R.A. Millikan
A.A. Michelson
Carl Kinsey
Henry G. Gale

Robert Millikan (top center) on the steps of Ryerson Laboratory, U. of Chicago, 1908. Other colleagues (L-R): A. A. Michelson, Carl Kinsey, Henry G. Gale.

ROBERT A. MILLIKAN
Oil Drop Experiment Notebooks

NOTEBOOK TWO:
March–April 1912

ARCHIVES
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

Abstract

Robert A. Millikan (1868-1953) began his experiments to measure the charge on the electron, e, in 1907. The experiments were performed in Ryerson Laboratory at the University of Chicago, where Millikan was professor of physics. For this work, and for work on the photoelectric effect, Millikan was awarded the Nobel Prize in physics in 1923.

Millikan gives his own account of the electron charge determination in his published autobiography in the chapter titled “My Oil-Drop Venture (e)” (Robert A. Millikan, *The Autobiography of Robert A. Millikan*, New York, 1950). With the aid of graduate students Louis Begeman, Harvey Fletcher, and J. Y. Lee, Millikan devised the method of measuring the rate of fall of a single electrically charged oil drop under the forces of gravity and electricity. From 1909 until the spring of 1912, Millikan reports, he spent every available moment in the laboratory on his oil-drop experiment. His first comprehensive, though to some extent preliminary, results were published in September 1910 in the journal *Science* as “The Isolation of an Ion, a Precision Measurement of Its Charge, and the Correction of Stokes’ Law,” *Science* 32: 436-448. He soon became embroiled in a controversy with the Viennese physicist Felix Ehrenhaft, who claimed to have found much smaller electric charges. Millikan went back to work on a new set of experiments. By the spring of 1912 he had collected the data for what he termed “the final, absolute determination of the numerical value of the electron” (*Autobiography*, p. 84). Results were published in August 1913 in “On the

http://resolver.caltech.edu/CaltechLN:LN_Millikan_R_2

Elementary Electrical Charge and the Avogadro Constant," *Physical Review* 2: 109-43. This last, definitive set of experiments were recorded in the only two lab notebooks which Millikan preserved among his papers. These two notebooks are presented here in facsimile. They cover the period from October 1911 through April 1912 and contain what Millikan himself considered his conclusive, historic work on this problem.

For an analysis of Millikan's notebooks and a defense of his experimental method, see the article by David Goodstein, "In Defense of Robert Andrews Millikan," published in *American Scientist* 89/1 (Jan-Feb. 2001): 54. http://www.americanscientist.org/issues/num2/2001/1/in-defense-of-robert-andrews-millikan/1

Administrative information

Copyright Notice

Copyright may not have been assigned to the California Institute of Technology Archives. All requests for permission to publish or quote from digital archives must be submitted in writing to the Caltech Archivist. Permission for publication is given on behalf of the California Institute of Technology Archives as the owner of the physical items and, unless explicitly stated otherwise, is not intended to include or imply permission of the copyright holder, if separate from Caltech. Obtaining copyright permissions is the responsibility of the user.

Preferred citation

Robert A. Millikan Oil Drop Experiment Notebooks. Lab Notes Online. California Institute of Technology Archives. Retrieved [supply date of retrieval] from the World Wide Web:
http://resolver.caltech.edu/CaltechLN:LN_Millikan_R_2

Contact information

Archives, California Institute of Technology
Mail Code 015A-74
Pasadena, CA 91125
Phone: (626) 395-2704 Fax: (626) 793-8756
Email: archives@caltech.edu

Graphics and content © 2008 California Institute of Technology.

OIL DRO

EXPERIMEN

R. A.

RYERSON

UNIVE

M

TABLE OF CORRECTIONS - TO VOLTMETER 2539
(R.I. No. 1508)

