PARAGON

S-7852

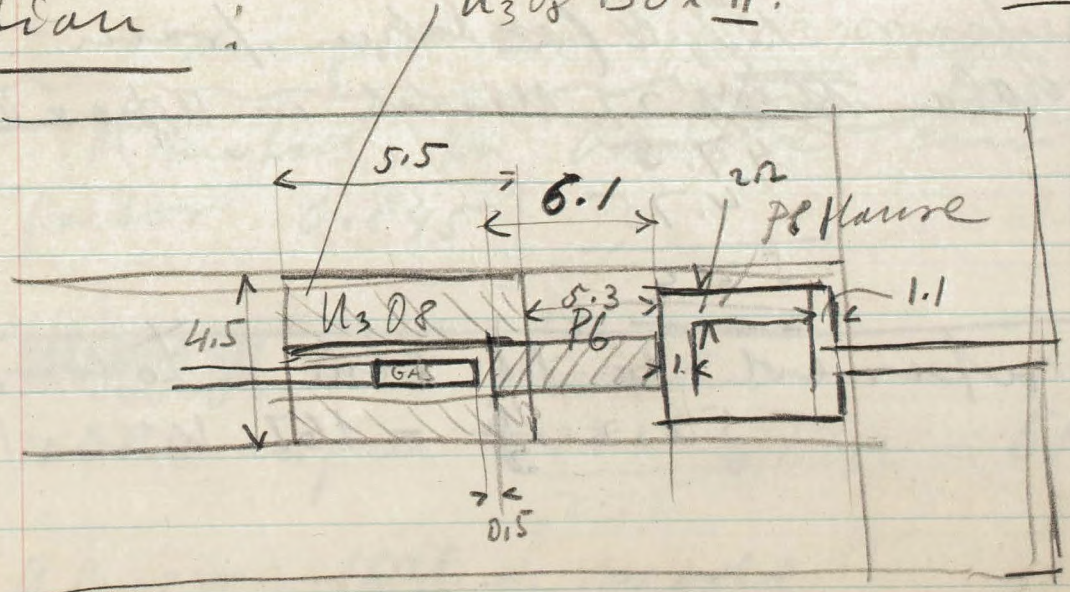
Appr. 2 mol - 39

Ion chamber
I 10 Atm He old filling
II 16 Atm H_2 removable gaps
Appr. 2nd III 11 Atm H_2 (147 lb/sq inch gage) +
$\frac{1}{2}$ H_2 6 Atm A (88 lb/sq. inch)
according to Bethe & Livingston
At. stopping power rel. air is:
$\frac{1}{2}$ H_2 0.22
A 1.92 } ∝ 6 MV

Yesterday's exp showed with Rh
that new position $\frac{68}{26} = \frac{1}{2.6}$ times
weaker neutron intensity; we got about
70 counts (with - without Rh) ≅ 180 counts

H_2 chamber 5 Atm H_2 Abs. appr. 2nd
POS I.

position:



U Box II

Reading: Ra + Be + U 1559
in 23 min
67.8

against
Ra + Be + Cd oh + U 366
in 18 min
20.3

no Cd cup

difference 47.5

this ought to be corrected for slow neutrons going through Cd perhaps 10% U (as taken from data ~~U. 27~~ 27. March on U_3O_8 Box II)

47.5
4.75
52.2

referred to 16 Atm to comp.
$52.2 \frac{16}{5} = 167$ Kicks (16 Atm)

Compute

(No. 1.)

Thick & 20 thin chamber

---

thin chamber 2.55 / min
in certain paraffin arrangement
with radon

thick chamber gave $80 - 2.5 = 77.5$ / min

$\lambda = 4.7\ 10^{-18}$ sec

$$\frac{dn}{dt} = \lambda N$$

$\frac{1000}{60 \times 4.7}\ 10^{18}$ Atoms in thin U layer

in gm: $\frac{\cancel{1000}\ \cancel{10^{18}}\ 10^{21} \times 238}{60 \times 6 \times 4.7 \times 10^{23}} =$ ____

in mgm: $\frac{238}{6 \times 6 \times 4.7} = 1.42$ U ~ 1.68 oxide

or with known value

12.385×10^{3} λ per sec

we get less: 1.34 mgm U metall ~ 1.59 mgm oxide

[U metall to Oxide conversion factor 0.845]

thick chamber oxide / oxide

oxide mgm $\frac{77.5}{2.55} \cdot 1.68 = 51$ mgm

U Box II 1636 gm oxide

Number of fissions/min in Box B. in

Pos I = $\frac{1636 \cdot 10^3}{51} \times 38.5 = 1,230,000$ fiss/min

Rh correction in Pos I. = 0.8

and therefore number of fissions/min

985,000

Apr. 11th

Computation ~~March~~ from 24

Photo-neutron fission

26
38
64 / 168 min = 0.38 / min

≅ 0.4 / min

distance roughly 5 cm

~~Thick chamber to thin chamber ratio~~ 51 mgm oxide

active in chamber

Photo-neutrons $3 . 10^6$ / sec

~~[illegible]~~

8 [illegible] mgm oxide = 43 mgm U metal

$$N = \frac{60 \; 3 . 10^6}{\cancel{60} \times 4\pi \; 25} \text{ /}\cancel{\text{sec}}\text{ cm}^2 \text{ min}$$

$$\sigma = \frac{0.38 \times 1000 \times 238}{N^{min} \; 43 \times 6 . 10^{23}}$$

$$\sigma = \frac{60 \times 4\pi \times 2.5 \times 0.38 \times 23.8 \times 10^3}{3 \times 100 \times 4.3 \times 6 \times 10^{24}}$$

$$\sigma \cong 10^{-24} \frac{2 \times 2.5 \times 4\pi \times 3.8 \times 2.38}{4.3 \times 6}$$

$$\sigma = \frac{\cancel{1} \times 4\pi \times 25 \times 0.38 \times 1000 \times 238}{\cancel{3600} \times 6 \times 10^{6} \times 43 \times 6 \times 10^{23} \times 60}$$

$$\sigma = \frac{\cancel{22} \; 4\pi \times 2.5 \times 3.8 \times 2.38 \times 10^{5}}{6 \times 4.3 \times 6 \times 10^{23} \times 6 \times 10^{8}}$$

$$\sigma \simeq \frac{4 \times 2.5 \times 2.38 \quad 10^{-2}}{3 \times 4.3 \times 6 \times} \quad 10^{-24}$$

$$\frac{24.8}{18 \times 4.3} = \frac{4}{3 \times 4.3}$$

$$= \cancel{3.2} \; 10^{-27} \text{ cm}^2$$

3.04×2

Distance ought to be integrated. "double" inverse square law!

"

Apr. 14th

Capitation of window observations.—

with Cd Cap 4 in pos. 4.

3881 counts above 5 in 232 m

16.73/min

and 1971 in 119 min giving 16.5

Also without cap

2800 in 117 min

~~2409~~ 23.9

Pb + Cd cap

164 in 62 min

2.64/min

Pb no Cd cap

264 in 40 m

6.6/min

5 Atm H_2 + 2 Atm Argon

same N_2 in argon.

6.6

Difference of 6.6 − 2.64 =

3.96 ≅ 4/min

is attributed to H_2

readings of counter about = 5-4

Therefore Cl opp correction factor

$$\alpha > \frac{23.9 - 3.96}{16.73}$$

> because it cuts down the membrane by ~~1.6~~ 28% (Rh measured)

~~Therefore~~

$$\alpha = \frac{23.9 - 3.96 \times 0.72}{(16.73 - 1.6)}$$

(was likely the Rh measurement done with „lead ring" | probably not)

$$\alpha = \frac{23.9 - 2.85}{16.73} \simeq \frac{21.4}{16.7} \; 15.B$$

$$= 1.26 = 1.28$$

Collected an of uncorrected (α) window values, —

4 to 5 ~~hrs~~ 628 in 9 l/min

6.91 /min

minus same with Cl ~~———~~ should

140 in 75 min =

1.98 /min

difference 4.93 /min

(4 to 5 / diff multiplied by 4.5 to account for slight y level.

