BOOK84R

Notes:
"1859" on spine

Blank pages: 12, 20, 24, 25, 28, 30, 32, 36, 38, 40

-page 2 has 1 (8.5x11) sheet taped to it
-the following pages have 1 or (2) (8.5x11) graphs taped to it: 2(2), 4, 6, 8, 12, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44(2), 46(2), 48(2), 50(2), 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 93(2)
-page 22 has a red post-it tag at top of page (can't make out writing)
- 4 (8.5x11) sheets glued to inside back cover sheets

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
August 31, 1999

[redacted]

SOME INSTRUCTIONS FOR USE OF THIS NOTEBOOK

1. This notebook is assigned to personnel performing research and development work and must be used for all original calculations, notes and abstracts from reports.
2. Assignee is responsible for the safeguarding of this notebook in accordance with security regulations.
3. This notebook must be returned to issuing office when completed or upon termination of assignee.
4. Every page or entry should bear a date and the signature of the person who made the entry.
5. Entries should be made in ink whenever it is reasonable to do so.
6. Alteration or amplification of entries made on previous dates should be made as separate entries under their own dates and cross referenced to the previous entries.
7. Charts, drawings and graphs drawn on special paper should be glued or otherwise securely fastened in place and should individually bear a date and signature. Do not obscure any information.
8. The notebook should be periodically reviewed by one or more independent persons in the department and should be signed and dated by them. Likewise, they should make a statement that they have "read and *understood* the foregoing material." Witnessing stamps for this purpose are available in your department's office.
9. It is advisable to preface each new item, such as a heat treatment, process or reaction, etc., with a very brief description of the purpose, objective or approach.
10. Description of the invention or discovery should be complete enough to be understood by anyone skilled in the art.
11. Reference to name or catalogue number should be made when standard items are being discussed, i.e., *Westinghouse* pump.
12. In cases where work is conducted in cooperation with others, it is often necessary to meet with them from time to time and to discuss new developments. The occurences of such conferences should always be entered in your notebook regardless of recording elsewhere, giving the date, who was present (if possible), and an outline of the subjects discussed. This often will establish error in occasional claims of other parties that you have appropriated information from them revealed during an interview, and thus provide you with patent protection.

Classification changed to: Unclassified
(level and category)

By authority of: CG-DAR-1
(classification guide)

Harrington 6/24/94
ADC or ADD signature (first reviewer) Date

Ted Davis 6/24/94
ADD signature (final reviewer) Date

[redacted]

6538

UO_2F_2 exp's

[redacted] AND CARBON CHEMICALS COMPANY

defined in the Atomic Energy Act of 1946.

OAK RIDGE, TENNESSEE

"This document consists of 147 pages.
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5-25-60

[redacted] SECURITY INFORMATION

NOTEBOOK NO. Y-NB-1859

INVENTORIED FEB 27 1975

~~A. Circle~~ Calvin Hopper

Assigned to: F. K. Fox

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Department: 3405

Location: 9213

Date: 11-10-52

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5-29-85 mlf

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Subject

8/24/88 nl

11/15/89 nl

11-15-90 BFC

8-5-91 BFC

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RESTRICTED DATA

This document contains restricted data as defined in the Atomic Energy Act of 1946.

[redacted]

VERNON BOOK LINE U. S. A.

1311.37
1268.93
1699.76
1501.56
5781.62

2941.44
2840.46
5781.90

2101.58
2098.03
3.55

401.82
3.22
398.60

265.84
3.22
262.62

Date 11-13-52

~~SECRET~~
~~SECURITY INFORMATION~~

Container sent to Mr. Bruce for conversion to UO_2F_2. Both on sample U-28

~~# 2~~		~~# 3~~
~~3343.66~~		
~~3344.69~~	(redistributed	~~3246.72~~
~~403.25~~	into smaller batches	~~406.26~~
~~2941.44~~ gm	(wt Plu. 3.22 gm)	~~2840.46~~
← 676.30 gm U. ?		# 3

bottle - 23-6

Gr.	1584.10	1675.19
Tr.	272.73	406.26
net	1311.37 gm	1268.93 gm
	= 301.6 gm U ✓	= 291.85 gm U ✓

U-28 11-10-52 Represents four bottles on the page

36.121
22,473
13.648
= 3.14 gm U ✓

.2300 gm U/gm ✓

assays	
Ave 98.68	per phone Parrott office
98.49	

\#2*

23-8

on hand Jan 5, 1953

Bottle 23-5
~~518.35~~
~~259.48~~ S-U-28
~~258.87~~
~~Re-distributed~~
~~82.8 gm U.~~
59.54

→

2101.58
401.82 ✓
1699.76

	1767.40
(23-8)	265.84
	1501.56
	1699.76
	3201.32

390.94 ✓ gm U

345.36 gm U

Re-sampled see page 2

~~SECRET~~
S[redacted]ITY INF[redacted]ATION

Signed

see P. 18.

2 1-10
Date

[redacted]
[redacted]

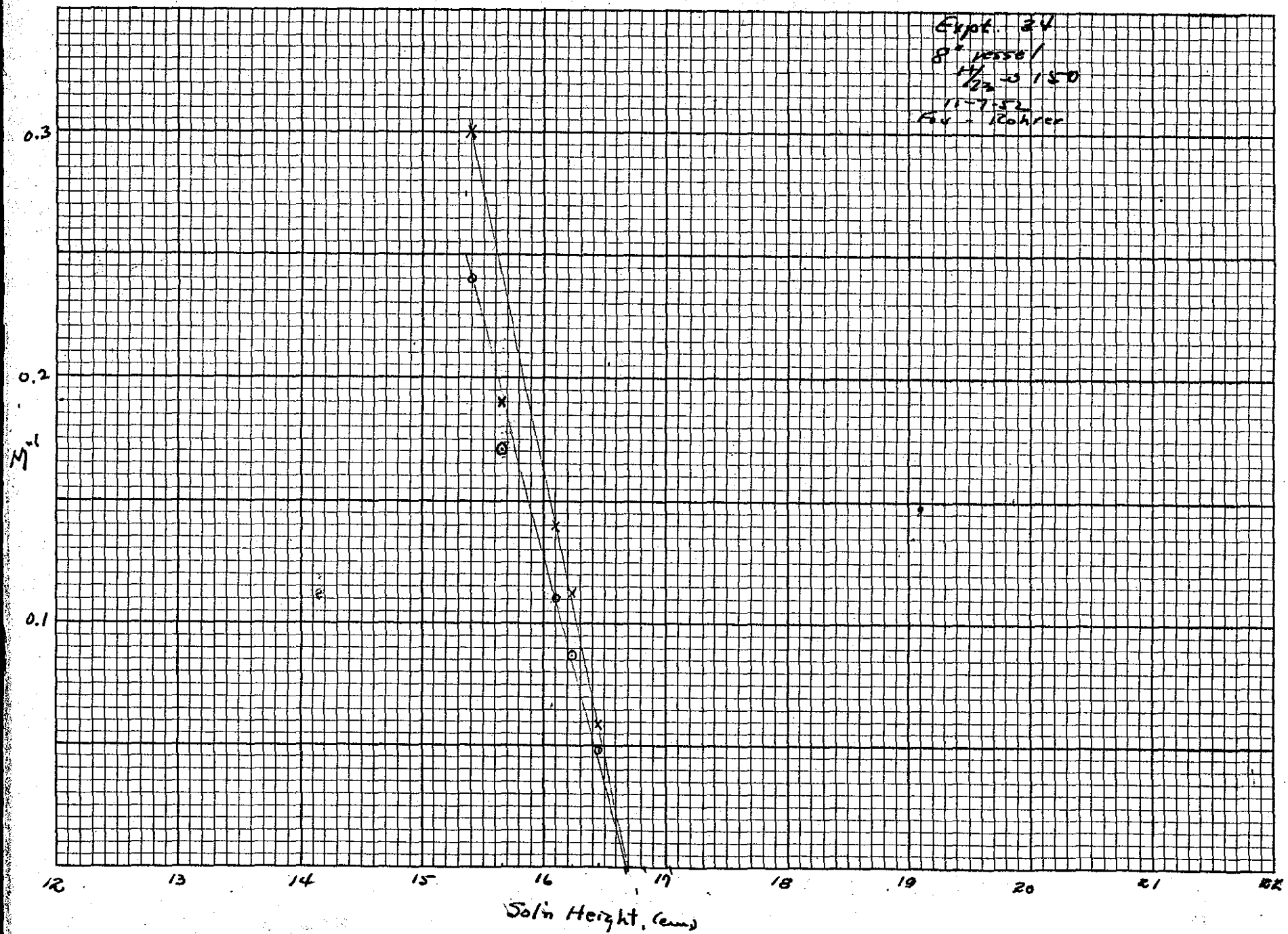
Container #2		Container #23-	
	37.519 Re-check		37.861 R
	37.526		37.867
sample A	22.596	U-37	22.744
U-36	14.930	Reg 130390	15.123
Reg. 130389	3.42 gm ✓		
	.2290 ✓		✓ .2289 3.4
sample B	~~102.239~~		~~100.744~~
in glass	102.257		100.763
E293	71.997	E-148	70.666
	30.260		30.097
	6.93 gm ✓		6.89 gm ✓

Re-gross container #2		5	23-8
1-10-53	+ 2098.03 [4]		+ 1760.93 *
before samples taken	398.40 *		262.62
	1699.43		1498.31
samples	45.20		45.22
	1654.23 [4] - present net wt.		1453.09
	378.82 gm ✓		332.61

[redacted]

[redacted]TION

+ No. plastic on pan - balance zero now true val
* adjusted tares


Expt. 24
8" vessel
11-7-52
Cav - Cohrer
0.3
0.2
0.1
M⁻¹
12
13
14
15
16
17
18
19
20
21
Soln Height. (cms)

CLASSIFIED WORK SHEET

Fox
Shrer
11-7-52

Expt # 34
8" Vessel

4/4150 CLASSIFIED [illegible]

4/23

m. x 1.062 = cm

Time	Source	Control	Safety	(in) Manifold	Soln Ht cm	C_1	x m^{-1}	C_4	o m^{-1}
2 35 P	in	14.32	13.4	6.06	6.436	2.75 } 3.38 4.00		11.5 } 11.63 11.75	
3 09 P	in	14.32	13.4	15.00	15.93	17.5	0.193	69	0.168 *
3 18 P	"	"	"	14.75	15.66	17.75	0.190	68	0.171
3 37 P	"	"	"	15.29	16.24	30.25	0.112	133	0.087
3 48 P	"	"	"	15.49	16.45	57.50	0.059	242	0.048
3 58 P	out	"	"	15.71	16.68	very slightly supra critical			
				15.65	16.62	sub-critical			
70-52	Cronin, Fox			2nd Run					
8 53 AM	in	14.3	13.2	6.0	6.43	3.0 / 3.5 / 3.5		11.25 / 11.0 / 11.25	
				14.5	15.4	9.25 - 11.5	.1304	450 - 460	.24
				15.16	16.10	28	.114	100	.11
				15.77	Supra crit				
				15.63	Sub.				
				15.70	Supra				
				15.66	16.63 just	crit		Crit Vol = 16.6 x 330 = 5480	
				15.64	Sub.				
				Crit mass =	914 gm. ✓				

U-26

48107
22,565
25,542
= 3.49 gm U ✓

✓ .1366 gm U / gm
1,2379 sp. gr. 26.0
& .134 gm 23 / gm

.16637 gm 23 / c
.16687

Notes:
* level rising during counting period. Lowered to equilibrate.

CLASSIFIED WORK SHEET

Y-685 (Jan'48) Y-12 DATA SHEET

NO. 340 10 DIETZGEN GRAPH 10 X 10 PER INCH EUGENE DIETZGEN CO.

Added ~ 1000 cm³ H₂O
water after Expt #34

Calc ∑H/23 at ~ 150:

V-24

.1366 × 1.67 = .2281

$\frac{.1366}{.1992} \times .0335 =$ .02294 ~~.02398~~

.02294 ~~.02398~~ × .1428 = .00328

$\frac{.75222}{.13446} \times 259 =$ ~~145.~~ ✓

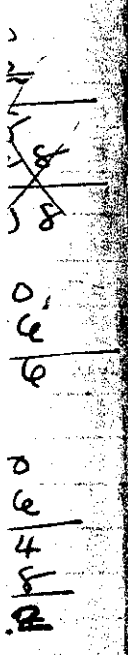
$\sum H/23 =$

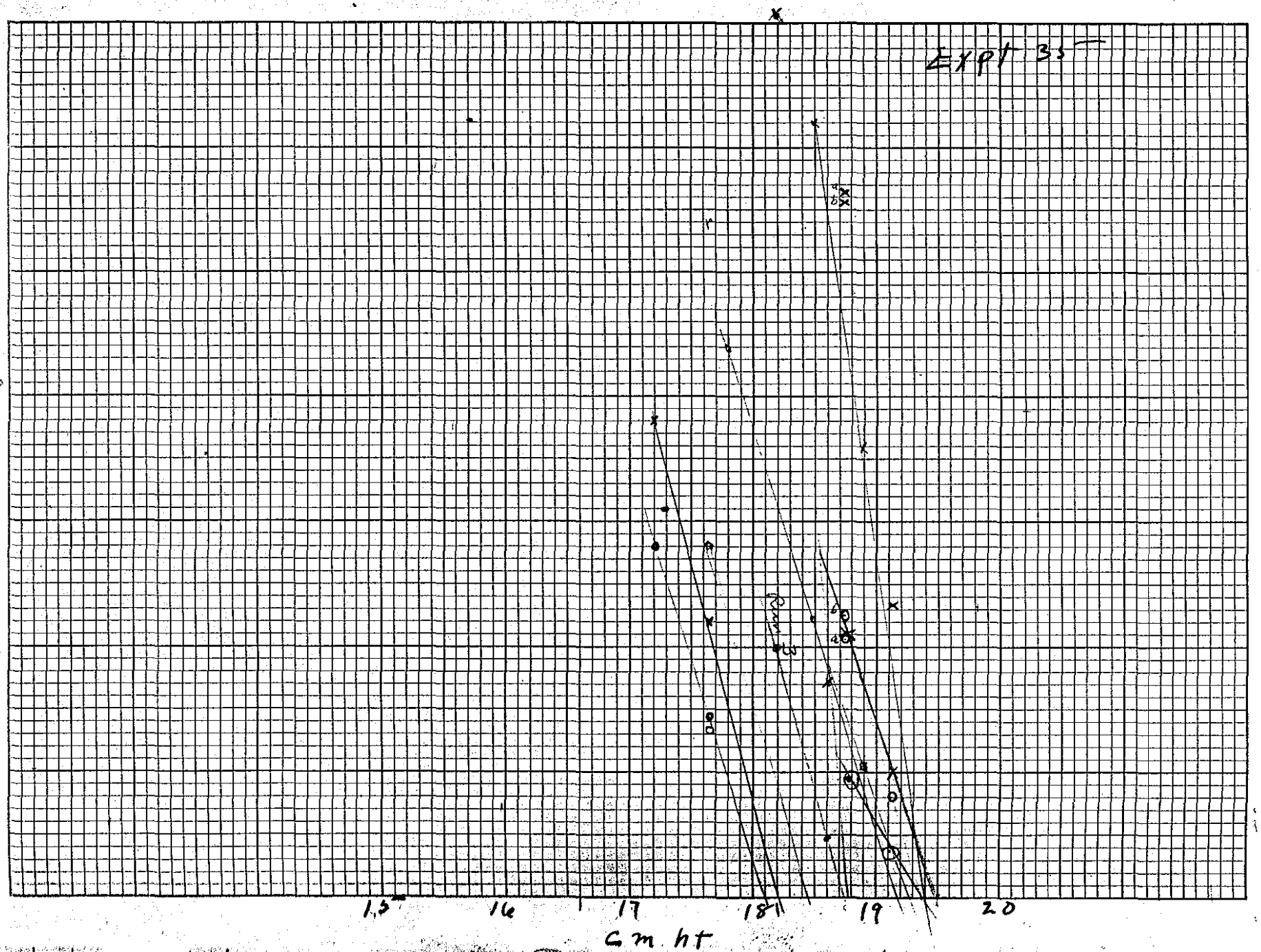
1.00000
.22822
.77178
.02328
.75508

.22810
-.02294
.25106

1.000000
25106
.74894
.00325
.75222

? – Liebig –




Expt 35
1.5
16
17
18
19
20
Cm ht

11-10-52 Cronin & Tox

Date

Expt 35
8" Vessel

H/23 ~ ~~220~~ 213

Run No.	Time	Source	Control	Safety	Manifold	Soln. ht. (cm)	G_1		G_4	
37		in	14.3	13,4	6.0*	6.43	4.0		11.5	
37		"	"	"	16.30	17.2	21.0	.19	81.5	.14
		"	"	"	16.63	17.46	35.5	.11	158.0	.073
				2nd Run						
No. 11		in								
		in	14.4	13.6	6.0		12.5 11 14.2 } 12.5		10.5	
		"	"	"	16.60	17.63	45.25	.27	151,5	.069
				Added water approx 600			$cm^3 H_2O$	Re-zeroed manifold		
							10		11.0	
					16.62	17.65	31.5		78.5	.14
				Lowered manifold added ~ 1000 $cm^3 H_2O$						
							Re-zeroed			
	1:38 P	in	14.4	13.7	6.0		11.5		11.0	
210		"	"	"	16.76	17.80	26.5	.43	50.25	.22
					17.41	18.49	37	.31	91.0	.121
					17.81	18.88	59/64	.18	4 Hours 204	.053
					18.1		slightly super			
					18.05 18.07	19.2	" "	Sub-Crit super	"	
	10-12-52									
				2nd Run (manifold re-zeroed - was - 0.30")						
	9:00 AM	IN	14.1	13.6	6.00		14.0 14.25 } 14.0		10.25 11.25 } 10.5	
					17.15	18.21	38.25	0.36	103.0 104.0	0.10
					17.50	18.59	74 89 84	0.17	230.5 240. 240 } = .044	
		Out			17.80	18.9	Super Critical			
					17.70 17.75	18.80 18.85	Sub-Crit. super			

(over) Added 300 $cm^3 H_2O$ - mixed & re-zeroed Manifold
+ Soln ht in manifold 31.4 cm = 7500 / 100 / 8600

* manifold zero off + .84"

Signed

Cm ht

10 × 10 to the inch, ½ in. lines accented. MADE IN U.S.A.

11-12-52 continued Expt 35

4 Date Crown-Fork

Run # 4

Time	S	control	Safety	Manı.	Cmht.	C1		C4	
1220	117	13.4	13.4	7.00		11.0		11.5	
1258 p	in	"	"	17.65	18.74	39	.282	110	.105
Rodder Fork		Lowered manifold for mixing starting up 1.10							
1.30	in	13.4	13.6	17.65	18.24	39.5	.278	103	.112
1.35.	"	"	"	18.00	19.12	93.75	.117	286.5	.040
	Attempted to raise source at 18.1 on manifold to check critical. Drive slipping. Lowered manifold. -								
			Run 5						
2.42	in	14.4	13.6	17.65	18.74	52	0.21	117	.098
				18.00	19.116	109.0	0.10	306	.038
				18.20	Super critical				
				18.14	19.3 Sub.		"		

Cmt. at essentially full - with ½ cm at most

Cmt Vol. = 19.3 x 330 = 6.37 ℓ

Cmt Mass = 6.37 x .1596 = 739 gm. ✓

~~1.237 @ 26.0 C~~

Test det. of Expt. 35 ~

~~U-27~~

53264
22.644
30.620 ✓ = 3.09 gm U

.1009 gm U/gm
1.165 @ 26.2
.0993 gm ^{235}U/gm
.1159 gm ^{235}U/cc

Removed ~ 3500 cm³ from system & added ~ 3900 cm³ H_2O & mixed.

Signed

H/23 for Expt #35:

.1009 × 1.67 = .1686

$\frac{.1009}{.1992}$ × .0335 = .01697

.01697 × .1428 = .00243

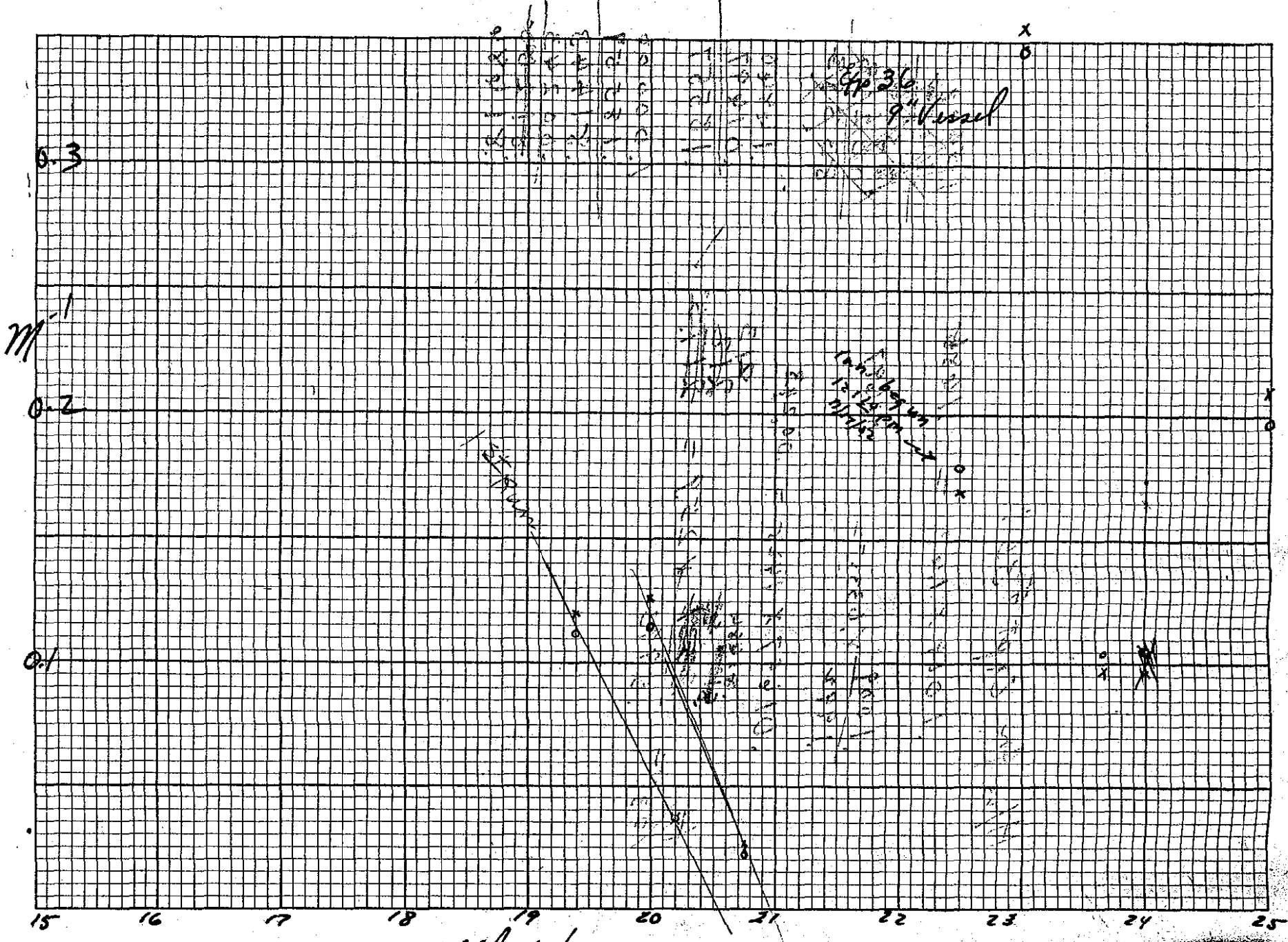
H/23 = $\frac{.81686}{.0993}$ × .259 = 213

~~212~~

~~217.5~~ ✓

.16860
.01697
.18557

1.00000
.18557
.81443
.00243
~~.81200~~
.81686


0.3
0.2
0.1
M-1
15
16
17
18
19
20
21
22
23
24
25
Manifold Hgt. (inches)
9" Vessel

Date 11-13-52 Robertson Fox

Exp 36 9" Vessel

H/4 nnn = 375 5

Time	S	Control	Safety	Manifold	amt/gt	C_4	M_4'	C_5	M_5'
2 35 PM	IN	10.6 out	13.6	7.00		8.25 / 9.25	8.0	10.0 / 9.5	10.0
2 54 pm	"	"	"	15.4		71.5	.112	83.5	.120
3 04 PM	"	"	"	20.2		218	.037	273.5	.037
		Lowered manifold added 800 cm³ H₂O & re-zeroed manifold.							
11-14-52 For Robertson 2:58 P									
	in	10.53 (out)	13.6 (out)	start up experiment.			x		0
3 07	"	"	"	7.00		9.0/9.0		6.0/6.25	
3 27	"	"	"	20.01		71.23	.126	525	.114
						357	.026	261	.023
		extrapolate to ~ 2							
	*	Lowered manifold added 2000 cm³ re-zeroed manifold.							
						8.75 / 8.0		5.75 / 6.25	
	LV	out	14.3	7.00					
	"	"	"	24.53		40		27.25	
11-14-52 For Austin				Recheck.			0		x
	"	"	"	7.00		8.5		5.75	
	"	"	"	23.0		24.75	.34	16.0	.36
				25.0 not cut full		42.75	0.199	27.50	0.21
+		Adjusted concentration of Soln							
11-17-52 For Robertson							0		+
12 10 PM	in	11.33 out	14.3 out	7.00		8.95	1	5.50	1
12 36 PM	"	"	"	22.50		48.75	.179	32.75 (50)	.169
12 46 PM	"	"	"	24.00		83.00	.103	57.00	.096

Baffle taken on manifold is 23.65.

Manifold was run up to 26.9 and there was no change on the levels on recorders. Level just began to fall off below 23.65. extrapolate to ~ 25.2

Continued on p. 7

+ Soln left in manifold 538 cm³ = 13,850 cm³

+ Removed ~ 3850 cm³ added ~ 1300 cm³ of 26% H/2 Soln

Signed

6 Date 11-15-52

Calibration of 10" Aperture

Vol. added		scale reading
	0	10 cm.
	300	12.2
	500	13.0
second test	700	13.6
1000	900	14.3
	1100	14.9
	1300	15.4
	1500	15.9
	1700	16.3
	1900	16.8
2000	2100	17.3
	2300	17.7
	2500	18.1
3000	2900	19.0
	3400	19.9
	3900	20.9
4000	4400	21.8
	4900	22.8
5000	5400	23.7
	3900	24.6
6000	6400	25.6
	6900	26.5
7000	7400	27.5
	7400	27.9
	7800	28.4
8000	8000	28.9
	8200	29.4
	8400	29.9
	8600	30.4
	8800	30.9
9000	9000	31.4

second test 14.7 — 17.2 — 19.3 — 21.1 — 23.0 — 24.9 — 24.8 — 29.0 — 31.7

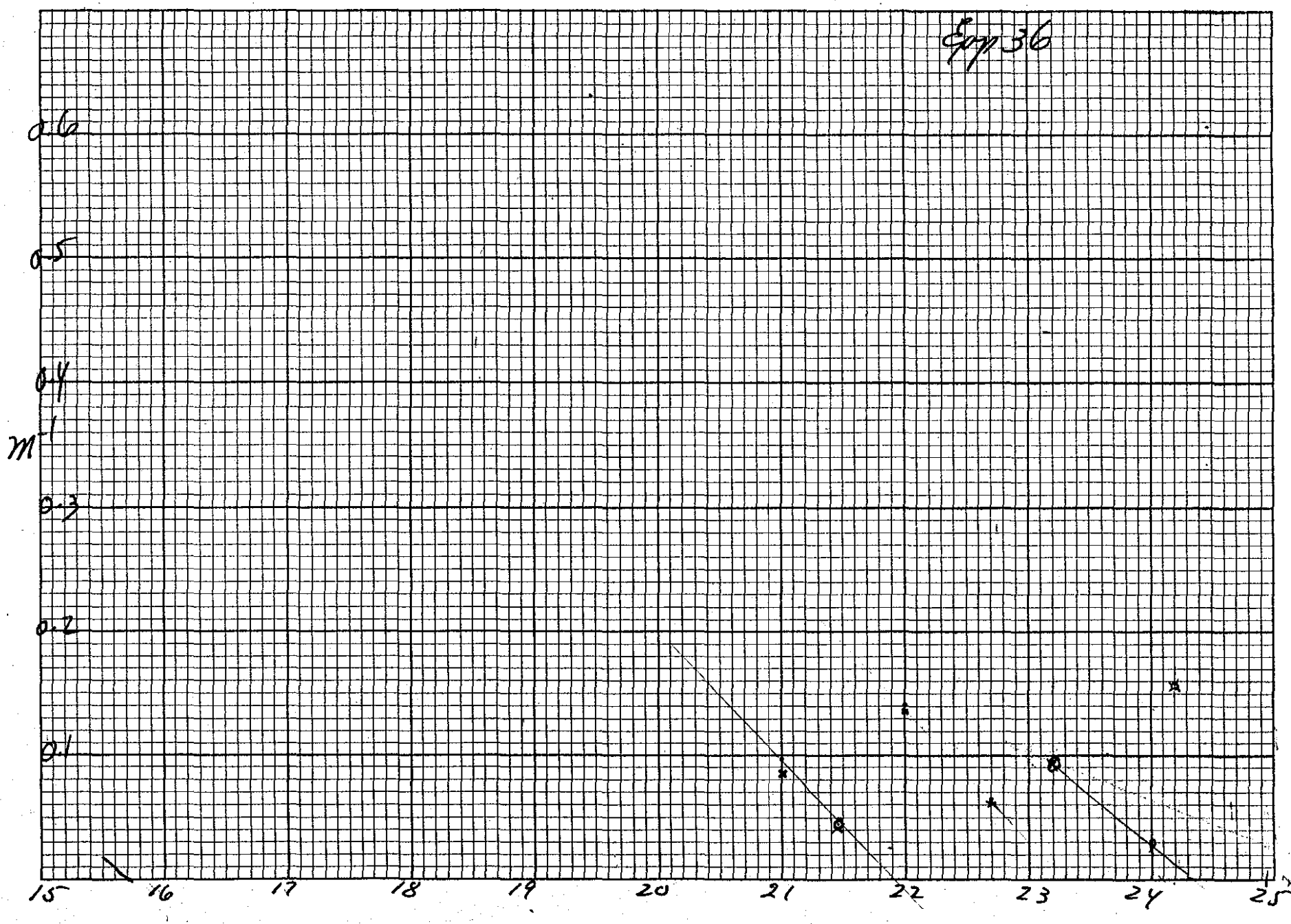
(second test more accurate - less no. of measurements)

Cont.

	9050	31.8
	9100	32.0
	9200	32.4
second test	9400	33.3
9500	9600 Signed	33.9
9645	9670	34.4
		35.8

Cont.

35.8 full


Exp 36
0.6
0.5
0.4
m⁻¹
0.3
0.2
0.1
15
16
17
18
19
20
21
22
23
24
25

For Curiosity
Date 11/17/52

Exp 36 Cont
9" Vessel

Conc. adjusted by adding 920 cm³ of approx H/K ~ 250 sol'n

Time	Source	Safety	Manifold	Counter	C_4	M_4^{-1}	C_5	M_5^{-1}
3⁰⁵	IN	out 14.3	7.0		9		5.5	
			21.0		99	.091	67	.086
3⁵⁷			21.46		202	.045	140	.043

Recheck of zero showed it off + 1.45". Hence, re-run without other change as further check on accuracy

8-6 ~ Cronin-Fox

9³² AM	in	out 14.3	7.00		9.0 (8.75)		6.0 (6.0)	
10³⁰ AM	IN	out 14.3	22.01		64	0.14	44	0.136
			22.70		139	0065	97.5	.062
	Added 800 cm³ H_2O		Reserved max					
12⁵⁸ P	in	out 14.3	7.00		8.0	-	5.5	-
1³² P	"	" "	29.2		51.0	0.159	35.0	.157
1³⁷ P	"	" "	27.90 (Flooded)		81.25		55.25	

Recorder level drops: 24.6.

Lowered manifold & added ~ 400 cm³ of H/23 = ~250

plus			23.01		87.0	0.103	61	.098
			Full.		151.25	1059	103.5	.058

Added 300 cm³ ~ H/23 250 - Re-zeroed manifold.

			23.20		92.75	.097	64	.094
			* Full (24.0")		304	.029	216	.028

24.00 very little drift downward

Doubt as to accuracy of zero. Also reading of 24.00 appears to be full.

9-6 Re-run

8.16	in	out 14.3	7.0		7.5		8.5	
	"	" "	full ?		286	0.025	211	0.04

Extrapolation shows that system would be crit at ~ 3" M. above full ht. = 0.28 cm

* zero off - should be full at ~~24.9~~ 24.4" M.

Crit. Vol. = 22.6 + .3 = 22.9 cm × 410 = 9390; ΣM = 9390 × .06641 = .624

Signed

8 Date

Calc. of H/33 at ~380:

.06158 X 1.67 = .10284

$\frac{.06158}{.1992} \times .0335^{-} = .01035^{-}$

.01035⁻ X .1428 = .00148

$H/_{33} = \frac{.88829}{.060\overset{75}{\cancel{55}}} \times 25.9 = \frac{\cancel{380}\ 399}{\cancel{384.5}}$ ✓

1.00000
.1028
8972
00148
.98852

.10284
.01035⁻
.11319

1.000000
.11319
.88681
00148
.88829

H/33 ~ 380 (Last dilution used in 9" cyl.)

