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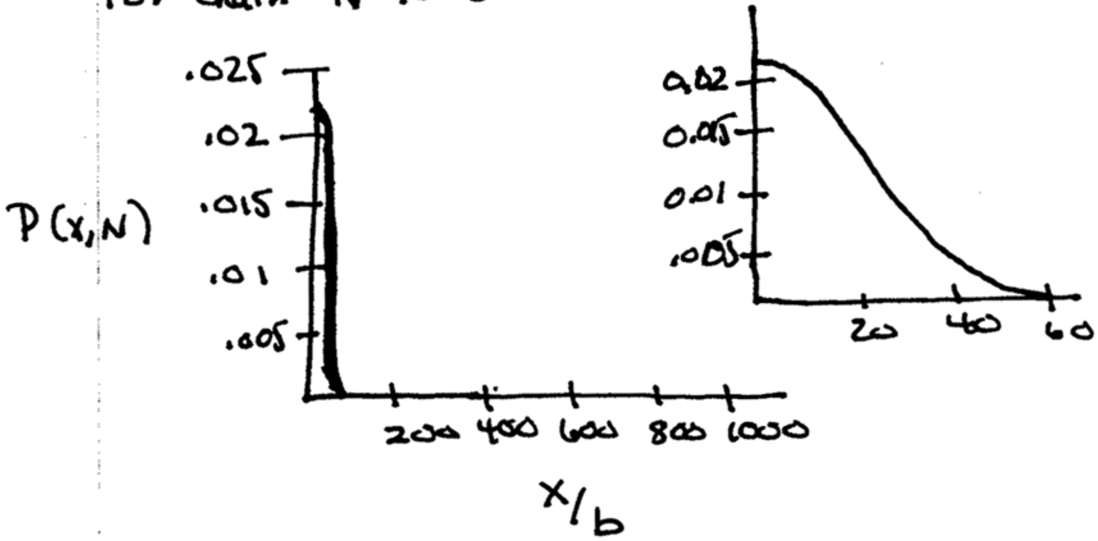
1-D probability distribution

$$P(x,N) = \left(\frac{3}{2\pi}Nb^2\right)^{1/2} e^{-3x^2/2Nb^2}$$

For chain N=1000



Probability that after N steps, ends are X apart.

Gives relative # for each "x"
To get total #, multiply by z^N (# possible configs)

<u>Elasticity</u>

How does the free energy of the chain change as it is stretched? U stays constant (to a 1st approx)
Need S

$$S = k \ln \Omega$$

$$\# \text{ configurations} = \Omega = P(x,N)\, z^n$$

$$S(x,N) = K \ln \Omega(x,N) = K(\ln P(x,N) + N \ln z)$$

$$S(x,N) = K\left[\frac{1}{2}\ln\left(\frac{3}{2\pi Nb^2}\right) + \left(\frac{-3x^2}{2Nb^2}\right) + N\ln z\right]$$

$$S(x,N) = \text{constant} - \frac{3Kx^2}{2Nb^2}$$

$$F = \underset{\substack{\uparrow \\ \text{presume} \\ \text{constant w/stretching}}}{U} - TS \sim -TS$$

At const T

$$F = \frac{3KTx^2}{2Nb^2} - \text{constant}$$

Retractive force

$$f_{elastic} = -\frac{\partial F}{\partial x} = -\frac{3KT}{Nb^2}x$$

$\Rightarrow$ looks like Hookean spring!

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Please see:
Figure 32.4 in Dill, Ken A., and Sarina Bromberg. *Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology*. New York, NY: Garland Science, 2003. ISBN: 0815320515.

Can translate 1-D results to 3D to get radial distribution function

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Please see:
Figure 32.6 in Dill, Ken A., and Sarina Bromberg. *Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology*. New York, NY: Garland Science, 2003. ISBN: 0815320515.

$$P(r,N) = 4\pi r^2 \left(\frac{3}{2\pi N b^2}\right)^{3/2} e^{-3r^2/2Nb^2}$$

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Please see:
Figure 32.7 in Dill, Ken A., and Sarina Bromberg. *Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology*. New York, NY: Garland Science, 2003. ISBN: 0815320515.