22.1 / min

extrapolated for kicks below 5
(real kicks)

~~between 5 to 6 4.2 with Cd shield~~
~~" " " " 1 with Cd shield~~

~~above 5~~

between 5 to 6 with Cd caps but ~~but no Cd shield~~

110 in 22 min 129 in 30 / min
5 / min 4.3 / min

and with Cd shield
25 in 25 min
1 / min (3.5 real)

above 5 with Cd shield

562 in 175 min
3.21 / min

As ~~between 5 to 6~~

Therefore above 5 real
counts = 16.73
- 1.6
~~13.53~~
15.13 / min

(This correction assuming 10% flow
neutrons getting through Cd shield
and to be verified)
in pure H_2

from 6 to 7

109 in 30 min
3.65 / min

real values probably are

4.93	3.5	3.2
4 to 5	5 to 6	6 to 7

from 5 to 8 uncorrected <u>counts</u>

260 in 30 min
8.7 / min

Cd shield correction would probably give
real value 6.4 / min

Preceding discrepancy makes me inclined to cut 20% of value for first 4.5 divisions bringing value down to $22.1 \times 0.8 = 17.7$

(reading direct between 7 & 8 would then be brought 2.9)
[again 20%, high]

17.7 (4½ div)
15.13
Total 32.83

$\alpha \times 32.83 = 42$

[For comparison with par. I and 16 then H_2 multiply by $\frac{16}{6.1}$ gives 260.
$1.95 \times \frac{16}{6.1}$]

No increase by 10% for Cd shield is necessary in this calculation.

Velocity distribution from 1 Atm and 2 Atm A chamber

observed values for large windows

5 to 8	above 8	above 12
8.7	5.9	2.16
	201/34	65/30

real values for small windows reduced by 20%:

4-5	5-6	6-7
4	2.8	2.55

Improved (Appr. 15th)

5 to 8	8 to 12
441/52 = 8.5/min	259/49 = 5.3/min

Curve as for corrected for X ray type with Cd shield measurement and 4 to 5, 5 to 6, 6-7 reduced by 20% observation error 4

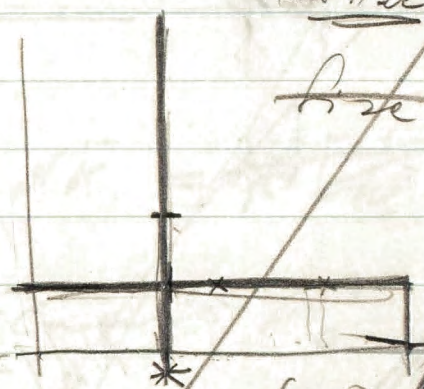
4 to 5	5-6	6-7	7-8	5 to 8	8 to 12
4	2.8	2.5 ↓ (2.2)	1.1 ↓ (1.4)	6.4 ↓ 2.15	1.33

