Chem 664

Solution to Problem Set #2

A. (1) Given that $g(N,s) = \sum_N s^N F_N$

$$s\frac{d}{ds}g(N,s) = \sum_N s N s^{N-1} F_N = \sum_N N s^N F_N$$

$$s\frac{d}{ds}^{(2)} g(N,s) = \sum_N s\, N \cdot N s^{N-1} F_N = \sum_N N^2 s^N F_N$$

$\vdots$

$$\frac{d}{ds}^{(k)} g(N,s) = \sum_N N^k s^N F_N\,, \quad \left[s\frac{d}{ds}^{(k)} g(N,s)\right]_{s=1} = \sum_N N^k F_N \equiv m_k$$

(2) If $F_N = (1-p)p^{N-1}$, $g(N,s) = (1-p)s\sum_{N=1}^{\infty} s^{N-1}p^{N-1} = \frac{(1-p)s}{(1-ps)}$

$$s\frac{d}{ds}g(N,s) = s\left[\frac{(1-p)}{(1-sp)} + \frac{(1-p)s(-p)(-1)}{(1-sp)^2}\right] = s\,\frac{1-p}{(1-sp)^2}$$

$$m_1 = 1\,\frac{(1-p)}{(1-p)^2} = \frac{1}{1-p}$$

$$s\frac{d}{ds}^{(2)} g(N,s) = s\left[\frac{(1-p)}{(1-sp)^2} + \frac{s(1-p)(-p)(-2)}{(1-sp)^3}\right] = \frac{s(1-p)(1+sp)}{(1-sp)^3}$$

$$m_2 = \frac{1+p}{(1-p)^2}$$

$$s\frac{d}{ds}^{(3)} g(N,s) = s\,\frac{d}{ds}\left[\frac{(1-p)(1+sp)}{(1-sp)^3}\right] = s(1-p)\left[\frac{(1+2sp)(1-sp) + s(1+sp)\cdot 3p}{(1-sp)^4}\right]$$

$$= s(1-p)\left[\frac{1+\;p - 2s^2p^2 + 3sp + 3s^2p^2}{(1-sp)^4}\right] = s(1-p)\left[\frac{1+4sp+s^2p^2}{(1-sp)^4}\right]$$

$$m_3 = \frac{(1-p)(1+4p+p^2)}{(1-p)^4} = \frac{1+4p+p^2}{(1-p)^3}$$

$$s\frac{d}{ds}^{(4)} g(N,s) = (1-p)s\,\frac{d}{ds}\left[\frac{s+4s^2p+s^3p^2}{(1-sp)^4}\right] = s(1-p)\left[\frac{1+8sp+3s^2p^2}{(1-sp)^4} + \frac{(s+4s^2p+s^3p^2)4p}{(1-sp)^5}\right]$$

$$= s(1-p)\left[\frac{1+11sp+11s^2p^2+s^3p^3}{(1-sp)^5}\right]$$

$$m_4 = \frac{1+11p+11p^2+p^3}{(1-p)^4}$$

Note here that $\sum$ of coefficients of the numerator for kth moment is $k!$ which is consistent with $k!/q^k$ in the cont. limit

A.(3) $G(N,s) = \int_0^\infty e^{-sN} F(N)\,dN$

$$\frac{d}{ds} G(N,s) = \int_0^\infty (-N) e^{-sN} F(N)\,dN = (-1)\int_0^\infty N e^{-sN} F(N)\,dN$$

$$\frac{d^2}{ds^2} G(N,s) = \int_0^\infty (-N)(-N) e^{-sN} F(N)\,dN = \int_0^\infty N^2 e^{-sN} F(N)\,dN$$

$$\vdots$$

$$\frac{d^k}{ds^k} G(N,s) = \frac{d^{(k)}}{ds} G(N,s) = (-1)^k \int_0^\infty N^k e^{-sN} F(N)\,dN$$

$$(-1)^k \left[\frac{d^{(k)}}{ds} G(N,s)\right]_{s=0} = (-1)^{2k} \int_0^\infty N^k e^{-0} F(N)\,dN$$

$$= \int_0^\infty N^k F(N)\,dN = m_k, \quad \text{Q.E.D.}$$

B. 1) $\alpha \lesssim 1$, $(1-\alpha) \equiv \zeta$, $w_N = \frac{N(N-1)}{2} \alpha^{N-2} (1-\alpha)^3$

$$= \frac{N(N-1)}{2} \frac{\alpha^N}{\alpha^2} (1-\alpha)^3$$

$w(N,\zeta) \approx \frac{N^2}{2} e^{-\zeta N} \zeta^3$ where $\frac{\alpha^N}{\alpha^2} \cong \alpha^N = (1-\zeta)^N \cong e^{-\zeta N}$

