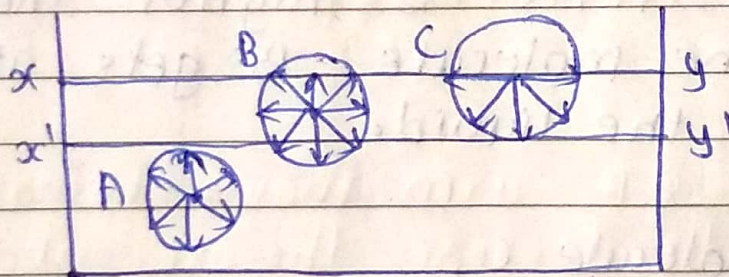


* Surface Tension γ

A liquid at rest shows a very interesting property called surface tension.

- It is the one of the important properties of a liquids.

(F) Surface tension on the basis of molecular theory :-



where,

x' & y' is the inner layer parallel to xy ,

A & B & C are molecule.

A is deep in liquid.

B within surface film.

C on the surface of a liquid

For molecule A ,

- A is deep inside liquid, then its sphere of influence is also completely inside the liquid.

- $\therefore$ A is a acted cohesive force.
- $\Rightarrow$ The net cohesive force acting on molecule A is zero.

For B molecule,

- Molecule B lies within the surface layer & below the free surface of the liquid.
- B molecule sphere of influence is part is inside in liquid & small part in air.
- cohesive force act in part of liquid & adhesive force act in part of air.
- liquid force is higher than air force.
- $\Rightarrow$ Thus, the molecule B gets attracted inside the liquid.

for molecule C,

- C lies exactly on the free surface of a liquid.
- Half of the sphere of influence in air & half in liquid.
- The no. of air molecules & the liquid molecule is same.
- Adhesive force try to pull the molecule above the liquid while cohesive force try to pull the molecule inside the liquid. cohesive force is stronger than A.F.
- $\Rightarrow$ Thus, the molecule C also get attracted inside the liquid.

12/11 - The force due to surface tension act tangential to the free surface of a liquid.

* Surface tension & surface Energy :

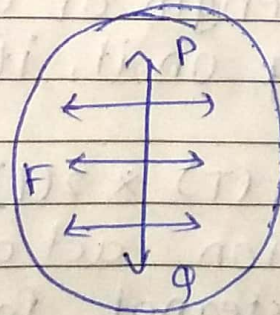
(a) Surface tension :

Surface Tension T is defined as, the tangential force acting per unit length on both side of an imaginary line drawn on the free surface of liquid.

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

- SI unit $\Rightarrow$ N/m

- Dimension $\Rightarrow [L^0 M^1 T^{-2}]$.



$$Pq = L$$

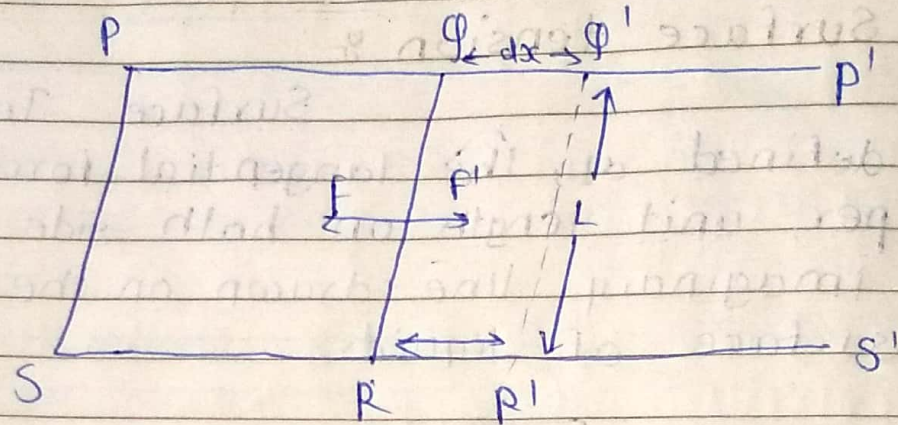
Force of surface tension.

(b) Surface Energy :

The surface molecules possess extra potential energy as compared to the molecules inside the liquid. The extra energy of the

molecules in the surface layer is called the surface energy of the liquid.

© Relation between the Surface energy &



Surface energy of a liquid.

Where,

$Q R$ are moved toward side $P S$ so as to decrease the area of the film.

The length of $Q R$ is L .

the F acting on it, it,

$$F = (T) \times 2(L)$$

(surface tension act on $Q R$ is $2L$).
(F is a external force).

- The $Q R$ moves to $Q' R'$ through distance dx . Therefore, work done is F , the force due to surface tension,

$$dW = F dx$$

put the value $F = T \times 2L$

$$\therefore dW = T(2Ldx)$$

But $2Ldx = dA$.

$$\therefore dW = T \times (dA)$$

$$dW = T(dA)$$

$\begin{aligned} \text{Surface energy} &= T(dA) \\ dW &= T(dA) \end{aligned}$

- Surface tension is also equal to the surface energy per unit area.