Apr. 17 Sunday

36 30

Planning

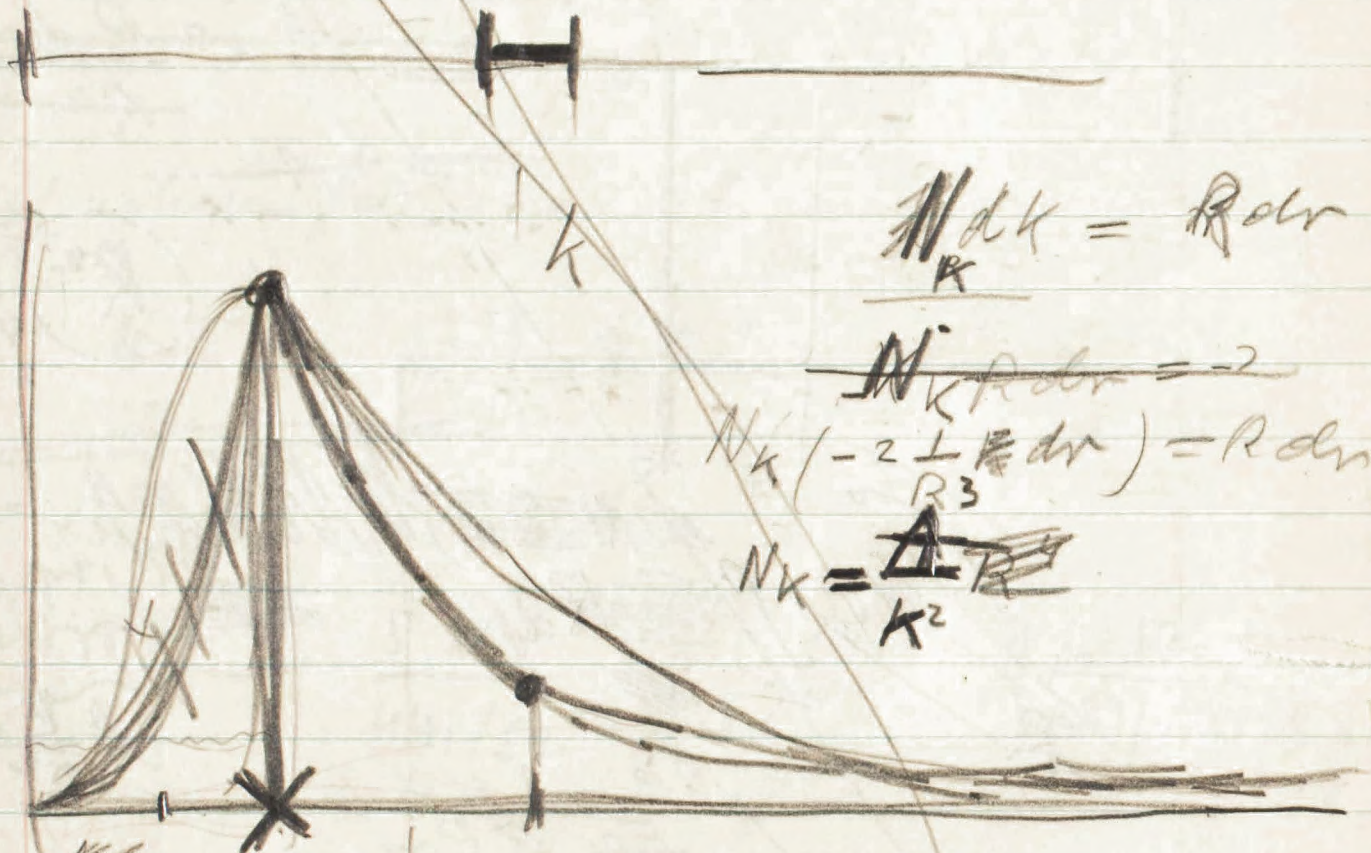
Saturation



Richtige $K = \frac{1}{R^2}$

R^{-2}

$\frac{dK}{dr} = -2\frac{1}{R^3}$ $dr = -2\frac{1}{R}K\,dr$

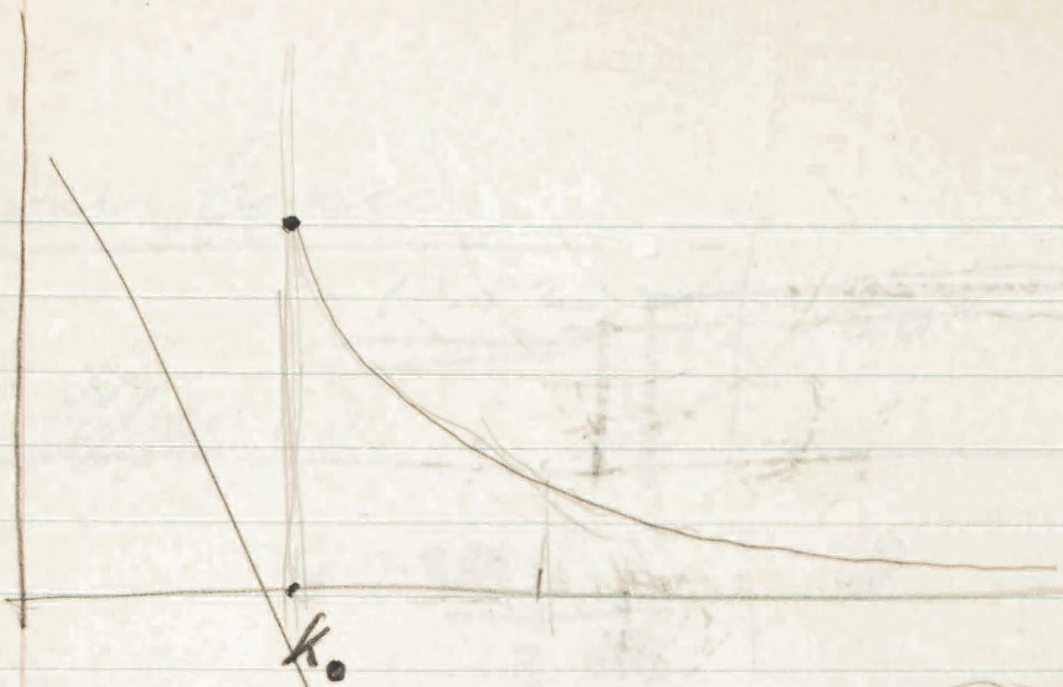


$\int_K dK = R\,dr$

$N_K R\,dr = -2$

$N_K\left(-2\frac{1}{R^3}dr\right) = R\,dr$

$N_K = \frac{\Delta R^3}{K^2}$



$$\int_{k_0}^{\infty} \frac{A}{k^2}\, dk = \frac{2A}{k_0^3} = \text{Const}$$

$$A = \text{const}\, k_0^3$$

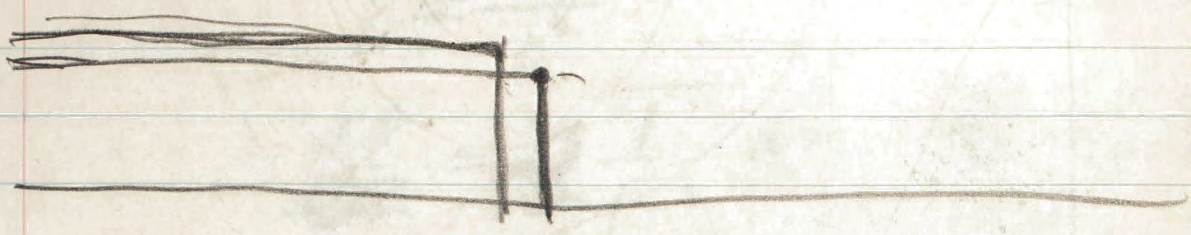
$$\int_0^{k} \frac{k_0^3}{k^2}\, dk_0 \quad \text{for values above } k$$

for values below k

$$\int_0^{k_0=k} \frac{k_0^3}{k^2}\, dk_0$$

$$\frac{1}{4}\frac{k^4}{k^2}$$

$$\frac{1}{4}\frac{k_0^4}{k^2} = \frac{1}{4}k^2$$



$$\frac{(N_r)(\varepsilon)}{\varepsilon}$$

Brown boxes

10.82 | 360

~~B6A~~

238 gm | 8

$\frac{454\ gm}{238}\ 8 = \frac{X}{10.8}\ 360$

$X\ (gm\ B) = \frac{10.8 \times 8 \times 454}{238 \times 360}$

$= 0.454 \times \frac{3620}{360} =$

$= 0.454\ gm\ Brown$

~~0.~~ .454 ~~gm~~

$\frac{500 \times}{360}$ ~~B2~~ B2

2 9

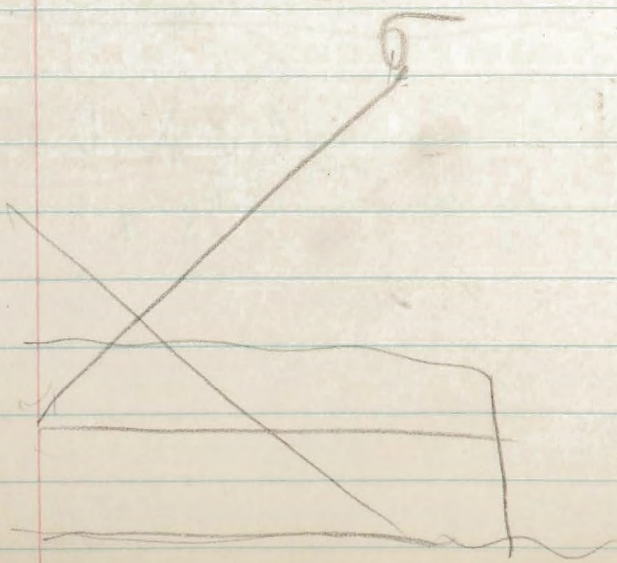
$\frac{10.8 \times 0.69}{35 \times 6.06}$

$$\frac{\sigma \int \times 7.2\,10^{25} \times 4.8\,10^{5}}{2.24 \times 2.12 \times 10^{6}} = 42$$

$$\sigma'' \int = \frac{42 \times 2.24 \times 2.12}{34.6} = 5.72$$

$$f(E) = \int_{E} \frac{N\sigma}{E}$$

$$E \cdot f(E) = N E$$



Geiger tube

19 disintegrations

42/min || 5 atoms/sec ||

51 mgm oxide

1636 gm oxide

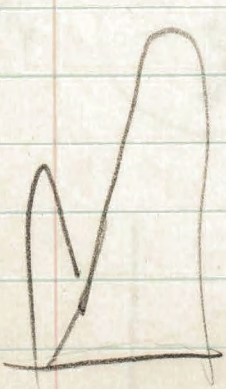
4cm 12cc.

$\frac{19}{51}$ fiss/min mgm

Total fissions $\frac{1636 \cdot 10^3 \times 19}{51}$ /min

= 600 000 fiss/min

$\times 018 \times 600{,}000 = 480\,000$/min



$\frac{2 \times 12 \times 5 \times 6\,10^{23} \sigma}{22\,400}$

$\times 480 \cdot 10^3 S$

$\times \frac{1}{4\pi \times 16} = 42$

Rechnerka

$$= \frac{2\pi \sin\varphi \, d\varphi}{4\pi} \int_0^{a\cos\varphi} x \, dx = \left[\frac{x^2}{2}\right]_0^{a\cos\varphi}$$

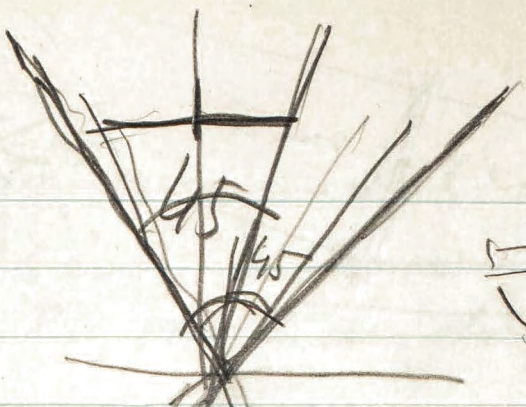
$$\left[\frac{x^2}{2}\right]_0^{a\cos\varphi} = \frac{a^2\cos^2\varphi}{2}$$

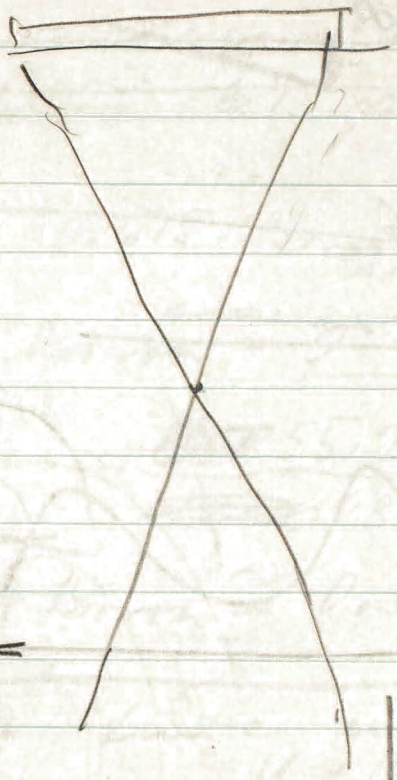
$$a \frac{2\pi}{4\pi} \int_0^{\frac{\pi}{2}} \sin\varphi\cos\varphi \, d\varphi$$

$$= \frac{a}{4\pi} \int_0^{\frac{\pi}{2}} \sin 2\varphi \, d\varphi = \frac{a}{8\pi} \int_{2\varphi=0}^{2\varphi=\pi} \sin 2\varphi \, d(2\varphi)$$