& $N-1 \approx N$, $0 \le N \le \infty$

Normalization of $w(N,\zeta)$

$$\int_0^\infty \frac{N^2}{2} e^{-\zeta N} \zeta^3\,dN = \frac{\zeta^3}{2} \frac{2!}{\zeta^3} = 1$$

$$\int_0^\infty x^2 e^{-ax^2}\,dx = \frac{2!}{a^3}$$

Hence $n(N,\zeta) = A \frac{N}{2} e^{-\zeta N} \zeta^3$ since $n(N,\zeta) \propto \frac{w(N,\zeta)}{N}$

where A is the normalization const

$$1 = \frac{A}{2}\zeta^3 \int_0^\infty N e^{-\zeta N}\,dN = \frac{A}{2}\zeta^3 \frac{1!}{\zeta^2} = \frac{A\zeta}{2}, \quad \therefore A = \frac{2}{\zeta}$$

$$n(N,\zeta) = N e^{-\zeta N} \zeta^2$$

$$m_2 = \int_0^\infty N^2 n(N,\zeta) = \zeta^2 \int_0^\infty N^2 \cdot N e^{-\zeta N} dN$$ SPS2/3

$$= \zeta^2 \frac{3!}{\zeta^4} = \frac{3!}{\zeta^2}$$

$$m_3 = \zeta^2 \int_0^\infty N^3 \cdot N e^{-\zeta N} dN = \zeta^2 \frac{4!}{\zeta^5} = \frac{4!}{\zeta^3}$$

$$N_z = m_3/m_2 = 4/\zeta = 4/(1-\alpha) \qquad m_k = \frac{(k+1)!}{\zeta^k}$$

$$N_w = m_2/m_1 = 3/\zeta = 3/(1-\alpha)$$

B.2) Poisson distribution, $n_N = \dfrac{e^{-\nu}\nu^{N-1}}{(N-1)!}$ which is highly peaked at $N \approx \nu >> 1$

$$\frac{\nu^{N-1}}{(N-1)!} = \frac{N\nu^{N-1}}{N!} = \left(\frac{N}{\nu}\right)\frac{\nu^N}{N!} \cong \frac{\nu^N}{N!}$$ since $\left(\frac{N}{\nu}\right) \cong 1$ when n_N is finite

$$n_N = \frac{e^{-\nu}\nu^N}{N!} \cong \frac{e^{-\nu}e^N}{(2\pi\nu)^{1/2}}\left(\frac{\nu}{N}\right)^{N+\frac{1}{2}}, \quad N! \cong (2\pi)^{1/2} N^{N+\frac{1}{2}} e^{-N}$$ Stirling's approx

$$\left(\frac{\nu}{N}\right)^{N+\frac{1}{2}} = \left(1 - \frac{N-\nu}{N}\right)^{N+\frac{1}{2}} \cong \left(1-\frac{N-\nu}{N}\right)^N = \left[\left(1-\frac{N-\nu}{N}\right)^{\frac{N}{\nu}}\right]^\nu$$

$$\left(\frac{\nu}{N}\right)^N = \exp\left[\ln\left(\frac{\nu}{N}\right)^N\right] = \exp\left[\nu \ln\left(1 - \frac{N-\nu}{N}\right)^{N/\nu}\right]$$

whereas

$$\left(1 - \frac{N-\nu}{N}\right)^{N/\nu} = 1 - \left(\frac{N}{\nu}\right)\left(\frac{N-\nu}{N}\right) + \cdots$$

$$\left|\frac{N-\nu}{N}\right| << 1$$

$$= 1 - \left(\frac{N-\nu}{\nu}\right) + \cdots \cong 1 - \left(\frac{N-\nu}{\nu}\right)$$

thus,

$$\ln\left(1 - \frac{N-\nu}{N}\right)^{N/\nu}$$

$$\cong \ln\left[1 - \left(\frac{N-\nu}{\nu}\right)\right] = -\frac{N-\nu}{\nu} - \frac{(N-\nu)^2}{2!\,\nu^2} - \cdots$$