U-29

58045⁻
22.725⁻
35.320

0.06158 gm U/gm
✓ .060$\overset{75}{\cancel{55}}$ gm ^{23}/gm
1.0932 @ 27°C

2.18 gm U ✓

$\cancel{.0662}$ gm ^{23}/cc
.06641

Signed

Cronin, Talley, Fox

Date 11-20-52

Expt. 37

10.4" Al. sphere

#23 — 400

9

Time	Source	Control	*Safety	Man. –	Vpt in sphere	C_4 7.5 / 7.5		C_5 5.0 / 4.75	
	In	14.66	14.3	7.0					
11 12	"	"	"	23.61		95.5	.079	68.5	.073
11 14	"	0	"	"		62.5	.120	42.5	.118
11 15	"	14.66	6.0	"	~ same as control (little more) in above				
11 21	"	"	14.3	"	9.05	+ 61.0		43.0	
11 29	"	"	"	24.00 Lowered 7.00	9.17 manifold	217.0 7.75	.034	151.5 7.25	.033
‡	"	"	"	"					
1 24	"	"	"	23.30	8.95	71.0	.109	51.75	.14
1 31	"	"	"	23.95	9.15	197.0	.039	141.75	.051
	Out	"	"	24.31	sub critical				
	"	"	"	24.33	supercritical				
	Added 300 cm³ H_2O (14.66) out				& rezeroed manifold				
3 50	in	"	14.4	6.84		8.75	–	7.00	–
3 50 4 13	"	"	"	24.3	9.25	117.0	0.075	81	.086
4 20	"	"	"	24.6	9.32	248.5	0.035	174.25	.0840
	Lowered Manifold Added 350 cm³ H_2O								
11-21-52			zero checked						
9 16 AM	In	14.68 UP	14.1	0.00		7.5 / 7.0		6.75 / 6.75	
	"		6	24.65	9.32	110.75	0.063	80.25	.084
	In	OUT	"	25.0	9.38	247.25	.028	180.	.038
9 50 AM	In	IN	14.1	25.0	9.38	73.5	.095	50.5	.154
				25.80	9.58	147.5	.048	104.5	.065
	"	"	"	27.00	Level – no change above ~ 26.0				
	"	"	"	26.20	no significant change after 2 min				
				26.0	" " " " "				
				25.9	Definite drop in activity (Full at ~ 24.0")				

* Re-checked vessel zero.

‡ -- Air bubbling around reactor

‡ -- Fuel Dump air valve stuck to blow air up under sphere on scram

Signed

10 Date

H/23 at ~ 400 :

.0582 x 1.47 = .0972 gm salt/gm

$\frac{.0582}{.1992}$ x .0335 = .0097

.1428 x .0097 = .00140 H_2O equiv. of HNO_3

$\frac{.8944}{.9042}$ x 25.9 = 406 ✓

.05725

1.0000 / .0972 / .9028 / .0014 / .9042

.0972
.00979
.10699

1.00000
.10699
.89301
.00140
.89441

H/23 ~ ~ 400 (Last dilution used in sphere)

U-30 79.068
22.631
56.437
= 3.788 gm U ✓

0.05820 gm U/gm
.0574 gm ^{23}/gm

1.0875 @ 27°C
✓ .0624 gm ^{23}/cc

Signed

Date 11-21-52
Rohrer, Fox

Expt 37 continued from p. 9.
Added 250 cm³ H_2O & rezeroed manifold

Time	Source	Control	Safety	Manifold (in)	Vol in sphere	C_4 ×	m^{-1}	C_5 ○	m^{-1}
11 54 A	in	14.7	14.4	7.00		2.5		5.0	
12 15 P	"	"	"	24.95	9.4	117.0	0.064	84.75	0.039
12 24 P	"	"	"	25.3	9.48	263.75	0.028	193.25	0.026
12 35	out	"	"	25.60		sub-critical		} crit ht = −25.63	
				25.65	9.55	super-critical			
	Control rod run in.			At will		began to ~~took~~ effect.			
12 38.	in	in	14.4	25.65		79.5	0.094	55.0	0.091
				29.0	not much rise over 25.65 reading up to 27.0				
				25.7	downward trend began here on manifold				
	was lowered.			25.5	noticeable downward trend				
				25.3	sharp drop				

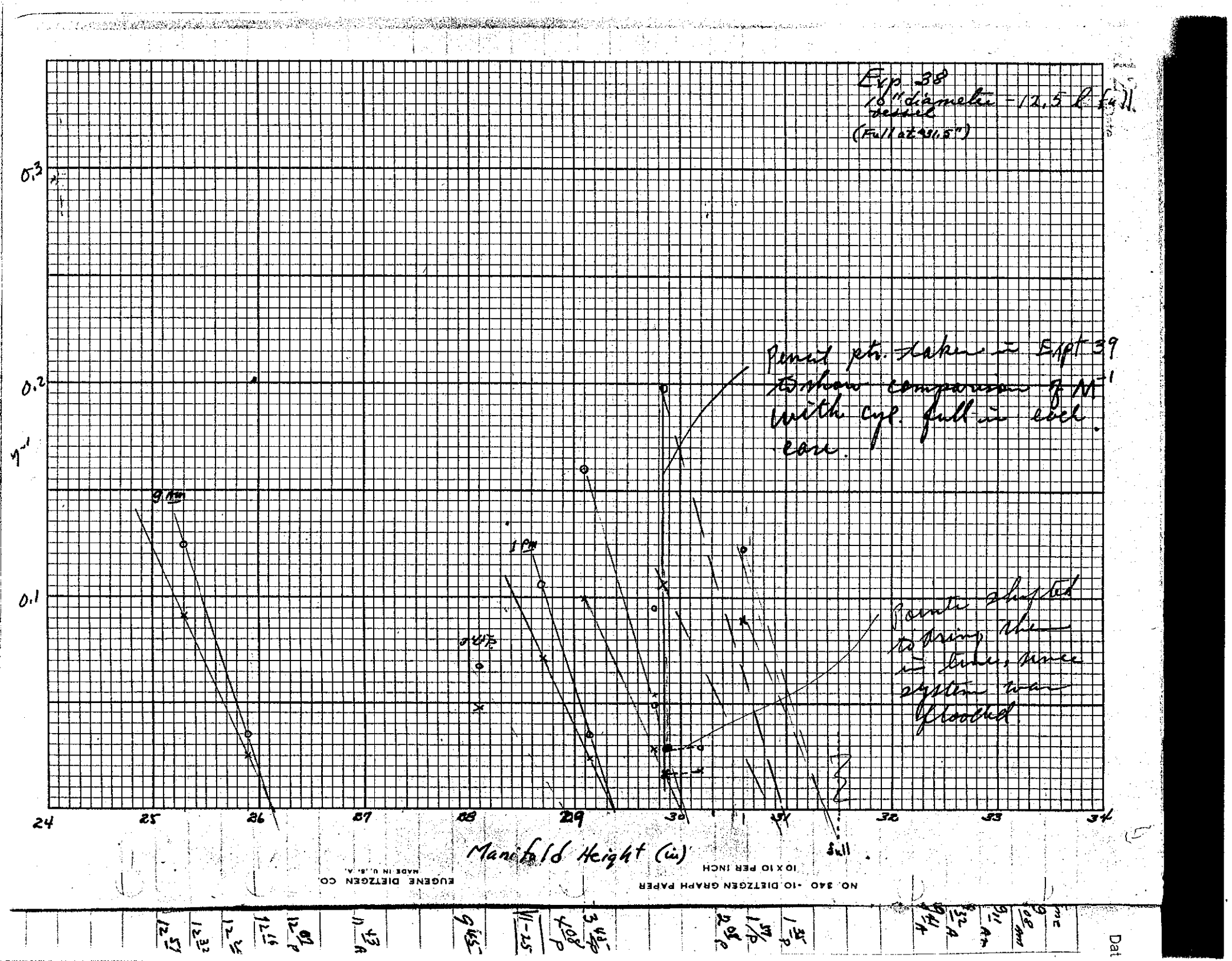
25.7 = ~ full ht. (zero Pf)

Reactor crit. full essentially (9645 cm³)

$9645 \times .062 \frac{43}{28} =$

Crit. Mass 602 gm. ✓

Signed


Exp. 38
18" diameter - 12.5 ℓ
reduced
(Full at 31.5")
Point pts. taken in Expt 39
Shows comparison of M⁻¹
with cyl. full in each
case.
Points plotted
to show the
in time, since
system was
flooded
0.3
0.2
0.1
y⁻¹
9 lbs
1 lbs
24
25
26
27
28
29
30
31
32
33
34
Manifold Height (in)
NO. 340 -10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U.S.A.

Rohrer, Fox

Date 11-24-52 Exp 38 10" diameter cylinder $H/_{23} = 405$ same as in final step of Exp 37

(manifold zeroed)

13

time	Same	Control rod	Safety blade	manifold height (in)	Solution height cm	C_4	$\circ$ m^{-1}	C_5	$\times$ m^{-1}	
9 08 am	in	out	out	6.00		9.25	(9.375)	4.5	(4.5)	Part A
9 11 Am	"	"	"	"		9.50		4.5		
9 32 A	"	"	"	25.3		75.6	0.124	49.5	0.091	
9 41 A	"	"	"	25.9		264.75	0.035	183.25	0.025	10 790 ✓
			Ext. Extrap.	26.1	crit. ht =	21.2 cm	× 509 =	~~10,800~~		cm³
						10 790 ~~10,800~~ × .062 = 43		674 gm. ✓		Value seems unconstant
		Added 2 liters H_2O			rezeroed manifold*					Part B
1 35 P	"	"	"	6.00*		9.50	-	4.5	-	"background" check
1 57 P	"	"	"	28.7		89.00	.107	63.25	.071	
2 08 P	"	"	"	29.15		268.00	0.035	186	0.024	
		Extrap crit. ht =		23.7	cm × 509 =	12,060 cm³				
				~~24.6~~	× ~~509~~ =	~~12,420~~				
		Rezeroed manifold.								
3 48 P		Began to raise manifold								
4 08 P	in	out	out	28.1		140.50	.068	93.00 ~~92.75~~	.048	
11-25-52		Added 1300 cm³ H_2O				10.5 10.5		4.50 4.75		
	in	out	14.4	6.00						
9 45	"	"	"	30.6		85.0	.123	51.5	.09	
		Apparently full at ~ 30.6"								
		Removed ~ 5.5 l & added ~ 1.5 l at $H/_{23}$ ~ 380 (Re-zeroed)								
11 43 A	"	"	14.6 up	6.00		12.5		5.0		
						12.5		5.0		
12 07 P	"	"	"	29.10		78.00	.160	50.25	.099	
12 16	"	"	"	29.75		255.0	.049	178.0	.028	
12 20	"	in		28.75		132.0	.095	87	.052	
12 32	"	in	8.2	29.75		79.0		51.25		
12 59	in	out	up	30.2		424.0	.0295	280.25	.0178	* Raised manifold - slight rise to ~30.5 in. > 30.5" bubbled up to 31.5. Lowered to 31.7. No change. Level shows slight drop at 30.00. Apparently full @ ~30.0"
		Within approx. .15" of crit when								
		25.1		25.25						
		∴ ~~24.55~~ + .15 =		~~24.7~~	× 509 =	~~12,570~~		12,850		cm³ = Crit. Vol (over)
		* Zero rechecked - high								~~40~~ .5"

Signed

Manifold Height (in)

NO. 340 - 10 DIETZGEN GRAPH PAPER 10 X 10 PER INCH EUGENE DIETZGEN CO. MADE IN U. S. A.

14

Date

Crit Mass = ~~12,570~~ 12850 × .04925 = ~~619~~ 633 ~~620~~ gm

Calc. of H/23 for Expts 38 & 39

.04675 × 1.67 = .07807

$\frac{.04675}{.1992} \times .335 = .00786$

.1428 × .00786 = .00112 H-O eq.

$H/23 = \frac{9152}{\cancel{.9230}\ .9219} \times 259 = \cancel{500}\ 514\ \cancel{517}\ \cancel{516}$ ✓

~~.04600~~
.04612

1.000
.0781
.9219
.0011
.9230

.07807
.00786
.08593

1.00000
.08593
.91407
.00112
.91519

V-31 (Last dilution used in Expt 38 & 39)

116.890
22.685
94.205 ✓

4.40 gm U

.04675 gm U/gm
.04612 gm 23/gm

1.0686 @ 24.2 °C

~~.04925~~ ~~.04925~~ gm 23/cc

~~.04925~~

.04928

Signed

Date 11-26-5~ Rohrer & Fox Expt 39 (Same as Expt. 38 except Water Reflector) 15

Time	Source	Control	Safety	Manl.				
					C_4		C_5	
2 10	In	Out	Out	6.00	~~25.25~~ ~~24.75~~	24.625	9.25 ~~8.00~~	8.625
2 31	in	out	out	30.0	~~69.00~~ ~~68.75~~	0.357	~~40.25~~	0.214
2 41	"	"	"	30.8	124.0	0.199	82.00	0.105
	Full at appx. 30.2 in.				Background re-check:			
2 53	in	~~Out~~	out	6.00	25.75		9.00	
2 59	"	"		"	26.50		8.75	

Rough comparison of M^{-1} tube full with corresponding value in Expt. 38 shows that Extrap. Cr.t. ht. is shifted appx. 0.8 cm ≈ ~~410~~ 407 cm^3

∴ ~~12,570 + 410 = 12,980 x .04485 = 641 gm.~~ 28 ~~638~~ 640

∴ 12830 + 410 = 13,260 x .04928 = 653

Signed

16 Date

See p. 83 B#1

Signed

Cont. from Page 1

#2	#5	#6	#7
Transferred to #1	✓ 4505.53	✓ 4458.28	✓ 4723.80
✓ 4409.08	4507.31	406.10	423.14
(?) 403.25	430.76	4052.18	4300.66
4005.83	4076.55		4340.46
4006.13	4074.77 error corrected		

Above bottles represented by V-31 — .04478 gm V/gm

187.29	190.56	189.44	201.06
	195.17		

See Page 18 all bottles transferred for wt. checking.
Balance zero (+1.20gm) with plaster on balance zero off +4.42 gm.

#8	#9 ✓
✓ 4697.92	3693.51
424.90	431.90
4272.97	3261.61
4273.02	
214.16 gmV	163.47 gmV ✓
214.14	

V-32 — 85.430 — ~~by phone 12/1 = 0.05010~~
11-28-52 — 22,466
Represents — 62.964 = 3.14 gm V ✓ — 0.05012 gm V/gm
Bottles #~~889~~
Changed to #788
next page

Signed

12-17-52 see preceding page.

#1	#4	#5 ✓
from #2	from #5	from #6
U-31	U-31 — (.04675	U-31
4413.74	4477.84	4482.60
407.10	403.10	430.66
4006.64	4074.74	4051.94
187.31 ~ gm U	190.49 gm U.	189.43 ✓

packed for shipping 1-26-53 Zero off total of + 4.42 gm.

#6 ✓	#7	#8
from #7	from #8	from #9
U-31	U-32	.05012 gm/gm U-32
13038	13038	
4705.80	4696.62	3686.37
406.10	423.14	424.75
4299.70	4273.48	3261.62
201.01 gm U	214.19 gm U	163.47 gm U ✓

7 & 8 packed for shipment 1-26-53

12-30 ~ ✓?

#9 Clean-up batch-Reactor washings → Sample U-33 68,353 gm 22,652 45.701 gm

~~431.65~~

3160.09
431.65
2728.44

.64 gm U

U-33 sent to 921 - 1/31/53.

1/31 Samples Req 13082 DC.

Results by phone 0.01399 gm U/gm

38.17 gm. U ✓

* changed to #12

Signed

Date 1-9-53 23-5 #10

(Composite of sample U-13 thru U-32)	1259.22 gm 252.62 1006.60 net	(Evaporated titration residues)	4894.60 gm. 887.30 4007.30 gm net

41.68 gm U sample taken before battler grossed. 40.719 gm U

Sample U-35	60.178 60.186 22.466 ~~357.728~~ gm net 37.72	U-34	186.114 * 186.218 22.579 163.639
	.04141 ✓		.01016 ✓
	1.56 gm U		1.66 gm U

Signed

* Probable error in 1st weighing

Date

U_{233} Oxyfluoride from ORNL

ORNL Data

Container No.	Date rec.	~~U of~~ Y-12 gms U	gms U	gms 23
~~FH-1~~				
FH-1 ~~47-33~~	Jan 14, 1953	359.36 ~~1,027.8~~	~~359.55~~ ~~367.79~~	354.98 ~~361.68~~
FH-2	Jan 26, 1953	329.15	~~331.54~~ 324.28	~~326.57~~ 320.13
FH-3		388.0	388.40	383.43
FH-4	3-10-53	561.20	562.80	556.04
FH-5	3-13-53	381.10	384.65	379.65
FH-6	3-26-53	237.40	239.34	236.23
			2259.02	
FH-7	~~4~~-7-~~33~~	1050	105.3	103.93
		2361.24 ✓	2364.32 ✓	

Container #23-3 contains pyette washings

Container #23-1A contains sample residues U-(32-38)(?) U-142, U-17-2, U29-2

7-8-53 Container 23-1A shipped to Y-12 – lab. U-20-2 U-24-2

Gross ~~#~~ 794.5 gm

275.6 Tare (old value)

518.9 gm net

= 14.14 gm U

Reg NO. 106325

02726 gm U/gm

[redacted]

UO_2F_2 FROM ORNL

Date 1-19-53

rec. 1-26-53

FH1

✓ 1667.95 (After sampling)
2 36.15 (X-10 wt) [238.95 - 2.81]
1431.80
12.58
1444.38

359.36 gm U (includes sample)

U-38 (1-19-53) (UO_2F_2)
35.387
22.807
12.580
3.13 gm U
Analysis .2488 gm U/gm (130391)

FH-2

gross 1475.09 before sampling
X10 tare 251.04
net 1224.05
× 0.2689
2/2 329.15 gm U.

Sample of FH-2 after gross wt take

U-20-2 (UO_2F_2)
(130392)
~~U Result by ...~~ 0.2689 gm U/gm ✓
36.661
22.548
14.113
= 3.79 gm U

2-12-53

FH-3

1799.85 gm Before sampling
269.11 — X-10 tare
1530.74

388.20 gm U

U-24-2 (2-12-53)

32.898
22.414
10.484 gm

(130393) .2536 gm U/gm ✓

3-13-53 (rec. 3-10-53)

FH-4

2582.90
224.91
2357.99

561.20 gm U ✓

U-14-2 (3-13-53)
130394

29.259
22.540
6.719 gm net

.2380 gm U/gm

Signed

Rec ~ 3-20
Date

FH-5
wt before sample
1731.84
234.91 (x-10)
net 1496.93 gm

FH-6
~ 3-26-53
1312.80
234.84
1077.94

U-17-2 sample (3-24)
130395
29.2556
22.5780
6.4776 gm net
1.65 gm U
0.2546 gm U/gm
381.1 ✓

U-27-2 (neg. 130396) 3-30-
29.7897
22.5724
7.2173
1.59 gm U
.2202 gm U/gm
ORNL - .298
237.4 ✓ gm

FH-7 (rec. 4-7-53)
795.48 gm gr
318.62
476.96 net
105.0 gm U ✓

356.23
321.15
388.20
561.20
381.10
237.40
105.00
2350.28

sample U-32-2
neg. 130397 (4-6-53)
27.5932
22.4175
5.1757 gm net 1.4 gm U

gm U/gm = .2202
ORNL - (.297)?

Signed

Date

Calibration of 5½" Dia. Vessel

1 l	7.0 cm	
2 l	13.8	
4 l	27.6	
6 l	41.2	
8 l	53.0	av. 6.83 cm/l
10 l	68.7	
12 l	82.3	area 146.4 cm²

Area of 5½" Dia is 152.8 cm²

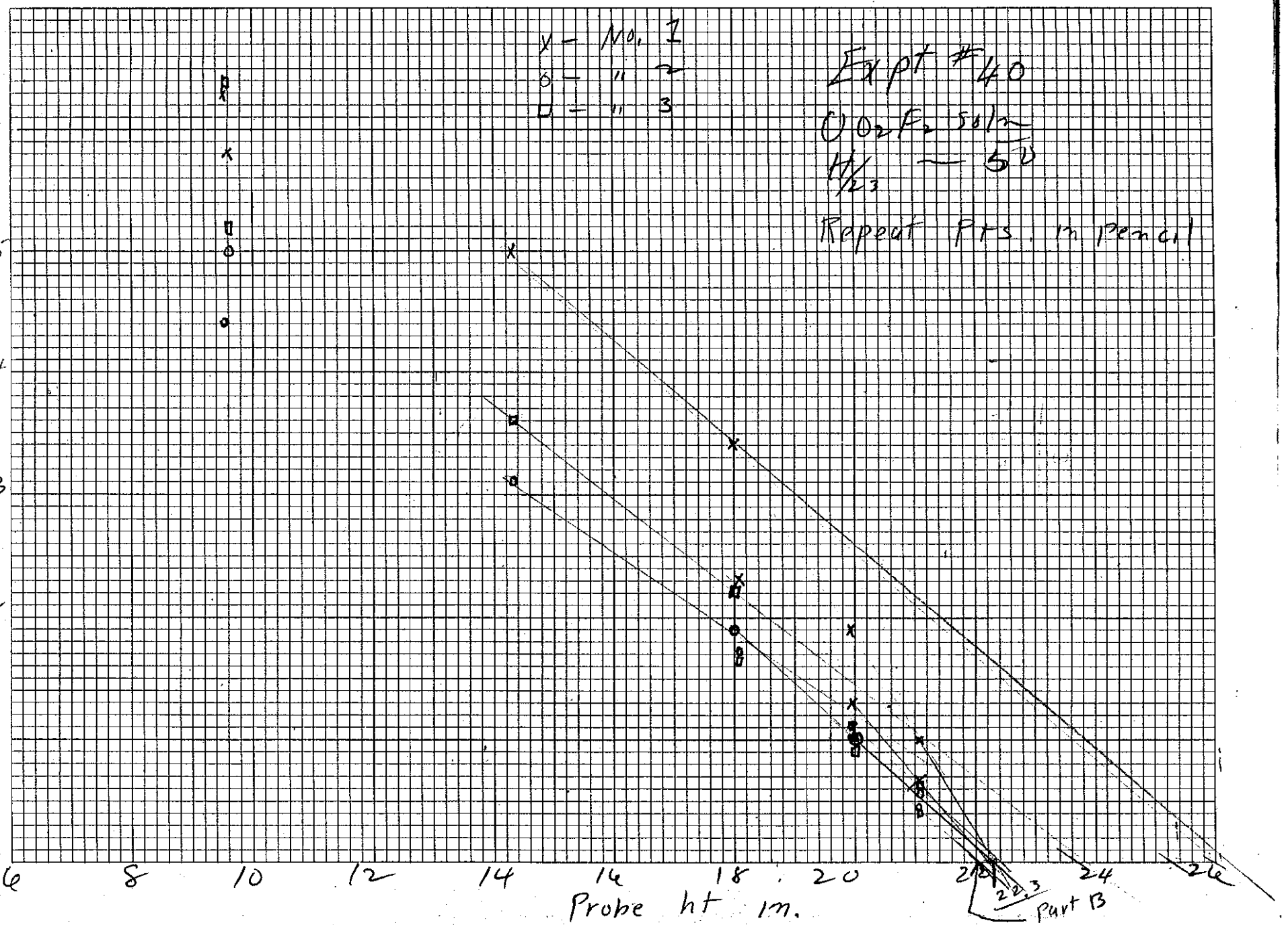
Calibration of 4½ Dia Vessel

2 l	20.7 cm	
4 l	41 2 "	av. 10.15 cm/l
6 l	61.7 "	
8 l	82.1 "	area = 98.5 cm²

Calibration of 6.75 Equatorial R.

1 l	4.6 cm	3.4 /
2 l	9.1	av area = 14.5
3 l	13.6	= 218.
3.6 l (taper begins)	14.5	
3.69 l full	19.1	

Signed



Date 6-29-53 Gilley Foy Rohrer

Expt #40 UO_2F_2 Soln. 27

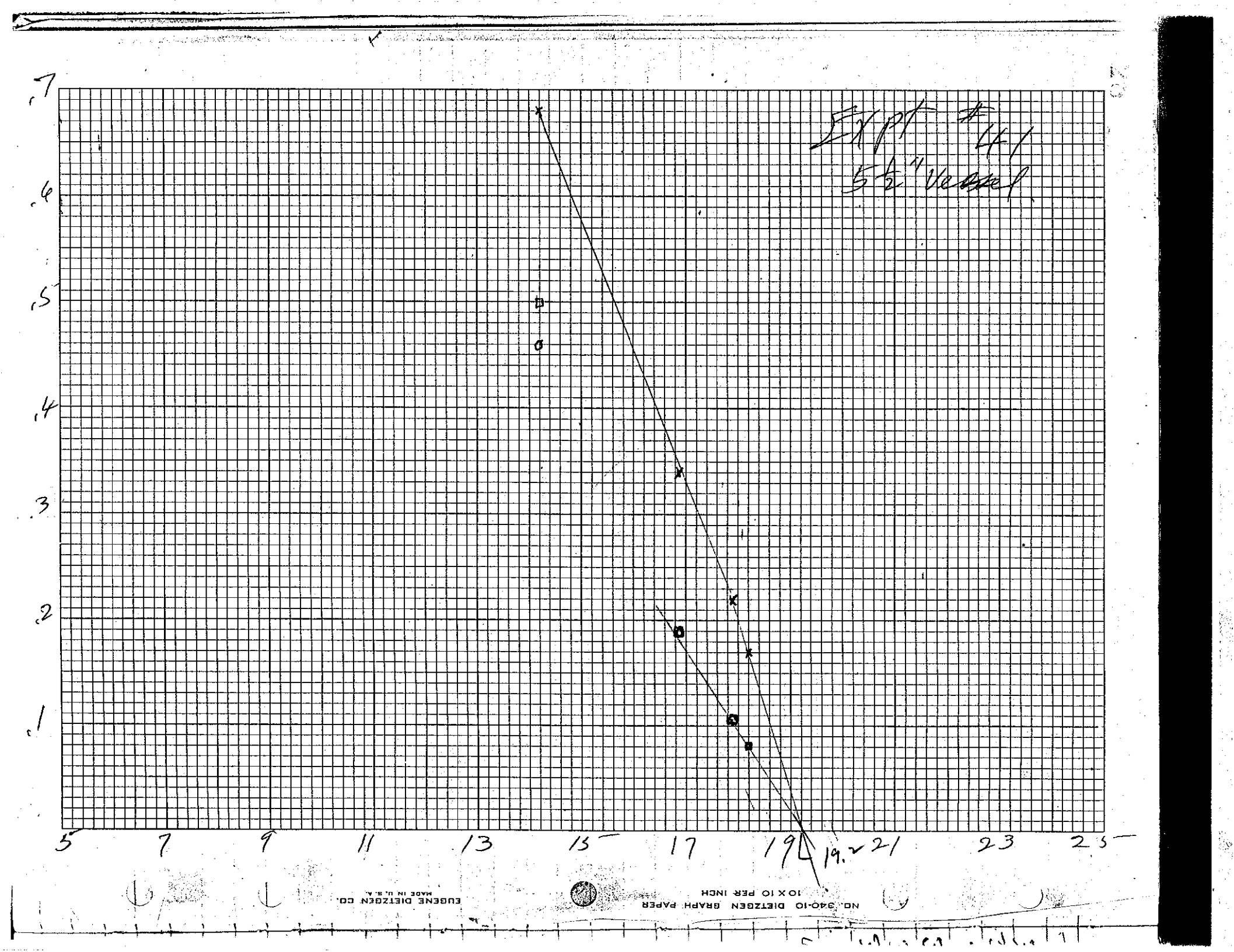
Part A 5" Vessel #/23 ≈ ~~50~~ 74.1

Time	Source	Safety	Probe	Mani.	#1		#2		#3	
2 35	In	up	.15"	~0	8.75	9.0	22.0	21	4.75	4.5
2 40	"	"	" "	"	9.0		20.5		4.0	
2 55	"	"	4.60	8.0"	10.75		27.75		~~5.0~~	
3 13	"	"	9.55	15.5	12.25	x	43.75	0	—	□
3 20	"	"	"	"	14.25	.63	48.0	.44	7.0	.64
3 39	"	"	14.31	22.75	17.75	.50	66.5	.31	12.5	.36
3 58	"	"	17.97	28.30	26.25	.34	111.5	.19	20.5	.22
4 07	"	"	19.95	32.75	47.5	.19	201.	.10	46.25	.11
			21.10	43.05	87.	.10	386	.055	75.0	.06
6-30-53 Gilley Foy			B Repeat for mixing.							
8 47 AM	in	up	1.0"	3.00	6.75 / 6.50	6.5	24.0	24.0	~~4.0~~ 3.5	3.75
9 05	"	"	"	"			24.0			
9 33	"	"	9.57	15.50	11.25	.58	48.0	.50	7.25	.52
	"	"	18.04	28.4	28.5	.23	139.0	.17	22.75	.164
			19.96	32.8	49.25	.13	240.25	.10	42.26	.089
21 x 2.54 = 53.3 cm 53.3 x 12.54 = 6.70 l			21.05'	44.	101.25	.064	536	.045	94.75	.04
			Ran out of Soup							

Extrapolated crit ht. = 22.3" ≈ 56.60 cm ✓

Est crit. vol. = 56.6 x 125.4 ≈ 7100 cm³ ✓

Est. crit mass ≈ 7100 x 3.325 = 23609m ✓


Expt #44
5½" Vessel
.7
.6
.5
.4
.3
.2
.1
5
7
9
11
13
15
17
19
19.2
21
23
25
EUGENE DIETZGEN CO.
MADE IN U.S.A.
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

Date 6-30-53
Galley, TAX

Expt 41
3½" Vessel

#4/23 ~~-30~~
74.1

Time	Source	safety	Probe	Manifold	C_1		C_2		C_3	
3 pm	in	up	0	~~180~~	6.4		15.0		~~3.5~~	
3.05	"	"	7.72	13.5	7.0	.8	17.25	0	3.25	0
—	"	"	11.18	19.0	8.0	.8	20.5	1.75	3.75	.84
3.36	"	"	14.20	24.0	9.5	.68	32.5	.446	6.50	.58
3.43	"	"	16.90	28.50	18.5	.34	79.75	.189	17.25	.189
3.57	"	"	17.90	31.50	28.75	.22	141.50	.104	31.25	.104
18.22 x 25.4 = 46.25 cm			18.23	44.0	37.75	.17	185.5	.081	39.50	.082
46.25 x 146.4 = 6.77 ℓ				Out of John.						

Extrap. Crit. ht 19.2"

19.2 x 2.54 = 48.75 cm³ report 48.70

~~4870 x .3322 = 1619.4 → 1620~~

48.7 x 146.4 = 7130 cm³

7130 x .3322 = 2368 → 2370

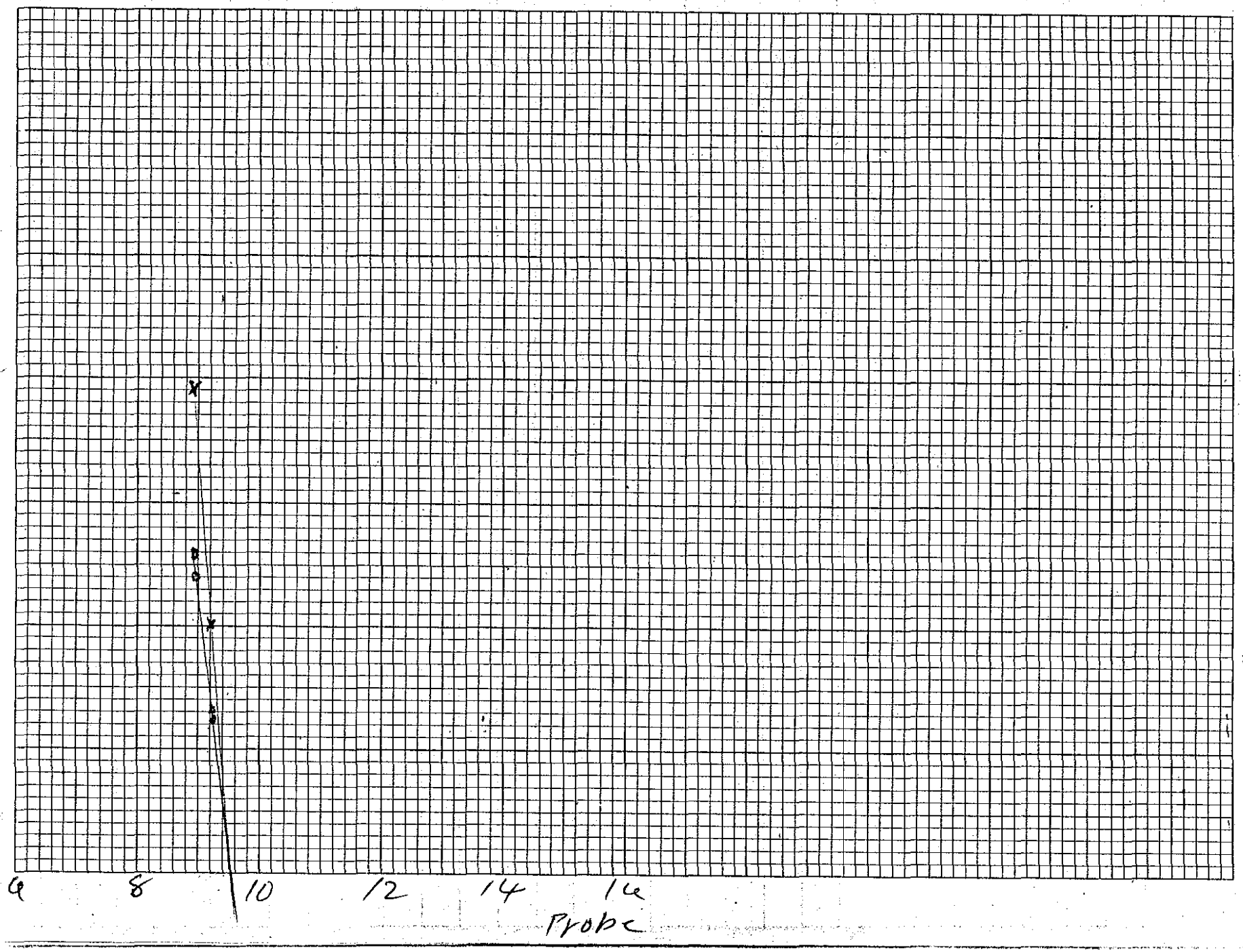
The above experimental result is not consistant with Expt. 40. ~~A possible explanation is both in the paraffin around the 5½" vessel.~~ The total volume of John check fairly well. (1-21-54)

Better explanation is the poisoning effect of the Urochrome lining 50% Cl

Signed

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



Date 7-1-53

Expt #42

6" Dia. Vessel

H/D — 74.1

Fully Top

Time	Source Safety	Probe in.	Man.	C_1		C_2		C_3	
11⁰⁰	in up.	3.80	9.0	12.5		39.0		7.75	
11²⁰	" "	8.95	14.8	31.75	.39	160.75	.24	30.0	.26
11³⁰	" "	9.22	17.35	62.5	.20	317.5	.123	59.5	.13
1⁰⁰ PM	out "	9.45	slightly	unst.					
1³²	" "	9.46	"	super crit.					