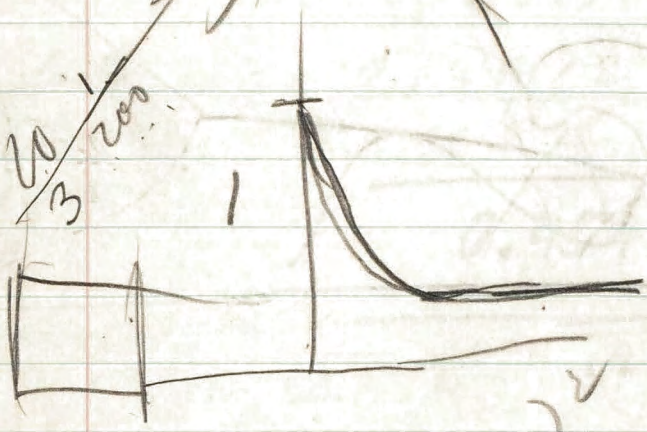
$$= \frac{a}{8\pi} \left[-\cos 2\varphi\right]_0^{\pi}$$

$$= \frac{a}{4\pi}$$





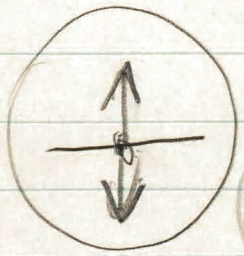
B

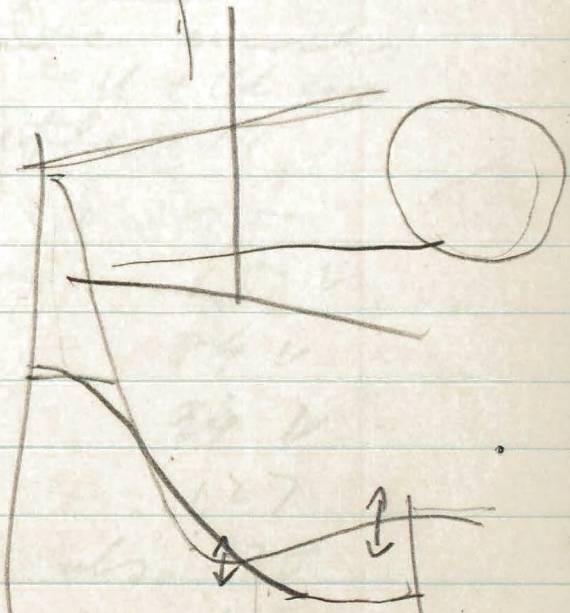


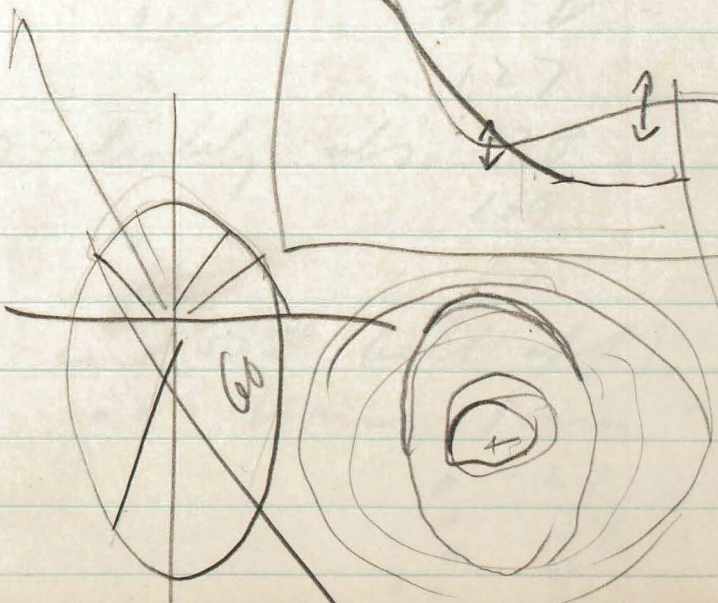
$$\frac{20 \times 200 \times 2020}{3}$$

3x10⁴

$$\frac{4 \times 10^4}{3}$$







1,000
580

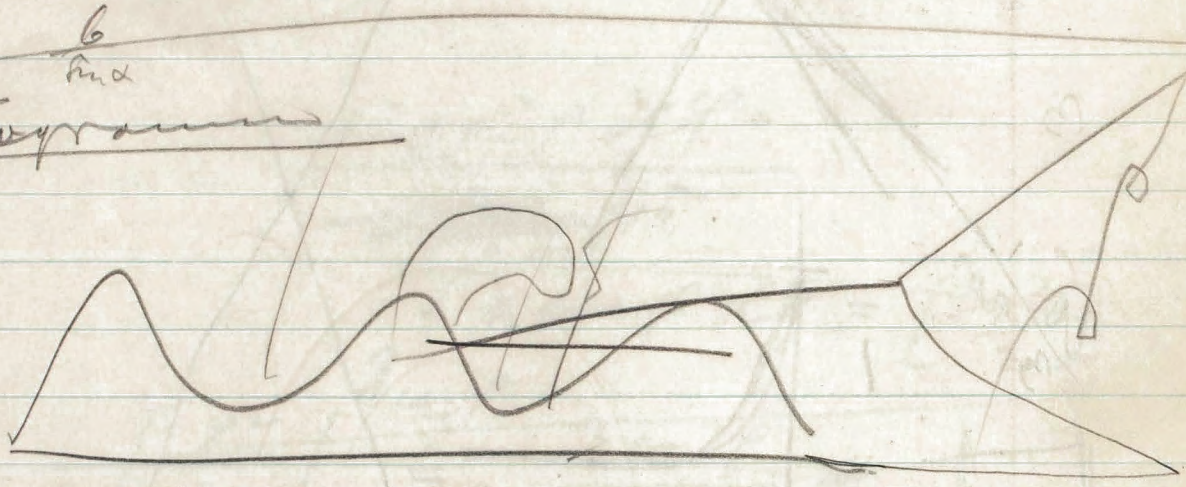
5.345
4.965
.380

sin α

4.968
863
5.828

6
sin α

Program



Boron computation in advance

$3.5\,cm \times 6.5 \times 10 = 227\,cc \times 3.5 = 800\,gm$

800 gm U oxide $\cong$ 675 gm U metall

$\frac{675}{454} \times 0.454 = 0.675$ Boron

0.675 Boron $\cong$ 0.863 B_4C

graphite $\frac{4 \times 10.82 + 12}{10.82} = \frac{55.3}{43.3}$ corr. factor

C/U 42;42; 221 gm.

0.454 Boron $\cong$ 0.580 B_4C

Folien 13

.. time counts U + Cd cap

. after 14

. 35

. 55 ↓

. 84 ↓

. 94 ↓

. 127

. probably also 128

169

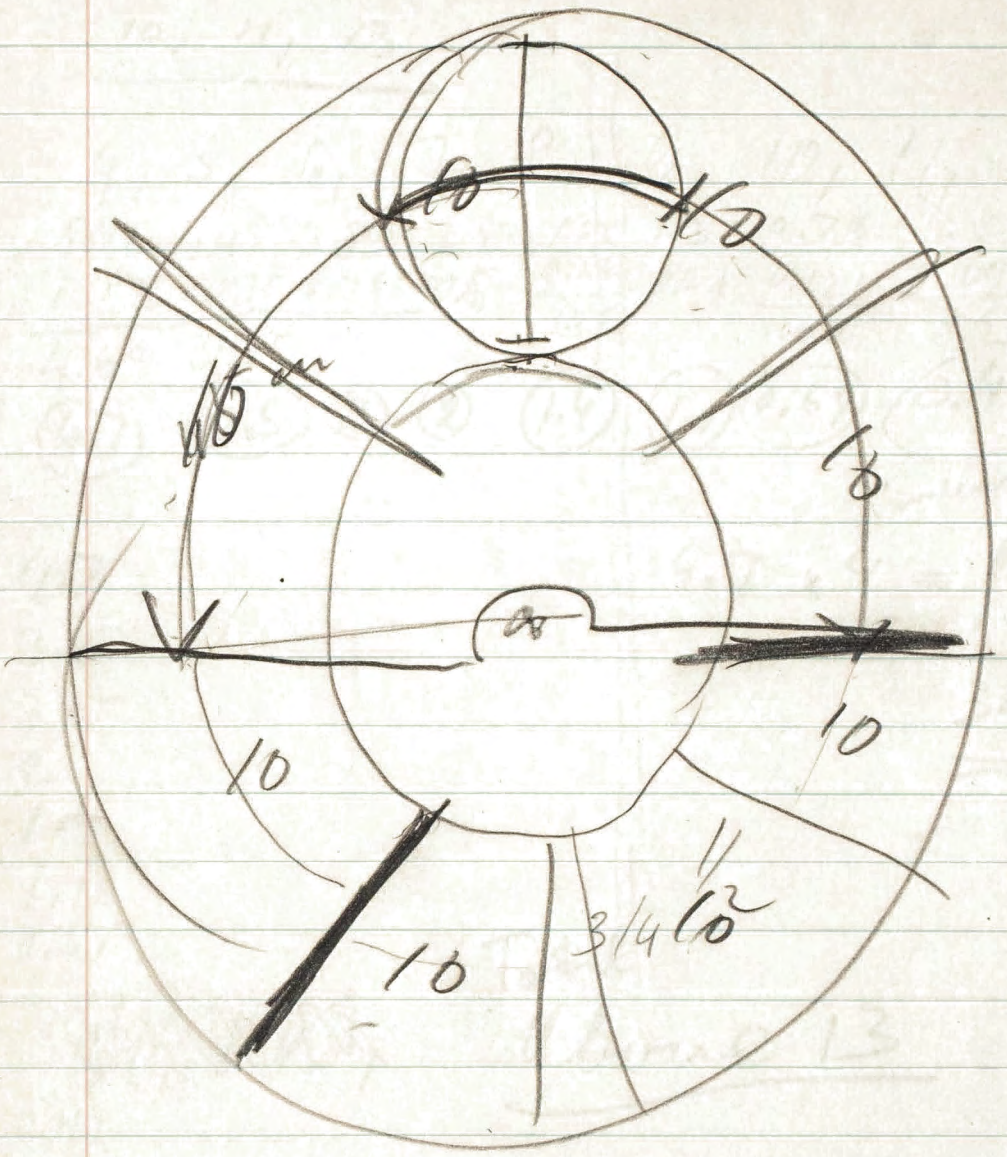
. 175

(between 127 and 175 half off)

... time from ...

7.57	24
8.07	34
8.18	25
8.33	30 m

1 line
4 observations
1 line



1/4

1/2 1/2

60 120 cm × 17/20 rpm

34 meters

80 20 60

$(a-x)x = ax - x^2$

$a - 2x = 0$

$x \frac{a}{2}$

Foam

Apr. 30.

Filters

10, 11, 13

4,	5,	6,	7,	8,	9,	10,	11,	12,	13,
5.92	4.45	3.8	2.52	1.62	1.3	0.79	.564	0.51	
1.23	0.975	0.79	0.5	0.266	0.21	0.121	0.097	4	
4.69	3.475			1.354		.67	467	7	
(4.7)	(3.5)	(3)	(2)	(1.4)	(1.1)	(0.67)	(0.47)	(0.47)	0.467

instead of (4.8)

4.7
3.5
3.-
2
1.4
1.1
0.67

4.7 × 4 = 18.8
14.1
32.9 =

Total
Above 13 1/min

0.47
0.47
0.47

17.78
4.7 /min
14.1 5 to 13 incl.

Total not corrected except for background

$\frac{459 \times 2}{908}$

Absorption

$$\begin{array}{r} 459 \\ 455 \\ \hline 914\ u \end{array}$$

$$\frac{914\ u}{238.17} \quad x = \left(\frac{b}{u}\right)$$

u_{abs} $\quad 383.5\ \sigma_u = \frac{0.908}{10.82}\ \sigma_b$

$= (B_{abs} \times 0.85 \times 0.0830)\ \sigma_b$

Einheit Umrechnung

for $\sigma_b = 500$

$u_{abs} = B_{abs}$

$$\sigma_u = \frac{0.85 \times 0.083 \times 500}{383.5}$$

$$= 9.22$$

$\frac{19.4}{14.5} = 1.34$ $\quad$ 12.3

und für Probe zum Vergleich $0.675 \times 1.5 \times 0.85$

$= 860$ mpa

U $\frac{81.5}{62.7} = 1.3$ $\log 1.3 = 0.262$

B $\frac{81.5}{67.5} = 1.206$ $\log = 0.182$

$\frac{262}{182} = 1.44$

$\sigma_n = 9.22 \times 1.44 = \underline{\underline{13.2}}$

for $\sigma_B = 500$

$\underline{\underline{40.7}}$ $\quad \frac{62.7}{40.7}$

$\underline{\underline{22.0}}$ $\quad 40.7$ $\quad \frac{67.5}{40.7}$ $\quad 26.8$

U $\frac{40.7}{22.0} = 1.87$ $\quad 0.2718$ $\quad = 1.49$

B $\frac{40.7}{26.8} = 1.52$ $\quad 0.1818$

Plus 13.7

Use in next experiment crystallin Boron

454 × 1.5 . 0.85 = 0.578 Boron

2× for U medal boxes and 900 rpm

for oxide

Pyrex letter from Corning
Glass works, Mr. Winsche
774 Pyrex B_2O_3 13%
later Mr. Winsche said 11.8%

May 5th

New Mica - Mica composition
1.68 oxide (assumed) before

now we have an Ilmart sheet
2.387 mgm giving 6.65/min

ratio of weights
1.42

against old Mica sheet
5.785/min
and Mica sheet 164/min
ratio $\frac{164}{5.785} = 28.4$
formerly this ratio
was $\frac{77.5}{255} = 30.4$
this value is perhaps
closer to truth as there
may be 6% counter loss
in to day's measurement.
(Ilmart sheet standard gave
$5.785 \times 1.42 = 8.2$)

May 9th Mica pyrex sheet No 1
2.808 mgm sheet 6.25 cm²

May 15 1935

11.8 to 13%

B_2O_3 in

Pyrex

#779

Mr. Wiancke

Corning glass

works

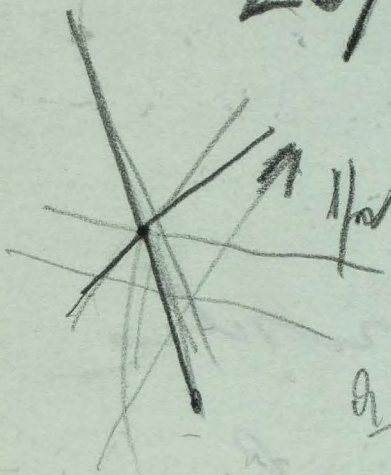
$\frac{4.8}{5}$

VII $\frac{1}{2}$ gr. $\frac{6.10^{23}}{12}$ 5×10^{-4}

$\frac{1}{2}$ 3ij $\frac{3}{24}$

25%

$\frac{10 \text{ gr}}{200}$



$\frac{900 \text{ gr}}{90 \text{ gr}}$

$\frac{900}{240}$

$\frac{90}{\text{gr}}$

May 8th

New Chamber for high pressure
Outside diam of sphere 3.17
wall thickness 0.7
(inside of sphere 3.03 cm)

Collecting body 1 cm long
0.94 cm diam
Volume measured (including rod) .6 cc
rod 3 mm/m diam 1 cm long inside the Al sphere

$V = 14.5\ cm^3 - .6\ cm^3 = 13.9 \sim 14$ cc

Vol. Volume inside of sphere 12.74 cc
1.5 cm diam

Bryan Corbett
Mitchell says Babcock 933-17

B +2.07%
C 16.63%

B4C would correspond to
Bryan 43.3
12
55.3

78% B

U-metall cells Cohen

Nr. 1 $8.36 \times 8.36 \times .696\ cm^3$

empty cell 101.29
filled 556.39
U 455.10 gm

Nr. 2 $8.36 \times 8.36 \times .716$

561.4
102.46
458.94

6.54 gm/cm²

Whittaker Beryllium measured by Bayer
May 12

$$\frac{541.2 - 83.9}{326.0 - 80.3} = \frac{457.3}{245.7} = \frac{1}{p} = 1.863$$

$$\log \frac{1}{p} = .27021$$

$$\sigma = \frac{3.8 \log \frac{1}{p} \cdot AW^{10.8}\ Q^{88.2}}{\text{grammes}\ \downarrow 2.82} = 348$$

At least 75% B i.e.
$\sigma < 464$
not more than 82%
$\sigma > 424$

Cryst B.

725.6 − 516.4
114.2 111.6
611.4 404.8

$\frac{611.4}{404.8} = \frac{1}{p} = 1.51$

$\log \frac{1}{p} = .178$

$\sigma = 347$
cryst.

