

Science-1

Project-2

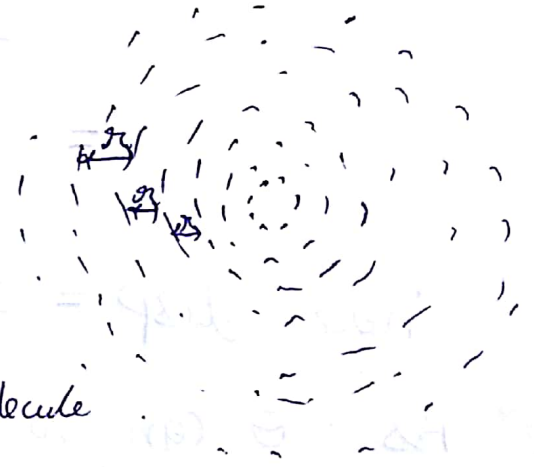
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Description:

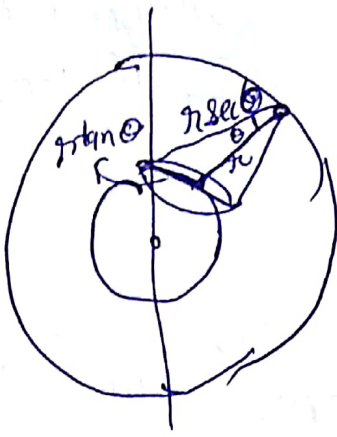
We have to analyze the transportation of oxygen through myoglobin using spherical galton board:

Assumptions

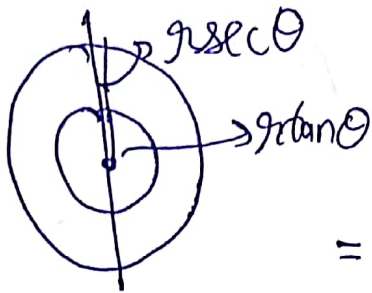
- No. of spheres of nails = n
- Distance between concentric sphere = r
- Spherical parbical (O_2) is the point dimension (in reality O_2 molecule is comparable to point parbicle and biomolecules are in sense near to each other which makes the assumption valid.
- Gravity acts towards the center of the sphere



Spherical galton Board.



θ can take value from $-\pi/6$ to $\pi/3$
 Assumption as it can drop
 max by 60°



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

$$= 2\pi \times r \tan \theta \times r \sec \theta d\theta$$

$$\pi r^2 \tan^2(\pi/3)$$

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

here $\text{disp} = r \sec \theta$

Total

As θ can vary from $0 \rightarrow \pi/3$

$$\text{displacement} = r \sec \theta_1 + r \sec \theta_2 \dots r \sec \theta_n$$

$$\text{Mean displacement} = \sum_{i=1}^N r \sec \theta_i$$

$$\langle r \sec \theta \rangle = \int_0^{\pi/3} r \sec \theta \cdot p = \text{prob}$$

$p = \text{probability of } \theta$

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

$$= \frac{\pi}{3} [\tan^2 \theta]_{0}^{\pi/3}$$

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

$$= \pi$$

$$\text{mean disp} \Rightarrow \sum_{i=1}^N x_i = \pi N$$

$$\text{Mean}^2 \text{ displacement} = \frac{\langle (N - \langle N \rangle)^2 \rangle}{\langle N^2 \rangle - \langle N \rangle^2}$$

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

$$\approx \langle x^2 \sec^2 \theta \rangle$$

$$\approx \int_0^{\pi/3} \frac{1}{3} x^2 \sin^2 \theta \times \frac{2}{3} \sec \theta \tan \theta N^2 d\theta$$

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

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

$$= \frac{14}{9} x^2 N^2 = K x^2 N^2 \text{ (constant)} \quad (K = \frac{14}{9})$$

$$\text{Mean square displacement} = \frac{14 x^2 N^2}{9} - x^2 N^2$$

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

Hence we get

Mean Displacement $\propto \pi N$

Mean Square Displacement $\propto N^2 x^2$