300 - 6.4		782 + 17.0		836 + 13.6	13.1
325 - 5.8		784 + 16.9		7 + 13.5	13.0
350 - 4.8		786 + 16.8		8 + 13.4	12.9
375 - 4.0		788 + 16.7		9 + 13.3	12.8
400 - 3.0		790 + 16.6	x 18.0	840 + 13.2	12.7 X
425 - 1.4		792 + 16.5	178	1 + 13.2	12.6
450 + 0.2		794 + 16.4	176	2 + 13.1	125
475 + 2.0		796 + 16.3	173	3 + 13.1	12.4
500 + 3.6		798 + 16.2	17.0	4 + 13.0	12.3
510 + 4.3		800 + 16.1	x 16.9	5 + 13.0	12.3
520 + 5.0		1 + 16.1	16.8	6 + 13.0	122
530 + 5.8		2 + 16.0	16.7	7 + 12.9	122
540 + 6.5		3 + 16.0	16.6	8 + 12.9	121
550 + 7.4		4 + 15.9	16.5	9 + 12.9	121
560 + 8.6		5 + 15.8	16.4	850 + 12.9	12.0 x
570 + 9.9		6 + 15.7	16.3	1 + 12.9	120
580 + 11.3		7 + 15.7	16.2	2 + 12.9	
590 + 12.7		8 + 15.6	16.1	3 + 12.9	
600 + 13.6		9 + 15.6	16.0	4 + 12.9	
610 + 14.2		810 + 15.5	x 160	5 + 12.8	12 x
620 + 14.6		1 + 15.5	158	6 + 12.8	
630 + 15.0		2 + 15.4	156	7 + 12.8	
640 + 15.2		3 + 15.4	155	8 + 12.8	
650 + 15.5		4 + 15.3	153	9 + 12.8	
660 + 15.7		5 + 15.2	15.2	860 + 12.8	
670 + 15.9		6 + 15.2	151	1 + 12.9	
680 + 16.2		7 + 15.1	150	2 + 12.9	
690 + 16.6		8 + 15.1	149	3 + 12.9	
700 + 16.9		9 + 14.9	148	4 + 12.9	
705 + 17.2		820 + 14.9	x 14.8	5 + 12.9	
710 + 17.4		1 + 14.8	147	6 + 12.9	
715 + 17.6		2 + 14.8	147	7 + 13.0	
720 + 17.8		3 + 14.7	146	8 + 13.0	
725 + 18.0		4 + 14.7	146	9 + 13.0	
730 + 18.1		5 + 14.6	14.5	870 + 13.0	
735 + 18.1		6 + 14.5	14.5	2 + 13.1	
740 + 18.1		7 + 14.4	144	4 + 13.1	
745 + 18.0		8 + 14.3	143	6 + 13.2	
750 + 18.0		9 + 14.2	143	8 + 13.3	
755 + 17.9		830 + 14.2	x 14.2	880 + 13.4	
760 + 17.8	x 19.6	1 + 14.1	14.0	2 + 13.5	
765 + 17.6		2 + 14.0	138	4 + 13.6	
770 + 17.5	x 19.3	3 + 13.9	13.6	6 + 13.7	
775 + 17.3		4 + 13.8	13.4	8 + 13.8	
780 + 17.1	x 18.7	835 + 13.6	13.2	890 + 13.8	

340.5

48) 200 (4
192

48) 250 (5
240
1
70
47
23

60
48
120

478
48) 1104

.06	4779
.08	4786
.3	4796
.15	4789
.08	4786
.02	4783
.42	4802
.52	4807
.13	4788

65
9) 7116
4791

02
Less .18% = 4.782

Wednesday March 13, 1912 θ= p=

Volts at 4.20

G		F
18.462		13.904
18.092		(17.188) — chronography-struck bottom
18.288		19.618
18.374		

668.0 + 15.9
~~829.5 + 14.7~~
844.0 + 13.0
848.5 + 12.9
~~651.5 + 15.5~~
504.0 + 04.2
844.0 + 13.0

657.0 +
841.0 +
830.5 +

833 + not used
839 +
839 +
819 +
838 +
838 +

(1)

Wednesday, March 13, 1912.
2nd Obs.

$\theta = {}^{22.94}$

G	F
22.076	15.676
22.010	15.652
21.834	15.856
22.102	
21.948	110.4—
21.886	
	4:58 P.M.

$p =$

Volts at 5:00 P.M.
(1) not used
(2) 838.0 + 13.4
(3) 839.0 + 13.3
(4) 819.0 + 14.9
(5) 837.5 + 13.4
(6) 838.0 + 13.4

4171.5 + 68.4
= 4239.9
4237.9

②

Wednesday, March 13, 1912
Third Obs.
5:15 P.M.

θ = 22.91

$p = \frac{67.25 \quad 51.58}{15.67}$

14

37

Voltsat. 5:30 1st bank not used
837.0 + 13.0
838.0 + 12.9
819.0 + 14.8
837.0 + 12.9
837.0 + 13.0
4168.0 + 66.6 = 4234.8

G	F	
	~~23.0~~	~~46.4 —~~
9.884	23.0	45.8 —
9.924	22.6	45.8 —
9.858		
9.860	~~21~~	37.6 —
9.912	18.9	37.8 —
9.902	—	37.4 —
9.902	—	58.6 —
9.904	—	81.6 —
9.902	41.6	82.6
9.814	16.0	31.9
	—	60.0
9.806	30.6	60.6

11) 9668
9.879

$\frac{1}{45.8} = .02183$

$\frac{1}{37.6} = .02660$

$\frac{1}{58.6} = .01706$

$\frac{1}{81.6} = .01225$ $\frac{1}{82.6} = .01211$

$\frac{1}{31.9} = .03135$

$\frac{1}{60.0} = .01667$

Differences

.02660
.02183
.00477

.02660
.01706
2) .0954
477

1706
1225
481

3135
1211
4) 1924
481

3135
1667
3) 1468
489

1012
2183
24) .12303
4731
4720

1012
2660
27) 12980
4733

1012
1706
25) 11826
4731

1012
1218
24) .11338
4722

1012
3135
28) 13255
4716

.1012
1667
25) 11787
4715

4893
481
481
477
477
5) 48553
4810

4731
4733
4731
4722
4716
4715
6) 148
4725
.00411

4810
4725
9536
4768

5:30 P.M.