9.46 × 2.54 = 24.0 cm crit ht.

24.0 × 179.5 = 4310 cm^{-3}

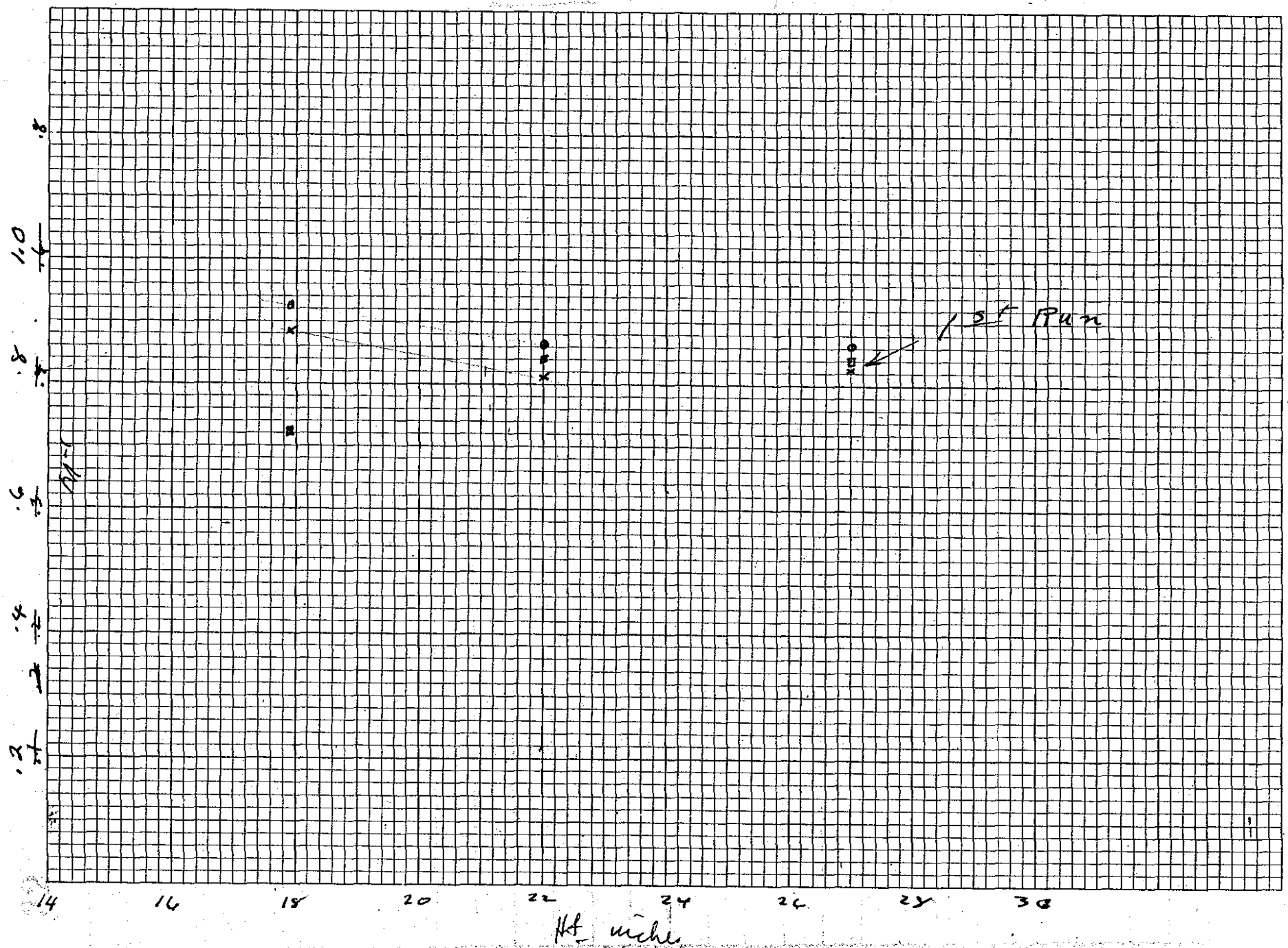
4310 × 3322 =

Crit Mass = 1430 gm

Signed

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



7-2-53
J. Dabley
Fox

Expt 43
$4\frac{1}{2}$ in Dia Vessel

H/23 = 50/74.1

Time	Source	Safety	Probe	Manifold	C_1		C_2		C_3	
8^{37} AM	in	up	~5.5	—	9.25		34.0		5.25	
9^{06} A.M.	in	up	16.92	25.0	10.25	0.926	38.5	0.883	7.25	0.725
9^{24}	in	up	22.0	32.0	11.0	0.864	42.0	0.81	6.25	0.84
9^{35}	"	"	26.97	59.0	11.0	0.864	40.75	0.~~85~~ 823	6.5	0.84

Apparently forgot to fill blade annulus with H_2O

Repeat after filling annulus ~2 l.

Time	Source	Safety	Probe	Manifold	C_1		C_2		C_3	
10^{23}	in	up	17.00	25.0	10.75		40.25		7.00	
—	"	"	22.40	32.5	10.75		41.5		7.00	
10^{44}	"	"	27.00	49	11.0		40.5	.84	8.0	.66

Result essentially same as above.

Calc. of total inventory from above

$27.0 \times 25.4 \times 98.5 = 6760 \text{ cm}^3$

See previous vol. Expt 40

Signed

34 Date

Calc. of H/23 for Expt 40-44:

.2425 gm U/gm from analysis

.2425 × .986 = .2392 gm 23/gm

1.2425 × 1.3 = 3158 gm salt/gm

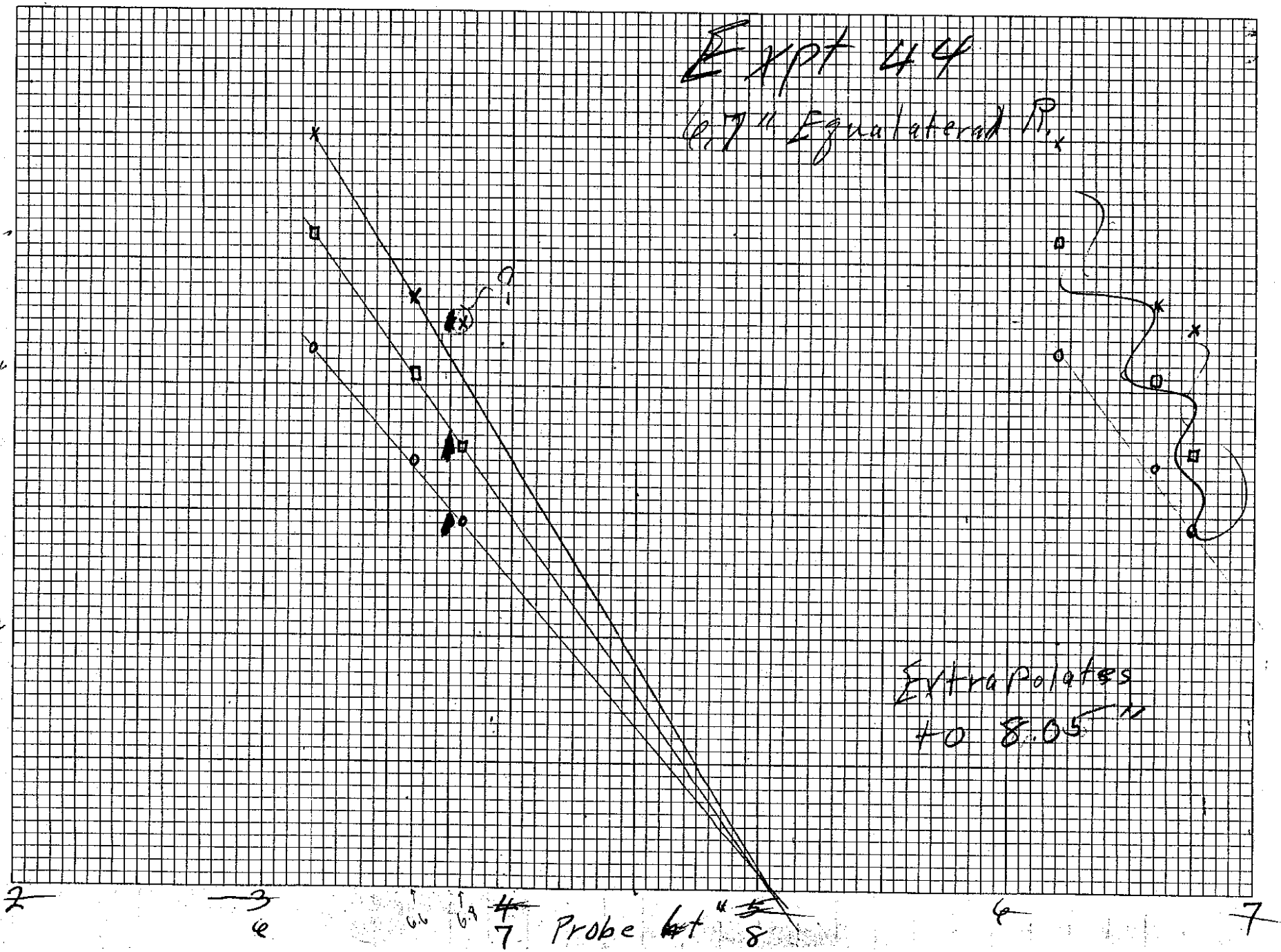
.0020 × .45 = .0009 gm H_2O

$$H/_{23} = \frac{25.9 \times .6845}{.2392} = 74.1$$

After HF correction $H/_{23}$ = 74.0

1.000000
.315800
.684200
.0020 gm HF
.6825 gm H_2O
.0009
.6834

Signed



Date 8-2-53 Gilley Fox ✓

Expt 44

6.7 " Equilateral Vessel

Time	Source	Safety	Probe	Manifold	C_1		C_2		C_3	
3[25]	in	up	0.0	0.0	9.25		27.0		6.5	
3[44]	"	"	6.18	12.0	15.25	.60	63.25	.43	12.5	.52
3[53]	"	"	6.60	12.8	19.5	.47	80.25	.34	16.0	.41
4[05]	"	"	7.5	13.6	20.5	.45	91.5	.29	18.5	.35

System not crit when full

~~Extrap. crit ht. = ~ 8.05" = 20.45 cm~~

~~Est. Crit Vol. = 20.45 x 218 = ~ 4460 cm³~~ ✓

~~4460 x .3322 =~~

~~Est Crit Mass = ~ 1480 gm~~

Since all other expts with 6.7" Vessel indicate M^{-1} curve dips downward near critical, a more reasonable Ext. Crit ht. = ~7.5" x 2.54 = 19.05 cm

19.05 x 218 = ~4150 cm³

4150 x .3322 = ~1378 ≈ 1380 gm

1.388 x .23935 = .3322 gm 23/cm³

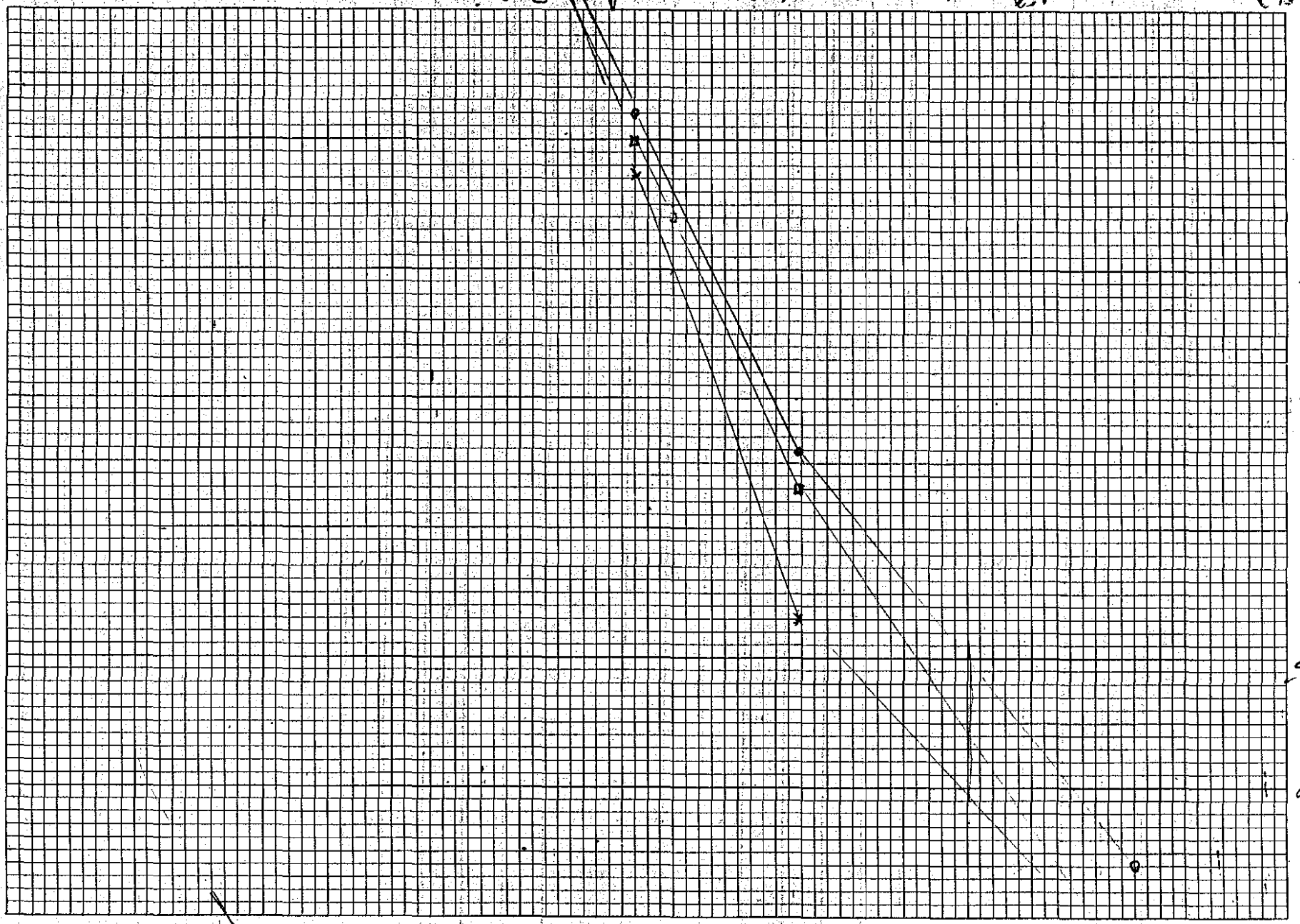
	43.3581
sampled 7-3-53 U-19-2	22.8635
Used — Expts 40-44	20.4946 gm net
~~Reg. No. 130398~~	✓ .23934 gm 23/cm

Assay: 98.68% U-233 ✓ .2425 gm U/gm

.572% U-234 ✓ sp. gr. 1.388

.034% U-235 Signed

.712% U-238 ✓ Free HF = .002 gm HF/gm.



Date 7-7-53
Gilley
Fox

Expt #45 — After concentrating
6.7" Equilateral Reactor #/23 = 48/46.0
Total Vol. of Salt — 4.3 l.

Time	Source	Safety	Probe	Manifold	C_1 9.25		C_2 31.0		C_3 7.0	
945	in	up	2.30"	10.0*	9.0	9.5	30.5	31.5	7.25	6.75
1000	"	"	4.90	13.75	12.5	.74	47.0	.75/.66	9.25	.75
1023	"	"	~~15.92~~ 6.00	16.30	19.5	.47	91.0	.34	18.75	.37
1037	"	"	6.55	17.70	71.5	.129	383.5	.081	69.5	.101
—	out	"	6.60	Sub-crit						
1058	"	"	6.63	Super-crit.						✓

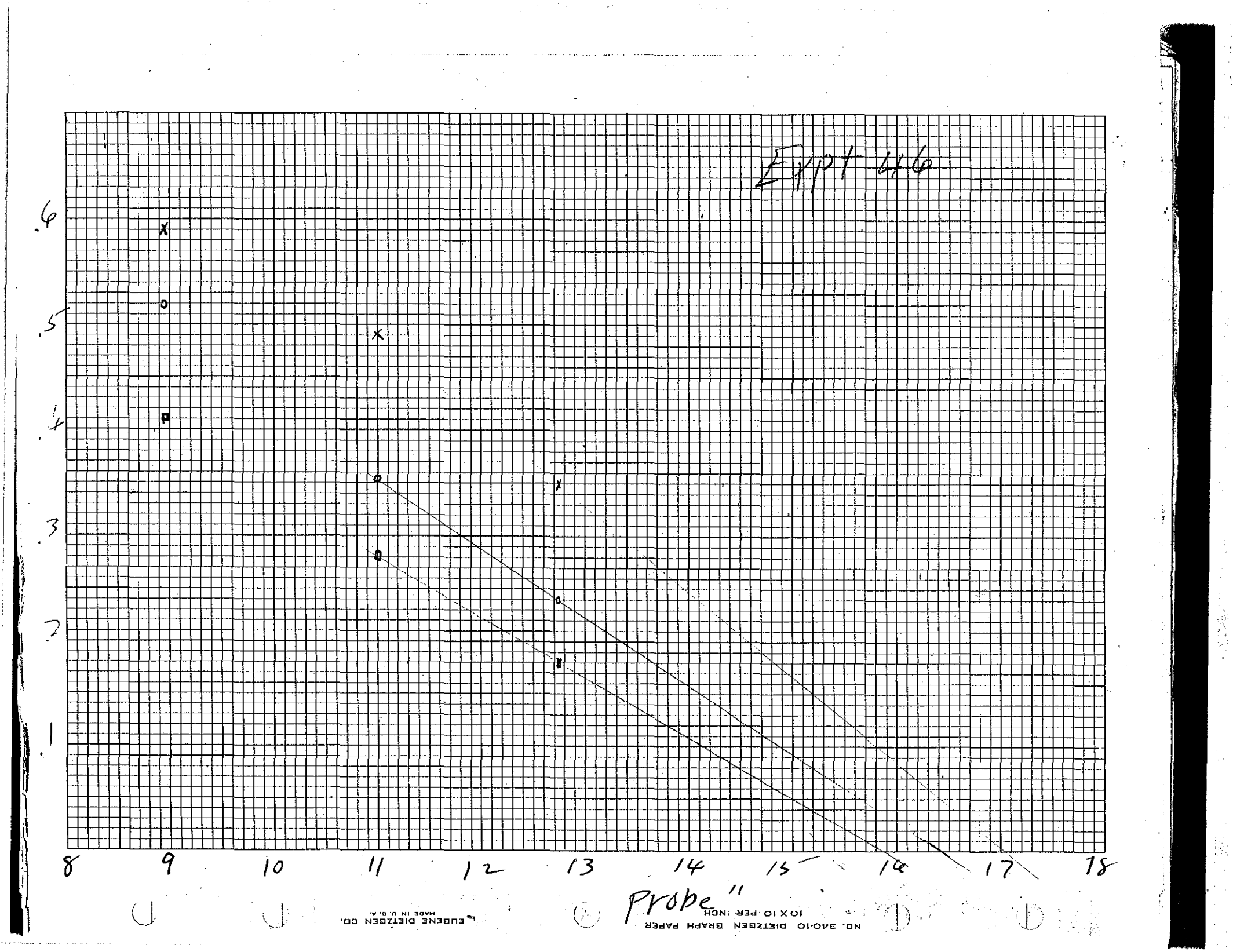
Crit Vol. = 6.63 × 2.54 = 16.84 cm × ~~218~~ = 3.67 l

Crit Mass 3,670 × .5190 = 1905 gm ✓

Air gap = ~~2~~ .3 cm

Signed

* not re-zeroed


Expt 446
.6
.5
.4
.3
.2
.1
8
9
10
11
12
13
14
15
16
17
18
Probe "
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U.S.A.

Date 7-7-53 Gilley Fox

EXPT. #46
5" Dia Vessel

$t_{1/2}$ 3 = ~~40~~ 39 ~~46.8~~ 45.9

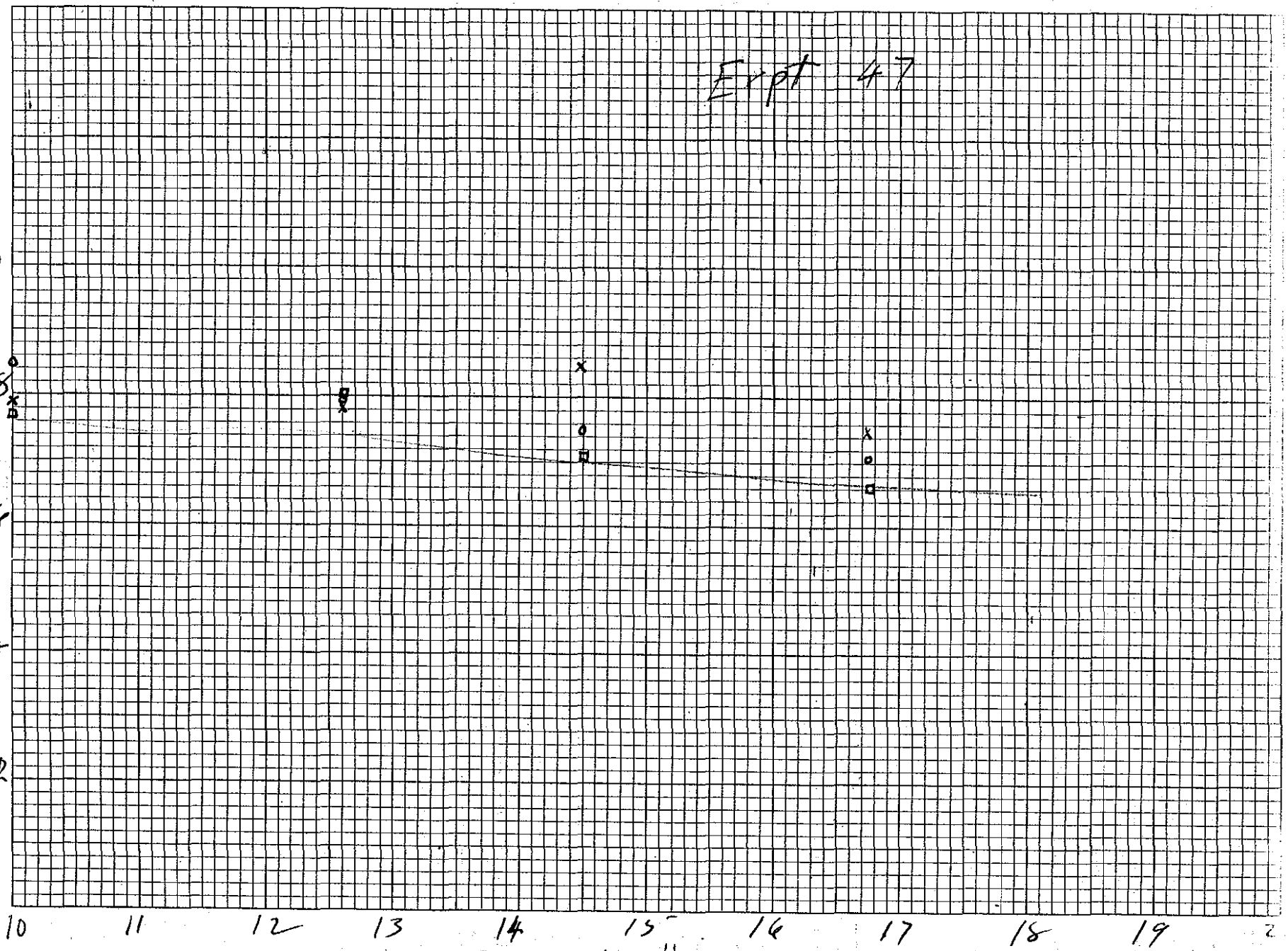
Time	Source	Safety	Probe	Manifold	C_1		C_2		C_3	
2 08	in	up	2.70	3.65	9.75		33.25		4.25	
2 25	[illegible]	"	8.95	12.0	16.5	.59	64.0	.52	10.5	.41
2 37	in	"	11.03	16.0	17.75	.49	93.75	.355	15.0	.28
2 47	"	"	12.74	29.0	28.0	.35	137.0	.24	23.5	.181

Est. Extrapolated Out ht ~ 16.5" ≅ 41.9 cm

41.9 × 125.4 ≅ 5260 cm³ report 5200

.5190 × 5260 = ~ 2730 g
report ~ 2700 ✓

Signed



Date 7-8-53 Gilley, Fox

EXPT #47
4 ½" Vessel

#/23 — ~~48~~ ~~45.0~~ 459 ✓ 41

Tissue	Source	empty	Probe	Mani-	C_1		C_2		C_3	
8 48 AM	in	up	3.75	3.25	8.75	8.85	31.0		4.75	
				"	9.25		34.0	33.0	4.75	5.0
8 54	"	"		"	8.5		32.0		5.5	
9 13	"	"	9.97	12.01	11.25		—		6.75	
9 18	"	"	~~10.~~ "	"	10.5	.79	39.0	.85	6.5	.77
9 25	"	"	12.62	15.82	11.25	.78	42.0	.79	6.25	.80
9 34	"	"	14.52	18.63	10.25	.85	43.75	.75	7.0	.71
9 50		"	16.75	29	12.5	.75	46.0	.71	7.75	.66
9 52	"	"	"	"	11.0		47.0		7.50	

Manifold empty

Extrapolate to ∞

Signed

Date

Calc. of H/23 Expt 45-47

.3279 gm V / gm. X .986 = .3230 gm 23 / gm

3279 x 1.3 = .42627 gm salt/gm

$H_{23} = \frac{25.9 \times .5739}{.3236}$

1.00000
42627
.57373 gm H_2O / gm

$= \frac{45.9}{46.0}$ ✓

using .324 gm V/gm $\frac{1.000}{.421}$ / .579

$\frac{.579 \times 25.9}{.3196} = 47.0$

Calc. H/23 for Expt 48-49

.2989 x 1.3 = .38857

1.000000
.38857
.61143

$\frac{.61143 \times 25.9}{.2950} = 53.7$ ✓

Signed

Date 7-8-53
Gilly, Fox

Expt #48
4½ Dia. Pipe

$H/_{23} \approx$ ~~50~~ 53.7
Added 700 cm³ H_2O

Time	source	safety	Probe	Manifold	C_1		C_2		C_3	
12^18	in	up	3.50	20	10.5	10.75	32.5	33.5	5.5	5.5
	"	"	"		11.0		34.5		5.5	
ran all soln in for mixing										
12^37	"	"	19.24	34.	12.0	.90	45.25	.76	7.5	.71
	* "	"	"	"	12.		43.0		8.0	system empty
1^07	"	"	12.97	15.3	11.5	.93	40.5	.81	6.0	
	"	"	"	"	11.5		42.25		6.25	.87
			17.11	21.3	12.5	.86	45.0	.75	7.0	.79
1^30	"	"	19.28	34	11.5	.93	43.5	.77	7.5	.74

19.28 × 2.54 × 98.5 = 4825 cm³
4825 × .4513 = 2180 gm in manifold

Extrapolate to ∞

.3236 ~~.3235~~ gm 23/gm

Soln used in Expts 45-47) 57.0882 ✓ .3279 gm U/gm
U-25-2 22.6395 ✓ sp. gr. 1.604
Reg No. 130399 34.4487 gm net

.3236 × 1.604 = .5190 gm/cm³

using value of gm U/gm from curve accepting density value

* lowered manifold to zero.

