$$\frac{1}{4}\int_0^{d_1}\frac{d\varepsilon}{(z+\varepsilon)^4} = \frac{1}{12}\left[\frac{1}{z^3} - \frac{1}{(z+d_1)^3}\right].$$

$$\therefore \int_0^{d_1}\int_0^{\infty} \frac{-\beta_{12} N_A \rho_1}{M_1} \times \frac{2\pi y\,dy\,d\varepsilon}{\pi^6}$$

$$\phi'' = \frac{-\rho_1 N_A \beta_{12}\pi}{6M_1}\left(\frac{1}{z^3} - \frac{1}{(z+d_1)^3}\right).$$

No. of molecules per unit volume in block-2 $= \frac{N_A \rho_2}{M_2}$

Total no. of molecules in block $z = \frac{\rho_2 N_A}{M_2} \times A\,dz$

- Energy of interaction of the molecules in the strip of ② per unit interfacial area with all molecules of ①.

$$= \frac{\rho_2 N_A}{M_2} dz\, \phi''$$

- energy of interaction of all molecules of ② per unit interfacial area with all molecules of ①.

$$= \int_d^{d+d_2} \frac{\rho_2 N_A}{M_2} dz\, \phi''$$

$$G^{LW} = \int_d^{d+d_2} \underbrace{\frac{\rho_1\rho_2 N_A^2 \beta_{12}\pi^2}{M_1 M_2}}_{\text{Hamaker constant }(A_{12})} \times \frac{1}{6\pi} \times \left(\frac{1}{z^3} - \frac{1}{(z+d_1)^3}\right) dz$$

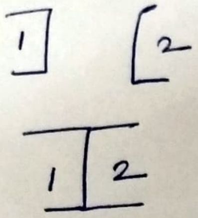
~~$G^{LW} =$~~

$$A_{12} = \frac{\rho_1\rho_2 N_A^2 \beta_{12}\pi^2}{M_1 M_2}$$

$$G^{LW} = \frac{-A_{12}}{12\pi}\left[\frac{1}{(z+d_1)^2} - \frac{1}{z^2}\right]_d^{d+d_2}$$

$$G^{lw} = -\frac{A_{12}}{12\pi}\left[\frac{1}{(d+d_1+d_2)^2}+\frac{1}{d^2}-\frac{1}{(d+d_1)^2}-\frac{1}{(d+d_2)^2}\right]$$

figure-2



• figure 1 & 2 are not same bcoz in figure 1 the widths are finite.

ΔG_{12}

For ① & ② infinitely large, $d_1 \to \infty$
$d_2 \to \infty$

$$G^{lw}(d) = -\frac{A_{12}}{12\pi d^2}$$

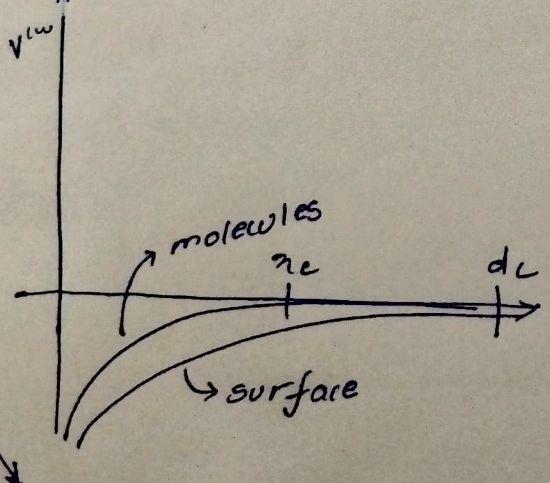
$$\Delta G_{12}^{lw} = G^{lw}(d)\Big|_{\text{at contact}} - G^{lw}_{d}\Big|_{\text{infinite seperation}}.$$

$d_0 \to$ min seperation distance b/w two surfaces at contact.

$$\Delta G_{12}^{lw} = -\frac{A_{12}}{12\pi d_0^2} = r_{12}^{lw} - (r_1^{lw} + r_2^{lw}) \longleftrightarrow -\frac{B_{12}}{r^6}$$

$d_0 \to$ material independent.

$$A_{12} = 12\pi d_0^2 (r_1^{lw} + r_2^{lw} - r_{12}^{lw}).$$



$d_c >> x_c$
$d \sim 100nm$

A_{12} / B_{12} can be calculated (refer pb 1)