$\frac{1}{9.88}$ = .1012 × 1.021 = v_1 = .10332 = $v_1 + v_2$ = .004867 ~~[illegible]~~

mean of 4810 and 4725 = $\frac{4725 \quad 4810}{4767}$ × 1.021

Log = -1.01412
" = -1.50796

Log = -3.68772
-1.50796
3 1983
-6.39253
+3.62696
-10.76549
7656

Volts = 4236.

e₁ = 5.827
2
5.825 Prbly low
e₁ = 5820

a
-164270 42079
3.62716 6249
-1.01412 .0145
-13.06888 .0623
-3.68772 6869
3) -11.38406 3754
-4.46035 44585
1.19507 .1951
3.65692 36536
2.34327 23464

l
-4.8547
1.1951
-5.6596
-4.46063
-1.1980

74
2011
~~2886~~
.0002895 = a
~~2889~~
~~.1595~~ = l/a
.1582 = l/a
~~.1587~~
1589

221.2
~~220.5~~ = 1/pa
~~2219~~
2220

OK

$e^{2/3}$
3) -10.7658
-4.9217 = -4.4217
-7.8410
8434

7644
2
3) 5298
-7.8433

~~69.84~~
69.73
69.7 = $e^{2/3}$

3) Thursday, March 14, 1912

First Observation

3:10 P.M.

Flickers some

θ = 23.00

p = 67.40
~~51.35~~
15.98
16.05

Volts at 3:00 P.M.

836.0 (not used)

840.5+12.7
840.5+12.6
822.0+14.7
840.0+12.6
841.0+12.6

41 84.0+75.2 = 4261.6

4259.2

15

36

~~34~~

Beauty

G		F	
89 9.314		11.954	11.927
9.356		11.900	
9.294		17.820	17.759 = .05631
9.216		17.726	
9.312		17.704	
9.254		17.786	
9.358		21.292	21.230 = .04710
9.438		21.168	
9.366		19.624	? .05191
9.236		34.556	34.594
	(17.6)	(34.7)	
9.270		34.632	
9.19.6	(17.6)	(34.0)	$\frac{1}{34.6}$ = .02890
9.256		13.546	$\frac{1}{13.55}$ = .07380
9.232		23.592	$\frac{1}{23.59}$ .04239
	—	(23.2)	
9.244		35.176	$\frac{1}{35.273}$ .02835
9.206		35.370	
	(18.0)	(35.4)	$\frac{1}{35.4}$ = .02825
9.228	34.0	68.4	$\frac{1}{68.4}$ = .01462
9.186			

18)4.9682
9.265

.01820 ÷ 4
= .004555

.04490 ÷ 10
= .004490

.03141 ÷ 7
= .004487

.1404 ÷ 3
= .04680

.01363 ÷ 3
= .004543

Differences
4543
4543
4680
4487
4490
4490
4550
7)3783
.004540 = mean dif.

.1080
1462
27).12262
.004542

1080
2835
30).13635
4545

1080
2890
30).13690
4563

1080
4710
34).1551
4562

1080
5631
36).16431
4564

4542
4545
4563
4562
4564
5)276
4555

.004555 × 1021 = $v_1 + v_2$ = .0046506

Log = −3.66767
−1.52183
3.1983
−6.38712
3.62807
−10.75863

3:35 P.M.

.1080 × 1021 =

v_1 = .11027

Log = −1.04245

½ " = −1.52183

a
−16.4270
3.6285
−6.0425
−13.0980
−3.6676
3)−11.4304
−4.4768

.0002998 = a
2984

l
−4.8549
1.2041
3.6506 Volts = 4246
−4.4768
−1.1738

.1492 = l/a
1490

1.2041
−3.6809
−2.3191

208.5 = 1/pa
2095

5.7363
42

$e^{2/3}$
3)10.75863
−4.91954
7.83908

69.04

e_1 = 5.735

e = 5.739 $e^{2/3}$ = 69.07

$e^{2/3}$ = 69.07
~~68.99~~

Correct 05% [illegible] and [illegible]

4) Second Observation Mar. 14, 1912 $t = 23.06$ $p = \frac{6773 \\ 5098}{16.75}$

4:00 P.M.

(16)

35

Beauty
Publish

Volts at 3:35 P.M.