Date 7-9-53 Gilley, Fox   Expt # 49   6.7" Vessel   H/U 23 ~ 80   (53.7)

Time	source	safety	Probe ht.	Manifold	C_1		C_2		C_3	
8:32	in	up	1.05	3.41	7.0		29.0		11.25	
8:58	"	"	6.10	12.70	17.75	.395	85.0	.34	27.0	.42
—			6.~~80~~75	13.85	48.5	.145	250.	.116	70.	.16

apparently full at ~6.8" - little further increase in activity

9:21	"	"	7.70	147	550	.127	247.	.108	75.	.15

Extrapolated crit. ht. = ~7.1"

~~Est. Crit. vol~~ = 218 x 7.1 x 2.54
= 3930 cm³ ✓

Crit ~~vol~~ mass = 3930 x .451~~3~~ = 1773
report 1770 ✓

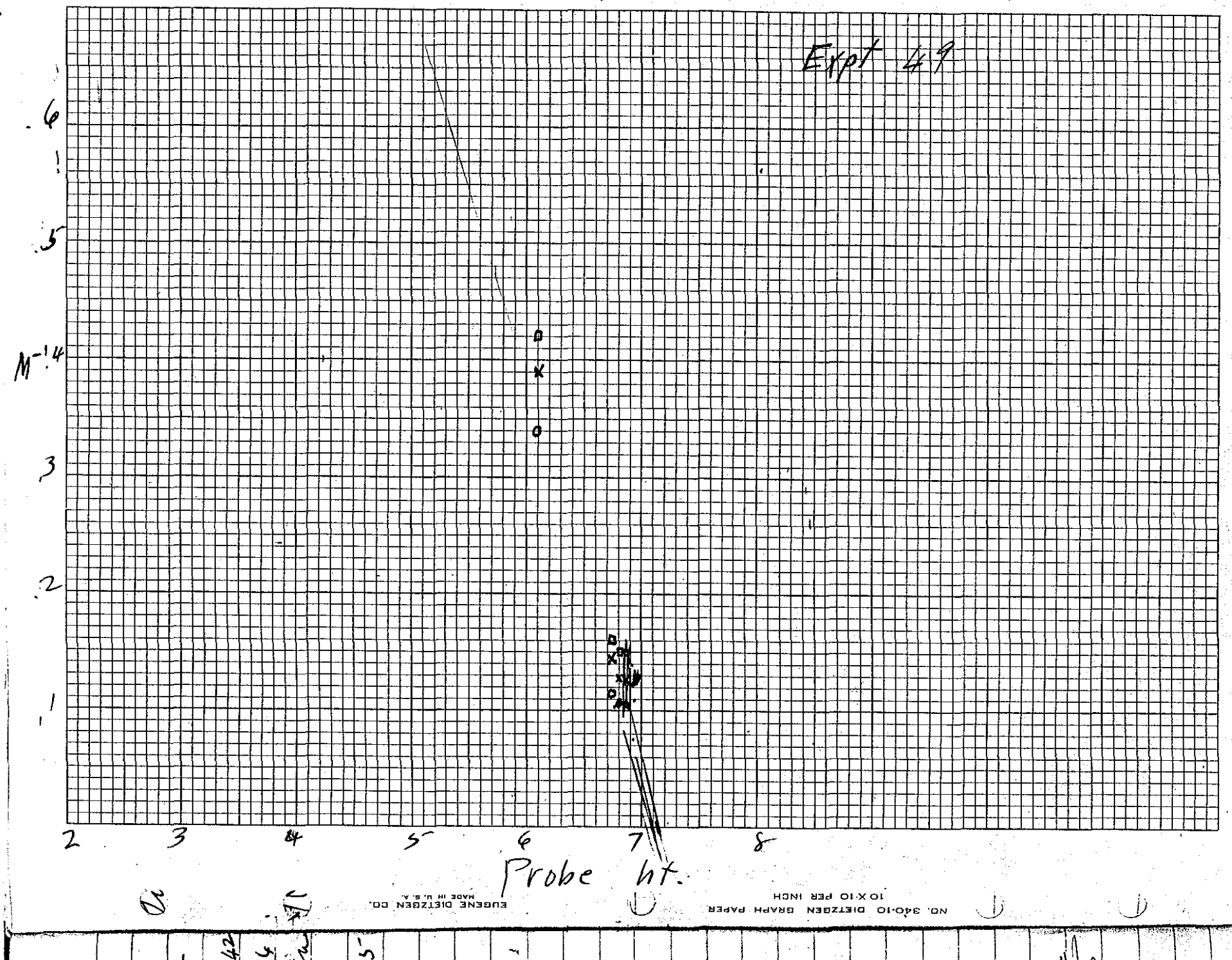
Expts. 48 - 49   U-40   38.6075   ✓ .2989 gm U/gm (→ .2950 gm U/gm)
Reg # 105~~3~~
19.6505
18.9570 gm net.   ~~1.388 gm/g.~~

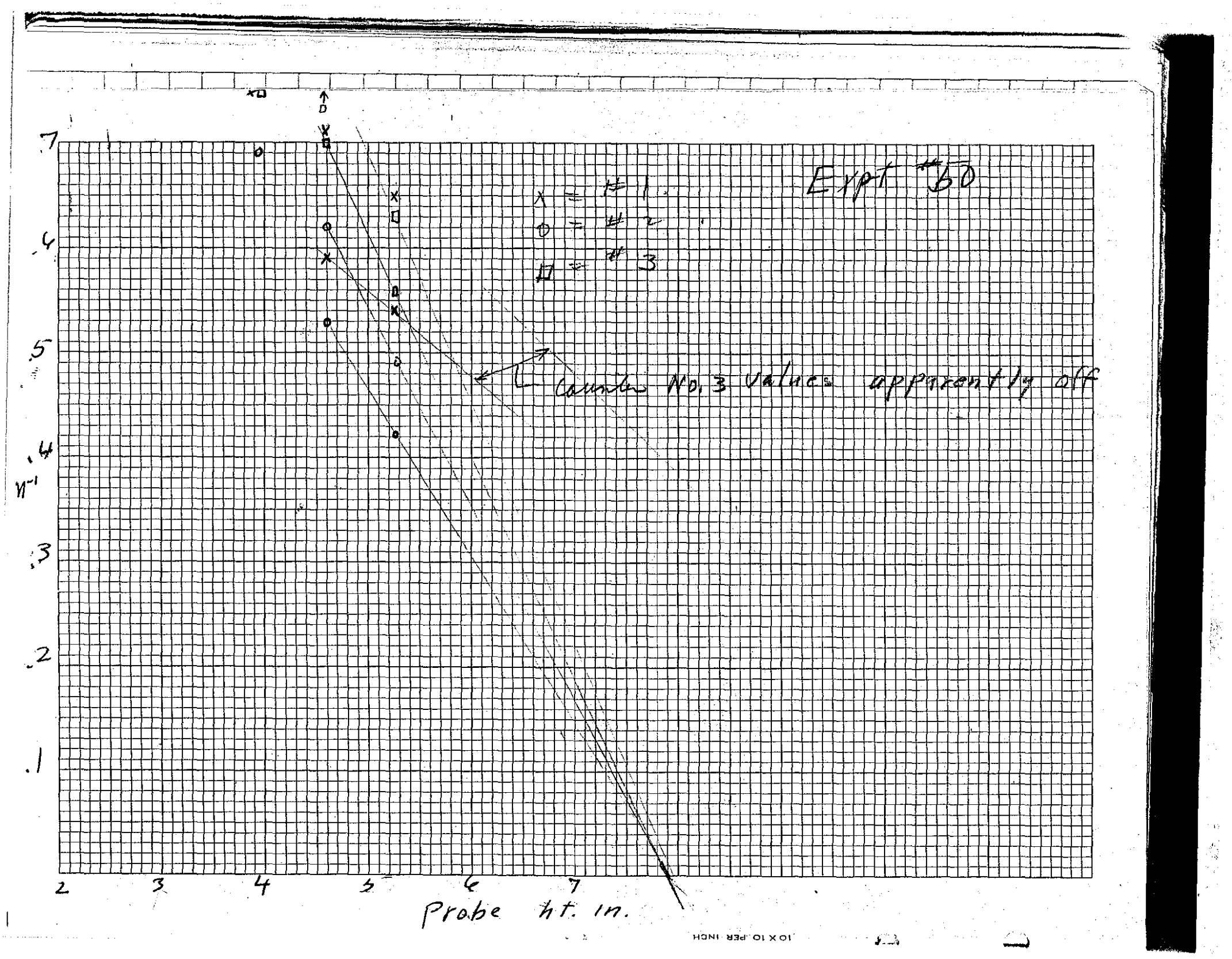
~~Free HF = .0025 gm HF/gm~~

✓ 1.530 gm/g.

.2950 x 1.530 = .45135 gm/cc

Signed


Expt 44
.6
.5
M-1.4
3
.2
.1
2
3
4
5
6
7
8
Probe ht.


Expt #60
x = #1
o = #2
□ = #3
Counter No. 3 values apparently off
n⁻¹
.7
.6
.5
.4
.3
.2
.1
2
3
4
5
6
7
Probe ht. in.

Date 7-10-63 Lilly Fox

Expt 50 — 6.7" Dia. Vessel — H/U - 34.2 — After further Evaporation*

Time	source	safety	Probe ht.	Manifold	C_1		C_2		C_3	
9 42	in	up	.92		8.25		29.5		11.0	
10 04	"	"	4.60	14.25	14.0	.59	55.2	.53	15.75	.70
10 22	"	"	5.25	17.2	15.25	.54	69.75	.42	19.5	.56
10 28	"	"	5.31*	24	16.25		70.75		20.75	
10 53	"	"	3.95	11.45	11.0	.75	43.0	.69	14.5	.76
			← Background to compare with Expt #45							
11 12	"	"	2.30		10.0 / 9.75	9.9	34.5 / 33.75	34.2	12.75 / 12.00	12.3
		Re-calculation:	5.25		15.25	.65	69.75	.49	19.5	.63
			4.60		14.0	.71	55.25	.62	15.75	.78

Long Extrap crit ht. = ~ 7.9" ≅ 20.05 cm

20.05 × 218 = ~4370 cm³ ✓

Est Crit Mass = ~ 4370 × .6835 = ~2990 ✓

Probe ht. in.

U-41 — Reg. 105327

46.5035
20.2535
26.2500

.3795 gm 23/cm³
✓ .3848 gm U/gm
✓ sp. gr. 1.81 × .3795 = .6835

H/23 calc:

1.3 × 3845 = .5000

1.0000
.5000
0.5000 gm H_2O/gm

H/U233 = 34.1

$\frac{25.9 \times .5015}{.3795}$ = 34.2

1.00000
.49985
.50015

* System empty

* Total Vol. of soln. Signed 3.5 liter Calc. 2.93

Date 7-10-53
Jilly
Fox

Expt #51 $4\frac{1}{2}$" D. Reactor

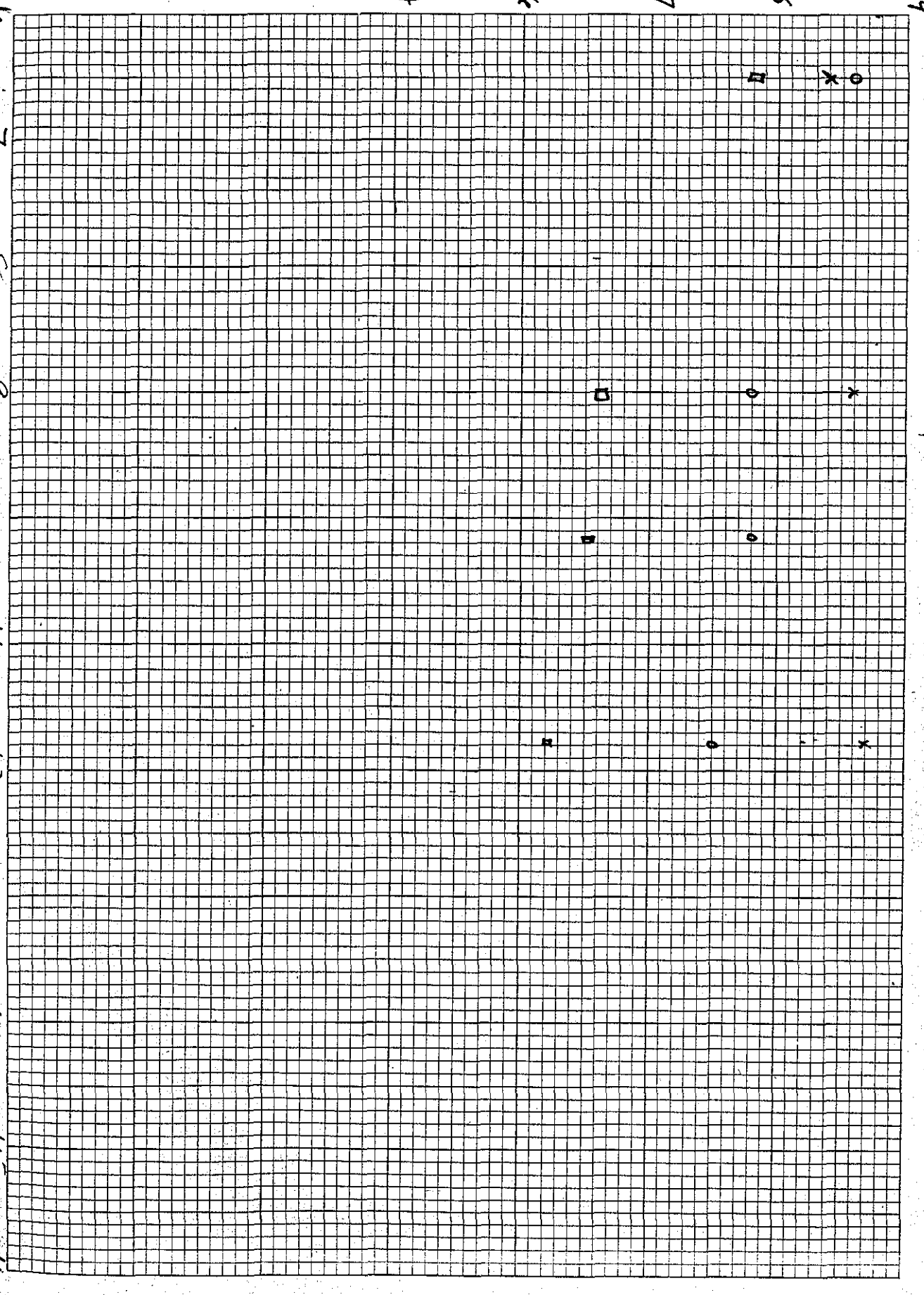
11/23 — 342

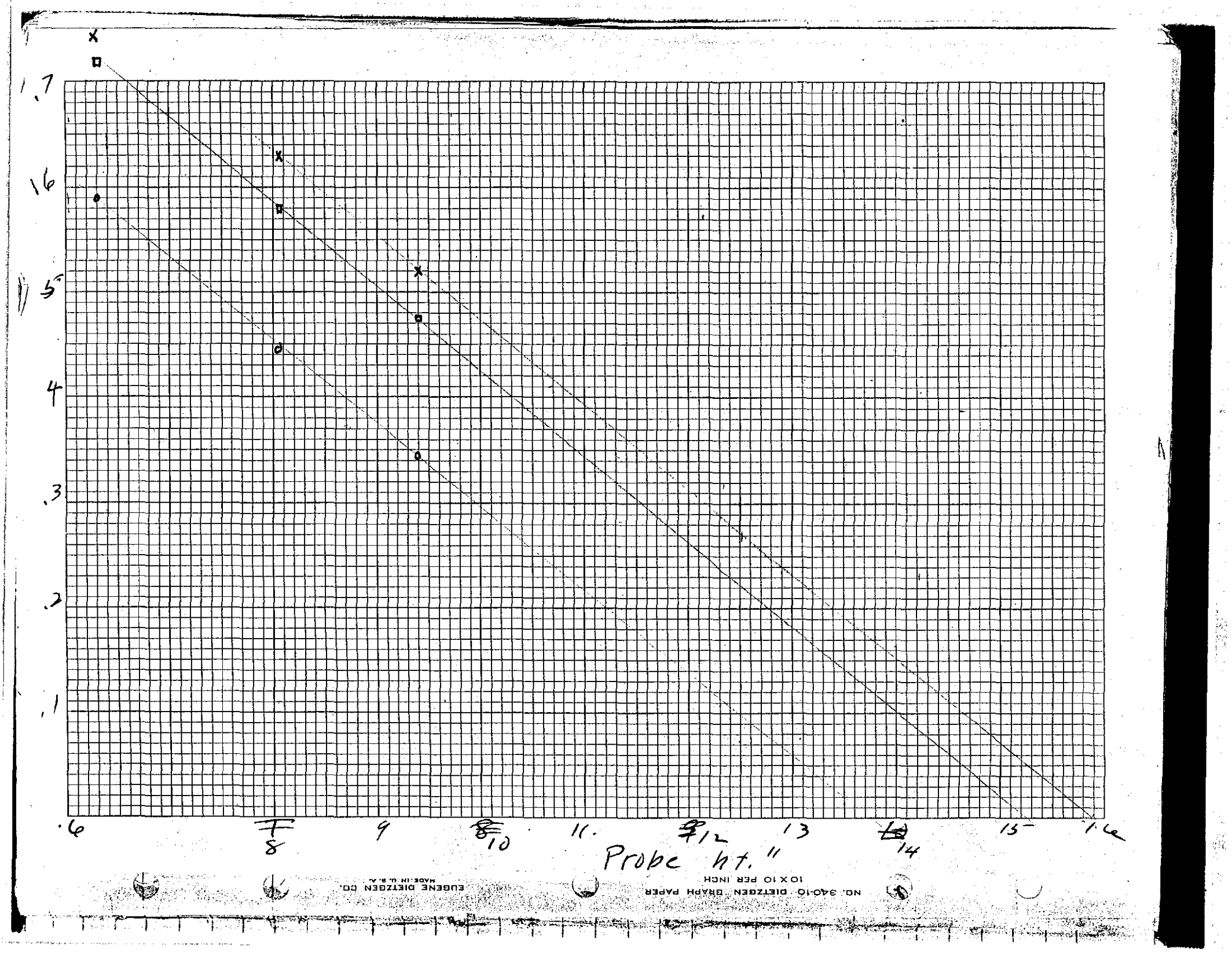
Time	source	Safety	Probe	Man.	C_1		C_2		C_3	
1 33 PM	in	up	2.35	7.3	10.5	10.5	33.5	34.0	7.0	7.25
1 38	"	"	"	"	10.5		(37.0)		7.75	
1 53	"	"	6.48	13.0	12.5	.84	39.5	.86	9.25	.78
2 05	"	"	9.00	14.7	12.25	.86	43.75	.78	11.0	.66
2 22	"	"	10.16	18.75	10.75	11.1	42.25	43.5	11.5	11.1
2 24	"	"	"	"	11.5	.95	44.75	.78	10.75	.65
2 36	"	"	11.77	—	12.0	.87	45.5	.75	11.75	.62
					12.0		46.0		12.25	

Noted an appreciable amt. of ppt. in soln

Extrapolates to ∞

Signed


10 X 10 PER INCH


1.7
16
5
4
.3
.2
.1
.6
8
9
10
11.
12
13
14
15
Probe ht. "

Date 7-10-53
Gilley
Fox

Expt. #52
5" D. Reactor

H/25 = ~~38~~ 34.1

Time	source	safety	Probe	Man.	C_1		C_2		C_3	
3^{38}	"	up	1.87	6.0	9.0		26.25		12.0	
—	"	"	6.29	12.96	12.0	.75	44.75	.59	16.75	.72
4^{06}	"	"	8.04	15.80	14.25	.63	59.0	.445	20.75	.58
			9.38	—	17.25	.52	74.0	.345	25.25	.475

Long Extrap Crit ht. ~ 15" = 38 cm

~~38 X 125.6 = ~4770~~ repeat 4800 cm^3

~~4~~800 X .6835 = 3280 gm ✓

Signed

Date 7-13-53
[signature] 70X

EXPT. #53 added 600 cm³ H₂
5" Dia. Reactor H/23 ~ 39.4 ✓

Time	source	safety	probe	Manifold	C1		C2		C3	
10 14	in	up	.96	4.0	7.75	7.4	27.75	28.0	10.5	10.
10 19	"	"	"	"	7.0		28.25		10.75	
10 29	"	"	5.49	10.87	11.25	.66	41.75	.67	14.0	.7
10 37	"	"	8.40	15.50	12.5	.59	57.0	.49	20.25	.5
10 44	"	"	10.87	—	18.75	.395	81.75	.34	29.25	.34
10 53	"	"	9.63	17.50	14.0	.53	66.5	.42	24.75	.4

Long Extrapolation crit ht. = ~16" = 40.6 cm
40.6 × 125.6 = ~5100 cm³
5100 × .6015 = 3060 gm ✓

U-42 49.5010
Reg. 105328 19.5545
29.9465 ✓ 1.707 sp. gr.

.3523~~5~~ 6 gm 23/gm
✓ .3570 gm U/gm

1.707 × .35236 = .6015

H/U233 = 39.4

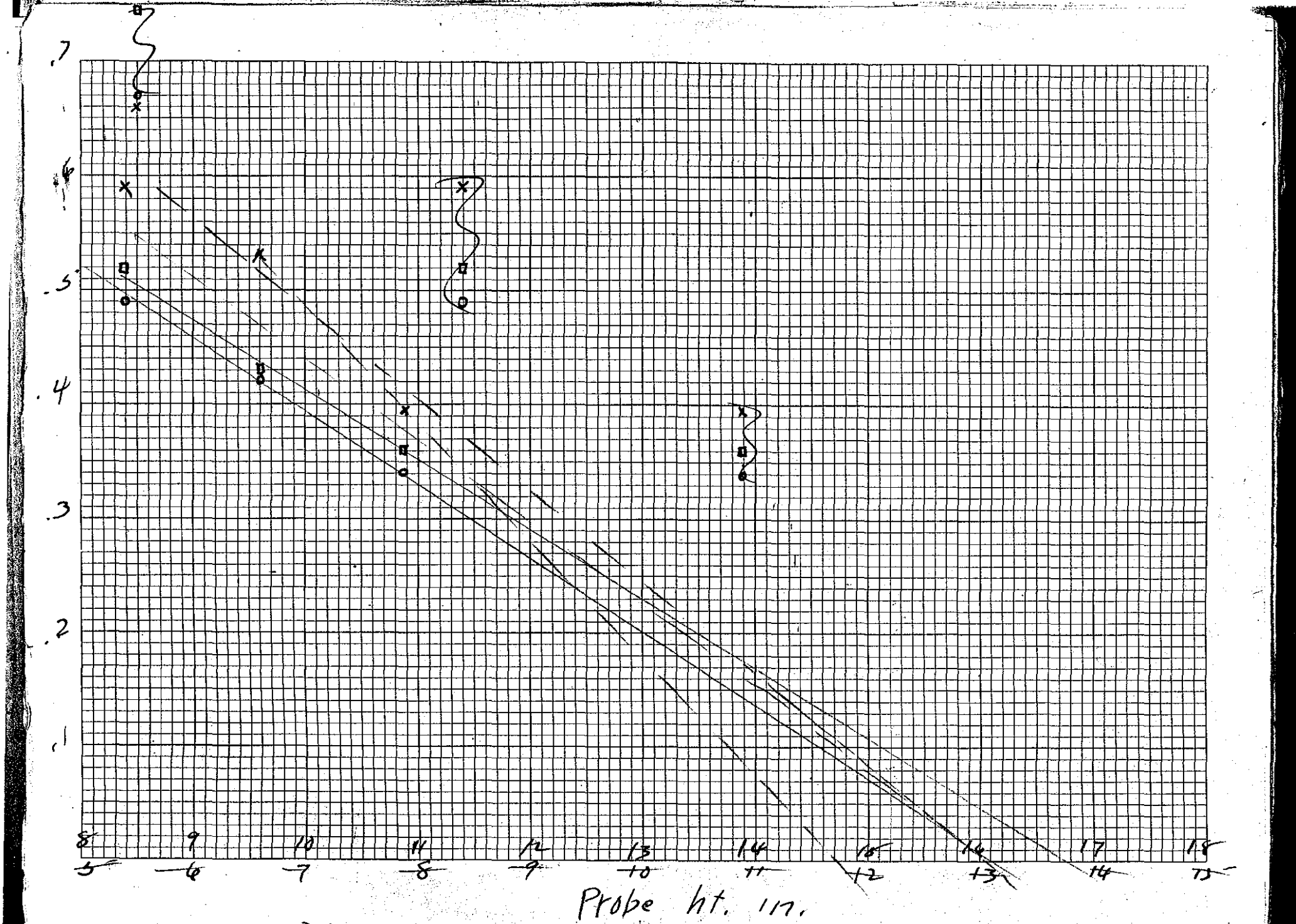
H/23 calc:
1.3 × .3570 = .4641

1.0000
.4641
.5359

$\frac{.5359 \times 23.9}{.35236} = 39.4$ ✓

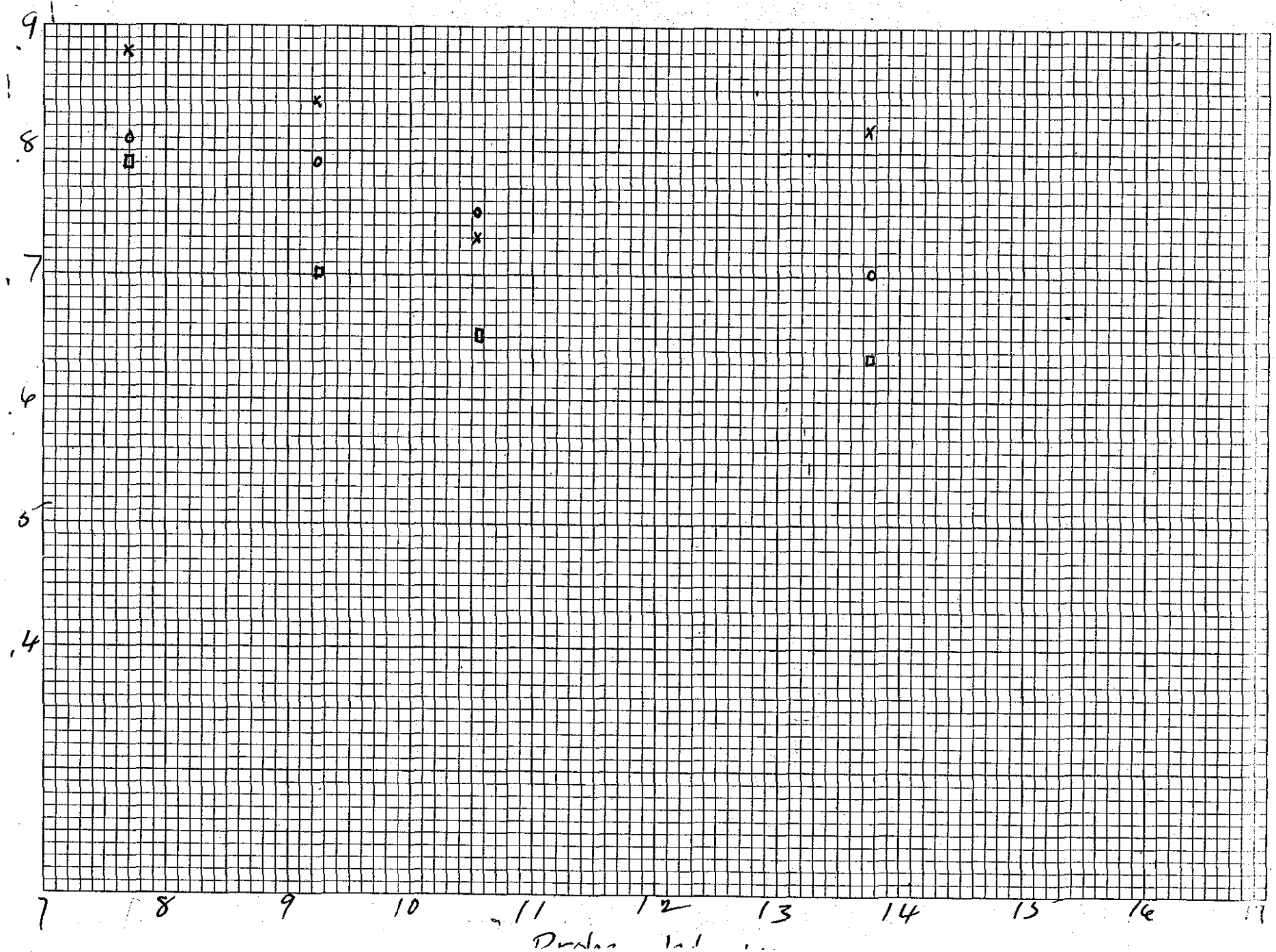
10.87" = ~~3~~480 cm³ Total Vol.

Signed



Probe ht. 117.

H				
	10.	74	.52	.43
			.34	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16

Date 7-13-63 Gulley TRA

Expt 54 $H/23 = 39.4$ 49

#4½" Dia. Reactor

Time	Source	Safety	Probe	M.	C_1		C_2		C_3	
2 40		up	2.00	—	9.0		31.25		6.5	
2 55	"	"	7.70	14.0	10.25	.88	38.75	.81	8.25	.79
3 05	"	"	9.24	16.05	10.75	.84	39.75	.79	9.25	.70
3 12	"	"	10.55	17.90	12.25	.23	41.50	.75	10.0	.65
3 20	"	"	13.75	—	10.25		44.75		10.25	
3 32	"	"	"	—	11.0	.82	44.30	.70	10.25	.634

Cut bt Extrap to D

Signed

50 Date 7-13-53 Expt #55 #/23894

Talley Fry

4.7" Equal Reactor

Time	Source	Capty	Probe	M	C_1		C_2		C_3	
234	in	up	1.10"	2.7	10.25	40.0	31.25	3.15	8.75	.8
238	"	"	"	"	9.75		31.75		9.0	
252	"	"	5.50	~~3.50~~ 11.40	15.0	.67	67.5	.47	18.75	
302	"	"	6.10	13.60	42.0	.24	112.75	.28	31.0	.2
312	"	"	6.20	22.4	~~34.25~~		132.5	.238	36.5	.2
318	"	"	"	"	33.0		135.5	—	36.5	—
325	"	"	5.70	13.20	18.75	.51	76.5	.41	21.0	.4
—	"	"	"	"	14.0	—	76.0	—	21.5	—
340	"	"	6.40	Raised -24 Tube	38.25	—	206.5	.152	58.25	.1
		Out of soln		repeat →	37.0	.27	202.0	.156	58.25	.1

Extrapolated crit ht = 6.7" = 17.0 cm

Crit Vol. = 17.0 × 218 = 3700 cm³ ✓

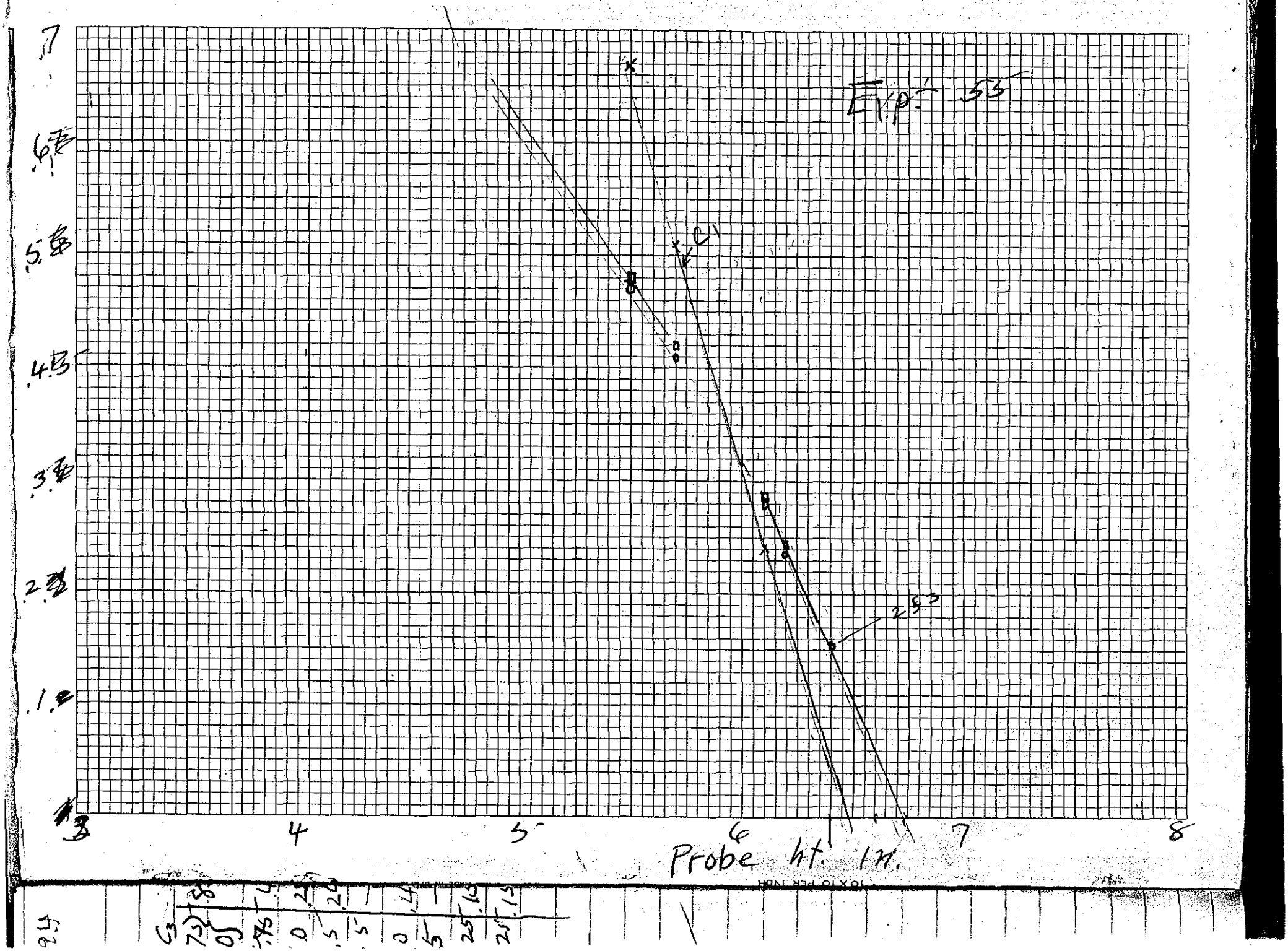
Crit mass = 3700 × .6015 ≈ 2225 gm ✓

Comparing multiplication curve with that of Expt. No. 45 one would expect it to become steep near crit. & that the crit ht. may be ~ 6.6"

This gives 16.77 cm = 3655 cm³ report 3660

3660 × .6015 = 2200 ✓

Signed


Exp: 55
C1
2 53
Probe ht. in.
3
4
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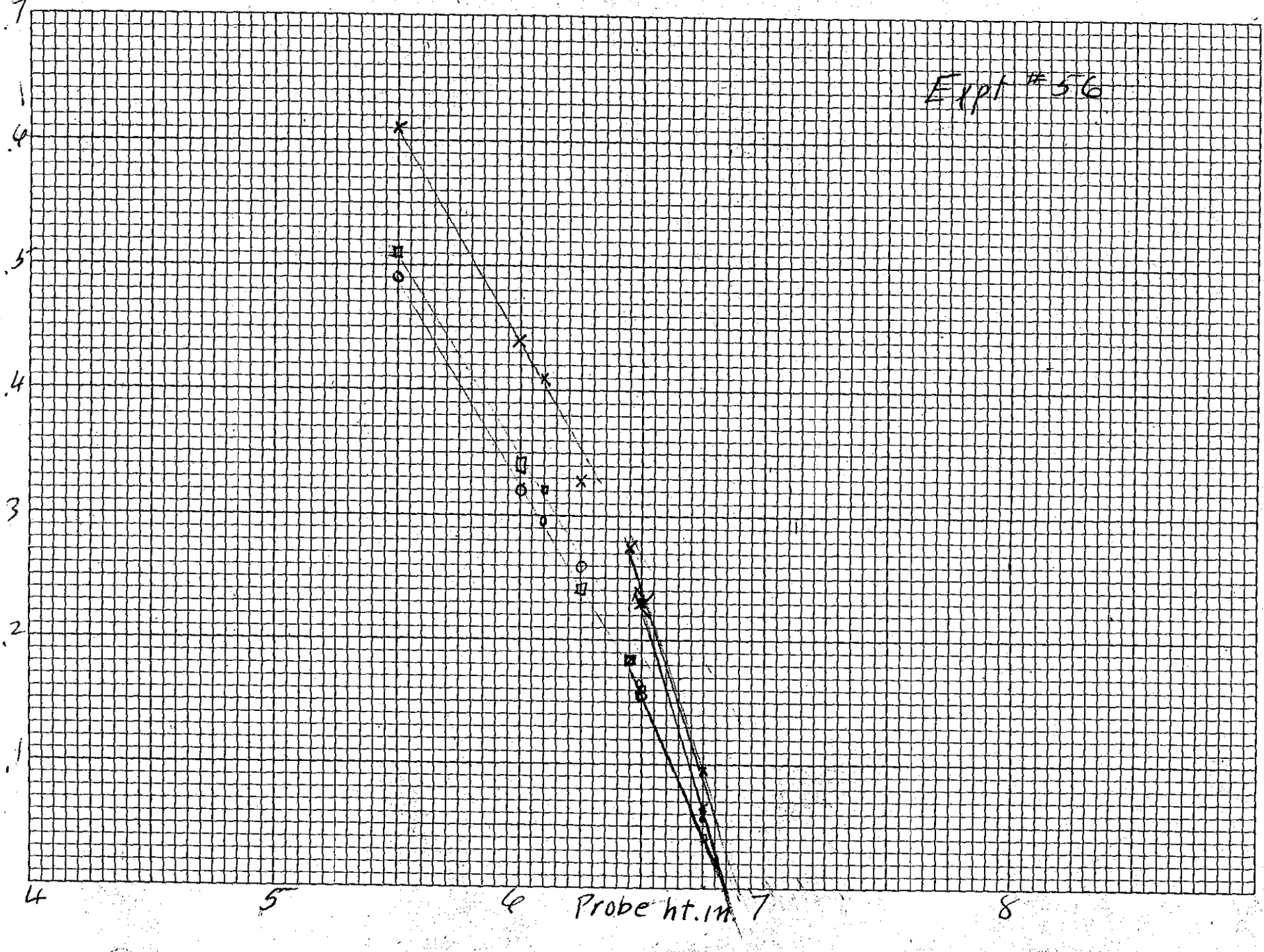
8



Date 9-14-03 Tilley Fox

Expt #36 6.7" Equatorial R.

