1

$$\int_{-\infty}^{t} e^{a'\tau} e^{-a(t-\tau)} d\tau \qquad t-\tau = x \qquad \tau = t-x$$

$$= \int_0^{\infty} e^{a't - a'x - ax} dx$$

k_f k_t

$$a' = -\left(A + \frac{B}{a}\right)(1-\alpha)^2 \xi + A + \frac{B}{a+a'}$$

$$\frac{a'}{A} = 2\alpha\left(1 + \frac{B}{Aa}\right) - \frac{B}{Aa} + \frac{B/Aa}{1+a'/a}$$

1.5×10^{-3}

$\frac{10^3}{1.5}$

$$A = \frac{k_f - 1}{\tau} \qquad A - D\lambda^2 = \frac{k_{fe}-1}{\tau}$$

$$\frac{B}{a} = \frac{1}{200\tau} \qquad A = \frac{k_f - 1}{\tau}$$

$$a' = \frac{k_{fe}-1}{\tau} + \frac{1}{200\tau}\frac{1}{1+a'/a}$$

$k_{fe} - 1 + \frac{1}{200} \frac{1}{1+a'/a}$

$a'\tau = k_e - 1 + \frac{1}{200}\left(\frac{1}{1+a'/a} - 1\right)$

$a'\tau = (k_e - 1) - \frac{a'/a}{1+a'/a}\frac{1}{200}$

$\boxed{a' = 2(k_e-1)\,200a}$

$200a\,\tau = \frac{k_e-1}{a'}200a - \frac{1/a}{1+a'/a}\frac{1}{200}$

$$a'\tau = k_{fe} - 1 + \frac{1}{200}\left(1 - \frac{a'}{a}\right) \qquad a' < a$$

$20(k_e - 1) < \frac{1}{10}$

$$a'\tau + \frac{1}{200}\frac{a'}{a} = k_e - 1 \qquad a' = \frac{k_e - 1}{\tau + \frac{1}{200a}}$$

average life of a generation

$$a'\left(1 + \frac{a'}{a}\right) = \frac{1}{200\tau}$$

200 a

$$a' = \sqrt{\frac{a}{200\tau}}$$

$\frac{2\times 200}{1000 \times 10} =$

.04

~~1.5~~ 10^{-3}

$$\tau = 10^{-6}$$

10^{-2}

$$a' = \sqrt{\frac{10^6}{10 \times 200}} = \sqrt{500} = 22$$

$\cancel{(k-1)}\,\cancel{200}\,a\,\tau = \cancel{k-1} - \cancel{\frac{(k-1)}{2}}$

$\cancel{\frac{200a}{2}\tau = 1 - \frac{1}{2} - \frac{1}{2}\frac{1}{1+\frac{(k-1)200}{2}}}$

~~300 m~~ $\frac{\cancel{200}}{600\,m}$ $\frac{1}{2\,m}$ 2500 m

$S_{tt} - 7S_t + 12S = S^{3/2}$

$S_t S_{tt} - 7S_t^2 + 12 S S_t = S^{3/2} S_t$

$\frac{S_t^2}{2} + 6S^2 = \frac{2}{5} S^{\frac{5}{2}} + c$ $\qquad S = Ae^{\alpha t}$

$A'' + 2A'\alpha + A\alpha^2 - 7A' - 7A\alpha + 12A = A^{3/2} e^{\frac{\alpha}{2} t}$ $\qquad \alpha^2 - 7\alpha + 12 = 0$

$\alpha = 3, 4$

$A'' - 7A' = A^{3/2} e^{\frac{\alpha}{2} t}$ $\qquad \frac{3}{2}r + \frac{\alpha}{2} = r$

$S = s + \sqrt{12}$ $\qquad s_{tt} - 7s_t + 12(s + \sqrt{12}) = (s + \sqrt{12})^{3/2}$