(2) 837.5 + 13.5
(3) 838.5 + 13.4
(4) 820.0 + 14.9
(5) 838.0 + 13.4
(6) 838.5 + 13.4
4172.5 + 68.6 = 4241.1
4239

Q		F
12,136		8,332
12,154		8,486
12,038		20.620
12,256		20.548
12,054		23,116
11,966		23,116
		45.148 (45.4)
11,968		45.108
	(22,4)	(45,2)
12,012		45.320
	(22,6)	(45,4)
	44.2	88.0 —
12,034		87.6 —
12,058	41.0	71.1 —
11,994	30.6	61.4 —
11,842	30.4	61.2 —
12,218	30.6	61.2 —
11,968	46.0	91.6
12,010	—	31.506
		31,590 (31.6)

15) 30609
12,040

$\frac{1}{20.59} = .04856$ } .00529

$\frac{1}{23.11} = .04327$ } $\frac{.02111}{4} = .00528$

$\frac{1}{45.12} = .02216$

$\frac{1}{45.4} = .02203$ } $\frac{.01064}{2} = .00532$

$\frac{1}{87.8} = .01139$

caught in route } .00495

$\frac{1}{61.2} = .01634$ } .00541

$\frac{1}{91.6} = .01093$ } $\frac{.02077}{4} = .005192$

$\frac{1}{31.55} = .03170$

$\frac{1}{12.040} = .083206 \times 1.021 = v_1 = .084963$

Log = −2.9292

$\frac{1}{2}$ " = −1.4646

4:35 P.M.

Differences
529
528
532
495
541
5192
6) 31442
.005240

From $v_1 + v_2$

.08321
3170
22) .11491
.005223

8321
1634
19) 9954
5240

8321
1593
18) 9414
5230

8321
1131
18) 9460
5259

8321
2266
20) 10537
5269

8321
4327
24) 12648
5270

8321
4856
25) 13177
5271

5223
5240
5230
5259
5269
5270
5271
7) 362
5252

.005252 × 1.021 =
$v_1 + v_2$ = .005362

Log = −3.7294
−1.4646
3.1983
−6.3923
3.6269
−10.7652
54

4236 = Volts

a
−16.4290
3.6271
−2.9292
−14.9833
−3.7294
3) 11.2541
−4.4214
1.2240
−3.6454
2.3546

l
−4.4547
1.2240
−5.6307
−4.4214
−1.2093

.1619 = $\frac{l}{a}$
.1622

.002639 = a
2632

2263 = $\frac{1}{pa}$
2270

5.825
1
e_1 = 5.8246
5.819

Error .3%

$e_1^{2/3}$
3) −10.7653
−4.9213
2
−7.8435
6975
$e^{2/3}$ 6972

Publish this because typical and good

~~Could offer and this because of [illegible] bad variation~~ $v_1 v_2$

OK

Third Obs. Thursday Mar. 14, 1912 θ = 23.04 p = 67.90 − 50.73 = 17.17

4:52 P.M. Volts at 4:38 P.M.

(2) 835.0 + 13.2
(3) 837.0 + 13.5
(4) 816.5 + 13.2
(5) 836.0 + 13.6
(6) 836.5 + 13.0
4167.0 + 67.5 = 4236.4
4234.5

No 17

(34)

G	F	
~~29.534~~		
29.032		
(28.9)	20.910	$\frac{1}{20.91}$ = .04783
29.136	(21.0)	
29.176	91.2 —	$\frac{1}{91.2}$ = .01096
29.204	49.5 —	$\frac{1}{49.5}$ = .02020
29.172	(34.2 —→)	?
29.030	34.6 —	
29.148	34.4 —	$\frac{1}{34.4}$ = .02909
29.114	91.0 —	$\frac{1}{91}$ = .01099
29.010		
9) 10 22		
29.114		

$\frac{.03687}{4}$ = .009218

$\frac{.00924}{1}$ = .00924

.00887 ÷ 1 = .00887

$\frac{.01808}{2}$ = .009040

9218
9240
887
9040
4) 36368
.009092 from Differences

.3434 − 1099: 5) .04533 = .009066
3434 − 2899: 7) 6333 = 9048
3434 − 2020: 6) 5454 = 9090

3434 − 1096: 5) 4530 = 9060
3434 − 4783: 9) 8217 = 9130

9066
9048
9090
9060
9130
5) 394
9079

5:13 P.M.

$\frac{1}{29.114}$ = .03434 × 1021 = .03506 = v_1

Log = −2.5448

½ " = −1.2724

.009080 × 1021 =

$v_1 + v_2$ = .0092707

Log = −3.9671
−1.2724
−3.1983
−6.4378 volts = 4231
3.6264
−10.8114

l = 00004168

a =
−16.4270 4209
3.6267 6264
−2.5448 5452
3) −14.5985 5925
−3.9671 9673
3) −12.6314 6252
−4.2105 −4.2084
1.2348 .0001624 = a
−3.4453 1619
2.5547 1616

−4.8547
1.2348
−5.6199
−4.2105
−1.4094

.2567 = $\frac{l}{a}$
2575
2579

358.7 = $\frac{1}{pa}$
360.0
360.6

OK

e_1 = 6.478
6.479
$e_1^{2/3}$ = 3) −10.8111
−4.9370
−7.8740
74.81

8106
2
3) 16212
7.8737

reduced to
e_1 = 6.473
e_1 = 6.466 chron. corr.
reduced to 7477 final Aug 23
~~74.75~~
~~74.67~~

6) Fourth Obs. Mar 14, 1912 $\theta = 23.09$ $p = \begin{array}{r} 68.56 \\ 50.01 \\ \hline 18.55 \end{array}$ $\begin{array}{r} 68.53 \\ 50.00 \\ \hline 18.53 \end{array}$