Added ~ 400 cm³ H₂O *

H/23 = 45.2

Time	source	safety	Probe ht.	M	C_1		C_2		C_3	
9 33	in	up	0.90"	13	9.0		28.5 / 30.5	29.5	9.25 / 7.75	8.5
9.37	"	"	"	"	9.0					
9 50	"	"	5.50	10.0	14.75	.61	60.0	.49	16.75	.51
9.59	"	"	6.10	13.1	21.75	.41	99.0	.296	26.25	.32
10 16	"	"	6.45	15.1	32.75	.275	157.5	.186	45.75	.185
10 22	"	"	7.30 full	.	94	.096	497	.257	138.5	.061
		Repeat after Mixing further								
11 12	"	"	6.02	11.4	20.25	.44	92.5	.32	24.75	.34
11 24	"	"	6.50	13.4	38.5	23 ~~.315~~	180.5	.155	53.75	.158
		Repeat after lowering Manifold								
1 22	"	"	6.24	12.9	27.0	.33	112.5	.26	35.0	.24
1 30	"	"	6.47	13.5	37.0	.24	176.0	.147	54.75	.155
1 40	"	"	full	"	134.5	.047	694	.042	207.5	.04

Extrap. Crit ht = 6.85" ≈ 17.4 cm ✓.

17.4 x 218 = 3790 cm³ ✓

Crit Mass ~~3970~~ 3790 x .5306 = ~~2105~~ 2010 ✓

U-43 R. 105329

51.4790
19.6755
31.8035

.3265 gm 23/gm
✓ .3308 gm U/gm

✓ 1.625 Sp gr.

.3265 x 1.625 = .5306

Calc H/23

1.3 x .3308 = .4300 (1.0000)
.570

.570 x 259 / .3265 45.2 ✓

H/U233 = 45.2

+ Full at ~ 6.75

Signe..

* Total vol now ~ 3900 cm by adding.

7-14-53

*Expt 45A added 400 cm³

6.7" D. Equal. Reactor

H/23 = 48.0

Essentially same H/23 as Expt #45, Approx. same total vol. Expt. to check on position of min. vol., since 2 previous expts. gave indecisive results

Time	So.	Safety	Probe	M	C_1		C_2		C_3	
2 38		up	1,30"	.4	10.25		29.25		9.5	
2 53		"	6.25	11.0	24.75	41	102.75	.285	30.5	.31
3 04		"	full	13.74	76.75	134	380.25	.077	116.25	.081
			Repeat after mixing							
3 48		"	6.45	11.3	29.0	33	131.25	.22	38.5	.247
3 55		"	full	13.4	70.5	145	350.0	.084	104.25	.091
7-15-53			Manifold laid on floor and thoroughly agitated in an effort to put ppt. in soln							
9 25		up	2.04 (-4.0)"		11.0		28.5		9.5	
			6.70 -5.8		33.0		171.0		46.25	
			full		75.6	145	416.0	.07	114.25	.083

Ext. cut. ht. 6.95" x 2.54 = 17.65 cm

17.65 x 218 = 3848 cm³

report 3850

Cut mass = 3848 x .5826 = 1935 gm

U-44

Reg 105330

42.8130

19.7272

23.0858

31574

.3155 gm²³/gm

.3199 gm U/gm ✓

1.592 gm U/gm ✓

1.592 x .3155 = .5026

H/23

1.3 x .3199 = 1.0 0000 / .41587 / 5 8413

H/U²³⁵ = 47.9

1584 x 259 / .3155 = 47,93 ✓

* It was estimated that the concentration was the same as in Expt 45 - by analysis found not true

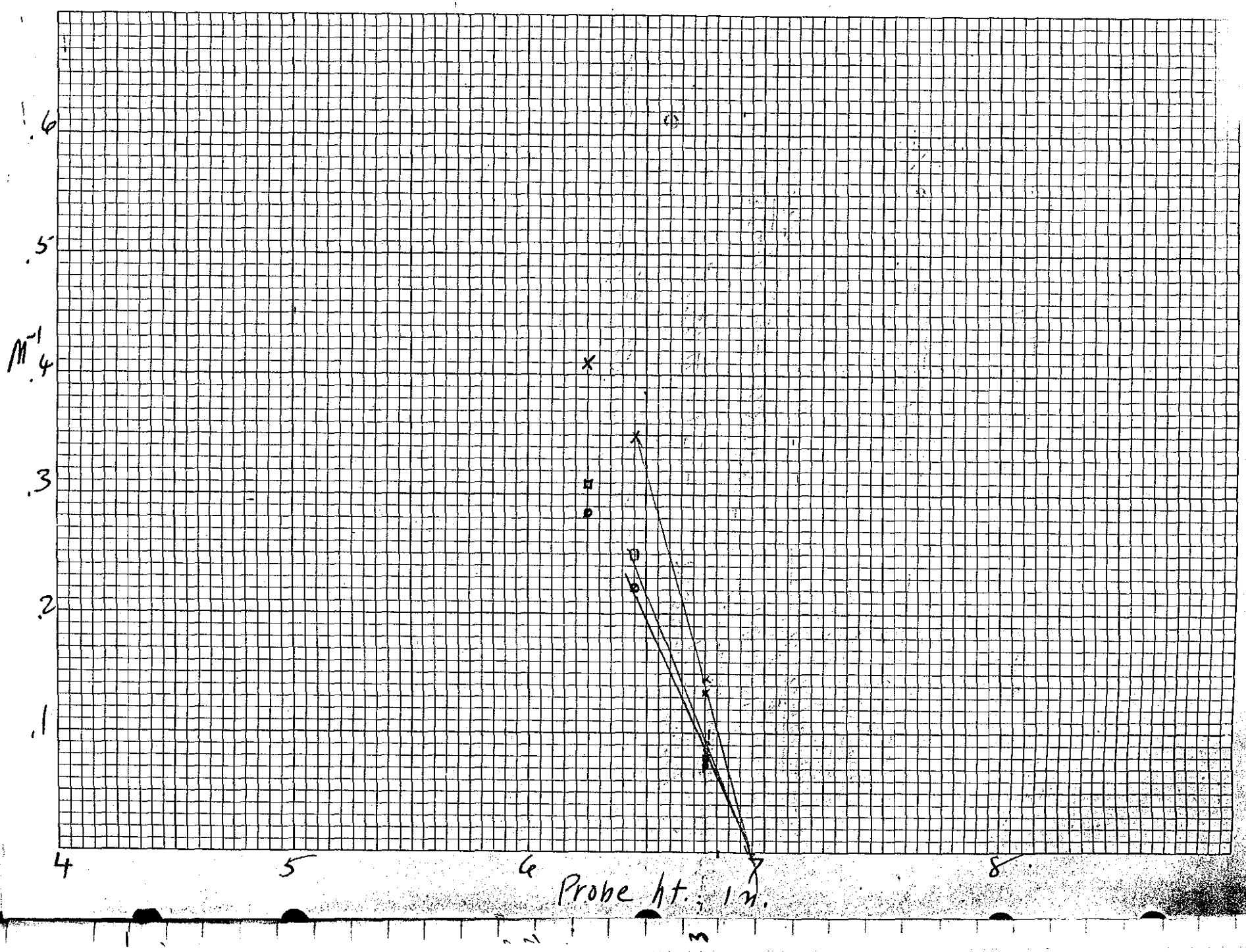
Signed

4

5

6 Probe ht. 1½"

8


.6
.5
M^{-1}
.4
.3
.2
.1
4
5
6
7
8
Probe ht.: 1 in.

Calc. of H/23 at ~ 15°:

.1394 × 1.3 = .18122 gm salt/gm

$\frac{.1394}{24.26} \times .002 = .00115$ gm HF × 45 = .00052 gm H_2O / gm

1.00000
.18122
.81878 gm H_2O
.001 - HF
.8176 gm H_2O
.0005
.8181

$$H/23 = \frac{25.9 \times .8187}{.137 \text{ te}}$$

$= 154.1$ V

154.2 neglecting HF

Dilution to ~ 120 #/23 :

Per. Total Vol Soln ~ 4.3 l

Drain out 2 l & set aside – remainder ~ 2.3 l

2.3 x 1.60 = 3680 gm soln.

approx. and .328 gm/gm 3680 x .328 = 1206 gm V

1206 x 1.3 = 1570 gm Salt.

2110 gm H_2O

$$120 = \frac{\frac{2110 + X}{9}}{\frac{1206}{233} = 5.18}$$

X = gms H_2O to add.

$120 \times 5.18 \times 9 = 2110 + X$ = 5590 − 2110 = 3480

added 3500 cm^3 H_2O after Draining out ~ 2.0 l

3500 − 2110 = 1390

2nd addition on basis of 150 #/23 :

$$150 = \frac{5610 + X}{9}$$

$$5.18$$

$150 \times 9 \times 5.18 = 5610 + X$

6990 = " "

6990 − 5610 = 1380 = X

add 1400 cm^3

2.30
3.50
1.40
7.20

Signed

54 7-15-53 Gablig Fox

Expt # 57 $\frac{H}{23}$ = ~~150~~ = 154.0

$7\frac{1}{2}$" D Reactor

Time	So.	Safety	Probe	Man.x	C_1		C_2		C_3	
1 37	in	up	.90	2.6"	9.25	9.1	21.75	22.4	7.75	7.6
	"	"	"	"	9.0		23.0		7.5	
1 55	"	"	6.25	14.0	23.75	.38	92.5	.24	29.25	.26
2 03	"	"	6.60	14.46	52.5	.173	259.25	.086	730	.104
	out	"	6.75	15.25	slightly sub.					
	"	"	6.77		"	super crit.				

Crit. Vol. ~ 3.9 l

Added 1400 cm³ H_2O see preceding Page

Time	So.	Safety	Probe	Man.	C_1		C_2		C_3	
3 07	in	up	5.95	11.01	13.0	.70	54.25	.41	14.25	.47
	"	"	6.52	—	18.75	.485	70.5	.32	22.75	.33
3 41	"	"	7.01	13.20	36.	.25	198	.113	51.5	.147
3 57	"	"	7.22	13.74	188	.048	864	.026	282	.027
	out		7.25 slightly super crit							
	"		7.25 " sub. "							

7.22 x 18.42 cm x 28.3 = 5250 cm³ ✓

~~$\frac{7.22}{7.50}$ x 5280 = 5100 Crit Vol.~~

Crit mass = 5250 x .1648 = 865 gm ✓

.1376 gm²³/gm

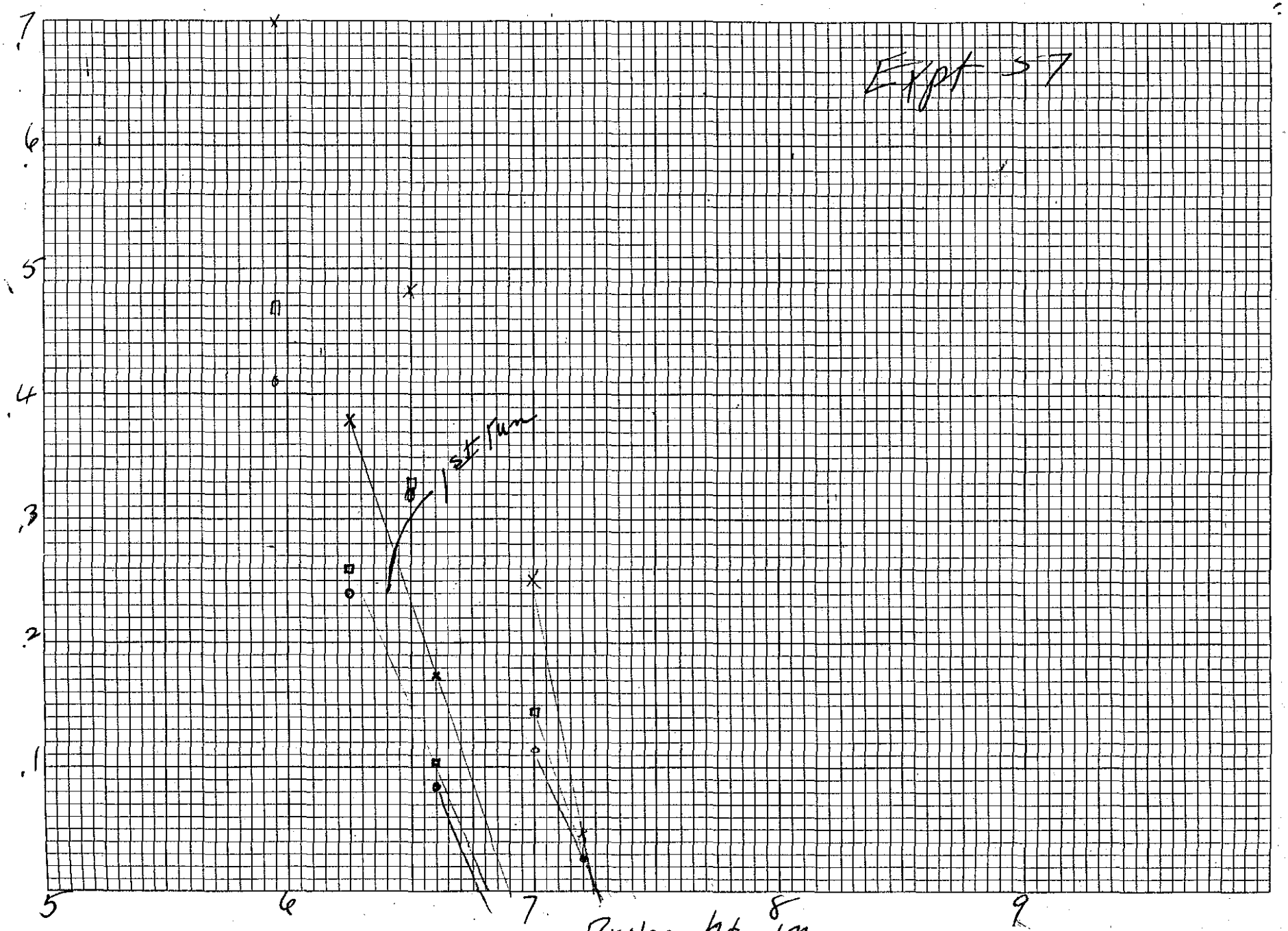
U-45 40.9275 ✓ .13940 gmU/gm

105331 19.6982

21.2293 ✓ sp gr. 1.198

1.198 x .1376 = .1648 gm²³/cm³

x manifold gauge


Expt 37
1st Turn
7
6
5
4
3
2
1
5
6
7
8
9
Probe ht. in.

Date 7-16-53

Dilution to ~ 280 H/U

present total vol in manifold = ~ 7.20 l.

Withdraw 3.0 l leaving 4.2 l $\frac{9.2}{7.2} = .584$

present total H_2O = ~ 7.0 l

after withdrawal = ~ 4.07 l

present total U = 1200 gm

after withdrawal = ~ 700 gm.

$$280 = \frac{\frac{4.09 + x}{9}}{\frac{700}{233} = 3.00}$$

$$\frac{7560}{4090} \quad \frac{7560}{4170} = x$$

$$2\ \frac{3560}{3470}$$

Present vol:

4.2
3.5
7.7 l

added ~ 3500 cm^3

$$260 = \frac{7560}{9}$$

$$x_1$$

$$260 x_1 = 8.40$$

$$x_1 = 3.23 \times 233 = 752 \text{ gm}$$

1st added 170 cm^3 at H/U = ~ 50

2nd " " 70 "

End of Expt 58 Total Vol = 7.94 l

Signed

 Date 7-16-53 Gilley Fox

Expt #58

8" Dia. Reactor

H/23 = ~~280~~ 250

Time	So	Safety	Probe	Man.	C_1		C_2		C_3	
1^00	in	up	1.00	24	10.5	11.0	33.75	31.2	7.5	7.6
	"	"	"	"	11.5		28.75		7.75	
1^27	"	"	~~6.90~~	~~14.30~~	~~12.5~~		~~36.25~~		~~10.0~~	
1^37	"	"	~~full*~~	~~18.1~~	~~12.25~~		~~43.0~~		~~12.0~~	

~~Switched to 8½ D. since it is so far from crit.~~
Found that blade had accidently fallen

	in	up	full		19.0	.58	73.25	.42	20.0	

~~Switched to 8½" Reactor after all~~

Added ~ 100 cm³ of H/U = ~50 soln

Time	So	Safety	Probe	Man.	C_1		C_2		C_3	
3^20										
3^40	in	up	7.20 ×	16.66	23.0	.48	89.25	.35	21.25	.36
3^43	"	"	~~5~~7.74	17.68	49.25	.16	221.5	.14	55.75	.136
		"	8.75	18.80	~~58.75~~		~~235~~		~~58.75~~	

7-17-53 added ~ 70. cm³ soln at ~ 50 H/U

Time	So	Safety	Probe	Man.	C_1		C_2		C_3	
9^10	"	"	1.25	2.7	~~6.5~~		30.0		7.0	
9^14	"	"	7.35	17.0	52.5	.18	256	.117	65.75	.106
9^23	"	"	7.47	17.22	273	.035	892	.034	261	.027

7.60 quite sub-crit but too high to count. Indicates that reactor became full at ~ 7.55 Raising level to 8.07 caused little change in act. Repeat for mixing check.

Time	So	Safety	Probe	Man.	C_1		C_2		C_3	
10^24	"	"	+7.73	17.0	51.75	.18	247	.121	63.75	.11
1		"	8.4" full	18.1"	329	.029	~~848~~	.035	438	.016

Ext. crit ht = 27.95" full at ~ 7.9" ~~334~~
7.95 × 2.54 = 20.2 cm

Very near crit on raising level in pipe

20.2 cm × 330 = 6.66 l × 1027 = ~~680~~ 681

.0911~~4~~ gm 23/gm
✓ .09234

U-46
105332

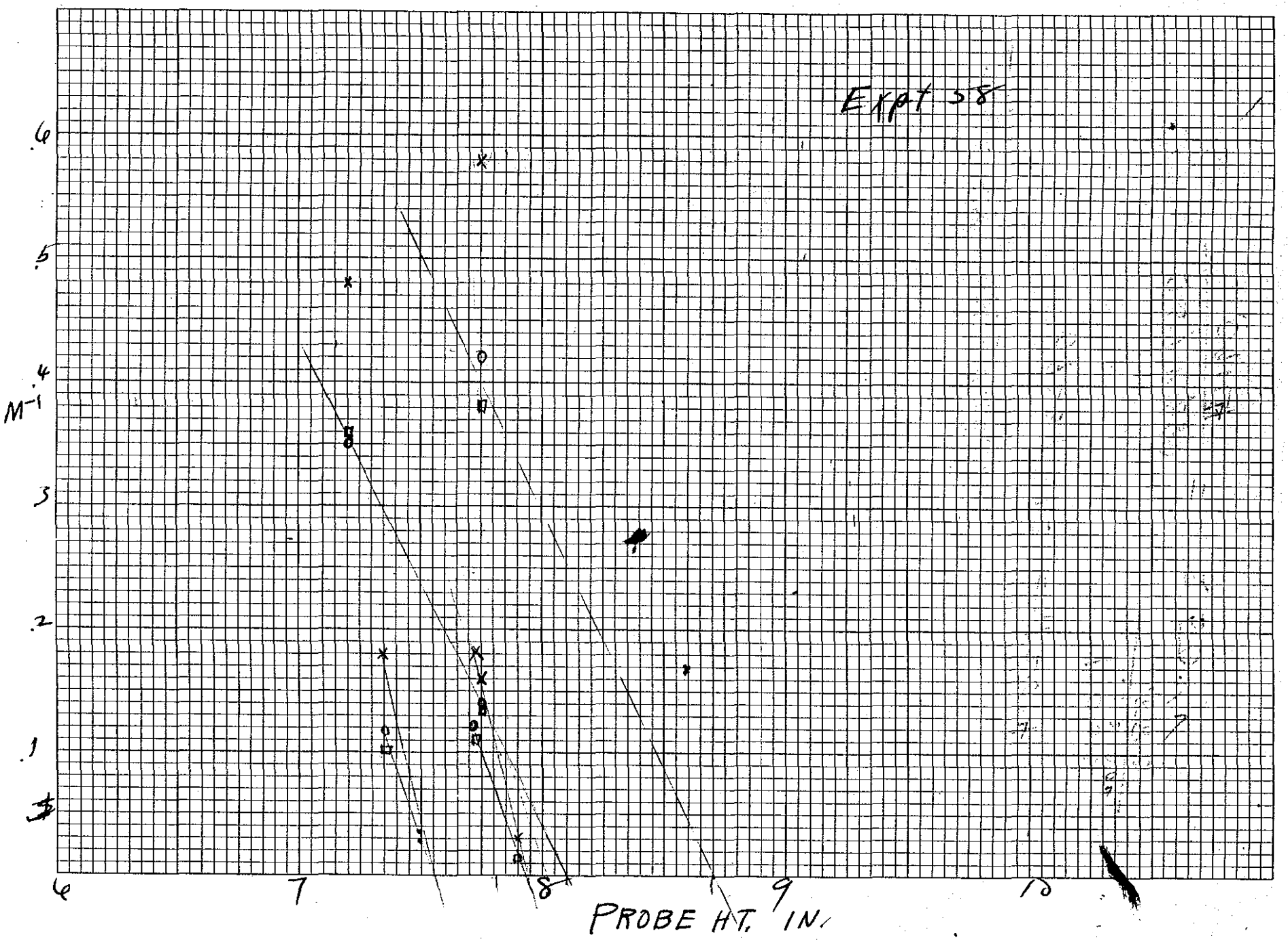
55.6984
20.6552
35.0432 ✓ 1.121 sp gr.

1.121 × .0911~~4~~ = ~~.1025~~ .1022 gm 23/cm³

~.4 ?

+ re-zeroed Probe - lowered ~~2.5~~" [illegible]
* reactor full at probe ht. of 7.75 or less

Signed


Expt 58
.6
.5
.4
.2
.1
M⁻¹
6
7
8
9
10
PROBE HT. IN.

EXAMPLE 5.8 H/23 Calc.

.09234 x 13 = 1.2004

1.000
.1200
.880

$$H/_{23} = \frac{25.9 \times .880}{.0911} = 250.1 \text{ V}$$

Date 7-17-53

Added 2 l of H/U ≈ 150 for 1st try at sphere un-reflected

2nd addition; ~450 cm³ at H/U = ~50 added

3rd addition: withdrew ~2.5 l soln
added 1100 cm³ at ~ H/U = 150
& ~1.0 l at H/U = ~50

Signed

58 Date 7-17-53 Gilley Fox

Expt #59 4/23 ≈

10.4" Dia. sphere
UN-reflected

Time	So	Safety	Probe Man.	C_1		C_2	C_3
2 12	In.	up	1.71	2.7	9.75	17.75	4.9
2 45	"	"	9.41	Empty	11.0 .89	27.75 .64	6.75 .72

Added ≈ ~~450~~ cm³ at ~ 50 H/u

4 03	"	"	6.60		11.75	27.5 .64	5.5
4 13	"	"	[illegible]	7.9	12.25	28.25	7.75 .6

see preceding page for addition

7-20-53 Frances, Fox

9 00 AM	"	"	7.0	6.15	—	21.0	5.25
9 45	"	" 24	9.70	27.4		41.0 .51	8.25 .64
			9.82	out of soln			

Added remainder (~350 cm³) at ~ 50 H/u

10 48	"	" 20	8.00	20.0	8.45 l	28.0 .75	7.0 .75
			9.5	23.5	9.5 l	39.0 .54	10.0 .52

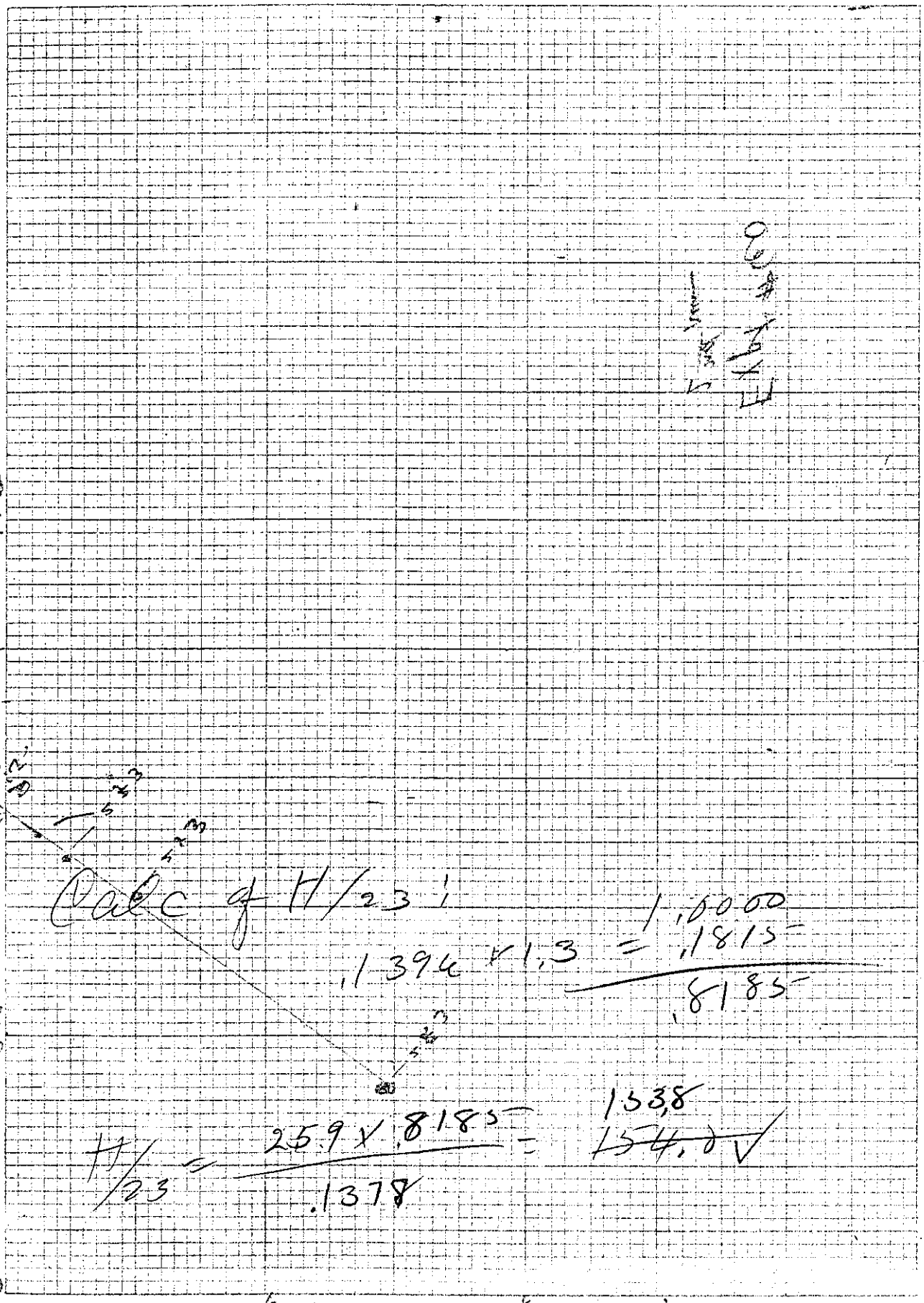
full very small change

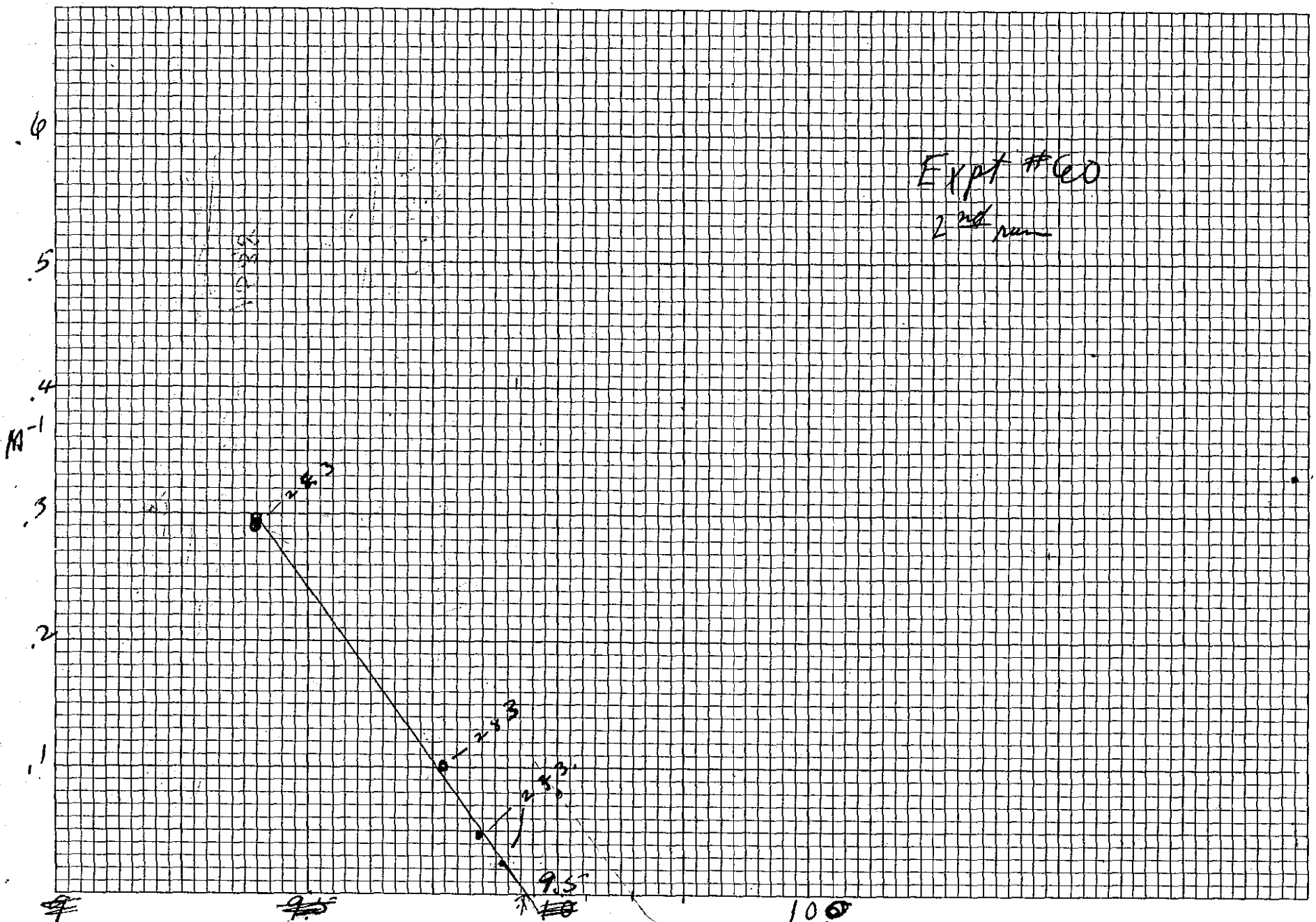
10.4" Dia sphere cannot be made crit with the amt of fuel on hand. It is doubtful if it could be made critical after any dilution Un-reflected

no analysis of soln taken
slightly more conc. than Expt. 60

Added ~ 2.5 l of that was withdrawn in #3 above

Signed


Calc of H/23
.1394 x 1.3 = 1.0000
.8185
H/23 = 259 x .8185 / .1378 = 1538
154.0


Expt #60
2nd run
.6
.5
.4
.3
.2
.1
A^{-1}
8.5
9.0
9.5
10.0
Probe ht. in.

Date 7-22-53
Frame Fox

Un-reflected Expt #60 #/23 = 154

10" Dia. Cylinder

Total inventory of fuel in manifold at ~12 l total vol.

Time	S.	Safety	Probe	Man.	C_2	C_3
12 32	"	Out	2.08*	5.7	20.25	5.5
~~1 20~~	"		~~9.02~~	~~21.3~~	21.0	5.5
41	"		9.02	21.3	72.0 .29	16.25 .34
	"		9.38	22.5	150.0 .15	36.0 .152
138	"		9.50	23.05	272 .078	66.25 .083

Added 500 cm³ H_2O

2 45	"	8.891	9.2*	21.3	70.5 .296	18.5 .295
2 56	"	9.27	9.57	22.45	211. .10	55.0 .10
3 10	"	9.34	9.64	22.8	443 .048	116 .047
3 29	"	9.38	9.68	22.87	808 .026	227. .024

Extrap. crit ht = 9.45" = 24.0cm

Was not taken critical because we had no automatic safety

$509 \times 24 = 12,22$ l ✓

$12,22 \times .1652 = 2019$ gm ✓

U-47. 36,5413 ✓ .1378 gm-23/gm

105333 14,6494 ✓ .1396 gm U/gm

16,8919 1,199 sp. gr.

.1652 gm 23/ C.C

* Alyse not zeroed readings 3" high

Signed

60 Date 7-21-53

Withdrew ~ 8.0 l from manifold & add ~ 3.6 l water for 8½" Reactor

Estimated total vol. = 7.6 l

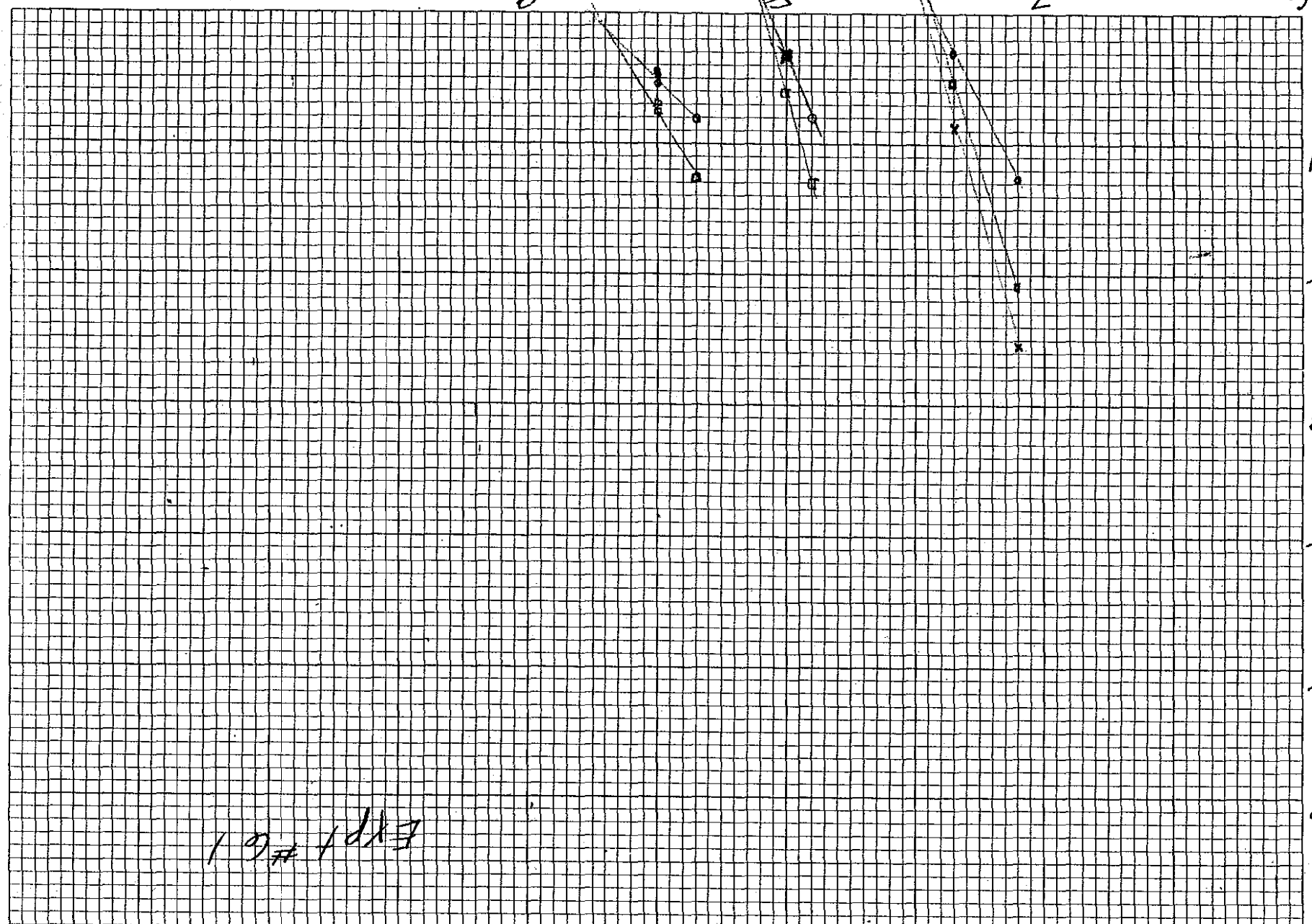
H/23 Calc

.07233 x 1.3 = .09403

100000
.09403
.90597 gm H₂O

H/23 = $\frac{25.9 \times .90597}{.07139} = 329$ ✓ (328.1)

Signed



Date 7-21-53

Francis for

Expt #61

8½" Dia. Reactor

Reflected

$H/_{23} = 329.61$

Time	S.	Safety	Probe	Man.	C_1	C_2	C_3
11 30	in	up	2.0	~5.4	10.25	15.7	8.0
12 25	"	"	7.10	~18.7	40.25 .255	122.5 .128	38.0 .24
12 38	"	"	7.35	19.1	117.5 .087	528 .03	162 .05

Extrapolates to 7.45"

added ~ 1700 cm³ H_2O

1 38	"	"	7.90	—	~~252~~	196 .08	61.5 .13
1 46	"	"	8.0	—	331 .03	435 .031	131 .04

added 800 cm³ H_2O

2 30	"	"	8.35	—	~~254~~	193 .081	62.5 .128
2 56	"	"	8.5 (full)			295 .055	103.5 .077
3 01	"	"	"			289	101.5

Extrapolated Crit. ht. = 8.75"

Repeat for mixing check

3 42	"	"	8.5 full	—		331 .047	112 .071

Extrapolated crit ht 8.75" = 22.2 cm

22.2 × 362 = 8040 cm³ ✓

8040 × .0778 = 626 gm ✓

.07139 gm → cm ✓

U-48 39.5686 ✓ .07233 gm U/gm.

105334 19.6809

19.8877 ✓ 1.090 sp. gr.

1.090 × .07139 = .0778 gm U²³⁵/cm³

Estimated total vol of soln = ~10.1 l.

Signed

Dilution for 9" Reactor:

Withdraw 2.5 l first

add 2.25 liters H_2O

.06050 x 13 = .07936 gm salt

1,00000
07936
92064

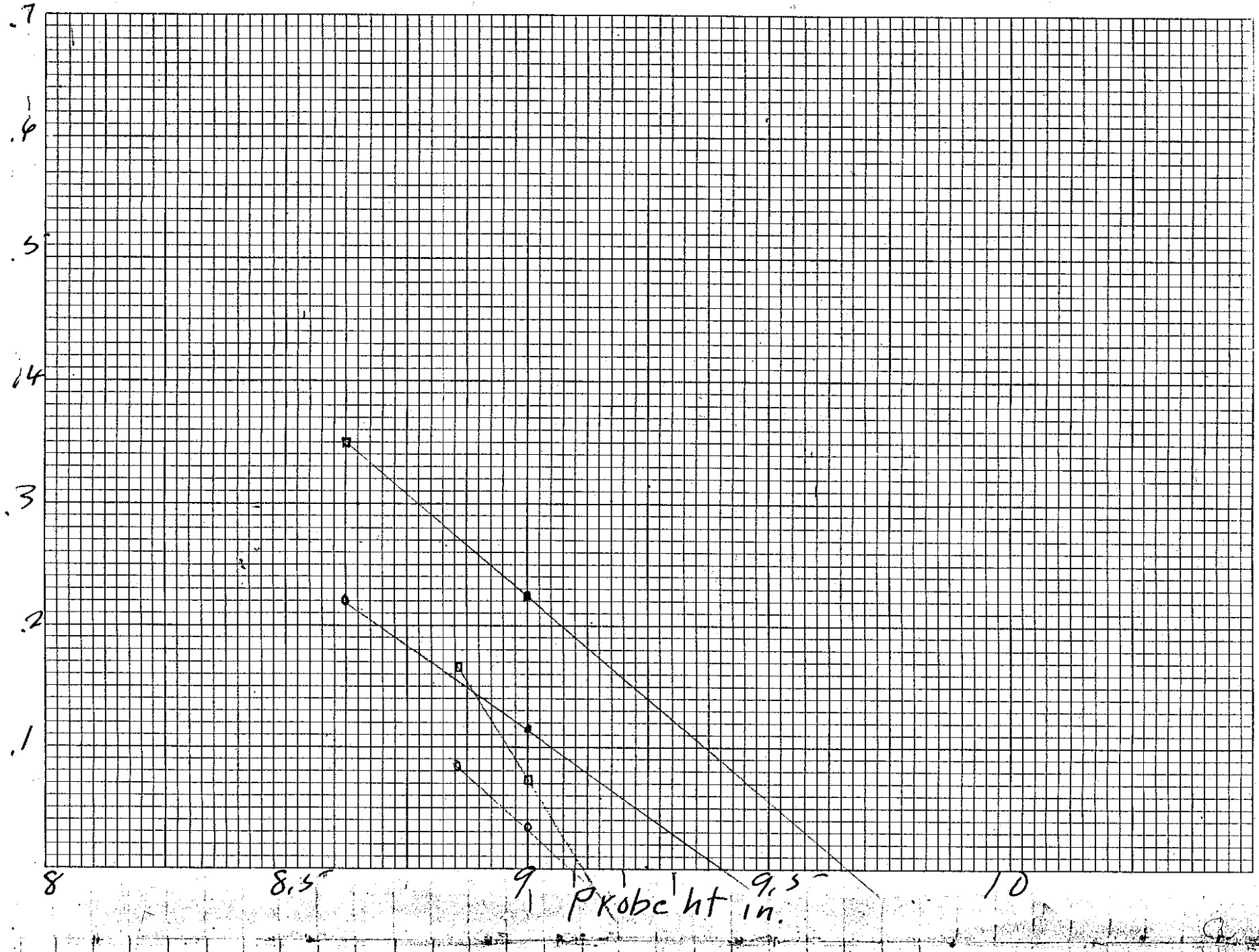
259 x 92165 = 395.7

$\frac{H}{23}$ = 060216

Signed

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



Date 7-22-53
Francis
Fox

Expt. 62
9" Dia. Reactor

#/23 = 396 ✓ 63

Time	S.	Safety	Probe	Man.	C_2 (13.6)		C_3 (6.3)		
9[38]	in	up	1.24	4.5	1425	140	13.0	5.5	7.0 6.5
10[24]	"	"	8.62	—	62.	.22	18	.35	
			9.0 full	—	119	.114	28	.225	

Added ~2.5 ℓ at #/u = ~ 310.

11[40]	"	"	8.86	—	160.5	.085	37.75	.166
11[50]	"	"	9.0 full		382.5	.035	87.0	.072 ✓

Extrap crit ht = 9.1 in x 2.54 = 23.1 cm

410 x 23.1 = 9475 ℓ ✓

~~9,48 x .0657 = 614 gm~~

947 x .0648 = 614

U-49 105335

38,9064
19,2435
19,6629

✓ .06026 gm 235/gm
✓ .06105 gm U/gm
✓ 1,080 gm/gm.
(1,0755 from curve)

1,080 x .06026 = .065 ✓

Curve value for density better 1.0755 x .06026 = .0648

Signed

Adjustment of soln for sphere:

1. Withdrew ~2 l soln
2. Added 600 cm³ H_2O

#/23 Calc

.0570 gm/gm × 13 = .0741 gm Salt/gm

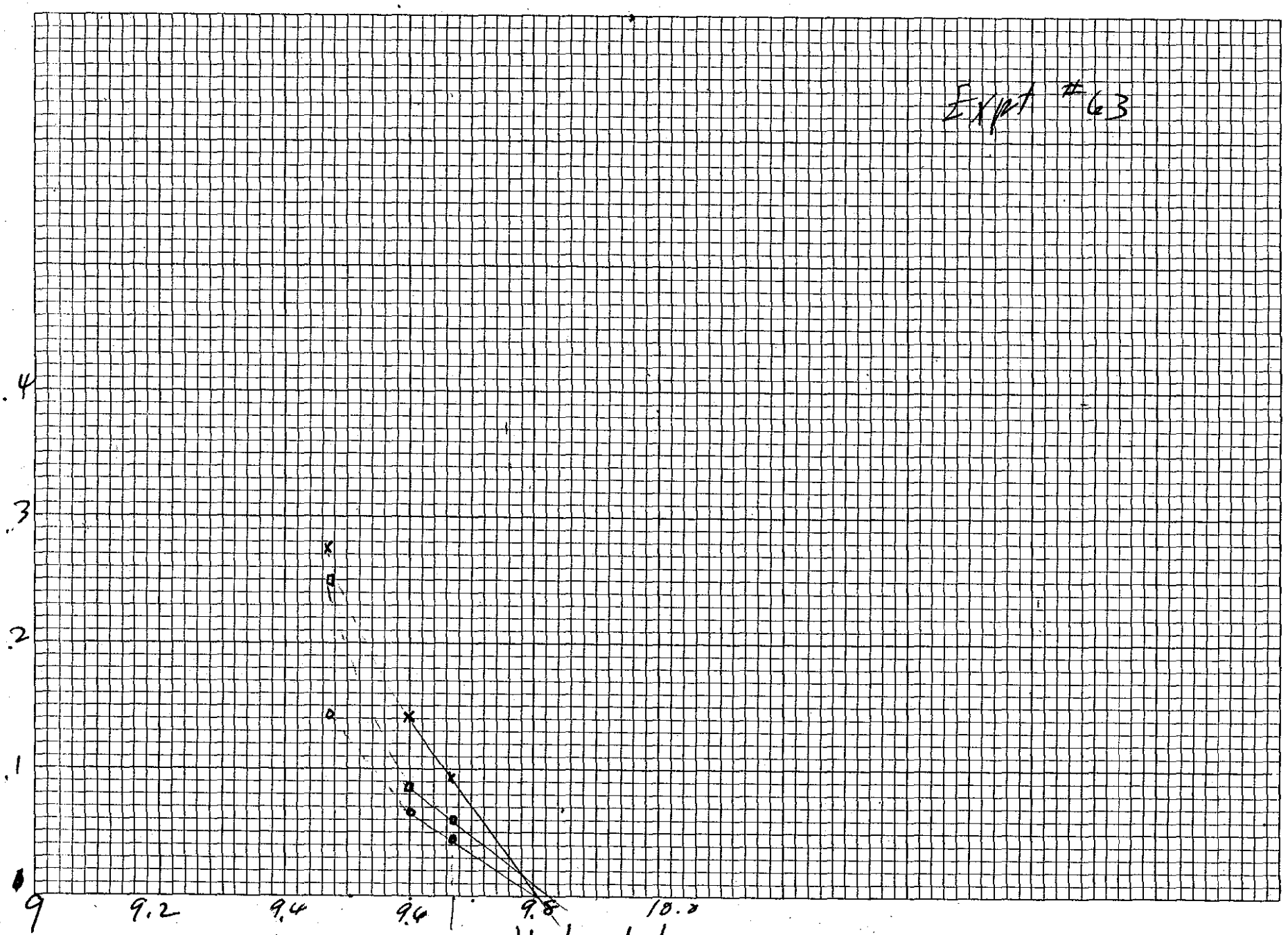
$\frac{.0570}{2423} \times .92 = .00047 \times .45 = .00021$ of H_2O

	1.0000
	.0741
	.9259
	.0005
	.9254
	.0002
	.9256

$\#/23 = \frac{25.9 \times .9256}{.05626}$

$= 4264$

Signed



7-22-53
Date Frauenfelder Fox

Expt 63
10.4" Dia. Sphere
Water reflector

#/23 = 426 ✓ 65

Time	S	safety	Probe	Man.	C_2		C_3	
2 37	in	up	3.32"	5.9"	−49.		9.5	9.5 9.5
3 15	"	"	~~9.58~~ ~~10.82~~ 9.77		158	.31	380	.25
			~~9.61~~ ~~10.71~~ 9.86		591	.082	1653	.057
Out			~~9.61~~ ~~10.94~~ 9.89		Super crit			
			~~10.93~~ 9.88		Sub. crit			

Added 300 cm³ H_2O

1-23-53

					C_1	C_2	C_3
9 00	in	up	9.41	2.20	5.35	9.0	19.0	7.0
"	"	"	~~9.52~~	9.50	9.35	− 32.5 .277	133 .142	38.5 .25
			~~9.67~~ 9.60	~~7.95~~	9.80	− 64.5 .14	291 .065	82.5 .085
			9.67	10.3	full	− 98.0 .092	421 .044	117.5 .04

Extrapolated Crit Vol = 9.80l ✓

9.80 × .0602 = 590. ✓

k_{-50} 46.4343 ✓ .0570 gm V/gm
105334 19.7231 ✓ .056265 " 23/gm.
26.7112 ✓ 1.070 eff. gr.

1.070 × .056265 = .0602 ✓ gm 23/cm³

Water temp = 25°C
+ Zero off = 1.05 "

Date

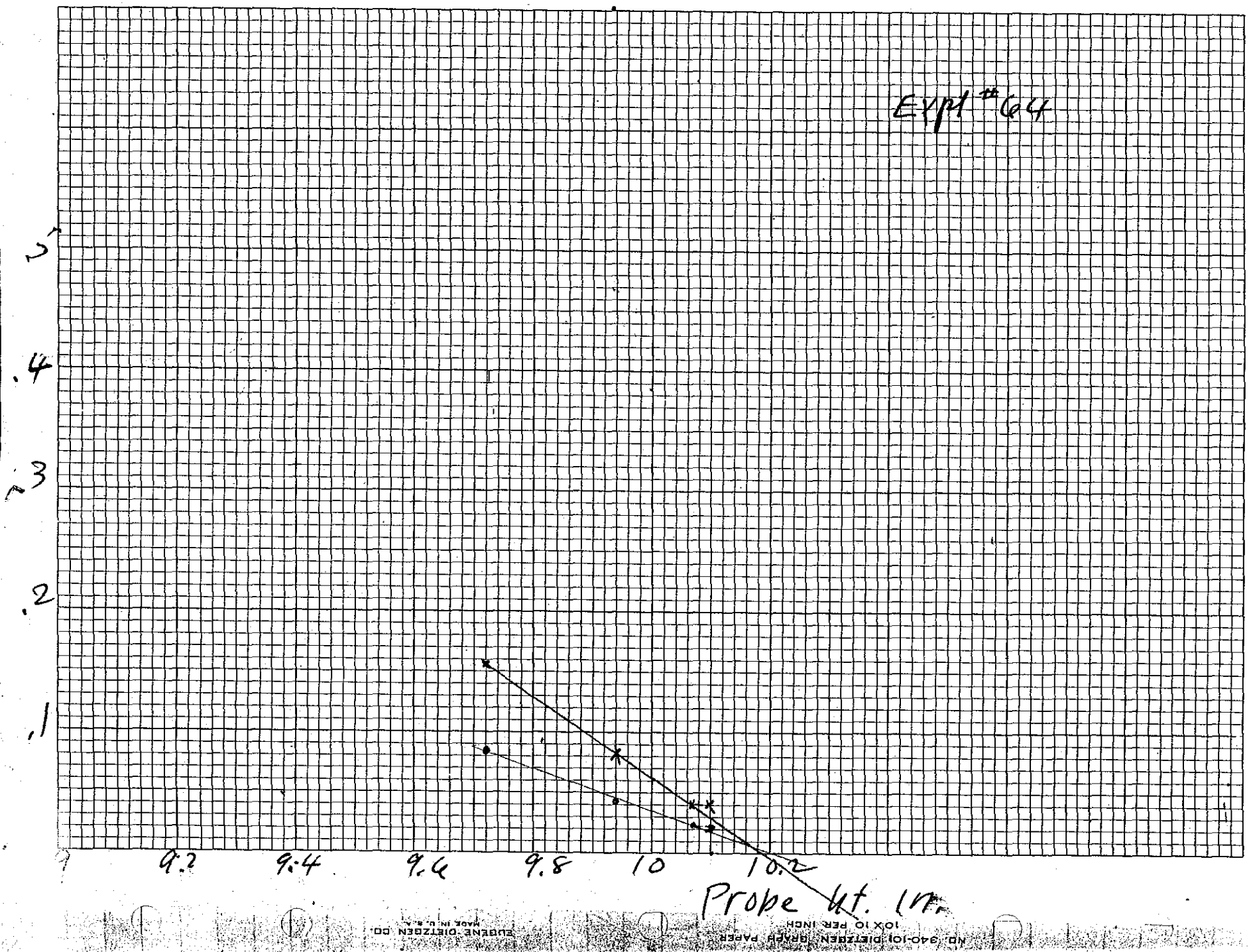
Solution adjustment for 15" P. Reactor :-

Present total vol ~ 11. l

Withdraw 2 l

Add 4 l. water (wrong amt)

Signed


Expt #64
.5
.4
.3
.2
.1
9.2
9.4
9.6
9.8
10
10.2
Prope Ht. in.
EUGENE DIETZGEN CO.
MADE IN U.S.A.
NO. 340-10J DIETZGEN GRAPH PAPER
10 X 10 PER INCH

Date 7-23-83 Francis Fox

Expt #64 $H/_{235}$ = 525

10" Dia. Reactor Water reflector

Time	S	Safety	Probe ht"	Man.	c_1	c_2		c_3	
1^{28}	m	up	1.30"	3.6	~10	21		5.5	
			full			53.5	.39	230	.24

added 700 cm³ at approx 160 H/U

Time	S	Safety	Probe ht"	Man.	c_1	c_2		c_3	
3^{07}	"	"	9.72		—	149.5	—	65.25	.084
			"			136.5	.154	65.0	.084
3^{25}	"	"	10.07	2845		523	.04	242	.023
			~10.1 full			527		246	

Repeat for mixing

Time	S	Safety	Probe ht"	Man.	c_1	c_2		c_3	
4^{08}	"	"	9.94			262	.08	129	.042
			~10.1 full			510	.041	251	.022

Full ht probably 10.07

Extrapolated Crit. ht. 10.2" = 25.9 cm

25.9 X 509 = ~~13,175~~ 13,180 l ✓

~~.0493 X 13,175 = 650 gm~~ ✓

.049286 13,180 = 649.6 report 650

Reg. 105338 U-51
57.2246
19.5926
37.6320

✓ ✓ .04715 gm U/gm
.04454 gm 23/gm
✓ 1.059 sp gr.

✓
1.059 X .04454 = .0493 gm 23/cm³
.049286

Water Temp 27.0°C

Signed

68

Date

Salt adjustment:

approx. vol to start 14 l.

1. added 1 l at #/u = ~380
2. added 7 l. water

2nd adj. Withdraw 1 l.
added 1 l water

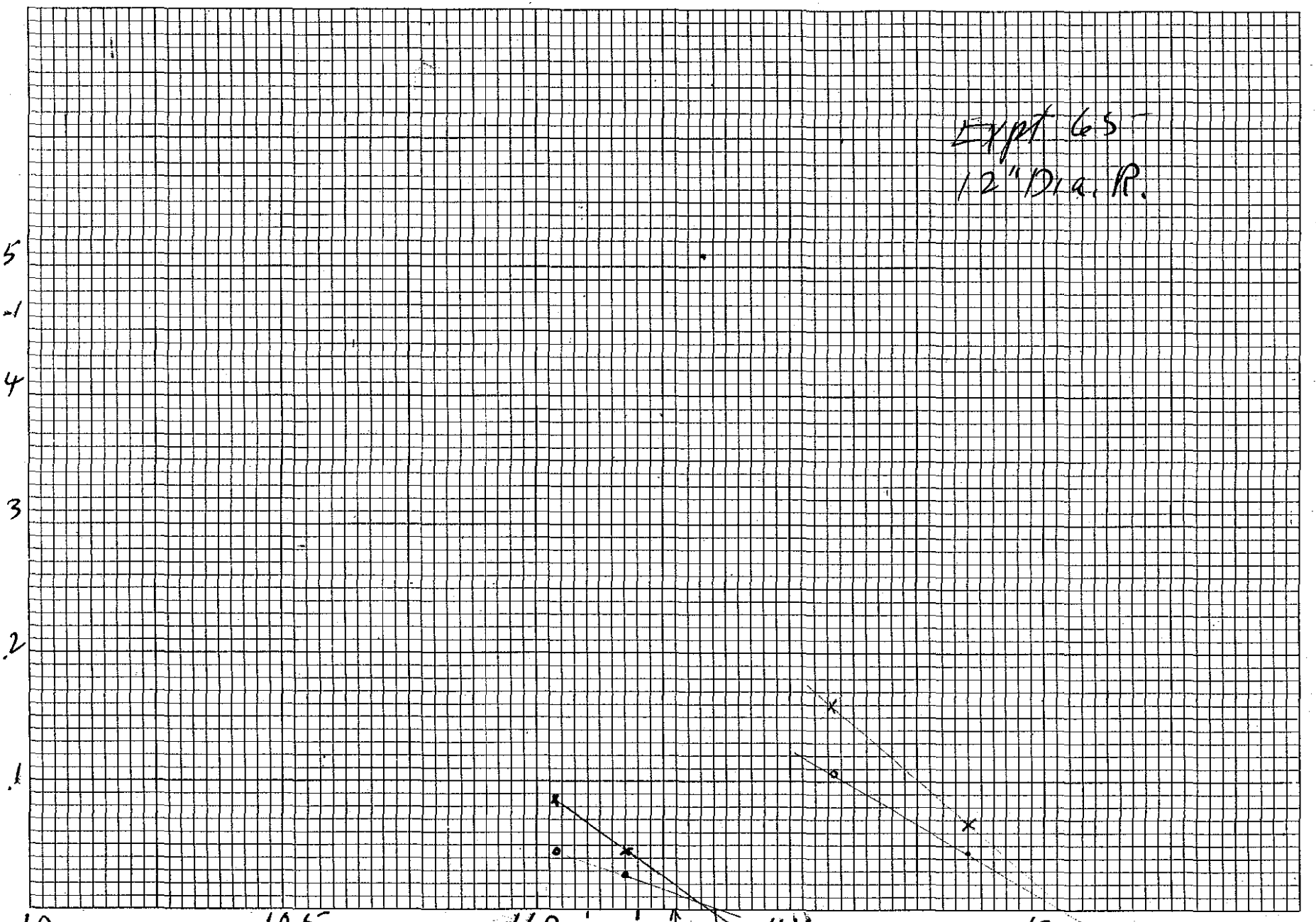
Date

.03243 x 1.3 = .042159 gm Salt

1,000000
042159
95841

#/29 = 25.9 x .95841 / .03200 = 775 ✓

Signed



Date 7-24-53
Francis
704

Expt 65
12" Dia. Reactor

$H/_{23}$ = 7755 ✓

Time	S.	Safety	Probe	Man.	C_2		C_3	
11[15]	in	up	2.09	0	13.5		3.5	
11[53]	"	"	11.07	346.5	1580	.085	72.5	.048
			11.17	351	298	.045	124	.028
			11.27	Super crit				
			11.26	Sub. "				

withdrew 1l. Add 1l. water

1[54]	in	up.	11.58	372.5	85.14	32.5	107
			11.86		200. 067	81.5	.043

12.0 slightly super crit.
Manifold at 318.96
full at ~12.05"
~~Cut at full = 22.35 l~~ ✓ 12 X 2.54 = 30.48 cm ✓
30.48 X 731 = 22.28 l ~~.03312 X 22.35 = 740 gm 22~~
.03312 X 22.28 = 738

U-52 ✓ 103.5402 ✓ .03243 gm U/gm.
105387 19.7648 ✓ .0320 gm 23/gm
83.7754 gm Sol. ✓ 1.035 Sp. gr. ✓

1.035 X .0320 = .03312 gm 23/cm³

Signed

 Date

7/23 Expt 66:

1.3 x .05798 = .07537

1.0000
.07537 (4)
.9246

$\frac{2.5.9 \times .9246}{.0572}$ = 41.86 (5) ✓

Expt 66

.637502
19.8082
14.3942

-53

105399

.0572 gm 23/gm

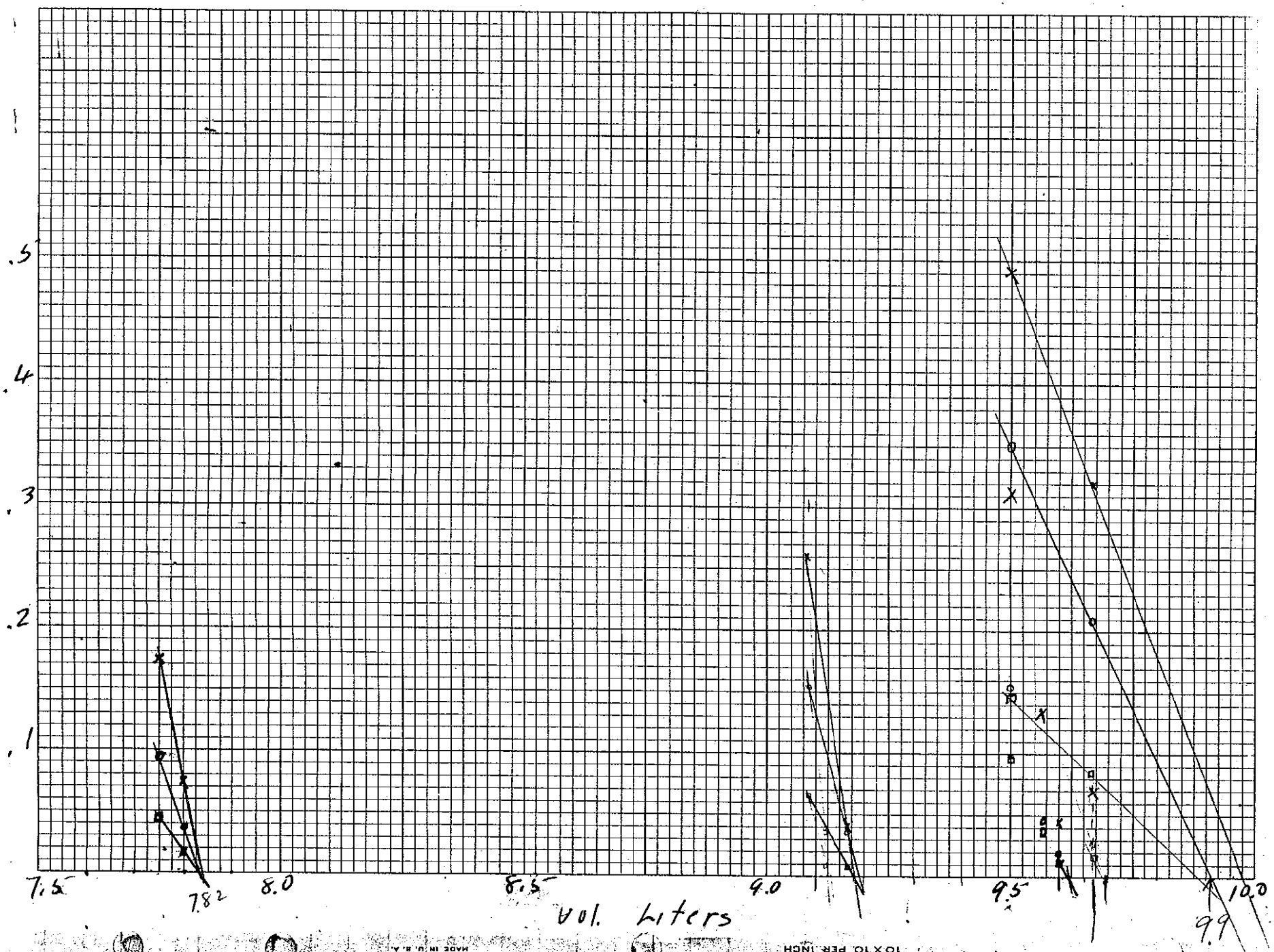
.05798 gmole/gm soln.

