surface;

$$T = \frac{F}{2(l+b)}$$



ii) When the rectangle of '2(l+b)' inside the liquid;

$$T = \frac{F}{4(l+b)}$$



Surface Energy:-

↳ The amount of workdone against Surface tension per unit change in Surface area is called Surface energy.

i.e.,

$$\text{Surface Energy (e)} = \frac{\text{Workdone in increasing Surface area}}{\text{Change in Surface area}}$$

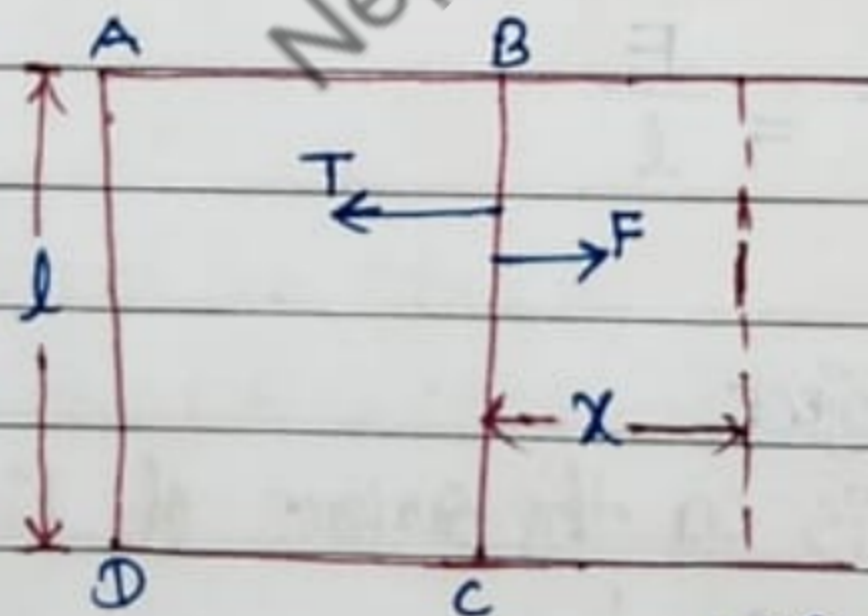


Fig:- Surface Energy

Let us consider a rectangular frame ABCD of wire in which BC can be slide horizontally. Suppose, it is dipped in a Soap Solution such that a thin layer is deposited over a Area. If BC due to surface area tension (T) the layer tends to minimize surface area. Suppose, force 'F' is applied perpendicularly to BC towards outwards. So, the membrane is extended by distance 'x' horizontally. Such that force is given by: