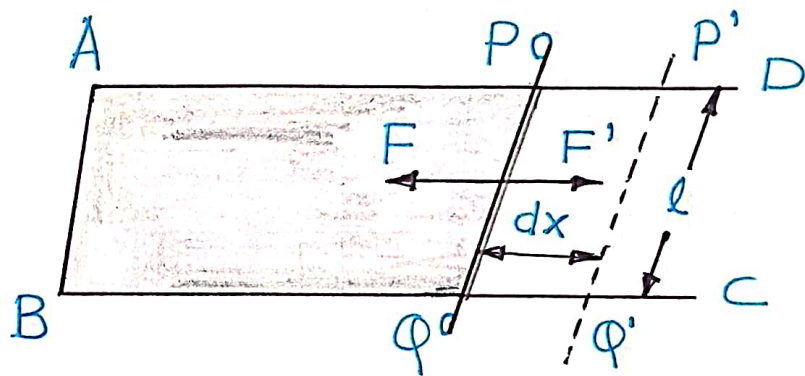


Relation between surface tension & surface energy per unit area.

or

show that the surface tension of a liquid is numerically equal to the surface energy per unit area.

Diagram :-



- consider a rectangular frame ABCD fitted with a movable arm PQ .
- The metallic frame is held in horizontal position is dipped into soap solution & taken out so that a soap film APQB is formed.

- Due to surface tension of soap solution, a force 'F' will act on each arm of the frame.

- Under the action of this force, the movable arm pq moves towards AB.

Now, work done will be,

$$W = F \cdot x \quad \dots\dots(1)$$

But,

$$\text{Surface tension} = \frac{\text{force}}{\text{length}}$$

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

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

$$\boxed{F = 2lT}$$

Put $F = 2lT$ in eqn (1),

$$W = 2lT \cdot x$$

But this work is stored as surface energy,

surface energy = work done

$$S.E. = 2lT \cdot x$$

$$\boxed{E = T a} \quad \text{-----} \quad [a = 2100]$$

If $a = 1$

$$\boxed{T = E}$$