1.071 sp. gr. Temp. 25° ± .5 C

1.071 x .0572 = ~~.06025~~
.04128 ✓

2.34 gm ✓

Signed



8-12-53 Expt #66 ~~[illegible]~~ 26.5°C **71**

Date Gilley / Fox / Thomas — Repeat of Expt #63 — $H/_{23}$ = 41~~8~~8.5*

10.4" Dia Sphere with H_2O reflector *Rm Temp

Time	safety	S	Probe	Man.	C_1		C_2		C_3	
9^12	up	in	2.85"	7.4	18.25		30.0		~~4~~.25	} 4.75
9^16	"	"	"	"	18.25		31.25		5.25	
9^48	"	7.75	~~7~~7.25	20.9 ~~7.25~~	105	.174	320.	.094	105	.046
		7.80	7.28	20.4	246	.074	772	.039	264	.018
	Withdrew 4.0 l & added 4.45 l at .033 gm²³/cm³									
8-12-53										
1^54	up	in 9.08	8.66	23.8	70.0	.26	199.0	.154	72.	.066
	"	" 9.17	8.75	24.15	452	.040	785	.039	567	.008
2^32	"	out 9.19	8.77	crit ht						
	withdrew 2.5 l & added 2.4 l at .033 gm/cm³									
4^03	"	" 9.62	10.00"	—	52.0	.351	135	.222	53.25	.089
4^08	"	" 9.67	full		56	.32	145	.21	56	.085
	"	" 9.50	9.44	—	37	.49	87	.35	32	.148
8-13-53	added 0.2 l at H/23 of 154									
9^43	up	in	2.75	~6.	17.0		17.6		5.4	
10^13	"	" (9.57)	9.64	—	127.5	.133	384.5	.045	154.0	.035
10^22	"	" (9.49)	9.79	—	376	.045	884	.02	480	.011
10^30	"	out (9.61)	9.84	Crit					*Temp.	26.2°C
	Repeat with stirrer running									
		(9.50)	9.40		54.25	.31	159.5	.152	56.2	.096
		(9.62)	9.90	27.37 crit						
*Probe pushed into soln →			5.76	31.02 crit	flooded				Temp	26.5°C

9.62 × .06128 (~~.06023~~) = ~~579.5~~ 589.5

.06129 = 589.6 $H/_{23}$ = 418.5 (~~426.2~~)

sample on previous page

~~[illegible]~~ Signed

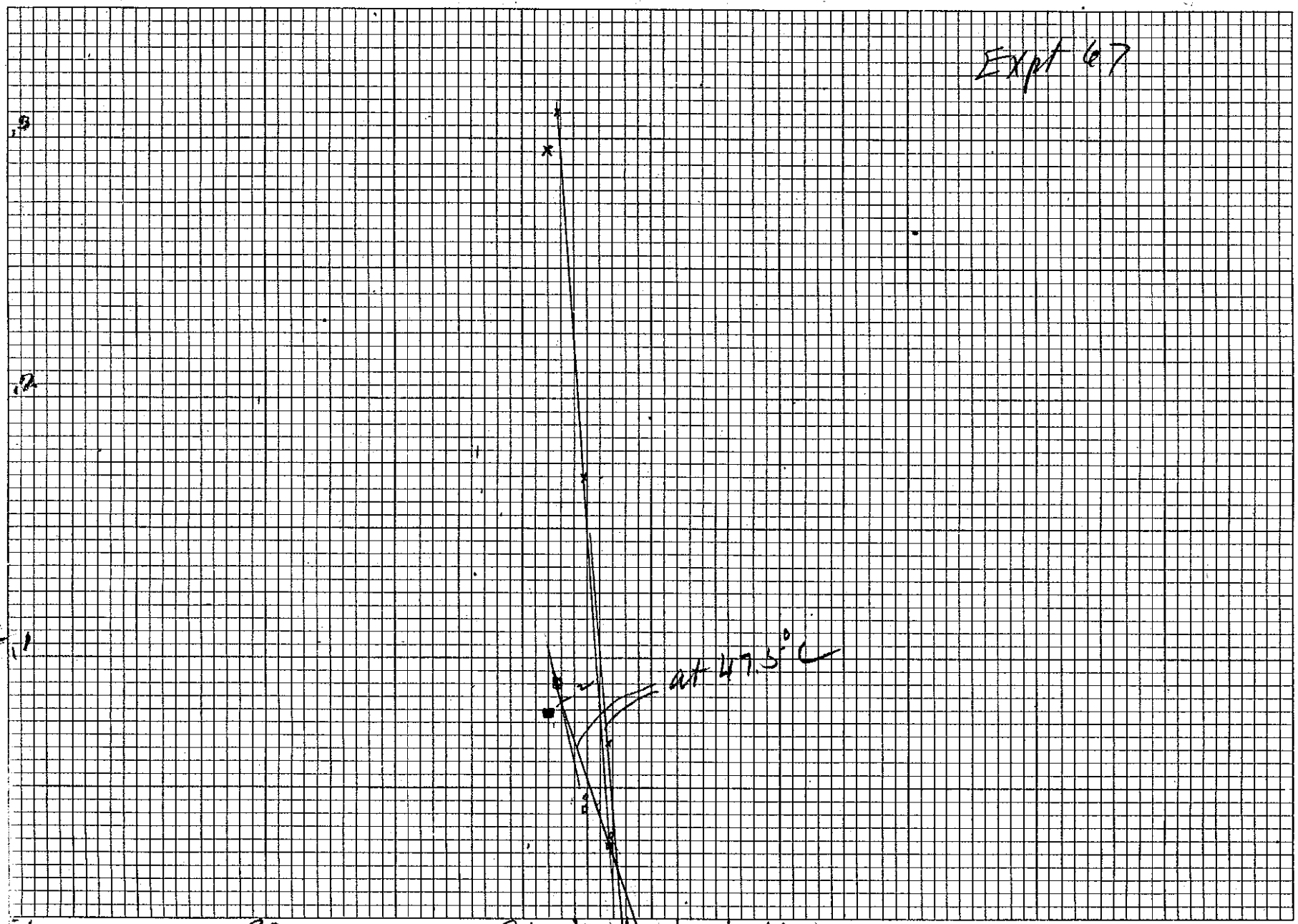
Date

4/23:

.0584e x 1.3 = ~~1000~~ 1,0000
~~1000~~ ,076
~~,240~~ ,924

$\frac{.924 \times 25.9}{.0577} = 414.7\ V$

Signed



Date 8-14-53 Thomas Fox Expt 67 H/23 = 414.5

10.4" sphere at ~~44°C~~ 39.5°C

Time	Safety	S	Probe in.	Manip in.	C_1		C_2		C_3	
					~~13.6~~ = not to be				~~2.2~~	
8 42	~~down~~	in	8.8	24.	24.2	(17)	24.4	(17.6)	13.25	(6.4)
8 52	up	in	full	Preliminary Test	243	.07	798	.023	300	.018
				Temp at ~ 41.5°C						
			added	50 cm³ salt at H/U = 154						
10 08	up	in	1.63"		15.5	163	12.25	12.4	~~.50~~	
			~~7.5~~		17.0		12.5		4.8	
10 30	"	9.53	9.57	25.77	55.5	.29	159.2	.078	61.2	.078
—	"	9.54	9.61	rise due to heating salt	63.2	.31	148.5	084	57.4	084
—	"	9.62	9.92	24.91	95.5	.17	266.25	.044	110.7	043
11 25	"		full	temp 41.5°C	139.8	.117	431	.029	169.0	.031
12 15	"	"	full	42.8°C at start	not counted		due to drift			
1 30	"	out	full	Cut at 39.5°C	Very slow upward drift in activity					
—			10.11	drained H₂O for cooling						
8-17-53			9.87	at 27.0C						
			.24"	12.5						

U-54

Reg. 105 341

66.4947
19.5932
46.9015

= .274 mU

.05770
.05846 gm U/gm

1,073 @ 23.4°C

1,073 X .05770 = .06191 ✓

Signed

Date

For Expt #68 added ~ 140 cm³ of Soln. at 15.4 #/ft³ (.1648 gm/cm³)

#/23 Calc. $.06193 \times 1.3 = \frac{1.0000 - .0805}{.9195}$

#/38 = $\frac{.9195 \times 25.9}{.06112} = 389.4$ ✓

Signed

Expt 68

.4

.3

.2

.1

9.0 9.2 9.4 9.6 9.8 10.0

Date 8-17-53 Thomas, Gilley, Fox — Expt 68, 10.4" sphere — Temp 83.2°C

H/23 =

Time	Safety	Source	Probe in.	Equiv. vol.	Manifold						
9⁴⁵	up	in	2.4	–	4.5"	20.5 } 21.5		23.5		50	
	"	"	"	–	"	22.5		23.5		50	
12⁰⁰	"	"	full		~25 ~84.0°C	56.7	.38	138.3	.170	51.3	.097
12⁰⁷	"	"	9.5	9.54		40.6	.53	85.1	.277	28.5	.175

added 60 cm³ at .1648 gm/cm³

Time	Safety	Source	Probe in.	Equiv. vol.	Manifold						
1⁴²	"	"	9.48	9.54	83°C	42.2	.57	95.5	.25	34.0	.147
			full			66.0	.325	165.7	.142	62.5	.08

Added 150 cm³ at .1648 gm/cm³

Time	Safety	Source	Probe in.	Equiv. vol.	Manifold						
2⁴⁵	"	"	9.47	9.52	(~82°C)	70.0	.308	178.2	.132	68.0	.074
3¹⁶	"	"	9.81	9.60	24.01	118.0	.182	323.5	.073	125	.04
3³⁰	"	"	full	~9.67	(83°C)	333	.065	935	.025	405	.012

4¹² " out " super crit at 89°

5¹⁵ " " full critical at 84.0°C — fuel perhaps not up to 84°C. Moderator raised 5°C in ~15 min.

5³⁸ " out full (not critical) temp 83.8°C

5⁵⁰ " " full crit 83.2°C — Due to evaporation

reflector level was 4.25" above sphere

.06112 ✓ gm 23/gm

.06143 gm U/gm

U-55- 84,4537

Reg 105342 — 19,7936

64,4601 gm net

1.076 at 23.4°C

~~.04577 gm 23/cm³~~

✓ .06576 gm 23/cm³

= 4.00 gm U

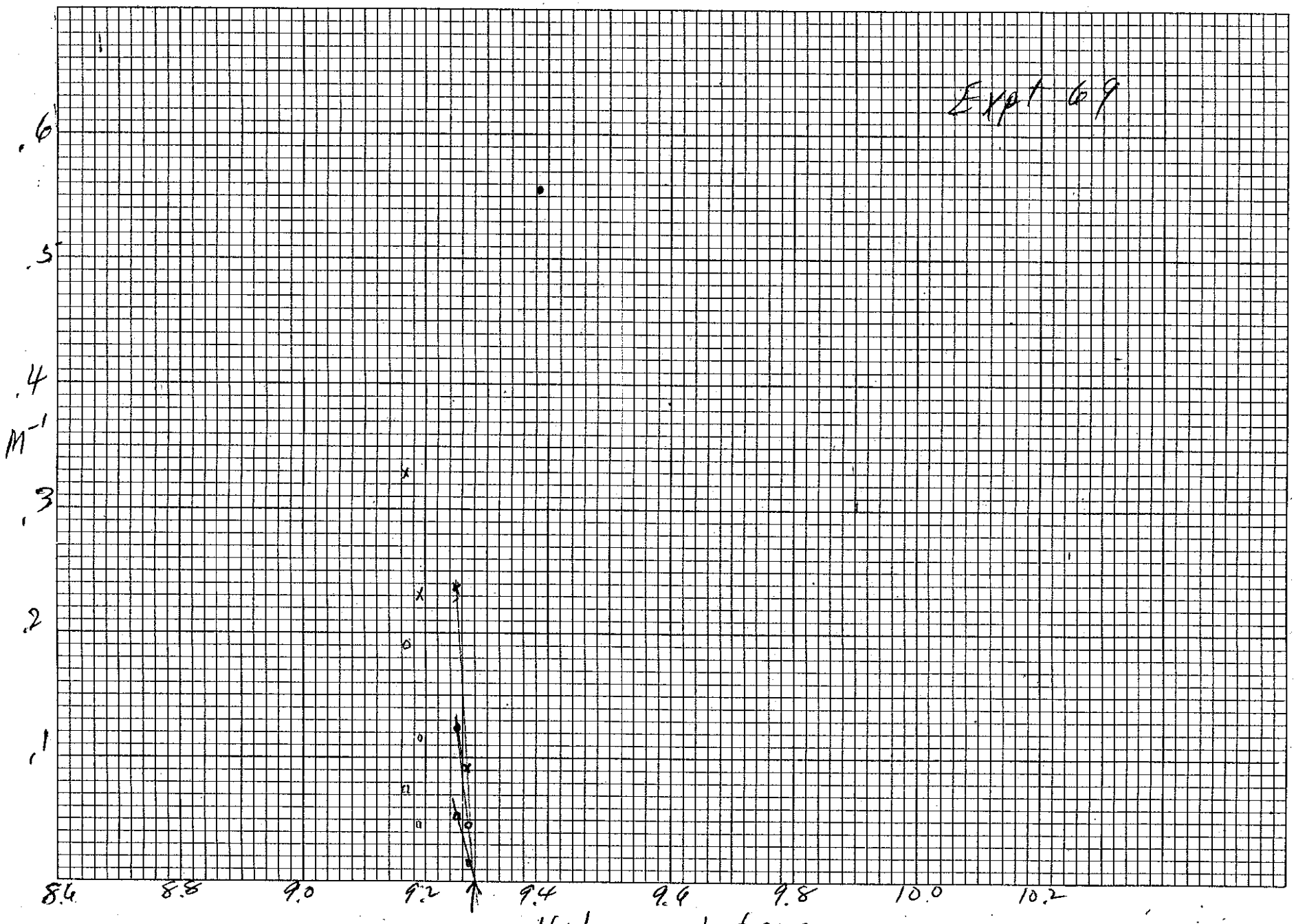
Signed

Sample F14 to test cleanliness of opened vessel after washing

Reg. no. 105340

result 2 ppm

Signed



8-18-53 Date Thomson Fox — Expt 49 — 10.4" sphere — H/23 - same as Expt 48 — Room Temp = 26.5°C — 77

Time	Safety	Source	Probe	Manifold	C_1		C_2		C_3	
8 53	up	in	~2.5	Empty	23.2	22	32.5	32	4.6	4.8
←	"	"	"	"	21.5		31.5		5.0	
9 20	"	" 9.25	8.85	23.17	94.0	.234	2598	.123	94.0	.057
		" 9.27	8.90		244	.09	734	.044	277	.017
		out	8.92		Crit					

Repeat after removing all heaters from reflector water

10 08	up	in 9.17	8.72		66	.33	169	.19	66	.073
		out 9.28	8.92		Crit.					

Repeat after draining top reflector to 4.25" above top of sphere — level same as ~ Expt 68

10 49	up	in 9.19	8.77		97	.23	274	.114	102	.047
		9.28	8.925		Crit (Effect barely measurable ^ of refl. difference)					

$\Delta V = \frac{9.66}{28} = 380\ cm^3 \simeq 38\%$

Sample same as Expt 48:

Crit mass $9.28 \times .0657 = 610.2$ gm.

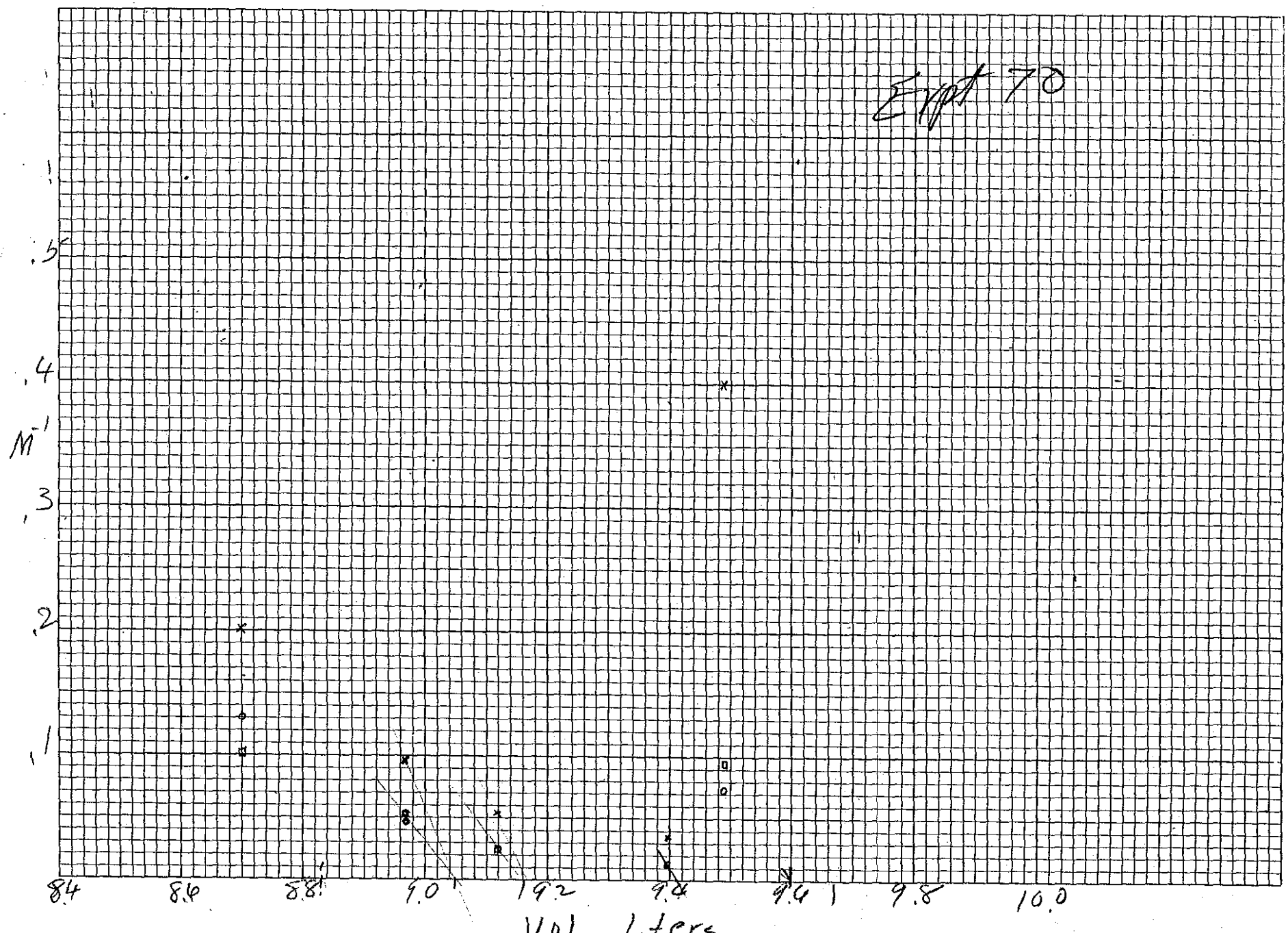
Signed

78. Date

H/X: .09352 X 13 = 1.00000 / .12157 / .87843

$\frac{26.1 \times .8784}{.0872} = 263.1$

Signed



Date 8-19-53 Thomas FRX

Expt #70 Using 93% U_{235} Soln

10.4" D. Sphere H/X = ~~2.00~~ 263.1

Time	Safety	Source	Probe	Manifold	C_1	C_2	C_3
3[32]	up	in	1.82"	5.76"	12.25 [11.5]	19.2 [19.8]	5.7 [5.6]
4[05]	"	"	"	"	10.5	20.5	5.5
4[22]	"	"	8.7	8.15	57. .20	151.5 .13	56 .10

Added 200 cm³ H_2O

8-20-53

9[07]	up	in	~~3.0~~ 2.75"	~~7.5~~ 2.30"	(8.5)	(12.3)	(5.0)
9[27]	"	"	8.97	8.46	3.087	89.5 .095	255 .048	97. .052

Repeat for mixing

10[00]	"	"	8.45	30.9	81.5 .1065	233.5 .0527	87 .058
10[06]	"	out	9.05	8.58	critical	temp. ~27°C	

~~8.70~~ Added 550 cm³ H_2O

10[35]			9.12	~~8.64~~ 8.70	166 .051	507 .024	199 .025

Added 1000 cm³ H_2O

11[40]	up	in	9.39	9.13"	2.685"	244. .035	744 .0165	303 .0145

Withdrew ~2 l & added 810 cm³ H_2O & mixed

1[18]	"	"	9.49	9.40	59.2 .40	1706 .072	53.6 .094
~1[35]	"	out	9.60	9.79	just crit.	Temp. 26.8°C	

~2[20] Replace heating elements, raise temp to 39.5°C

Crit. mass = 9.60 × .09710 = 932.2 gm ^{25}

Sample Ref 215326

61.2759
19.5514
41.7245

✓.09352 gm U/gm
✓.087 gm ^{25}/gm U
✓1.114 at ~25°C

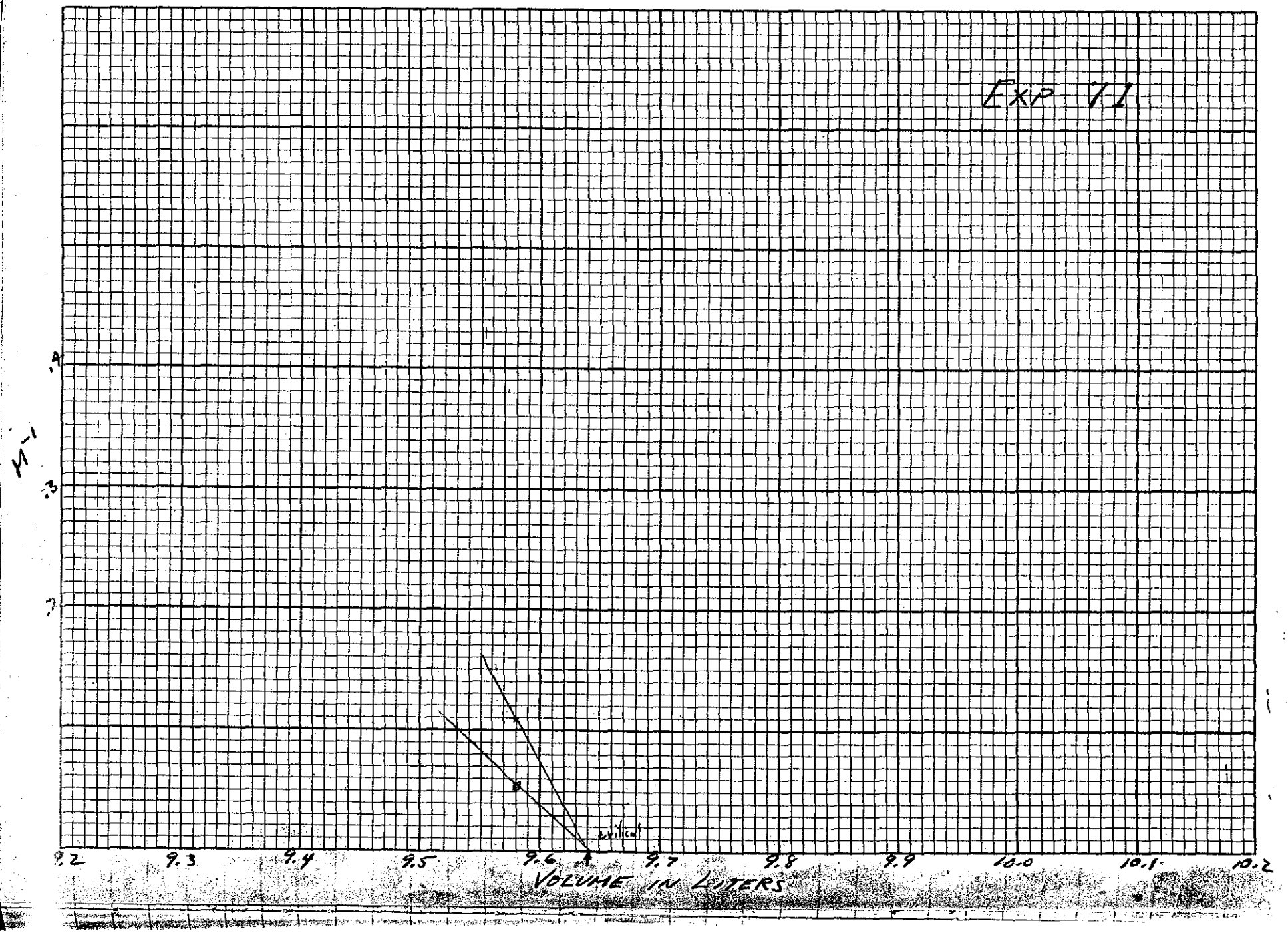
1.114 × .087 = ~~.0973~~ gm ^{25}/gm
.09780
.097096

Assayer Ref 984092 = 93.2% ^{25}

Signed

NO. 340 , -10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



Date 8-20-53 Expt #71 93.4% U^{235}-Sol
Thomas Hoff 10.4" sphere Temp 39.5

Time	Safety	Source	Probe	Manifold	C_1	C_2	C_3
			Expt #70	background	8.5	12.3	5.0

	exp	mc								
3[08]	up.	in	9.581	9.64	3333	78.2	.109	223	.055	88.5 .052
3[18]	up	out	10.02 below 3480 10.04 above	critical	—	—	—	—	Temp. 39.6	

Conc. of soln not changed for Expt #71

Withdrew 3 Y 61 from manifold &
Added 1270 cm^3 of .2244 gm U/gm soln for
Expt 72

 Date

H/25 Calc. .16174 × 1.3 = .132084

1.00000
.132084
.86792

$\frac{261 \times .8679}{.09476}$ = 239.3

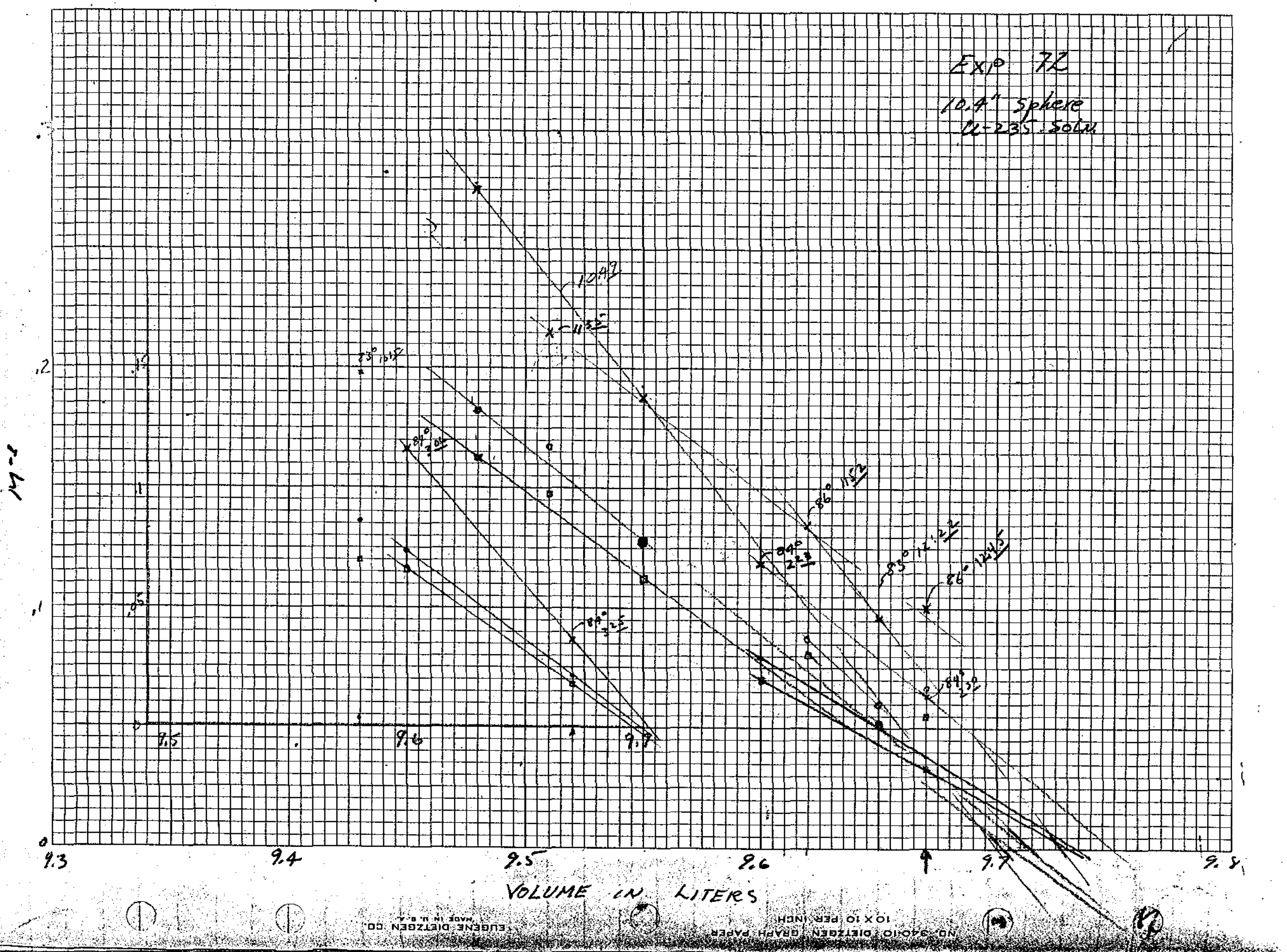
Reg 215327

67.2991
19.6426
47.6565 gm net

✓ 0.10167 gm U/gm
0.0948 gm ^{25}/gm
✓ 1.127 at 25°C

1.127 × .0948 = .1068 gm ^{25}/cm^3
.10679

Signed



EXP 72
10.4" Sphere
U-235 Soln
9.3
9.4
9.5
9.6
9.7
9.8
VOLUME IN LITERS
0
.1
.2
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.

Date 8-21-53 Thomas Fox

Expt 72 H/X =

10.6" Dia Sphere Temp (see below)

Time	temp	Rotely	Source	Probe	Manifold	C_1		C_2		C_3	
9 26	~50°	up	in	1.77	5.1"	9.5		16.9		5.8	
10 30	79.2°	up.	in	9.55R 9.56"	out 34.97	50.5	.188	132.8	.128	51.8	.112
10 48	~82°	"	"	9.48L 9.34"		34.5	.275	93.0	.182	35.6	.163
		added		40 cm³ at .299 gm U/cm³ & ~100 cm³ at							
~.10 gm U/cm³											
11 35		up	in	9.37 (9.51)	~33.80	44	.216	100.8	.168	39.3	.147
11 52	86°C			9.62 9.94	~34.70	70	.135	190	.089	72.2	.080
12 22	~83°C	up	in	9.65 10.12	>40.00 Temp 85° 12:32	99.2	.096	281.5		111.0	
12 32		Temperature increasing from 82° to 85°C power level constant									
		activity level constant									
12 45	86°C	up	in	~~9.61~~ ~10.13	Temp 86°C	95.	.10	274	.067	105.5	.055
1 30		added		30 cm³ of .299 gm U/cm³ at		50 cm³ at ~.10 gm U/cm³					
2 23	84°C	up	in	9.47 9.92	34.50 35.68	72.5	.119	211.5	.079	83	.070
2 30		"	"	full		148.5	.064	441.5	.038	170.5	.034
		added		60 cm³ at .299 gm U/cm³							
3 05		up	in	9.60 9.81	Temp ~84°	82	.114	229.5	.074	87.5	.064
3 25				full 10.4		258.2	.037	779.5	.022	312.5	.0185
4 00	80°C	(sphere full at ~10.2" on probe) 10.31				To check expansion.					
8/24/53		Reading on probe at room temperature 9.61" Temp. 23°C									
		added		60 cm³ of soln at .299 gm U/cm³							
8 48		up	in	2.03		8.5		15.7		4.9	
10 15	88°C	"	"	9.58 9.71	33.67	57.5	.148	180.3	.086	70.0	.070
10 50		up	out	10.50	full - critical (soup temp 81.8° H_2O temp 80.5)						
		added		35 cm³ of soln at .299 gm U/cm³							
12 14		"	out	10.25	super crit	Temp - soup 83.2°C H_2O 83.5°					
				10.23	just "						
12 48		"	out	10.7 (full) critical				temp - soup H_2O		85°C 86.2	

Sample previous page

Signed

84 Date 10-19-53 Thomas 704

~24°C

Calibration of 12.5" sphere

Vol. of right glass: 10cc = 4.13 cm.