Boron amorphous and commercial
$\sigma = \frac{3.8 \log \frac{1}{p} \; A.W. \; Q}{.454} \rightarrow 70.0$

$\frac{1}{p} = \frac{113^{m}}{96} = 1.178$ $\log \frac{1}{p}$ .07115

$= 450$

Boron Content
200 mesh

$\frac{1}{200}$ of Bod $\frac{23}{200}$ cm $= \frac{3}{2} \frac{70}{100}$ cm

1443

1465 − 22
1337 − 22
22
1315

Carbon
92%

III U_3O_8 tin

147.0 gm

empty ~~13 8 1 3 0 0~~ gm U_2O_3 ~~tin~~ tin

Belgian stuff

(16. May.)

filled 58.8 oz

1 oz =

Boron ~~carbide~~ for graphite, too late 0.4 gm

should place ~ with U metall for

$6k = 8$

for Beyer

~~.69897~~
.30103

$500 = 3.8 \log 2 \times 10.8 \times 8.3 \times 8.3$

X

$X = \frac{3.8 \times 0.301 \times 1.08 \times 6.88}{50}$

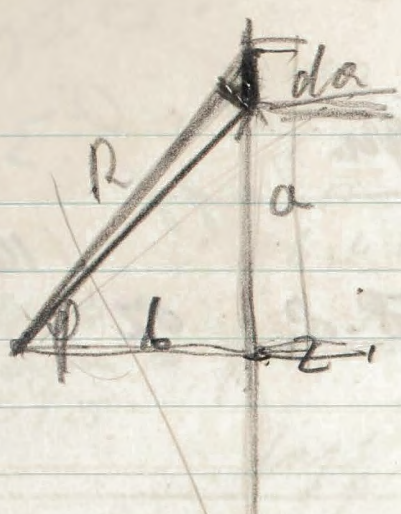
$= 1.7$ gm

U II box of Cahan

spend U metall

transferred to Zinn box

31.250 gm left over



$2\pi \sin\varphi \cos\varphi$

$\frac{2\pi a\, da}{R^2}$

$\frac{2\pi a\, da}{R^2}$ $\frac{2\pi R \cos\varphi}{R\cos\varphi}$

$2\pi \log\varphi$

$a = R\sin\varphi$

$da = \frac{R \cos\varphi\, d\varphi}{\cos\varphi}$

$2\pi \sin\varphi \cos\varphi\, d\varphi$

$2\pi \log(\cos\varphi)$ $2\pi \int_0^{\varphi} \sin\varphi \cos\varphi\, d\varphi =$

$2\pi \log \frac{b}{(a^2+b^2)^{1/2}}$ $\frac{1}{2}\sin 2\varphi$

$\pi \log \left(\frac{a^2+b^2}{b^2}\right)^{1/2} = \pi \sin^2\varphi$

$\sin\varphi = \frac{a}{(a^2+b^2)^{1/2}}$

$\sin^2\varphi = \frac{a^2}{a^2+b^2}$

$\frac{1}{2}\cos 2\varphi$

$-\cos 2\varphi$

$2\sin^2\varphi$

$\sin 2\varphi$

$\frac{1}{2}\cos 2\varphi$

$2\sin^2\varphi$

$2\sin\varphi\cos\varphi$

$$\int_{b_1}^{b_2} \frac{a^2}{a^2+b^2}\, db = \left[\frac{a}{2} \tan^{-1}\frac{b}{a}\right]_{b_1}^{b_2}$$

$= \frac{Val}{R^2} = \frac{5.6}{3}\ \frac{1}{200}$ gives $R^2 = 4.46$

Volume of Ion chamber

U_3O_8 Box 797 gm U_3O_8
~ 675 gm U empty Box 37.8 gm
Oxide from ~~tiy~~ 500 lbs lot
analyzed by Urenew

$$\frac{675}{240}\ 8 = \frac{0.82\ \text{Carbide} \ \text{~~Boron~~ weight} \times 500}{10.8}$$

$$\text{Carbide weight} = \frac{675 \times 10.8 \times 8}{0.82 \times 500 \times 240}$$

183.5 C / graphite
~~37.5 empty~~
~~221.0 total~~ 5 h 10 gms

0.59 gm

$$\frac{1}{R^2} = \frac{\pi}{2}\left[\tan^{-1}\frac{b}{a}\right]_{b_1}^{b_2} \frac{a}{\pi a^2 (b_2 - b_1)}$$

$$\frac{1}{R^2} = \frac{1}{2}\left[\tan^{-1}\frac{b}{a}\right]_{b_1}^{b_2} \frac{1}{a(b_2 - b_1)}$$

$$63.8\quad R^2 = \frac{2a(b_2 - b_1)}{\left[\tan^{-1} b/a\right]_{b_1}^{b_2}} = \frac{2 \times 3 \times 1.6}{0.152}$$

Project

1.) $\int_0^R u\rho_1 d\bar{r} + \int_R^\infty h_1 \rho_1 d\bar{r} + \int_R^\infty h_a \rho_1 d\bar{r} = N + \alpha \int_0^R u\rho_1 d\bar{r}$

2.) $\int_0^\infty h_a \rho_2 d\bar{r} = N$

$\int_0^R \rho_1 d\bar{r} = \cancel{A_R}$; $\int_R^\infty \rho_2 d\bar{r} = \cancel{2B}$; $\int_0^\infty \rho_2 d\bar{r} = \cancel{C_a}$

~~Out of~~ Out of 1 and 2 by dividing h_a

$\frac{h_1}{h_a} A + B = C + (\alpha - 1)\frac{u}{h_a} \int_R^\infty \rho_1 d\bar{r}$ ~ A

~~h_a~~ $\frac{h_1}{h_a} + \frac{B}{A} = \frac{C}{A} + (\alpha - 1)\frac{u}{h_a}$

Umebell in circular cell

No 1. Cell 2 — 31.25 = 458.94
— 31.25
427.69 gm U
mebell

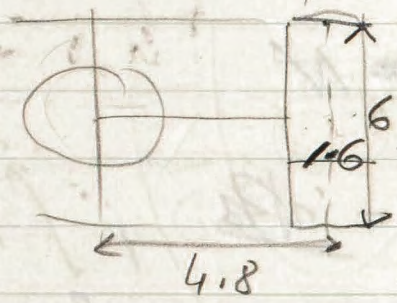
Computing spherical chamber

Pro. I.

427.7 gm U ; chamber 13.9 cc

gm At A + 10 H2 ;

$\sqrt{(4.8)^2 + (3)^2}$

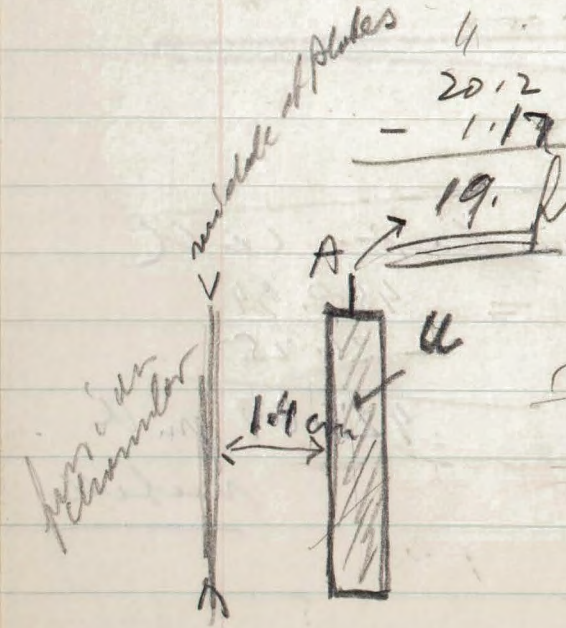


23 23+9 = 31 ($\overline{r^2}$ roughly estimated = 27

$\frac{N}{340}$ (N number of fission neutrons)

Thick Fission chamber

1616 / 80 cm ; $\alpha_1 = 127/108 = 1.17$



ratio of U to wall

0.67

we will take 80% correction

5. 24 - 39
see Ndiagrams of same date

$\frac{19}{29.2}$ f/[illegible] thin chamber;
1.42 mgm U in thin chamb.

196,000 × 0.8

U abs corr.

$27 cm^2$

157.000 fissions/min

13.5 recoils

13.5 [illegible] = $\frac{N_A \sigma \rho \; 157.000 \times Cd \text{ reduction}}{340}$

$\frac{2 \times 14 \times 10 \times 6,10^{23}}{22,400}$

$13.5 = \frac{28}{22.4} \frac{6}{100} \frac{157.000}{340\,000}$ ~~1/4~~ ,5 ρ(Cd)

$\frac{340}{157} \frac{13.5}{6} \frac{22.4}{28} = 3.9$

assuming Cd faktor to be 0.7
we get $\sigma\rho = 5.6$ ~~[illegible]~~

but forgot to integrate for solid angle!