$$\ln(1 \pm u) = -u \pm (u^2/2!) \ldots$$

$$\therefore \nu \ln\left(1 - \frac{N-\nu}{\nu}\right)^{N/\nu}$$

$$\cong \nu\left[-\frac{N-\nu}{\nu} - \frac{(N-\nu)^2}{2\nu^2} - \cdots\right]$$

$$\cong -(N-\nu) - \frac{(N-\nu)^2}{2\nu}$$

Finally

$$\left(\frac{\nu}{N}\right)^N \cong \exp\left[-(N-\nu) - \frac{(N-\nu)^2}{2\nu}\right]$$

$$n_N \cong \frac{e^{-\nu}\cdot e^N}{(2\pi\nu)^{1/2}} \cdot e^{-N} \cdot e^{+\nu} \cdot e^{-(N-\nu)^2/2\nu} = \frac{1}{(2\pi\nu)^{1/2}} e^{-(N-\nu)^2/2\nu}$$

Normalization $\int_0^\infty n(N,\nu)dN = \frac{1}{\sqrt{2\pi\nu}}\int_0^\infty e^{-(N-\nu)^2/2\nu}dN$

$\nu >> 1$ $\quad \left(\begin{array}{l} N-\nu \equiv u, \ dN = du \\ N=0, \ u=-\nu \underset{\nu>>1}{\approx} -\infty, \ N=\infty, \ u=\infty \end{array}\right)$

$$= \frac{1}{\sqrt{2\pi\nu}}\int_{-\infty}^{\infty} e^{-u^2/2\nu}du = \frac{1}{\sqrt{2\pi\nu}}\cdot 2\int_0^\infty e^{-u^2/2\nu}du$$

$$= \frac{1}{\sqrt{2\pi\nu}}\cdot 2\cdot\frac{1}{2}\sqrt{\frac{\pi}{1/2\nu}} = 1$$

Proof of $G(N,s) = e^{-s\nu}e^{+s^2\nu/2} = e^{\nu(\frac{s}{2}-1)s}$

not required

$$G(N,s) \equiv \int_0^\infty e^{-sN}\frac{e^{-(N-\nu)^2/2\nu}}{\sqrt{2\pi\nu}}dN = \frac{1}{\sqrt{2\pi\nu}}\int_0^\infty exp[-sN-(N-\nu)^2/2\nu]dN$$

exponent: $-sN-(N-\nu)^2/2\nu = -(2\nu sN + N^2 - 2\nu N + \nu^2)/2\nu$

$$= -[N^2 + 2\nu(s-1)N + \nu^2(s-1)^2 - \nu^2(s-1)^2 + \nu^2]/2\nu$$

$$= -[N+\nu(s-1)]^2 + \frac{s^2\nu}{2} - s\nu$$

$$G(N,s) = \frac{1}{\sqrt{2\pi\nu}}e^{s^2\nu/2}e^{-s\nu}\int_0^\infty e^{-[N+\nu(s-1)]^2}dN$$

$=$ where $\int_0^\infty e^{-[N+\nu(s-1)]^2}dN = \int_{-\infty}^{\infty} e^{-u^2/2\nu}du$

$$= 2\cdot\frac{1}{2}\sqrt{\frac{\pi}{1/2\nu}} = \sqrt{2\pi\nu}$$

$\left(\begin{array}{l} N+\nu(s-1) \equiv u \\ dN = du, \ N=0, \ u=\nu(s-1) \approx -\infty \\ \quad\quad\quad\quad \text{if } 0 \le s < 1 \\ N=\infty, \ u=\infty \end{array}\right)$

$$G(N,s) = \frac{1}{\sqrt{2\pi\nu}}\cdot e^{s^2\nu/2}e^{-s\nu}\cdot\frac{1}{\sqrt{2\pi\nu}} = e^{\nu(\frac{s}{2}-1)s}$$

Q.E.D.