Volts at 5:15 P.M.
(2) 833.5 + 13.6
(3) 835.0 + 13.2
(4) 816.0 + 14.5
(5) 834.0 + 13.9
(6) 834.5 + 13.4
4152.0 + 68.1 = 4230.1
(1) 829.5 + 14.2
4981.5 + 84.5 = 5066.0

Volts at 5:45 P.M.
(1) 829.0 + 14.2
(2) 833.5 + 13.9
(3) 833.5 + 13.9
(4) 814.5 + 15.3
(5) 833.0 + 13.9
(6) 833.0 + 13.9
4976.5 + 85.1 = 5061.6

at 6:30 P.M.
828.0 + 14.3
832.0 + 14.0
833.0 + 13.9
814.0 + 15.3
832.0 + 14.0
832.0 + 14.0
4971 + 85.5 = 5056.5
855

no 18

33

G		F
~~13.170~~ ~~13.126~~ ~~13.140~~ ~~13.120~~		~~28.506~~
	~~5:55 PM~~	
	6:00 PM	
	22.2	44.4 —
21.344		31.992
		32.116
	(16.2)	(32.2)
21.186	36.3	72.9 —
21.250		44.766
21290		32.288
21.088	22.6	45.4 —
21.180		32.720
21.006		45.4 —
21.060		45.354
21.172		(45.4)
20.938		76.0 —
9)10170 21.130		6:30 PM

$\frac{1}{32.1} = .03115$
} $\frac{.01726}{2} = .00863$
$\frac{1}{72.0} = .01384$
} .00845
$\frac{1}{44.77} = .02234$
} .00863
$\frac{1}{32.29} = .03097$
} .00894
$\frac{1}{45.4} = .02203$
} .00853
$\frac{1}{32.72} = .03056$
} .00851
$\frac{1}{45.35} = .02205$
} .00889
$\frac{1}{76.0} = .01316$
7)6058
.008654

$\begin{array}{r} 4732 \\ 1316 \\ \hline 7).06048 \\ .008640 \end{array}$ $\begin{array}{r} 4732 \\ 2205 \\ \hline 8)69374 \\ 8671 \end{array}$ $\begin{array}{r} 4732 \\ 3056 \\ \hline 9)7788 \\ 8653 \end{array}$ $\begin{array}{r} 4732 \\ 2203 \\ \hline 8)6935 \\ .8669 \end{array}$

$\begin{array}{r} 4732 \\ 3097 \\ \hline 9)7829 \\ 8699 \end{array}$ $\begin{array}{r} 4732 \\ 2234 \\ \hline 8)6966 \\ 8707 \end{array}$ $\begin{array}{r} 4732 \\ 1389 \\ \hline 7)6121 \\ 8744 \end{array}$

864
8671
8653
8669
8699
8707
8744
7)4783
.008683

$\frac{1}{21.13} = .04732 \times 1021 = v_1 = .04830$
Log = −2.6839
$\frac{1}{2}$ " = −1.3420

.008683 × 1021 =
$v_1 + v_2 = .0088653$

Log = −3.9477
−1.3420
3.1983
−6.4880
+3.7040
10.7840

5058 = V

a
−16.4270
+3.7040
−2.6834
−14.8149
−3.9477
3)12.8672
−4.2891
1.2681
−3.5572
2.4428

.01846 = a
1840
38

l = .00003860
−4.8547
1.2681
−5.5866
−4.2891
−1.2975

.1984 = $\frac{l}{a}$
1990

$277.2 = \frac{1}{pa}$
2780

OK

$e_1 = 6.076$
$e^{2/3} = 71.72$ final

$e_1 = 6.074$
Chron. corr.
reduced to 71.73

6.081
$e^{2/3}$
$e_1 = 6.083$
23)107841
−4.9280
7.8569
$e^{2/3} = 71.80$

7)

Friday March 15, 1912

θ = 23,05

p = 68.77 − 49.76 = 19.01

Valtsat 3:50

829.5 + 14.2
834.0 + 13.8
836.0 + 13.6
815.0 + 15.2
834.0 + 13.8
834.0 + 13.8
4982.5 + 84.4
= 5066.9

No 19

37

G	F	
4:15 — P.M.		
	33.4	68.4 —
24.016		42.188
	(21.0)	(42.4)
24.142		42.078
	—	(42.2)
24.130		42.098
	(21.2)	(42.3)
24.070	34.6	69.9 —
24.000	100.8	203.2 —
24.030		23.844
24.046		30.606
24.028	22.0	42.8 —
23.968		42.944
		(~~43.0~~)
24.018		71.4 —
23.770		~~31.080~~
23.882		30.652
(12.2 24.2)		
12) 481.00 24.008		4:47 P.M.