$S_t = F(S)$ $\qquad S_{tt} = F' S_t = F'F$ $\qquad F'F - 7F + 12S = S^{3/2}$

$S = S(S_t)$ $\qquad S_t = S' S_{tt}$ $\qquad S_t = x$

$\frac{x}{S'} - 7x = S^{3/2} - 12S$ $\qquad x - 7S'x = (S^{3/2} - 12S)S'$

$\frac{x^2}{2} = \frac{2}{5} S^{5/2} - 6S^2 + C$ $\qquad x = (S^{3/2} - 12S)S' + C' = x - 7S'x + C'$

$C' = 7S'x = 7(xS)' - 7S$

$FF' - 7F = S^{3/2} - 12S$ $\qquad S = s^2$ $\qquad \frac{d}{ds} = 2s\frac{d}{dS}$

$\frac{1}{2s} F F_s - 7F = s^3 - 12s^2$

$F = s^2 G$

$\frac{1}{2s} s^2 G(2sG + s^2 G_s) - 7s^2 G = s^3 - 12s^2$

$G^2 + \frac{s}{2} G G_s - 7G = s - 12$

$(G-3)(G-4) + \frac{s}{2} G G_s = s$ $\qquad (G-3)$

$\frac{G G_s}{(G-3)(G-4)} + \frac{2}{s} = 0$ $\qquad \frac{\frac{3}{7}(G-4)}{(G-3)(G-4)} + \frac{\frac{4}{7}(G-3)}{(G-4)(G-3)}$

$\left(\frac{3/7}{G-3} + \frac{4/7}{G-4}\right) G_s + \frac{2}{s} = 0$ $\qquad \frac{3}{7}\ln(G-3) + 4/7 \ln(G-4) + 2\ln s = \ln C$

$(G-3)^{3/7}(G-4)^{4/7} = C\frac{1}{s^2}$ $\qquad (G-3)^3 (G-4)^4 = \frac{1}{C^7 s^{14}}$

$G_s\left(\frac{3}{7(G-3)} + \frac{4}{7(G-4)}\right) + \frac{2}{s} = \frac{C'}{C} = \frac{G G_s}{(G-3)(G-4)} + \frac{2}{s} = \frac{2}{(G-3)(G-4)} = \frac{2}{\frac{1}{C^2 s^2}} = 2C^2 s^2$

$\frac{C'}{C^3} = 2s^2$ $\qquad -\frac{1}{2C^2} = \frac{2s^3}{3} - \frac{1}{2}c$ $\qquad -\frac{1}{C^2} = -c + \frac{4s^3}{3}$ $\qquad C = \frac{1}{\sqrt{c - \frac{4s^3}{3}}}$

5

real fast reaction!

with $\sigma_f + \sigma_c = 2\,10^{-26}$

$\sigma = \frac{20 \quad 2\,10^{-26} \quad 6\,10^{23}}{240}$

$1/\sigma = \lambda = 1000\,cm$

at 100,000 V

$\frac{1}{30}$ $v^2 = 3\times10^6$ v^2 u

$v = 1.7\times10^3 \times 2 \times 10^5$ cm/sec

$\tau = \frac{10^3}{4.3\times10^3\times10^5} = \frac{1}{4.3}\,10^{-5}$ sec

tolerable!

of 10^6 Volt

$\frac{4\pi R^2 \frac{d\rho}{dr} \frac{\lambda}{3} v}{R} - \frac{k-1}{\tau}\frac{R^3}{A}$

$4\pi R^2 \frac{\lambda}{3} v$

$\frac{1}{3}A - \frac{D}{R^2}$ $D = \frac{dR}{dt}$

$\frac{\frac{d\rho}{dt}}{\rho} = D - AR^2$ $\sqrt{\frac{D}{A}} = R_0$

$R^3 A -$

1 Wedn Jan 6th 43

$$a' = \frac{B}{a+a'} - \frac{B}{a} + 2\chi\left(A + \frac{B}{a}\right)$$

$$A = \frac{k_f^{\infty} - 1}{\tau}$$

$$\frac{B}{a} = \frac{1}{200\tau}$$

delayed fraction is: $\frac{1}{200}$

$$a' = \frac{B/a}{1 + \frac{a'}{a}} - \frac{B}{a} + 2\chi\left(A + \frac{B}{a}\right)$$

$$- \frac{B}{a} \frac{\frac{a'}{a}}{1 + \frac{a'}{a}}$$

$$a' = 2\chi\left(\frac{k_f^{\infty} - 1}{\tau} + \frac{1}{200\tau}\right) - \frac{1}{200\tau} \times \frac{a'/a}{1 + a'/a}$$

$$\tau a' = 2\chi\left(k_f - 1 + \frac{1}{200}\right) - \frac{1}{200} \frac{a'/a}{1 + a'/a}$$

$$a\tau \frac{a'}{a} = 2\chi\left(k_f - 1 + \frac{1}{200}\right) - \frac{1}{200} \frac{a'/a}{1 + a'/a}$$

for $a'/a = y \ll 1$

$$a\tau\, y + \frac{1}{200} y = 2\chi\left(k_f - 1 + \frac{1}{200}\right)$$

$$\left(a\tau + \frac{1}{200}\right) y = 2\chi\left(k_f - 1 + \frac{1}{200}\right)$$

$$y = \frac{2\chi\left(k_f - 1 + \frac{1}{200}\right)}{a\tau + \frac{1}{200}}$$

$$a' = \frac{2\chi\left(k_f - 1 + \frac{1}{200}\right)}{\tau + \frac{1}{200a}}$$

$\chi = \frac{1}{200}$

for $\tau = 0$

$a' = a\, 2\chi\, \frac{200}{20}$

$a' = \frac{1}{10}\, 2$

V

Wedn. June 6 – 43

let us put ~~arbitrarily~~ arbitrarily

$$\frac{a'}{a} = \cancel{\ldots} \quad \Big|\, 2x\left(k_f - 1 + \tfrac{1}{200}\right) \Big| \; 200$$

what is relationships between τ and Z

$$1 - (a\tau\, n\, 200 - 1) Z = \frac{1}{200}\, \frac{n Z 200}{1 + n Z 200}$$

$$(1 - a\tau\, n\, 200) = \frac{n}{1 + n Z 200}$$

$$-a\tau\, n\, 200 = \frac{n}{1 + n Z 200} - 1$$

$$\tau a n 200 = 1 - \frac{n}{1 + n Z 200} = \frac{1 + (200 Z - 1) n}{1 + n Z 200}$$

$$a\tau = \frac{1 + (200 Z - 1) n}{n 200 (1 + n Z 200)}$$

$$Z = 2x\left(k_f - 1 + \frac{1}{200}\right)$$

~~Check~~ ~~first~~ instantaneous only

$$A - D\lambda^2 = \frac{k_{eff} - 1}{\tau} \qquad k_f - 1 - \tau D \lambda^2 = k_{eff} - 1$$

$$A = \frac{k_f - 1}{\tau}$$

$$k_f - 1 - \tau D \lambda_0^2 = 0$$

$$\lambda^2 = \lambda_0^2 (1 - \xi)^2$$

O.K.

$$k_{eff} = k_f - 1 - \tau D \frac{k_f - 1}{\tau D} (1 - \xi)^2 \quad \frac{k_f - 1}{\tau D}$$

$$k_{eff} = 2\xi (k_f - 1)$$

3

$x = \frac{1}{200}$ $b = 1 \times \frac{1}{200} = \frac{1}{20}$

$z = \frac{1}{2000} = 2\,10^{-3}$

~~Therefore~~ $\frac{a'}{a} = \cancel{\frac{1}{200}}\ 200\,z$

$a' = 2\,0\,2$

$\frac{1}{b'} = \frac{200\,0}{20} = 100\,\%$

allowing $n = 1000$

$\cancel{a\tau = 1 + (\tfrac{1}{10} - 1}$

$1 - \frac{n}{1 + n z 200} = \cancel{a\tau}\, n\, 200$

$1 + n z 200 - n$

$1 - \alpha = \frac{n}{1 + n\beta}$

$1 - \frac{n}{1 + n\beta} = \alpha$

$\frac{1 + n\beta - n}{1 + n\beta} = \alpha$

$a\tau\, n z 200 = z - \frac{1}{200}\, \frac{n z\, \cancel{200}}{1 + n z 200}$

$(a\tau\, n\, 200 - 1)\cancel{z} = \frac{n \cancel{z}}{1 + n z 200}$

$a\tau\, n\, 200 = \frac{1 + (z\, 200 + 1)\, n}{1 + n z 200}$

4

$$a\tau \cancel{} = \frac{1 + (2200+1)\, n}{(1 + n\, Z\, 200)\, n\, 200}$$

$$a\tau \cong \frac{\cancel{1+}\, n}{n^2\, 200^2\, Z} =$$

$$a\tau = \frac{1}{n\,(200)^2\, Z}$$

$$= \frac{2000}{1000 \quad 200^2}$$

$$a\tau = \frac{2}{40000} = \frac{1}{2 \times 10^4}$$

$$\tau = \frac{1}{2\,10^3}$$

for $x = \frac{1}{2000}$

$n = 10^4$

$\tau = \frac{1}{2\,10^5} = \frac{1}{2}\,10^{-5}$ allright

if abs of Water 10 times normal

scattering of H 60

" abs of H " 4 15 collision

3 m/m free path for el. tc

4.5 cm $2.5\;10^5$ cm

velocity 2500 meter ~~2500000 cm/sec~~

$t = \frac{4.5}{2.5}\,10^{-5}$ sec

(6)

Cont. Jan 7th -43

$$a\tau = \frac{2x}{\frac{a'}{a}}\left(kf - 1 + \frac{1}{200}\right) - \frac{1}{200}\frac{a'/a}{1 + a'/a}$$

$1/a' = 1\,\text{sec}$

$$\tau = \frac{1}{a}\;\frac{2x}{\frac{a'}{a}}\left(kf - 1 + \frac{1}{200}\right) - \frac{1}{200}\frac{a'/a}{1 + a'/a} \cdot -$$

$1/a = 10\,\text{sec}$

$\frac{a'}{a} = 10$

$\left(kf - 1 + \frac{1}{200}\right) = \frac{1}{20}$

$$\cancel{\tau = \frac{2}{a}\,\frac{x}{20} - \frac{1}{200}\,\frac{10}{1+10}}$$

$$\cancel{a = \frac{1}{10}}$$

$$\cancel{\tau = x - \frac{1}{200}}$$

$$\tau = \frac{10 \times 2\,x}{10}\,\frac{1}{20} - \frac{1}{200}\,\frac{10}{1+10}$$