$$\left[\frac{d}{ds}G(N,s)\right]_{s=0} = \left(\frac{2s}{2}-1\right)\nu G(N,s)\Big]_{s=0} = -\nu$$

$$m_1 = +\nu$$

$$\frac{d^2}{ds^2}G(N,s) = \nu G(N,s) + \nu(s-1)\nu(s-1)G(N,s)$$
$$= [\nu + \nu^2(s-1)^2]G(N,s) \quad \text{where } G(N,s)\Big|_{s=0} = 1$$
$$m_2 = \nu + \nu^2$$

$$\frac{d^3}{ds^3}G(N,s) = \frac{d}{ds}\left\{[\nu+\nu^2(s-1)^2]G(N,s)\right\}$$
$$= 2\nu^2(s-1)G(N,s) + [\nu+\nu^2(s-1)^2]\nu(s-1)G(N,s)$$
$$= \left[3\nu^2(s-1) + \nu^3(s-1)^3\right]G(N,s)$$
$$m_3 = 3\nu^2+\nu^3$$

$$N_z = m_3/m_2 = \frac{3\nu^2+\nu^3}{\nu+\nu^2} \approx \nu$$

$$N_w = m_2/m_1 = \frac{\nu+\nu^2}{\nu} = 1+\nu \approx \nu$$

C. (1.35) $\quad w_N = p^{N-1}N(1-p)^2, \quad \ln w_N = (N-1)\ln p + \ln N + 2\ln(1-p)$

Since at N_{max}, $w_{N_{max}} > 0$, $\dfrac{dw_N}{dN} = \dfrac{d\ln w_N}{dN}$

$$\left.\frac{d\ln w_N}{dN}\right)_{N_{max}} = \ln p + \frac{1}{N_{max}} = 0, \quad N_{max} = \frac{1}{\ln(\frac{1}{p})}$$

If $p \lesssim 1$, $\ln\left(\frac{1}{p}\right) = \ln\left[\frac{1}{1-1+p}\right] = \ln\left[\frac{1}{1-(1-p)}\right]$

$$= \ln[1+(1-p)+(1-p)^2+\dots] \approx \ln[1+(1-p)]$$
$$\approx (1-p) + \frac{(1-p)^2}{2!} + \dots \approx (1-p)$$

Hence $N_{max} = \dfrac{1}{1-p} = N_n$

p	0.99	0.995	0.998
N_n	100	200	500
N_{max}	99.5	199.5	449.5

(i) $n_N(p) = \dfrac{(N+f-2)!}{(f-1)!(N-1)!} p^{N-1}(1-p)^f$ for N-mer with f-branch

$p^{N-1}(1-p)^f$ is analog of MPD with termination probability for each f branch

$(N-1+f-1)$ = # of objects whose permutation is $(N+f-2)!$

Distinct combinations $= \dfrac{(N+f-2)!}{(f-1)!(N-1)!}$

Thus, $n_N(p) = \underbrace{\dfrac{(N+f-2)!}{(f-1)!(N-1)!} p^{N-1}(1-p)^f}$, $f=1$, $n_N(p) = \dfrac{(N-1)!}{0!(N-1)!} p^{N-1}(1-p)$
$= p^{N-1}(1-p)$
MPD

Normalization:

$$\sum_{N=1}^{\infty} n_N(p) = (1-p)^f \sum_{N=1}^{\infty} \frac{(N+f-2)!}{(f-1)!(N-1)!} \cdot p^{N-1}$$

$$= (1-p)^f \left\{ \frac{(f-1)!}{(f-1)!0!} p^0 + \frac{f!\,p}{(f-1)!1!} + \frac{(f+1)!\,p^2}{(f-1)!2!} + \cdots \right\}$$

$$= (1-p)^f \left\{ 1 + fp + \frac{(f+1)f}{2!} p^2 + \frac{(f+2)(f+1)f}{3!} p^3 + \cdots \right\}$$

$$= (1-p)^f \cdot \frac{1}{(1-p)^f} = 1, \text{ normalized}$$

(ii) $N_n \overset{?}{=} \dfrac{(f-1)p+1}{1-p}$

$$g(N,s) = \sum s^N n_N(p) = (1-p)^f \left\{ s\frac{(f-1)!}{(f-1)!} p^0 + \underbrace{s^2 \frac{f!}{(f-1)!} p + s^3 \frac{f(f+1)}{2!} p^2 + \cdots} \right\}$$
$= (1-p)^f \dfrac{s}{(1-sp)^f}$

$$m_1(N) = \left[s\frac{d}{ds} g(N,s) \right]_{s=1}$$

$$= \left[s(1-p)^f \left\{ \frac{1}{(1-sp)^f} + \frac{fsp}{(1-sp)^{f+1}} \right\} \right]_{s=1}$$

$$= \left[(1-p)^f \cdot \frac{s(1-sp) + fs^2p}{(1-sp)^{f+1}} \right]_{s=1} = \left[(1-p)^f \frac{(f-1)s^2p + s}{(1-sp)^{f+1}} \right]_{s=1}$$

