SCIENCE-1 Project

Oxygen transport through myoglobin

YOUTUBE LINK: https://www.youtube.com/watch?v=Gbb2WM9xEMA&feature=youtu.be

Science-1
Project-2

Shubh Maheshwari
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Description:

We have to analyse the transportation of oxygen through myoglobin using Spherical galton board:

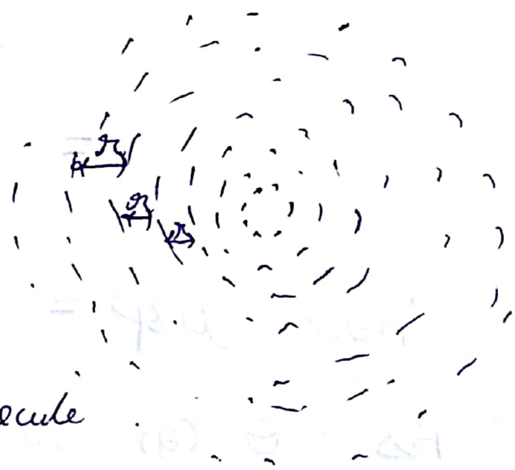
Assumptions

→ No. of spheres of nails $= n$

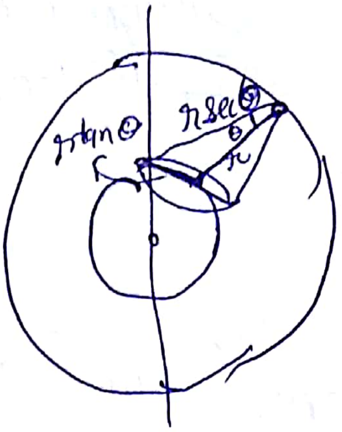
→ Distance between concentric sphere $= r$

→ Spherical partical (O_2) is the point dimension (in reality O_2 molecule is comparable to point particle and biomolecules are in sense near to each other which makes the assumption valid.

→ Gravity acts towards the center of the sphere

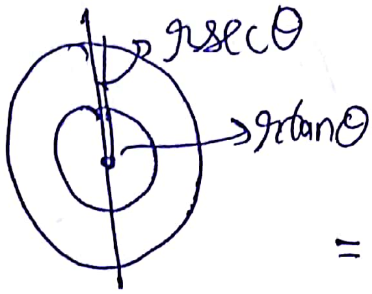


Spherical galton Board.



θ can take value from $-\pi/6$ to $\pi/3$

Assumption as it can drop max by $60°$.



Probality to have derivation of angle θ which moving from one sphere to another

$$= \frac{2\pi \times r\tan\theta \times r\sec\theta\, d\theta}{\pi r^2 \tan^2(\pi/3)}$$

$$= \frac{2}{3} \sec\theta \tan\theta . d\theta$$

here disp $= r\sec\theta$

Total

As θ can vary from $0 \to \pi/3$

displacment $= r\sec\theta_1 + r\sec\theta_2 \; . \; . \; . \; r\sec\theta_n$

Mean displacment $= \sum_{i=1}^{N} r\sec\theta_n$

$$\langle r\sec\theta_n \rangle = \int_0^{\pi/3} r\sec\theta . p \quad p = prob$$

p = probality of θ

$$= \int_0^{\pi/3} r\sec\theta \times \frac{2}{3}\sec\theta\tan\theta d\theta = \int_0 \frac{2}{3} r \sec^2\theta \tan\theta d\theta$$

$= \frac{r}{3}[\tan^2\theta]_0^{\pi/3}$

$= \frac{r}{3} \times [3-0]$

$= r$

mean disp $\Rightarrow \sum_{i=1}^{N} r = rN$

Mean² displacment $= \langle (N - \langle N \rangle)^2 \rangle$

$= \langle N^2 \rangle - \langle N \rangle^2$

$\langle N^2 \rangle = \left(\sum_{i=1}^{N} r \sec\theta \right)^2$

$\simeq \langle r^2 \sec^2\theta$

$\simeq \int_0^{\pi/3} \frac{1}{3} r^2 \sec^2\theta \times \frac{2}{3} \sec\theta \tan\theta \, N^2 \, d\theta$

$\simeq \frac{2}{9} [\sec^3\theta]_0^{\pi/3} r^2 N^2$

$= \frac{2}{9} [8-1] r^2 N^2$

$= \frac{14}{9} r^2 N^2 = k r^2 N^2$ (constant) $\left(k = \frac{14}{9}\right)$

Mean square displacment $= \frac{14 r^2 N^2}{9} - r^2 N^2$

$= \frac{5 r^2 N^2}{9}$

Hence we get

Mean Displacment $\propto rN$

Mean Square Displacment $\propto N^2 r^2$