$$\tau = \frac{x}{10} - \frac{1}{200}$$

draft

$$a' = \frac{B}{a}\,\frac{a'/a}{1 + a'/a}$$

$$x = \left(\tau + \frac{1}{200}\right)10$$

$$x = \left(10\tau + \frac{1}{20}\right)$$

$\tau = 1/100$ sec

$x = \frac{2}{20}$

$10\tau = \frac{2}{200}$

Stolper

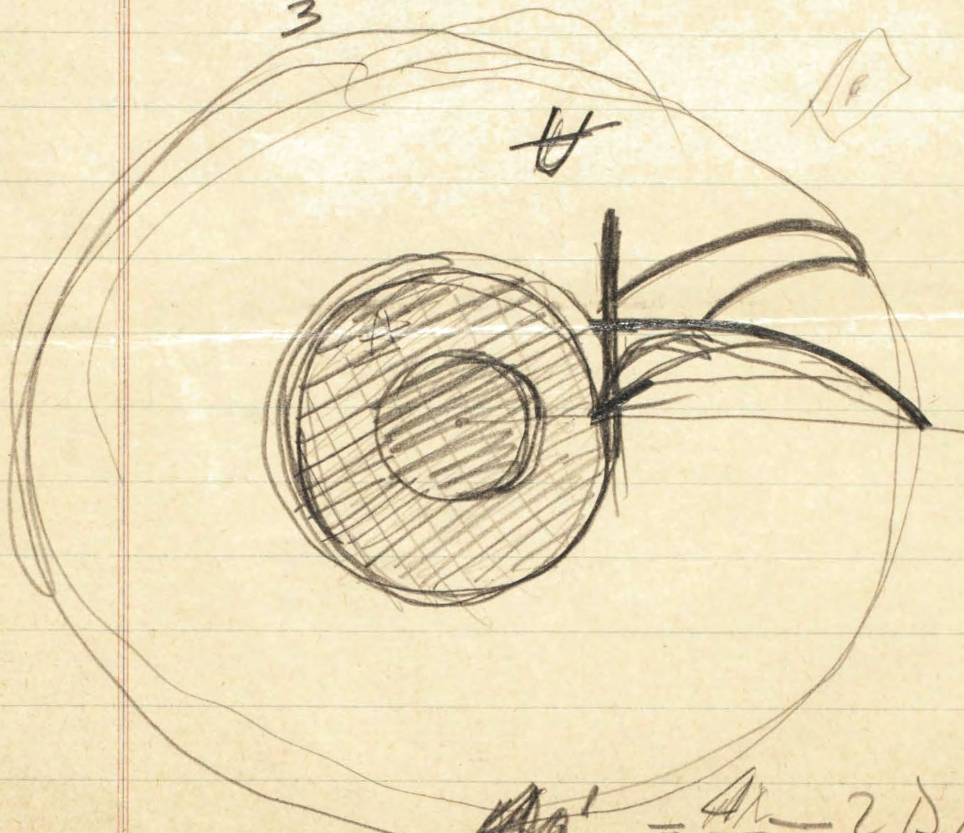
41

$$\frac{\partial^2 \rho}{\partial x^2} - A\rho = 0$$

$\frac{3}{3\,gm}$ $\frac{UO_2}{4\,gm}$

$\frac{3}{9}$ $\frac{4}{240}$ $\frac{1}{60}$

$\frac{1}{3}$



$$a' = \frac{\Delta\lambda}{\lambda} - 2D\lambda^2 + \cancel{A}$$

$$\underline{\underline{D\lambda^2}}$$

$\frac{\Delta t}{a}$

$\sigma_t = 2{,}5$ $\sigma_c = 1{,}5$ $\Sigma = 15 - 2$ $3{,}75 / 5$

$$\frac{1}{l^2} \qquad \frac{\Delta\lambda}{\lambda}$$

$\frac{W}{a}$ 10^5 cm/sec

$$aa' + a'^2 = -\overset{(-D\lambda^2+A)}{\cancel{D\lambda^2}}(a+a') + B$$

$$a'^2 + a'(a + D\lambda^2 - A) + D\lambda^2 a - B = 0$$

$$\cancel{a' = -\tfrac{1}{2}(a+D\lambda^2 - A) \pm \tfrac{1}{2}\sqrt{(a+D\lambda^2)^2 - 4(D\lambda^2 a - B)}}$$

$$\cancel{a' = -\tfrac{1}{2}(a+D\lambda^2 - A) \pm \tfrac{1}{2}\sqrt{(a-D\lambda^2)^2 + 4B}}$$

$$a' = -\tfrac{1}{2}(a+D\lambda^2 - A) \pm \tfrac{1}{2}\sqrt{(a+D\lambda^2-A)^2 - 4(D\lambda^2 a - B)}$$

$$a' = -D\lambda^2 + A + \frac{B}{a+a'}$$

$$a'^2 + aa' = +K(a+a') + B \qquad K = A - D\lambda^2$$

$$a'^2 + a'(a-K) - Ka - B = 0$$

$$a' = \frac{-(a-K)}{2} \pm \tfrac{1}{2}\sqrt{(a-K)^2 + 4(Ka+B)}$$

$$a' = \frac{-(a+D\lambda^2-A)}{2} \pm \tfrac{1}{2}\sqrt{(a+D\lambda^2-A)^2 + 4[B+a(A-D\lambda^2)]}$$

$$(\cancel{a+}D)\ \tfrac{1}{2}\left(a^2+D^2\lambda^4+A^2+2aD\lambda^2-2Aa-2AD\lambda^2 + 4B+4aA-4aD\lambda^2\right)^{\frac{1}{2}}$$

$$= \tfrac{1}{2}\left[a^2+D^2\lambda^4+A^2-2aD\lambda^2+2Aa-2AD\lambda^2+4B\right]^{\frac{1}{2}}$$