$= \dfrac{(f-1)p+1}{(1-p)}$, Q.E.D. If $f=1$, $m_1 = \dfrac{1}{1-p}$, MPD result

(iii) To prove that $\dfrac{N_w}{N_n} \cong 1 + \dfrac{1}{f}$

$$m_2(N) = \left\{ s\frac{d}{ds}\left[(1-p)^f \frac{(f-1)s^2p + s}{(1-sp)^{f+1}}\right]\right\}_{s=1}$$

$$= \left\{ s(1-p)^f\left[\frac{(f-1)2sp+1}{(1-sp)^{f+1}} + \frac{[(f-1)s^2p+s](f+1)p}{(1-sp)^{f+2}}\right]\right\}_{s=1}$$

$$= (1-p)^f\left\{\frac{(f-1)2p+1}{(1-p)^{f+1}} + \frac{[(f-1)p+1](f+1)p}{(1-p)^{f+2}}\right\}$$

$$= \frac{(1-p)[(f-1)p+1+(f-1)p] + [(f-1)p+1](f+1)p}{(1-p)^2}$$

$$= \frac{[(f-1)p+1](1+pf) + (1-p)(f-1)p}{(1-p)^2}$$

$$N_w = m_2(N)/m_1(N) = \frac{1+pf}{(1-p)} + \frac{p(f-1)}{(f-1)p+1}$$

If $f=1$, $N_w = \dfrac{1+p}{1-p}$ which is of MPD

$$N_w/N_n = \frac{\dfrac{1+pf}{(1-p)} + \dfrac{p(f-1)}{(f-1)p+1}}{\dfrac{(f-1)p+1}{(1-p)}} = \frac{1+pf}{(f-1)p+1} + \frac{p(1-p)(f-1)}{[(f-1)p+1]^2}$$

$$\underset{p\to 1}{\cong} \frac{1+f}{f} + \underbrace{\frac{(1-p)(f-1)}{f^2}}_{\cong\, 0} \cong 1 + \frac{1}{f}$$

$$N_w/N_n \underset{f=1}{\cong} 2 \quad (\text{MPD result})$$

E. (1.37)

We use the notations given in Handout #5-1

(i) $n_N = \dfrac{(N_n-1)^{N-1}}{(N-1)!} e^{(1-N_n)} = \dfrac{\nu^{N-1} e^{-\nu}}{(N-1)!}$, $\nu \equiv N_n - 1$

(ii)

$$w_N = \frac{N n_N}{\sum N n_N}, \quad \sum_{N=1}^{\infty} N n_N = e^{-\nu} \sum \frac{N \nu^{N-1}}{(N-1)!}$$

$$= e^{-\nu}\left(1 \cdot \frac{\nu^0}{0!} + 2\frac{\nu^1}{1!} + 3\frac{\nu^2}{2!} + 4\frac{\nu^3}{3!} + \dots\right)$$

$$= (1+\nu)e^{-\nu} \cdot e^{\nu} = 1+\nu = \underline{\underline{N_n}}$$

where $e^{\nu} = 1 + \nu + \dfrac{\nu^2}{2!} + \dfrac{\nu^3}{3!} + \dfrac{\nu^4}{4!} + \dots$

$\nu e^{\nu} = \nu + \nu^2 + \dfrac{\nu^3}{2!} + \dfrac{\nu^4}{3!} + \dots$

$(1+\nu)e^{\nu} = 1 + 2\nu + \dfrac{3}{2}\nu^2 + \dfrac{1+3}{6}\nu^3 + \dots$

$= 1 + 2\nu + \dfrac{3}{2!}\nu^2 + \dfrac{4}{3!}\nu^3 + \dfrac{5}{4!}\nu^4 + \dots$

$$\therefore w_N = \frac{N \nu^{N-1} e^{-\nu}}{(1+\nu)(N-1)!}$$

(iii) $N_w = \sum N w_N$

$$= \sum \frac{N^2 \nu^{N-1} e^{-\nu}}{(1+\nu)(N-1)!}$$

$$= \frac{e^{-\nu}}{(1+\nu)}\left(1^2\frac{\nu^0}{0!} + 2^2\frac{\nu}{1!} + 3^2\frac{\nu^2}{2!} + 4^2\frac{\nu^3}{3!} + \dots\right)$$