$\frac{1}{42.14} = 2373$

$\frac{1}{42.3} = .02364$ } .00933

$\frac{1}{69.9} = .01431$ } .00939

$\frac{1}{203.2} = .004921$ } $\frac{.037029}{4} = .009257$

$\frac{1}{23.84} = .04195$ } .00927

$\frac{1}{30.6} = .03268$ } .00939

$\frac{1}{42.44} = .02329$

~~$\frac{1}{43}$~~ } .00925

$\frac{1}{71.4} = .01400$ } $\frac{.01863}{2} = .00929$

$\frac{1}{30.65} = .03263$

Differences

.933
939
927
9257
939
925
929
7) 2197
.009311

9280
9283
9279
9293
9290
9316
9328
9341
8) 2410
9301

.04166
3259
8) .07425
.009281
94

4166
1400
6) 5566
9277

4166
2326
7) 6493
9276

4166
3265
8) 7431
9289

4166
4195
9) 8357
9286

4166
4921
5) 46587
9316

4166
1431
6) 5597
9328

4166
2369
7) 6535
9336

$\frac{1}{24.01} = .04166 \times 1021 = .042534 = v_1$

Log = −2.62873
½ " = −1.3149

l = .00003764

a

−16.4270
3.7044
−2.62873
−14.76013
+3.9776
3) 12.78253
−4.26084 .0001823 = a
1816
1.2790
−3.5398
2.4602

−4.8547
1.2790
−5.5757
−4.2608
−1.3149

.2065 = l/a
2073

2885 = 1/pa
2893

mean = .009301 × 1021 =

$v_1 + v_2 = .009496$

Log = 3.9776
−1.3149
−3.1983
−6.4808
3.7044
−10.7864

5062 = V

6.166
e₁ = 6.117

~~Chron. corr. reduces to e₁ = 6.117~~

e₁ = 6110

e^⅔ = 72.03 reduced to

Error 2%

$e^{2/3}$

−10.7865
2
3) −19.5730
−7.8577

$e_1 = 72.17$
72.10

7865
2
3) 5726
7.8575
72.03

Beauty

Publish this surely beautiful!!

8) Friday March, 15, 1912

Second Observation

5.00 PM.

$\theta = 23.13$

Volts at. 4.49

$p = \frac{6890}{\frac{4955}{19.345}}$

828.0 + 14.3
838.0 + 13.9
834.0 + 13.8
814.0 + 15.3
832.5 + 14.0
832.5 + 14.0
4974.0 + 85.3 = 5059.3

G		F	
15,050		14.994	
14.904		11.886	$\frac{1}{11.89} = .08413$
14.878	(16.4) (33.2)	33.254	$\frac{1}{33.19} = .03013$
14.968	(33.2)	33.132	
14.956		43.526	$\frac{1}{43.65} = .02291$
14.868	(52.2) (43.8)	43.768	
14.912	(17.0) (33.6)	33.386	$\frac{1}{33.49} = .02986$
		33.594	
14.912			
14.822	57.1	114.0	$\frac{1}{114.0} = .008772$

$8 \overline{)\ 7220}$
14.903

5.35 PM

$\frac{1}{14.903} = .06710$

Differences

$\frac{.05400}{8} = .00677$

.00722

.00695

$\frac{.02104}{3} = .007030$

677
695
722
703
$4 \overline{)\ 2797}$
.006992

6710
8772
$11 \overline{)\ .075872}$
06900

6710
2986
$14 \overline{)\ 9696}$
6922

6710
2291
$13 \overline{)\ 9001}$
6923

6710
3013
$14 \overline{)\ 9723}$
6945

Error high will not use

Can work this up + probably is ok
but point is not important
Will work if have time Aug 22

9)
Friday, March 15, 1912.
Third Observation –
at 5:55 P.M

$\theta = 23.09$ $p = 19.73$

Volts at 5:37

828.0 + 14.3
832.5 + 14.0
834.0 + 13.8
814.0 + 15.3
832.5 + 14.0
832.5 + 14.0
4973.5 + 85.4 = 5058.9

$\boxed{2020}$ (31) ~~29~~

Q		F
	65.2	130.4
20.026		31.140
19.978		15.322
19.930		13.662
20.032		13.762
19.986	68.0	136.0
19.978	—	138.5
19.986	32.0	65.2
19.900	—	65.0
19.972		42.482
19.826	(21.4)	(42.3)
	32.0	65.0
19.931		31.774
19.888		35.264
239.433		(25.4)
19.953		

$\frac{1}{130.4} = .007669$
} $\frac{.02444}{3} = .008147$
$\frac{1}{31.14}$ .03211
} $\frac{.04063}{5} = .008166$
$\frac{1}{13.71} = .07294$
} $\frac{.06565}{8} = .008206$
$\frac{1}{137} = .00729$
} $\frac{.00807}{1} = .00807$
$\frac{1}{65.1}$ .01536
} $\frac{.00818}{1} = .00818$
$\frac{1}{42.48}$ .02354
} $\frac{.00816}{1} = .00816$
$\frac{1}{65.0}$ .01538
} $\frac{.01610}{2} = .00805$
$\frac{1}{31.77}$ .03148
} $\frac{.0812}{1} = .00812$
$\frac{1}{25.26}$ .03960