$$\tfrac{1}{2}\left[(a-D\lambda^2+A)^2+4B\right]^{\frac{1}{2}}$$

$$a' = -\frac{a+D\lambda^2-A}{2} \pm \frac{1}{2}\sqrt{(a-D\lambda^2+A)^2+4B}$$

If $B << (a-D\lambda^2+A)$

$$a' = -\frac{a+D\lambda^2-A}{2} \pm \frac{\left[(a-D\lambda^2+A) + \frac{2B}{a-D\lambda^2+A}\right]}{2}$$

$$\frac{\partial a'}{\partial\lambda} = -D\lambda \pm \frac{-(a-D\lambda^2+A)D\lambda}{\sqrt{(a-D\lambda^2+A)^2+4B}}$$

If $B = 0$ $\quad a' = \frac{1}{2}\left\{a+D\lambda^2-A \pm (a-D\lambda^2+A)\right\}$

$$= a \quad \text{or} \quad D\lambda^2-A$$

and $\frac{\partial a'}{\partial\lambda} = 0 \quad \text{or} \quad 2D\lambda$

12

$$\frac{\partial \rho}{\partial t} = D\frac{\partial^2 \rho}{\partial x^2} + A\rho + B\int_{-\infty}^{t} e^{-(t-\tau)a}\rho(\tau)\,d\tau$$

$$\rho = e^{a't}\sin\lambda x \qquad \lambda l = \frac{\pi}{2}$$

$$a'\{e^{a't}\sin\lambda x\} = -D\lambda^2\{\ \} + A\{\ \} +$$

$+$

$$\boxed{\lambda_1 = \sqrt{\frac{A}{D}} \qquad \lambda_2 = \sqrt{\frac{A + \frac{B}{a+a'}}{D}}}$$

e^{at}

$$+B e^{-at}\int^{t} e^{a\tau} e^{a'\tau}\,d\tau =$$

$$\int_{-\infty}^{t} e^{(a+a')\tau}\,d\tau \qquad \frac{B}{a+a'}\cancel{e^{(a+a')t}}\,\cancel{e^{-at}}$$

$$a' = -D\lambda^2 + A + \frac{B}{a+a'}$$

$$a'(a+a') = B$$

$$\frac{a'(a'+a)}{a} = \frac{B}{a} = \frac{1}{100}A$$

$$\frac{a'}{a}(a'+a) \qquad a \ll 1 \qquad \frac{1}{1000}\cancel{A}$$

4 cm

$6\cdot10^{24}$

$6\cdot10^{-27}$

$\frac{1}{4}10^{6}$

10^{9}

4000

10^{-4} sec.

10^{-1}

$\frac{1}{3}$ sec

10^{-3} sec

for $A = \dfrac{-B}{2a}$ $\quad$ 2

$$a' = -D\lambda^2 \cancel{B} - \frac{B}{2a} + \frac{B}{a+a'}$$

for large ℓ $\quad \lambda = 0$

$$a' = \cancel{-D\lambda^2} - \frac{B}{2a} + \frac{B}{a+a'}$$

$$\frac{a'}{a}(a'+a) = \frac{1}{a}B - \frac{1}{2}\left(1 + \frac{a'}{a}\right)B = \frac{B}{a}\left(1 - \frac{1}{2}\left(\frac{a+a'}{a}\right)\right)$$

$$\cancel{\frac{0}{0}}$$

$$a' = \frac{B}{a+a'}$$

$$\frac{1}{a}$$

$$\frac{dN}{dt} = \frac{B}{\cancel{\quad}} \cancel{B} \int_{-\infty}^{t} e^{-a(t-\tau)} N(\tau)\, d\tau$$

$$e^{a't}$$

$$a' = B e^{-at} \underbrace{\int e^{(a+a')\tau}\, d\tau}_{\frac{e^{(a+a')t}}{a+a'}}$$

$$a' = \frac{B}{a+a'}$$

$$a'(a+a') = B$$

$$(a')^2 + a a' = B$$

$$\frac{-a \pm \sqrt{a^2 + 4\cancel{a}B}}{2}$$