$$= \frac{e^{-\nu}}{(1+\nu)}\left(1 + 4\nu + \frac{9}{2!}\nu^2 + \frac{16}{3!}\nu^3 + \dots\right) = \frac{e^{-\nu}}{(1+\nu)} \cdot e^{\nu}(1+3\nu+\nu^2)$$

$$e^{\nu}(1+3\nu+\nu^2) = 1 + \nu + \frac{\nu^2}{2!} + \frac{\nu^3}{3!} + \frac{\nu^4}{4!} + \dots$$
$$+ 3\nu + 3\nu^2 + 3\frac{\nu^3}{2!} + 3\frac{\nu^4}{3!} + \dots$$
$$+ \nu^2 + \nu^3 + \frac{\nu^4}{2!}$$

$$= 1 + 4\nu + \frac{8+1}{2!}\nu^2 + \frac{1+9+6}{3!}\nu^3 + \frac{1+12+12}{4!}\nu^4 + \dots$$

$$= 1 + 4\nu + \frac{3^2}{2!}\nu^2 + \frac{4^2}{3!}\nu^3 + \frac{5^2}{4!}\nu^4 + \dots$$

$$\therefore N_w = \frac{\nu^2+3\nu+1}{\nu+1}$$

$$= \frac{(\nu+1)^2 + (\nu+1) - 1}{(\nu+1)} = \frac{N_n^2 + N_n - 1}{N_n}$$

$$N_w/N_n = \frac{N_n^2 + N_n - 1}{N_n^2} = 1 + \frac{1}{N_n} - \frac{1}{N_n^2} \cong 1 + \frac{1}{N_n}$$

PDI = 1.01 if $N_n = 100$

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F. (1.40)

$$\Pi/c = RT\left(\frac{1}{M_n} + A_2 c + \cdots\right)$$

Units in cgs: pressure $\frac{dyn}{cm^2} = \frac{erg}{cm^3} = 10^{-1}\,Pa$

$$dyn = g \cdot \frac{cm}{s^2} = 10^{-3}\,kg\,\frac{10^{-2}\,m}{s} = 10^{-5}\,N$$

$$\frac{dyn}{cm^2} = \frac{10^{-5}\,N}{10^{-4}\,m^2} = 10^{-1}\,N/m^2 = 10^{-1}\,Pa$$

Thermal energy

$$RT = 8.314 \cdot 10^{7}\,\frac{erg}{mol \cdot K} \cdot 296.15\,K = 2.46 \cdot 10^{10}$$

$$= 8.314 \cdot \frac{J}{mol \cdot K} \cdot 296.15\,K = 2.46 \cdot 10^{3}$$

$$\Pi/c \Rightarrow \frac{dyn/cm^2}{g/cm^3} = \frac{g \cdot \frac{cm}{s^2}/cm^2}{g/cm^3} = \frac{1/s^2 \cdot cm}{1/cm^3} = cm^2/s^2$$

$$A_2 \Rightarrow \frac{cm^2/s^2}{\frac{erg}{mol} \cdot \frac{g}{cm^3}} = \frac{\cancel{cm^2}/\cancel{s^2}}{\frac{g \cdot \cancel{cm^2}}{mol \cdot \cancel{s^2}} \cdot \frac{g}{cm^3}} = mol \cdot cm^3/g^2$$

c (g/cm^3)	$2 \cdot 10^{-3}$	$4 \cdot 10^{-3}$	$6 \cdot 10^{-3}$	$8 \cdot 10^{-3}$	$10 \cdot 10^{-3}$
Π (dyn/cm^2)	508	1040	1580	2150	2740
Π/c (cm^2/s^2)	$2.54 \cdot 10^5$	$2.60 \cdot 10^5$	$2.63 \cdot 10^5$	$2.69 \cdot 10^5$	$2.74 \cdot 10^5$

Intercept: $2.45 \cdot 10^5$

Slope : $2.5 \cdot 10^6$

$$M_n = \frac{8.314 \cdot 10^{7} \cdot 2.9615 \cdot 10^{2}}{2.45 \cdot 10^{5}} \cong 10^5\,g/mol$$

$$A_2 = \frac{2.5 \cdot 10^6}{8.314 \cdot 10^7 \cdot 2.9615 \cdot 10^2} \cong 10^{-4}\,mol \cdot cm^3/g^2$$