Volts at 6:25 PM,
827.0 + 14.4
831.5 + 14.1
832.0 + 14.0
813.5 + 15.4
831.0 + 14.1
831.0 + 14.1
4966.0 + 86.1 = 5052.1

differences

8147
8166
8206
8070
8180
8160
~~8050~~
~~8120~~
6) 48929
.008155

~~8157~~
~~8160~~
8188
8184
8185
8201
8204
8225
6) 1185
8198

.5010
3960
11) 8972
8157

5012
3148
10) 8160
8160

5010
1538
8) 6548
8185

5010
2354
9) 7364
8182

5010
1536
8) 6546
8183

5010
729
7) 5739
8199

5010
7294
15) 12304
8202

5010
3211
10) 8221
8221

6:25 PM

$\frac{1}{19.95} = .05010 \times 1.021 = v_1 = .05115$

Log = −2.7088
$\frac{1}{2}$ " = −1.3544

v

a
−16.4270
3.7036
−2.7090
−14.8396
−3.9227
3) −12.9169
−4.3056
1.2452
−3.6008
2.3992

l
−4.8547
1.2952
−5.5595
−4.3056
−1.2539

.1794 = $\frac{l}{a}$
.1799
.1802
.0002027 = a
2015
250.7 = $\frac{1}{pa}$
2519

$v_1 + v_2$ = .008198 × 1.021 = .008370

Log = −3.9227
−1.3544
−3.1983
−6.4754
3.7036
−10.7718

5054 = V

$e^{2/3}$

5413
3

−10.7720
3) −19.5490
−7.8480

$e_1 = 5.916$
$e_1 = 5.910$
$e^{2/3} = 7.041$ $e^{2/3} = 70.47$

14 9 t 14

~~Weight and~~
~~beautiful~~
~~[illegible]~~
~~V. [illegible]~~
~~[illegible]~~

10) Saturday March 16, 1912.- $\theta = ^{22.97}$ p=

at 3:30 PM.

831.0 + 14.1
836.5 + 13.6
837.0 + 13.5
817.0 + 15.1
836.0 + 13.6
836.0 + 13.6
4993.5 + 83.5 = 5077.0

G		F
	~~[illegible]~~	~~[illegible]~~
4:05 P.M.		
16.714		20.692
16.478	—	135.4 —
16.502	67.6	134.5 —
16.542		Balance Speed.
4⌊22.36		
16.559		

$\frac{1}{20.69} = .04833$

$\frac{1}{135} = .007407$

$\frac{1}{16.56} = .06039 \times 1021 = v_1 = .06166$

Log = −2.7900

$\frac{1}{2}$ l = −1.3950

3⌊.04.0923
.6820

6039
7407
10⌊67797
.006780

6039
4833
16⌊10872
.006795

mean = .006796 × 1021 = .06939

Log = −3.8413
−1.3950
−3.1983
−6.4346
V = 5068 +3.7048
10.7298

e_1 = 5.368

a
−16.4270
3.7048
−2.7900
−14.9218
.3.8413
3⌊11.0805
−4.3602

.002292 = a

Cant get β

$e^{2/3}$

10.7298
2
3⌊−19.4596
7.8199

66.055 = $e^{2/3}$

Second Observation

θ = 22.98

$p = \frac{7790}{38.95}$ = 38.95

Saturday, March 16, 1912 —

4:30 P.M.

Volts at 4:46 —
829.5 + 14.2
833.5 + 13.9
834.5 + 13.7
814.5 + 15.3
833.5 + 13.8
833.5 + 13.8
4979.0 + 84.7 = 5063.7

No 21

~~28~~ 30

G	t_F	F.	
		11.886	= .08413
15.172	48.4	96.4 —	.01037
15.172		11.808	.08468
15.064		33.544	$\frac{1}{33.69}$ = .02968
15.210		33.878	
15.160		59.5 —	.01681
15.150		23.667	.04224
15.174			

7) 1100

15.157

} .01931 = .006437

.05300

} $\frac{.01300}{2}$ = .006500

} $\frac{.02543}{4}$ = .006352

3) 1289

.006430

6598
4224
17) 10822
6366

6598
1681
13) 8279
6369

6598
2968
15) 9566
6371

6598
1037
12) 7635
6363

6363
6364
6366
4) 1289
6367

4:45 PM

$\frac{1}{15.157}$ = .06598 × 1.021 = .067365 = v_1

Log = −2.8284

$\frac{1}{2}$, 1 = −1.4142

mean { 6430 + 6367 = .006399

mean $v_1 + v_2$ = .006533

log = −3.8151
−1.4142
3.1983
−6.4276
3.7047
−10.7229

V = 5066

a

−16.4270
3.7047
−2.8284
−14.9601
−3.8151
3) −11.1450
−4.3817
1.5905
−3.9922
+2.0278

−4.8547
1.5905
−5.2642
−4.3817
−2.8824

.07626 = $\frac{l}{a}$

76.66

.002412 = a

2407 = a

106.6 = $\frac{1}{pa}$

107.2

e_1 = 5.284

e_1 = 5.278

$e^{2/3}$

−10.7229
2
3) −14.4454
−7.8151

6.533 = $e^{2/3}$

e^3 65.28

Probably a little low.