Volume	Height	corrected Height	Corrected Volume
0	19.4cm.	0	0
535	22.4	3	534
1000	23.7	4.3	999
1482	24.7	5.3	1481
2000	25.6	6.2	1999
3000	27.3	7.9	2998
4000	28.8	9.4	3998
5000	30.2	10.8	4998
6040	31.5	12.1	5997
7000	32.7	13.3	6999
8000	33.9	14.5	7997
9000	35.1	15.7	8996
10000	36.3	16.9	9996
11000	37.4	18.0	10996
12000	38.8	19.4	11996
13000	40.1	20.7	12995
14000	41.5	22.1	13995
15000	43.2	23.8	14994
15470	44.1	24.7	15464
16000	45.2	25.8	15994
16265	45.9	26.5	16259
16635	47.1	27.7	16628
17000	49.1	29.7	16993
17024	49.8	30.4	17017
17026 full	50.8	31.4	17018

$V = 4.19 r^3$

$r^3 = 4.060$

$r = 15.9$

$r^2 = 31.92$

Signed

Date 9/25/53 — Exp. 73 — H/U_{-233} ~ 379 ; Temp. 96.5°C — 85

For Thomas — 10.4" Diameter Sphere

Time	Temp	Safety	Source	Probe	Manifold	C_1	C_2	C_3	
—	—	—	—	—	—	2.1	2.5	2.6	
3 12 P.M.	84°C	up	in	9.23"	—	5	15.25	—	
3 58	92°C	up	up	9.68	20.06	critical			
404	93.5	up	up	9.70	20.07	critical.			
9-28-53	added 60 cm³ H_2O								
9 35	~59°	up	—	2.92"	0	3.5	8.0		
11 20	89°	up	out	9.65"	19.78	critical			
—	94°	"	"	9.77	1990	"			
	added 60 cm³ H_2O								
1 48	96.5°	up	out	10.10	20.20	critical			
1 48	96.5	up	out	8.12	Rod calibration				
2 25	86.5	up	out	10.20	20.21	critical		vol	9.737
3 15	added 3½" of Reflector water								
3 35	closed drain valve + drained Reflector Water.								
9-29-53	24°	—	—	9.22	—			vol.	9.416 ℓ

added 5

$H/_{23} = .06363 \times 1.3$ — 1 00000 / ,08272 / ,91728

$\frac{259 \times .91728}{.0628} = 3783$

U-56 — Ref 105343

91.6975 / 19,7148 / 71.9827

.06280 ✓ / ✓ .06363 gm U / gm soln

✓ sp. gr. 1.080 @ 24°C

1.080 × .06280 = .06782 ✓ gm U/cm³

4,58 gm U

Signed

9-30-53
Water from East Tank: Sample E-1
After spill
Reg 105347

9-30-53 Water from reflector tank drained
On 9-29-53;
Sample F101; 23 ppm.
Reg 105345

9-30-53
Water from reflector tank drained on
9-28-53;
Sample F-102 Signed 0.14 ppm
Reg 105346

Date 4/29/53 EXP. 74 H/4-233 ~ 399 Temp - 65.5 87

Fox
Thomas

10.4" Sphere

9.00 added 500 cc of H_2O

Time	Temp.	Safety	Source	probe	Manifold	
1.30	65	up	up	10.09	18.62	critical
2.30	65.5	up	up. full	10.2	18.62	critical

$H/_{23} = 13 \times .06036 = \begin{array}{r} 1.00000 \\ .07847 \\ \hline .92153 \end{array}$

$\frac{.92153 \times 25.9}{.05957} = 400.6$

$V-57 - \begin{array}{r} 111.2411 \\ 19.7541 \\ \hline 91.4870 \end{array}$

$\begin{array}{r} .05957 \\ \sqrt{.06036} \end{array}$ gm⁴/gm mole

Mg 105 344

$\sqrt{}$ sp. gr. 1.075 @ 2°C

$\sqrt{.064024}$ gm²³/cm³

5.52 gm J

Signed

88 11-3-53 (Starting date)
Date
Tests on 23 rinsings:

Sample - S - From sphere
Reg no 105356 0.6 ppm

Sample M - From manifold
Reg. 105355 — 1.2 ppm

Sample from paper leaching: 1st Batch returned to Step-Can
P-1 : Reg 105365 — 0.70 ppm

P-2 Paper leaching : Batch in plastic beaker
Reg. 105366 — 34.0 ppm
This Batch re-leached 11-18-53

P-3 - Paper leaching ; Composite from three batches
(End of above except for 1
Reg 105367 — 0.62 ppm batch)

11/23 Expts 1.3 x .03873 = 1.00000 / .05035 / .94965

H/23 = 25.9 X .94965 / .038226 = 643.4

Signed

Date 10-20-53 Exp. 75 H/U-233 ~ 660

~~Fox~~ Thomas 12.5" DIA. sphere Temp @ critical = 56°C

Time	Temp	Safety	Source	probe	Volume	Manifold	C_1	C_2	C_3
10.45	~24°C	up	in	3.60	~600cc	986.	1.8	6.6	1.0
12 43	"	"	"	12.3	~17 (full)		3.0	9.5	2.2
added ~ 100 cm³ of conc. 23 soln - no analysis									
2 15	21°	up	in	12.30	~17(full)	987	3.25	10.25	4.0
added ~ 200 cm³ of conc. 23 solution - no analysis									
330	21°	up	out	10.16	15.96 l.	928	critical	not full.	

Drained 800 cc of Soln + added ~ 500 cm³ H_2O

10/21/53 Fox Thomas

Time	Temp	Safety	Source	probe	Volume	Manifold	C_1	C_2	C_3
8:45	21°	up	in	~3.0	~500cc	95400	3.25	3.75	.5
9 30	21°	up	in	10.46	16.3 l.	982.8	8.0 2.4	26.5 6.4	2.5 5
9 37	21°	up	in	10.53	16.35 l	983.15	51 15.7	223.5 59.6	14.5 29
9 45	21	up	out	10.55	16.360	983.20?	critical		
Withdrew ~1l. & added ~ 400 cm³ H_2O Total ~ 17.4 l									
11 25	21	up	out	10.91	16.63	985.67	critical		
2:00 Inserted heating elements, begin heating									
5 25	56°	up	out	12.55 ~~full~~	full	988.35	critical, closed valve and drained reflector water.		

10/22/53

8 20 down out 11.35

10 00 Removed sample; added ~100 cc of conc. 23 solution, no analysis. for next expt.

0.0382 ~~6~~ 3

√ 0.03873 gm U/gm

U-58

Reg 105351

89.2648 gm.
20.5509
68.7139

√ 1.044 sp. gr.

.03998 gm²³/cm³ √

2.066 gm U

Signed

90 Date 10/22/53 EXP. 76 $H/U_{-233} \pm 602.9$

For Thomas 12.5" Diameter Sphere Temp. @ critical = 99.5°C

Time	temp	Safety	Source	probe	Vol.	Manifold	C_1	C_2	C_3
1332	93.5	up	in		11.35		critical		
1345	95.0°	up	in		11.35		sub critical		
1422	99.0	up	up		11.65		critical		
1529	99.5	up	up		12.34	full	critical		

10/23/53

8[illegible] 33.5° - - 10.71

105354 - Mass assay; 233 — 98.72

234 — .50

235 — .06

238 — .72

100.00

$H_{233} = 1.3 \times .04119 = \frac{100000}{.94645 \quad .05355}$

$\frac{.94645 \times 25.9}{.040654} = 602.9$

$\nu .040654$ gm 23/gm

$\nu .04119$ gm U/gm

$\nu 1.049$ sp. gr.

$\nu .04265$ gm 23/cc

U-59 96.8246

Reg 105352 20.8419

75.9827

813 gm U

Signed

Date 10-23-53 Thomas Fox

Expt 77
12.5" Dia Sphere

$H/_{23}$ = 663.4

Room Temp =

Time	Temp	Safety	Source	Probe	Vol
6 05	26.3	up	out	12.38	full

Reflector H_2O Temp 26.3
Soup Temp 26.0

Insert rod to 5.92"

10-27-53 Thomas, Fox
Expt # 77 B – Rod calibration

3.15	~21°	up	out	11.69	critical

.03873 x 17,018 = 659.1 gm 23 ✓

$H/_{23}$ = .03762 x 1.0 $\frac{1.00000 - .04891}{}$
= $\frac{259 \times .95109}{.03713}$ = 663.4

Expt. 78
Calc of Crit. Mass: ~~17,018~~ 16,980 cm^3 x .06734 = ~~1146~~ 1144 gm 23
1143.8

$H/_{23}$ = 1.3 x .06325 $\frac{1.00000 - .08222}{}$
$\frac{259 \quad .91778}{.06243}$ = 380.8

Exp. 77 U-60
Reg 103353

Gross: 98.7610
Tare: 20.7909
Net: 77.9701
2.93 gm U

✓ .03713 gm 23/g
✓ .03762 gm U/gm
✓ 1.043 sp gr at 23.4°C
✓ .03873 gm 23/cm^3

Exp. 78 U-61
Reg. 105354
Exp. 78

Gross: 113.9535
Tare: 20.7238
Net: 93.2297
5.40 gm U

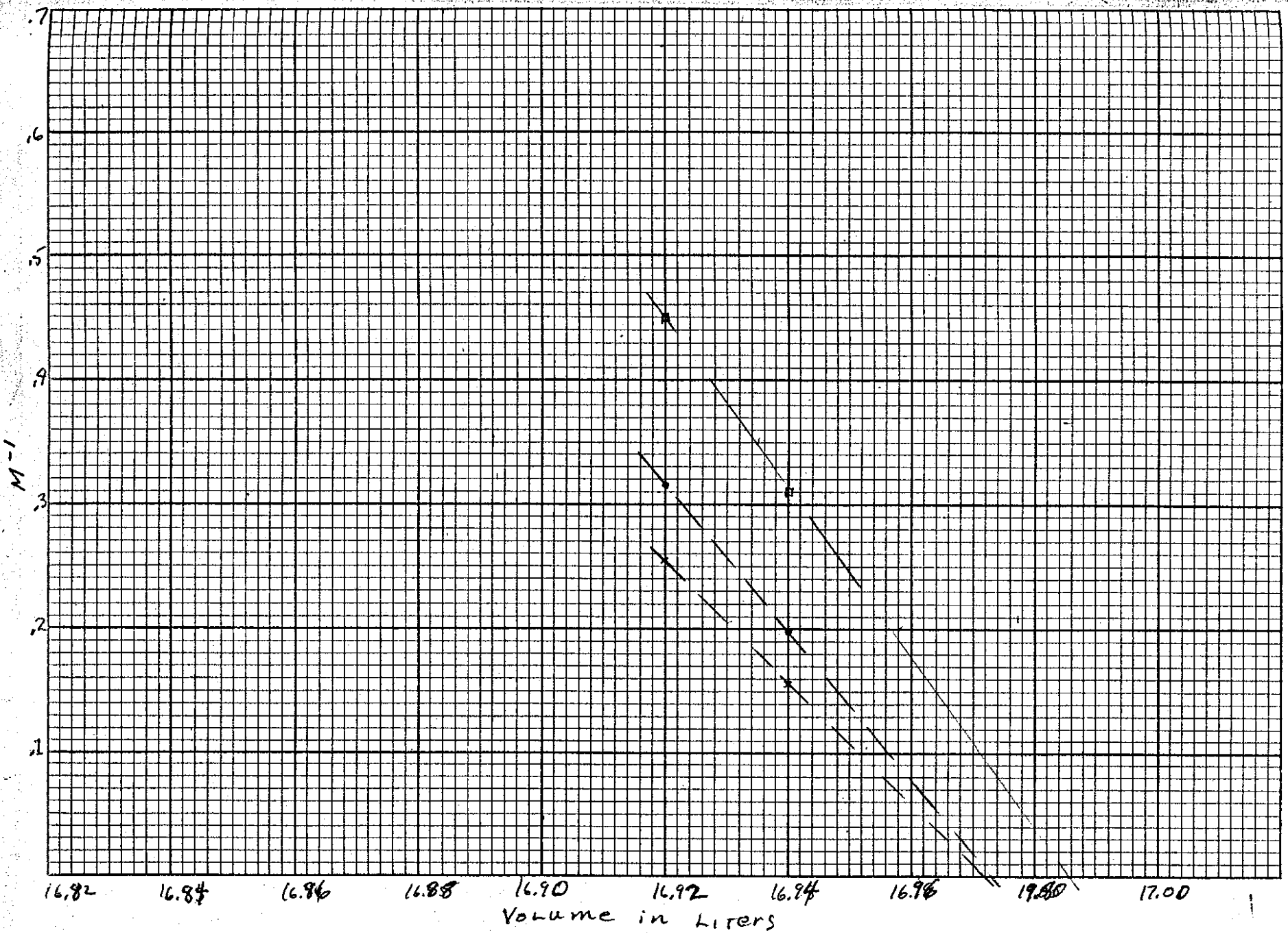
✓ .06325 gm U/gm
.062427 gm 23/
Signed ✓ .06734 gm 23/cm^3
✓ 1.079 sp gr at 23.4°C

92 Date 10/28/53 Exp. 78

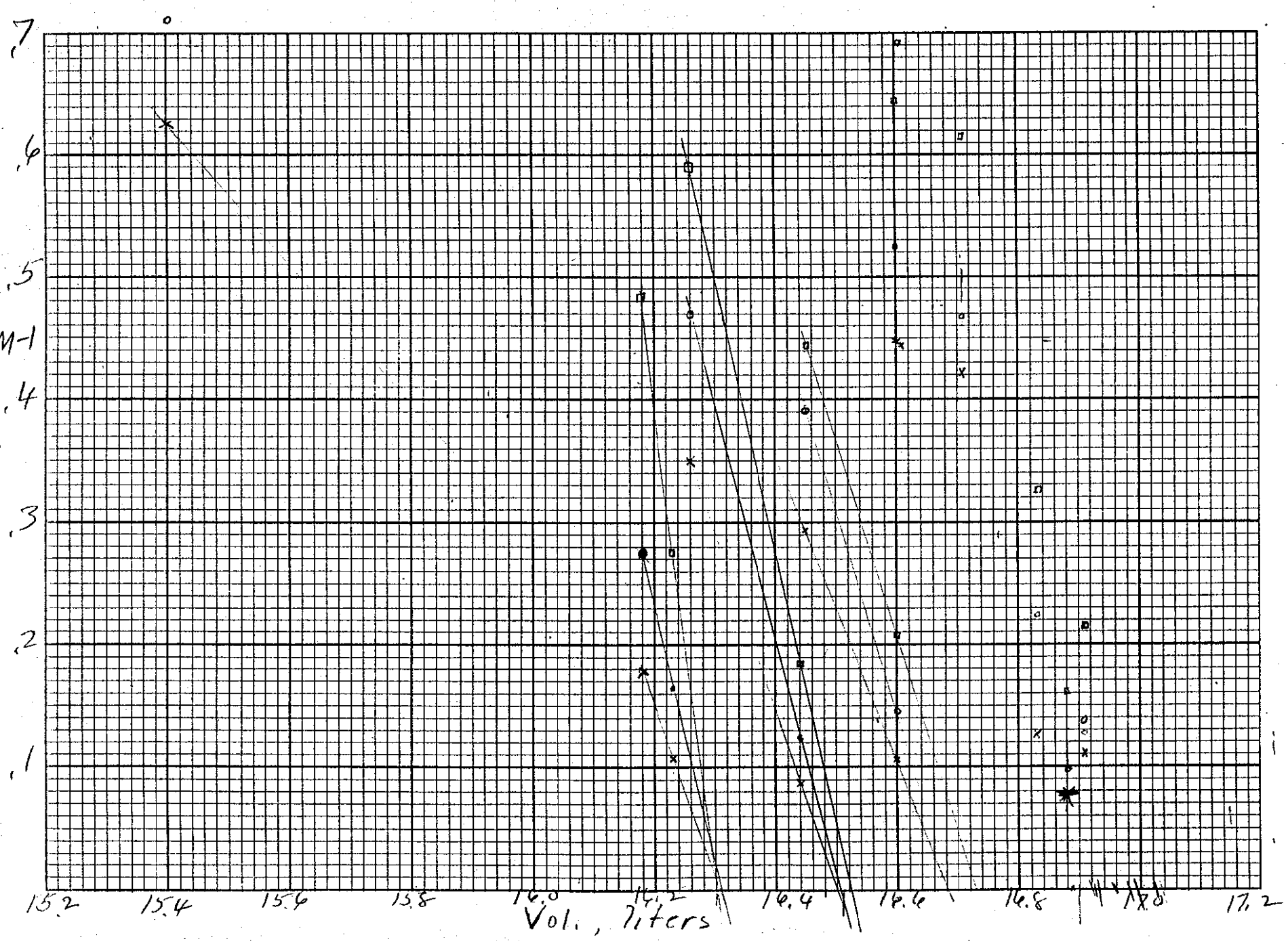
Fox Thomas 12.5" Dia. Sphere (BARE) Room temp ~ 21°C

Time	Safety	Source	probe	Volume	Manifold	C_1	o	C_2	x	C_3	□
11 15	—	in	~3	~~2.5 l.~~ ~~~550~~		5.3		24.3		5	
12 05	—	in	9.75	15.4	54.45"	7.5	.708	39.0	.624	6	.83
12 25	—	"	10.35	16.18	55.97	19.5	.127	136.8	.178	13	.385
12 42	—	"	10.39	~~16.17~~ 16.23	54.29	32.75	.162	226.5	.107	18	.278
				Extrapolated crit. 16.3 liters							
~1 00	Removed 500 cc of Soln. Added 500 cc of H_2O										
2 10	—	in	10.44	16.26	56.38	11.25	.47	70	.35	8.5	.59
2 30	—	in	10.65	16.44	57.93	43.5	.122	277	.088	27	.185
				Extrapolated Crit. Vol. 16.51 l							
2 45	Removed 500 cc of Soln Added 500 cc of H_2O										
3 37	—	in	10.64	16.43	58.02	13.6	.39	82.7	.294	11.2	.446
3 45		in	10.87	16.60	58.75	36	.147	227.5	.107	24	.208
				Extrapolated crit vol. 16.7 liters							
10/29/53	Fox + Thomas		Removed 500 cc of Soln added 500 cc of H_2O								
8 40	Backyard	in	~4"	1.4 l.	—	5.5	—	30	—	4.5	—
9 08		in	10.88	16.69	60.62	10.5	.524	67	.448	7	.643
	Drained back because of insufficient feed.										
	Added ~120 cc Soln (no analysis) + ~300 cc H_2O										
10 25	—	in	10.95	16.61	57.34	00		70	.43	6.5	.692
10 37	—	"	11.24	16.83	58.67	24.7	.222	242	.124	13.8	.326
10 42			11.33	16.88	58.80	55.5	.089	391.8	.077	28	.161
				Extrapolated Critical Vol. 16.93							
				Added ~120 cc of H_2O							
11 50	—	in	16.03	16.71	56.71	11.75	.468	71.5	.42	7.34	.614
12 05	—	in	11.41	16.91	58.68	39.5	.139	271.5	.11	21.0	.275
12 22		out	11.47	16.92	58.80	Crit					
12 30				Added ~180 cc of H_2O							
1 19	—	in	11.43	16.920	57.40	17.5	.315	118	.254	10	.45
1 20		in	11.54	16.94	58.34	27.8	.198	192	.156	14.5	.31
11 37		out	11.75	16.98 Signed Critical							

Calc Page 91 Sample on preceding page



10 X 10 PER INCH



Date 110653 Exp. 79 U-235

Fox and Thomas 12.5" Diameter Sphere (unreflected) Room temp 27°C

Time	Safety posit.	Sowa position	probe rd. reading	Volume in sphere	Manifold height	C_1	M^{-1}	C_2	M^{-1}	C_3	M^{-1}
2 18	—	in	1.2"	.5 l.	23.83"	8.1	—	29.4	—	0.6	—
3 45	—	in	11.73	16.98 l	54.10"	12	.673	53.75	.547	1.75	.343
3 55		in	11.88	empty manifold — Sphere full (on elevating table)							
110853	Fox + Thomas		added ~ 100 cc of soln @ .42 gms U/cc.								
background 10 20		in	2.80"	2.5 l.	27.5"	7.3	—	25	—	3.6	—
11 35	—	in	@ 11.28"	16.85 l	~53.41	9.5	.77	43	.582	5	.72
11 47	—	in	~~full~~ 5"	full	54.2	13.8	.529	70	.357	7.5	.48
12 30			added ~ 70 cc of Soln @ .42 gms U/cc.								
1 25	—	in	11.30	16.86 l.	53.24	10.2		45.5"		5.5	
			added ~ 150 cc. of Soln at 0.42 gms U/cc.								
2 37	—	in	11.10"	16.75	52.88	11.5	.634	45.2	.552	5.2	.692
2 310			drained back - added ~ 40 cc of Soln at 0.42 gms U/cc								
4 08		in	11.20	16.80 l.	52.94	11.0	.664	52.5	.478	5.3	.680
4 33	—	out	12.3	17.02 l.	~53.00	"just" critical					

17020 X .12521 = 2131.0 gm ✓

$$\frac{1.298 \times .11683}{1.00000} = .15165$$

$$\frac{24.1 \times .84835}{.10888} = 203.\#$$

sample 251 Gross = 516010
Req. # 215334 Tare = 27.5791
Net = 24.0219 gms

✓ .11683 gm U/gm
.10888 gm 25/gm
✓ 1.150 Sp.gr. corrected

2.80647

✓ 1.2521 gm 25/cm³

Signed

94 Date 11/11/53

Fox
Thomas

U-235

10.4" Exp. 80
~~5~~" Diameter Sphere

Time	Temp	Safety position	Source position	Manifold height	probe reading	Volume ℓ	C_1 M^{-1}	C_2 M^{-1}	C_3 M^{-1}
11⁰⁰	~80°C	up	in	~20"	R<.5"		6.0	17.0	3.0
11¹⁵	79°C	up	out	38.88	8.92	9.28	critical – necessary to dilute		
1⁰⁰		Removed ~5.00 ℓ of Soln – Added ~2.50 ℓ H_2O							
~~1²⁶~~	R-74.5 C-73.5	up	out	45.30	10.38	9.660	critical full –		
4³⁰	R. 74 C-74	up	out	45.30	10.38	9.660⁺	critical full –		

Added ~ 900 cc H_2O for next expt. Total vol. ~ 15.5 ℓ.

sample 252 | Gross 77.2170
Req.# 215335 | Tare 23.7908
net 53.4262

5.3 gms U

.099440 gm V/gm
.09268 gm 25/gm

1.123 Sp. gr. V

.09268 × 1.123 = .10408

Signed

Date 11/12/53 Exp. 81 U-235 --

Fox and Thomas 10.4" Diameter Sphere

Time	Temp	safety position	source position	manifold height	Probe height	Volume l.	$C_1 M^{-1}$	$C_2 M^{-1}$	$C_3 M^{-1}$	
9[47]	~30°	up	in	—	—	—	5.3	12.1	2.5	
10[35]	R-30 C-29	up	out	44.05	9.66"	9.59 l				critical.
10[45]		added 125 cc of H_2O								
11[12]	R 29.8 C:29	up	out	44.03	9.73	9.61				Critical
11[15]		added 200 cc of H_2O								
12[30]	-29	up	out	43.99	9.87	9.64				critical
12[45]		added 50 cc of H_2O								
1[40]	28.8	up	out	44.04	9.94	9.645 l				critical
1[45]		added 50 cc of H_2O								
1[57]	28°	up	out	44.05	9.98"	9.65 l.				critical.
1[50]	28°	*	added 100 cc H_2O							
2[15]	27.5°	up	out	44.00	10.04	9.655 l.				critical

sample 253: Gross 65.6672 .091840 ✓
Reg. # 215336 Tare 22.9716
Net 42.6956
3.9 gms U. 1.118 sp. gr.

Expt. 82-85 in back of book

Signed

96 Date 10-15-53 23 Inventory

Container	I	II	III
Gross	1783.88 gm	1376.30 gm	1285.26 gm
Tare	219.36	227.03	222.24
net	1564.52	1149.27	1063.02
Sample In	27.7557	IIa 28.8591	IIIa 24.3264
	19.5582	19.6230	20.6639
	8.1975	9.2361	5.6625
	1.15 gm U	1.9 gm U	1.37
Reg no.	105348	105349	105350
	.1399 gm U/gm	.2152	.2423 gm U/gm
	218.87 gm U	247.32	257.57

Container	IV (23-III)	V	VI (II)
	1828.63	2120.30	1281.82
	226.08	213.13	237.05
	1602.55	1907.17	1044.77

nitrate washings

Sample IVa	28.1858	Ia	30.0524	IVa	24.9740
Reg no	20.8371	Reg no.	20.8546	Reg no.	20.7336
105357	7.3487	105362	9.1978	105358	4.2204
	1.20		.43 gm		.85
	.1637 gm U/gm		.04694 gm U/gm		.2023 gm U/gm
		(23-97.66%; 24-.52; 25-.96%; 28-.86)			
	262.34 gm U		89.52 gm U		211.36

Signed

Date

VII (FH-7)

1300.98 gm
225.47
1075.51

27.7889
20.8896
6.8993

Reg. 105360
1.779 mV
.2561 ✓
275.44

X (56-23)

1305.27
221.33
1083.94

27.2781
20.0610
7.2171
1.679 mV
Reg. 105361
.2311 ✓
250.50 gm V

VIII + XI

2436.78
236.73
2200.05

56.8414
20.8172
36.0242

105363
1.01 mV ✓
.02806 gm V/gm
33.46 gm V
10.28
43.74 Total gm V in VIII

XI (combined with VIII)

1246.89
237.67
1009.22
1.64 lost in transfer
1007.58 net

35.1448
20.7975
34.3473
.359 mV
105364 ✓
0.01020 gm V/gm
10.28 gm V

VIII Separate

1429.20
236.73
1192.47
1009.22
220.1.69
2200. .05
1.64

Mass
98.63% -23
.54% -24
.04% -25
.79% -28

23 - 98.61
24 - 0.52
25 - 0.04
28 - 0.83
mean

IX (FH-6)

681.09
226.27
454.82

IX transferred from XII

105359
.2852 ✓
129.71 gm V

XII (58-23)

1957.09
230.62
1726.47

26.8467
20.9311
5.9156
1.69 gm V
105359
.2852 ✓
207.1

Signed

~~Date~~ XIII	XI	XIV
2294.82	2172,47	2220,48
228.04	237.67	221,21
2066.78	1934,80	1999.27
(a) 53.2777	XI-2 141.1077	137.1123
19.1452	21.0271	20.5308
34.1325	120.0806	116.5815
.173		
(105368) ~~negative~~ 105369	105370	105371
.005068 gm 4/gm	.00040	.003812
10.47	.77	7.62

XIIIb sent ~~0 sa~~
reg 105369

23 - 95.58 ✓
24 . 0,55
25 .13
26 .74

Signed

Date

SECRET
SECURITY INFORMATION

Extra Sampler

I	II	III	IV	V
25.1364	28.0120	27.1845	28.6071	28.3058
19.7760	19.7530	19.6669	20.8846	20.2073
5.3604	8.2590	7.5176	7.7225	8.0985
Reg no. 105348	105349	105350	105357	105362
.1399 gm U/gm	.2152	.2423	.1637	.04694
✓0.75 gm U	✓1.78	✓1.82	✓1.24	✓0.38

VI	VII	VIII	X	XI
27.9538	31.7585	45.2707	27.5422	43.4764
20.8731	20.8489	20.8769	20.7808	20.9075
7.0807	10.9096	24.3938	6.7614	22.5689
105358	105360	105363	105361	105364
.2023	.2561	.02806	.2311	.01020
✓1.43 gm U	✓2.79	✓0.68	✓1.53	✓.23

XII	XIII
30.8232	44.2173
20.7825	20.7990
10.0407	23.4183
105359	(Sent to Lab. on 105369)
.2852	
✓2.86 gm U	+189 +2

Quan 15.51

SECRET
SECURITY INFORMATION
Signed

100 Date

	35	36	37	38
Personnel	✓	✓✓	✓	✓
Valves open	✓✓	✓✓	✓	✓✓
Source in	✓✓	✓✓✓	✓✓	✓✓
Insts checked	✓✓	✓✓✓	✓✓	✓✓
Scram "	✓✓	✓✓✓	✓✓	✓✓
Safety Blade up	✓✓	✓✓✓	✓✓	✓✓
Control operable	✓✓	✓✓✓	✓✓	✓✓
Red Light	✓✓	✓✓✓	✓✓	✓✓
Vessel zero calibrated	✓✓	✓✓✓	✓✓	✓✓
Air Valve open			✓✓	—

Check List

Sample F-103 1st Barrel of water from 12.5" Reflector tank; Reg #215340
result: .04 PPm

Sample F104 2nd Barrel of water from Reg No. 215341 12.5" Dr. Sphere Reflector tank
result: .04 PPm

Sample Resolver from Jar:

U-57	U-56	U-58	U-59	U-60
85.5951	60.1167	47.0109	50.6239	74.3853
19.7541	19.7148	20.5509	20.8419	20.7909
65.841	40.402	26.460	29.7820	53.595
105344	105343	105357	105352	105353
.06036	.06363	.03873	.04119	.03762
✓3.97	✓2.57	✓1.02	✓1.19	✓2.02

U-61	I a	II a	III a	IV a
81.3208	23.7095	24.9782	22.9573	24.0681
20.7238	19.5582	19.6230	20.6039	20.8871
60.5976	4.151	5.355	2.294	3.231
105354		[redacted]		
.06325	.1399	[redacted]	2423	.1637
✓3.83	✓1.58	SEC[redacted] ✓1.15	✓.35	✓.53

I a – Empty

VI a Empty

S, M & P-1 Fluorometric

II a	VII a
22.9586	31.4648
20.8896	20.8172
2.069	10.647
.2541	.02806
v .53 gm	v .30

X a	XI a	XII a
22.6872	31.5255	22.3135
20.0610	20.7975	20.9311
2.626	10.7280	1.382
.2311	.0102	.2852
v .41	v .11	v .40

Callihan's sum 19.402

My total 19.36

+ "b" samples 15.51

34.87 gm

4.57

30.30

With container XI –

Samples No.

IV b 1.26

X b 1.53

II b 1.78

4.57

SECRET
SECURITY INFORMATION

RESTRICTED DATA
This document contains [illegible]
defined in the Atomic Energy Act, 1946.

Fox + Thomas — Exp. 82

U-235
12.56" Diameter Sphere
Reflected.

Time	Temp.	Safety position	Source position	Manifold Height	Vol.	Probe height	C_1	M_1^{-1}	C_2	M_2^{-1}	C_3	M_3^{-1}
10:53	~52°C	up	in	—	< .5 ℓ	.9"	5.5	—	14.5	—	1.75	—
10:53		added 800 cc of H_2O										
10:57	~56°C	up	in	—	< .5 ℓ	1.2"	5.6	—	11.5	—	1.5	—
11:02	81°C	up	in	26.96	16.4 ℓ.	10.61"						
11:05		added 800 cc of H_2O										
11:10	92°C	up	out	27.99	full	12.36	Slightly sub critical.					
11:30.5	83°C	up	out	27.99	full	12.28	Slightly super critical					
11:35	87.5	up	out	27.99	full	12.—	just critical.					
11:38	87° — Temp of solution											
11:53	~22°	—	—	—	16.6 ℓ	10.85"						

sample #254
Reg#: 215342
Gross: 59.6656
TARE: 19.9868
Net: 39.6788
Analysis: .05460 gms U/gm soln
2.2 gms U
gms U5/gm soln.
1.0695 sp. gr.

Sample # 257
Reg. #215345
Gross: 70.0155
Tare: 19.6675
Net: 50.3480
Analysis: .05650 gms U/gm soln
gms U5/gm soln
by hydro.

12/2/53
Fox and Thomas

Exp. 83

4-235
12.56" Diameter Sphere
Reflected

0900 added 450 cc of H_2O to the Solution of Exp. 82.

Time	Temp	Safety position	Source position	Manifold height	Probe height	Volume of Soln.	C_1	C_2	C_3
						Remarks			
1750	75°C	up	~~up~~ out	29.64	11.66	16.97 ℓ	Slightly	subcritical	
1810	72.5	up	out	29.85	11.81	17.0 ℓ.	Slightly	subcritical	
1826	71.0	up	out	29.93	11.87	17.0+ ℓ.	Slightly	supercritical	
1852	72.0	up	out	29.93	11.94	17.0++ ℓ	Slightly	subcritical	
1854	-72.5°	up	out	30.24	full 12.20	full	Slightly	Subcritical	turn heat off.
1949	69.2°	up	out	30.16	12.22'	full	just	critical	
1955	70.5°C	measure of soup temperature with Thermocouple.							

.0555 = current published

not accept.

Sample #255
Reg. # 215343

Gross	50.1476
Tare	21.1825
Net	28.9651

1.6 gms U.

Analysis .0543627 gms U / gm Soln
gms U-235 / gm Soln

1.0459 sp. gr.
(1.0698)

Fox + Thomas Exp. 84 | U-235 12.56" Dia. Sphere Reflected

20253

2[30] Added 900 cc's of H_2O to solution of Exp. 83

Time	H_2O Temp	Soln Temp	Safety position	Source Position	Manifold height	Probe height	Vol of Soln	Critical: Sub, just, Super
3 30	16°C	36°C	up	out	30.15	12.27	full	✓ Super
4 05	38°C	33°C	up	out	29.+	11.50	16.974	✓ Super
10353								
9 15	38°	36°	up	out	29.27	11.60	16960	✓ Super
9 30	~~43~~°	37.5	up	out	29.30	11.67	16975	slightly Super
9 41	43.5	41°	up	out	29.35	11.78	16996	slightly Sub
10 19	43.5	42°	up	out	29.64	11.96	full	slightly Super
10 45	42.8	43	up	out	29.64	11.98	full	✓ Sub

Sample 256 | Gross 53.7194 | Tare 19.6466 | Net 34.0728 | 1.8 gm U-235 | .05162 $\frac{gm^{25}}{cm^3}$

Analysis: .05199 gm U/gm soln | .048444 gm U-235/gm soln | 1.0657 sp. gr.

Sample 258 | Reg. # 215346 | Gross : 90.7932 | Tare : 19.6159 | Net : 71.1773 | sp. gr. = 1.0662 by hydro. | 3.1 gm U-235 | .05151 $\frac{gm^{25}}{cm^3}$

Analysis: .05192 | .04838 | 1.0658

Exp. 8.5 11053

Rod Calibration for U-235 in 12.5" Diameter Sphere

Following the experiment in which the 12.5" diameter spherical reactor is made critical at room temperature the reactor is to have ~~an~~ additional (by adding ~25 cc of concentrated solution to the mixture) activity added to the system. The following procedure will be followed in calibrating the rod in order to facillatate the comparison with the calibration made using U-233.

I. a) Insert the rod to 8.2"
b) bring the system to criticality by adding fuel. {at low power}
c) withdraw the rod to 8.7" (Rod displacement 1/2")
d) obtain period from ln N. by allowing Power level to rise about one decade.
e) Try reverse, i.e., allow reactor power to become stable and insert rod 1/2".

II a) ~~Insert~~ Reactor just critical with rod inserted to 8.2"
b) withdraw rod to 9.2" (Rod displacement 1.0")
c) repeat (d) + (e) of I

III a) Reactor just critical with rod inserted to 8.2"
b) withdraw rod to 9.7" (Rod displacement 1.5")
c) repeat (d) + (e) of I.

IV a) Reactor just critical with rod inserted to 8.2"
b) withdraw rod to 10.2" (Rod displacement 2.0")
c) repeat (d) + (e) of I

over

Time	Temp	manifold height	Probe height	Critical sub	just super
12:58	−29°C	29.13	11.44	✓	
12:57	~ 29°C	29.20	11.47		slightly
3:43	22°C	29.07	11.31 ≈ 16,850 ℓ		✓
			~ 868 gm 25		

? Tubby

RESTRICTED DATA

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