

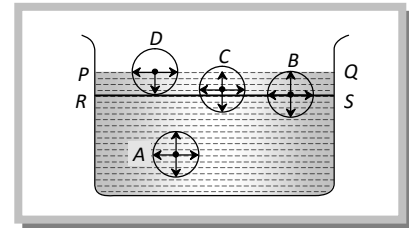
## Molecular Theory of Surface Tension.

The maximum distance up to which the force of attraction between two molecules is appreciable is called molecular range ( $\approx 10^{-9} m$ ). A sphere with a molecule as center and radius equal to molecular range is called the sphere of influence. The liquid enclosed between free surface (PQ) of the liquid and an imaginary plane (RS) at a distance  $r$  (equal to molecular range) from the free surface of the liquid form a liquid film.

To understand the tension acting on the free surface of a liquid, let us consider four liquid molecules like A, B, C and D. Their sphere of influence are shown in the figure.

(1) Molecule A is well within the liquid, so it is attracted equally in all directions. Hence the net force on this molecule is zero and it moves freely inside the liquid.

(2) Molecule B is little below the free surface of the liquid and it is also attracted equally in all directions. Hence the resultant force on it is also zero.



(3) Molecule C is just below the upper surface of the liquid film and the part of its sphere of influence is outside the free liquid surface. So the number of molecules in the upper half (attracting the molecules upward) is less than the number of molecule in the lower half (attracting the molecule downward). Thus the molecule C experiences a net downward force.

(4) Molecule D is just on the free surface of the liquid. The upper half of the sphere of influence has no liquid molecule. Hence the molecule D experiences a maximum downward force.

Thus all molecules lying in surface film experiences a net downward force. Therefore, free surface of the liquid behaves like a stretched membrane.