1,5 MEV. corresponds to $\sigma =$ 3,5

→ multiply $\frac{13.8}{13.5} \frac{8}{7} \frac{7}{7.5} \times 5.6 = 6.1$

for 16 spherical chamber

Integration of solid angle

$$\left[2\pi \log (a^2+b^2)^{1/2} - 2\pi \log b \right] = \frac{\text{Vol}}{R^2}$$

$$\frac{2}{a^2} \cdot \frac{\pi}{\pi a^2} \left\{ \log (a^2+b^2)^{1/2} - \log b \right.$$

$$\frac{2}{a^2} \left\{ \frac{1}{2} \log (a^2+b^2) - \log b \right.$$

b	b^2	a^2+b^2	$\frac{a^2+b^2}{b^2}$	
4.1	16.8	25.8	1.24	4.820
4.3	18.5	27.5	1.22	4.804
4.5	20.2	29.2	1.20	4.787
4.7	22.0	31.0	1.19	4.779
4.9	24.0	33.0	1.17	4.762
5.1	25.9	34.9	1.16	4.753
5.3	28.0	37.0	1.15	4.745
5.5 →	30.2	39.2	1.14	4.736

$\log 10 = 4.605$

$$\frac{1}{R^2} = \frac{2\pi \times 1.346}{\pi a^2 \times 8} = 0.187 \quad 0.374$$

$$R^2 = 26.7$$

~~Ionization chamber to far from U; cut it down~~ !

~~and reverse~~

~~Try at higher pressures. for still faster neutrons~~ ~~12 At A~~ ~~10 H~~

Assumption:

25% of neutron H.P. come from backward

75% come from front; absorption we assumed average path 1.4 times 1.6 cm. corresponding $e^{-0.73}$ for full thickness

σ eff being 14×10^{-24}

.215	.624	0.132
.199	.646	.128
.182	.662	.120
.174	.685	.119
.157	.714	.112
.148	.760	.112
.140	.805	.113
6.186	.131	.876
		115

minus 4.84

1.346

.951

All this based on Phil's measurements of June 6th;

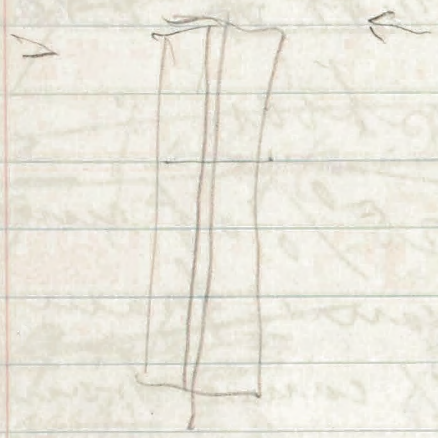
Result 0.707

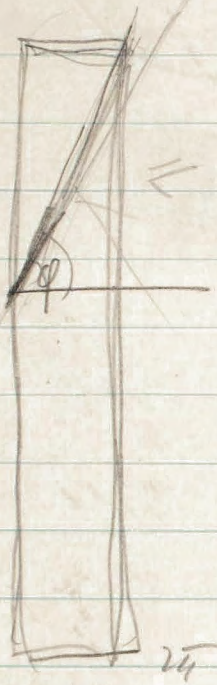
reduction due to U absorption

$= \frac{.951}{1.346}$

$3.2 < \sigma_H < 4.5$

$1.9 \qquad\qquad 1.35$





$$\int_0^{\frac{\pi}{2}} \frac{2\pi \sin\varphi \, d\varphi}{\cos\varphi} \cdot \int_0^{\frac{\pi}{2}} 2\pi \operatorname{tg}\varphi \, d\varphi$$

$$2\pi \left[\log \cos\varphi \right]_0^{\frac{\pi}{2}}$$

$$2\pi \sin\varphi \, e^{\cos\varphi} \, d\varphi$$

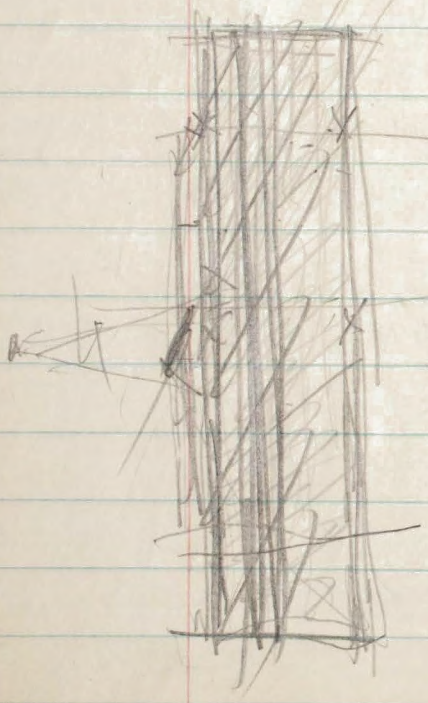
2 cm

$$\frac{18\pi}{240} \quad \frac{20 \times 10^{-24}}{\frac{18}{24} \cdot 1.2} \quad 6.10^{23}$$

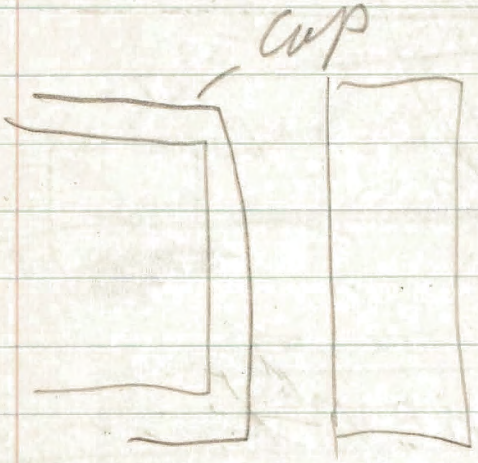
$$= \frac{21.2}{24}$$

$$e^{-}$$

16 1/m



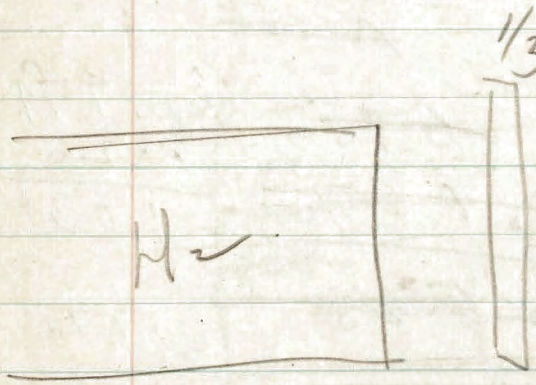
Atmos Corrections for absorption of Hydrogen & metall



a be value for H_2

b be value for $H_2 + A$

both measured with cap; counting above a fixed level



$$\frac{1}{3} V \text{ and } H_2 A = \frac{c\ b}{a}$$

lighter

1.17 MEV

1.081
− 0.259
.822

4.

0.067 MEV min 1.1 million

1.34 − 1.08 = 0.26

1.08 − 1.26 = .82

heavier

1/2 | .673 | 1.8

$\frac{200}{2.4} = 83.4$ MEV heavy

neutron $\frac{83.4}{140} = .595$ MEV

min

~~.595~~ 0.771
0.26
1.031

~~.595~~ − ~~.067~~

1/2 | .261 | 1.065

.5 2/3 8 maximum

~~.528~~ .771
− .26
.511

.772
.260
1.032

~~0.0172~~

.772
− .260
.512 1.065 MEV

maximum energy of heavy particle

~~This gives 4.45~~ = 6

Weighted mean

$2\pi \log(a^2+b^2)^{1/2} - 2\pi \log b = \frac{Val}{R^2}$

Values

1) 120 120

$\frac{100.000}{120}$

834 000

$\sqrt{(0.834 + x)} = \sqrt{1.8}$

$x = .18$

$\sqrt{0.834} - \sqrt{.18} = \sqrt{\text{min}}$

0.914
.424
0.490
0.24

Gives 4.1

$= 0$

.240
.834
.834
1.8

Ratio of masses 140 to 100

200 140
100

1.4

200 1.4 / 2.4 = 200 / 1.4

Mean mass of cyclist 1.17 MEV

Running 3 MEV

$\sqrt{0.834} \times \sqrt{x} = \sqrt{4}$

Time underground
gives 4.47 for $\bar{\sigma}$
from 6-7 including
real value of probably 4.1
$\sigma_f = 6.1$ $\quad \rho = \frac{6.1}{4.1} = 1.49$
add $\frac{6}{15} \times 1.5 + 1.5 = 2.1$

$\sqrt{0.834} + \sqrt{x} = \sqrt{5}$
$\sqrt{0.834} - \sqrt{x} = \sqrt{E_{min}}$
$2\sqrt{0.834} - \sqrt{E_{max}} = \sqrt{E_m}$
$4E_0 + E_{max} - 4\sqrt{E_0}\sqrt{E_{max}} = E_{min}$
$\sqrt{E_0} + \sqrt{E_0} = \sqrt{E_{max}} \quad | \quad \sqrt{E_0} = (E_{max}^{1/2} - E_0^{1/2})$
$\sqrt{E_0} - \sqrt{E_0} = \sqrt{E_{min}}$
$2E_0^{1/2} - E_{max}^{1/2} = E_{min}^{1/2}$

2, 3, 4, 5,
0.16 0.01 0.03 0.16

$(1.83 - 2.24) = (0.4)^2 = 0.16$ MEV (5 MEV)
$1.83 - 2 =$
$1.83 - 1.73 =$
$1.83 - 1.43 = 0.4$

Fermi – Anderson

Mn ~ U

20 gm of $MnSO_4$ for 100 gm U_3O_8

797 U Vol = 273 $MnSO_4$ Val,

$$\begin{array}{r} - \underline{159.4} \\ 113.6 \end{array}$$

Zirconium

	2	3	4	MEV
f	1.26	1.19	1.15	
$\frac{1}{\sigma}$	.251	0.2975	0.337	
$\frac{f}{\sigma}$	0.317	0.351	0.387	$\times 10^{24}$

(N) = (13 and 14)

$$\text{Number of neutrons / sec, min} = \frac{13.5 \text{ (old val.)} \cdot 1/\sigma \quad \text{(lamps)} \quad 4\pi \times 26.7}{0.707 \times 0.82 \times 13.9 \times \ldots \; N/cc}$$

$R^2 = 26.7$

$= 1/\sigma$

$$\text{"N"} = L^{10} \times \frac{273}{297} \qquad \frac{2.7 \times 10^{19}}{6.02 \times 10^{23}}$$

$$= 4.98 \; 10^{20}$$

$$13.9 \text{ "N"} = 6.92 \; 10^{21}$$

H Atoms
in diameter

Number from U cell / min =

$$\frac{f}{\sigma} \; \frac{(13.5) \times 4\pi \times 26.7}{0.707 \times 0.826.92 \times 10^{21}}$$

!!

$$\frac{f}{\sigma} \; 1125 \times 10^{-21}$$

$$\text{"}\left(\frac{f}{\sigma}\right)\text{"} \; 1,125,000 \; / \text{min} \times \frac{1}{1.393}$$

$$\text{"}\frac{f}{\sigma}\text{"} \; 812^{000}$$

gives 825000 for 13.7 instead of 13.5

compare with [illegible] 196,000 / min

1,393

This gives the three values

$E_{max}=2$ 1.83 m/fiss.

$E_{max}=3$ 2.03 m/fiss

$E_{max}=4$ 2.23 m/fiss

this has to be increased perhaps by 10%, on account of δ & Δ curve. —

—

In paper we shall say: number of neutrons emitted by U cell.

factor not 0.707

but $\nearrow \frac{2.66}{1.91}$

$$0.707 \times \frac{1.33}{\left(\frac{1.04+0.87}{2}\right)} =$$

$0.707 \times 1.393 = 98.5\%$

by this to divide, count to obtain number of neutrons

Similarly

Number of collisions in

H cell is .393 smaller

than simple uncorrected value

$$N_1 = \frac{13.7}{H} \frac{13.7 \times 10^{24}}{2 \times 10 \times 2.7 \times 10^{19}} \frac{273}{297}$$

$$N_1 = \frac{.316 \times 10^{24} \times 13.7}{13.9 \quad 2 \times 10 \quad 2.7 \times 10^{19} \quad \frac{273}{297}}$$

$$= 10^4 \frac{.316 \times 13.7 \times 297}{13.9 \times 2 \times 2.7 \times 273} = \frac{1.74}{13.9 \times 2} = 0.$$

$$N_1 = 770 \text{ n/min} = \frac{8700}{13.9}$$

$$\frac{627 \times 4\pi \cdot 26.7}{0.985} = 294 \quad 627 \text{ n/m}^2$$

$$\frac{627 \times 4\pi \, 2667}{0.985} = 213{,}500$$

check

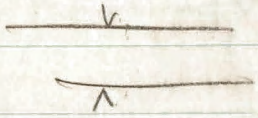
x 13.9

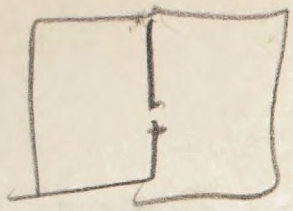
$^{11}B + n \rightarrow {}^{8}Li + \alpha$

10^{4} A

10^{-4} cm

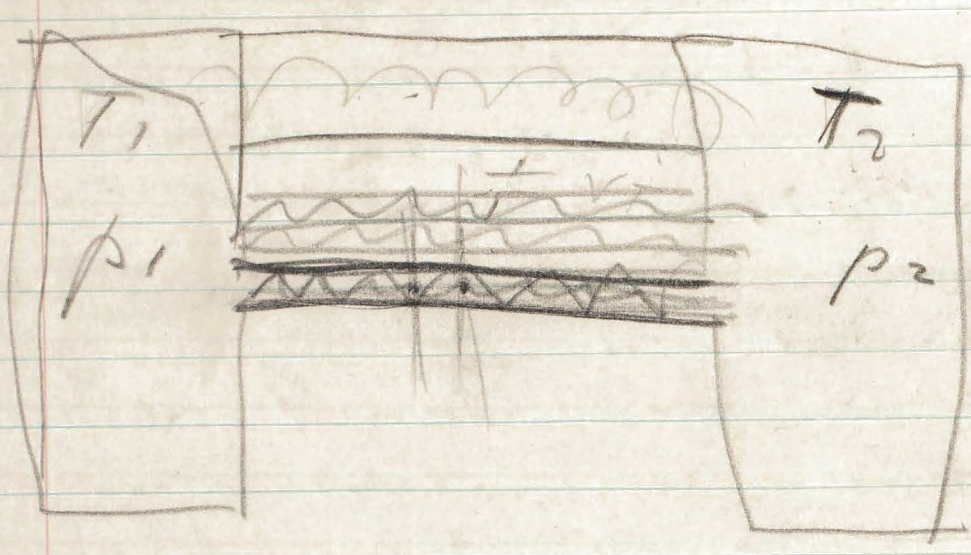
10^{5}

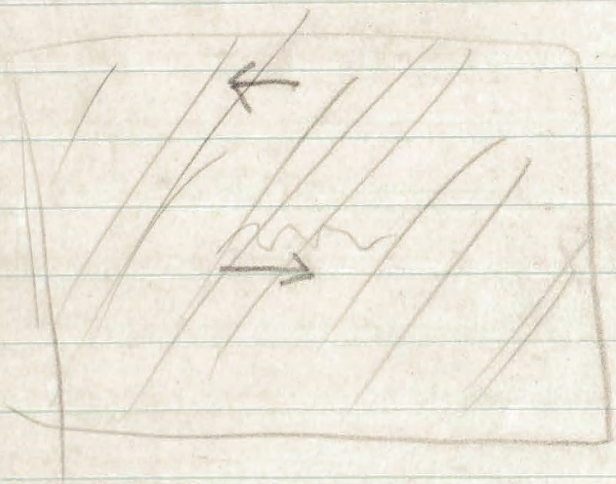




$\frac{1}{T_2}$

10 ¢





H_2

$c\,H_4$

$\frac{p_2}{T_2} = \frac{\rho_2}{\rho_1} = \frac{\sqrt{T_1}}{\sqrt{T_2}}$

p

$\frac{\rho \sqrt{T_2}}{\sqrt{T_2}} \frac{p_2}{T_2} = \text{const}$

$\frac{\rho}{T} = \rho_1 / T_2$

$\frac{p}{\sqrt{T}} = \text{const}$