12) Third Observation

Saturday, Mar. 16, 1912

5:05

$\theta = 22.93$

$p = \frac{7915 \\ 37150}{41.65}$

Volts at 5.29 P.M.

829.0 + 14.2
833.0 + 13.9
834.0 + 13.8
814.0 + 15.3
833.0 + 13.8
833.0 + 13.8
4976.0 + 84.8 = 5060.8

G		F	
33.682		19.908	
33.822		19.922	
33.666	(16.6 33.6)	19.830	$\frac{1}{19.87}$ = .05033
		19.818 3478	
33.486		24.862	
33.634		24.628	(24.6)
33.500	(33.4)	24.910	(24.6)
33.514		49.744 2400	(24.9 49.8)
33.530	(17.0 33.6)		
8|4834			
33.604			

$\frac{1}{24.8}$ = .04032

$\frac{1}{49.74}$ = .02010

5.27 P.M.

$\frac{.01001}{1}$ = .01001

mean = .01006

$\frac{.02022}{2}$ = .01011

.02976
.05033
8|.08009
.01001

.02976
.04032
7|.7008
10011
10011
9972
3|.29994
.01000

2976
2010
5|.4986
009972

$v_1 + v_2$ = .01021

Log = -2.0090
-1.2413
-3.1983
-6.4486
-3.7043
10.7443

No 22

$\frac{1}{3360}$ = .02976 × 1021 = .030385

Log = 2.4826

$\frac{1}{2}$ 11 = -1.2413

a

-16.4270
3.7043
-2.4826
-14.6139
-2.0090
3|-12.6049
-4.2016
1.6196
-3.8212
2.1788

l

-4.8547
1.6196
-5.2351
-4.2016
-1.0335

.1080 = $\frac{l}{a}$

.0001591 = a

150.9 = $\frac{1}{pa}$

5.550
2
e_1 = 5.548

reduce for chem to

e_1 = 5.537 → 67.50 = $e^{2/3}$

$e^{2/3}$

10.7441
2
3|-19.4882
7.8294

67.50
9
6741

Too high e by 1/2%

~~Must though be [illegible] first~~

For error is small

Found atomizer out of order
Took apparatus apart + reset up entirely

Not plotted but may plop

Wed. March 20 1918 $\phi = 23.01$

$\phi = \frac{7476}{4270}$ 32.06 $\frac{7475}{4269}$ 32.06

Volts at
2.50 P.M

834.0 + 13.8
839.0 + 13.3
839.0 + 13.3
818.5 + 15.1
839.0 + 13.3
837.5 + 13.5

5007.0 + 82.3 = 5089.3

Volts irregular
loose contact of
battery connections

G	F		S	F	
9.842					
9.942			9.852	32.6	68.4
9.926					
9.930		23.608			
9.878		21.906			
		23.096			
9.960		23.610			
9.854		35.876			
9.904		38.614			
9.824		38.806			
		(38.6)			
9.806		39.244			
	(19.3)	(39.2)			
9.900		41.812			
		(42.0)			
9.866		40.032			
	(19.6)	(40.2)			
9.900		38.766			
9.954		40.390			
	(20.6)	(40.4)			
9.860		37.466			
	(18.0)	(36.4)			
9.964		39.088			
	(18.6)	(39.0)			
9.942	11.2	22.6 —			
9.888		22.292			
	(11.0)	(22.2)			
9.872					
9.966		76.836			
	(37.0)	(77.0)			
	33.0	66.4 —			
	26.7	57.6 —			
9.896	32.4	65.0 —			

Wed. Mar. 20th 1912

θ = 22.99

Second Observation 4:45

Volts at 4:25

$\boxed{\text{No } 22}$ (29)

p = 75.40 − 41.93 = 33.47

75.38 − 41.93 = 33.45

832.0 + 14.0
837.0 + 13.5
838.0 + 13.4
817.5 + 15.1
837.0 + 13.5
837.0 + 13.5
4998.5 + 83.0 = 5081.5

8333
8342
8256
3| 931
8310

53

G		F
23.184		
23.230		
23.420		24.730
23.302		17.586
23.344		17.600
23.194		17.624
23.228		20.606
23.210		
		146.4—
Drop	75.0	—1st div.
	87.0	—2nd div.
23.110		42.768
	(21.2)	(42.5)
23.202		42.448
23.068		42.718
23.158	73.0	145.4—
23.244	73.2	144.6—

13| 2894
23.223

$\frac{1}{24.73}$ = 4044

3.01638

$\frac{1}{17.603}$ = .05682

.00838

$\frac{1}{20.6}$ = .04854

$\frac{1}{146.4}$ = .00683

$\frac{.4171}{5}$

$\frac{1}{65.0}$ = ~~.04538~~

$\frac{1}{42.645}$ = .02345

63
4271

$\frac{1}{145}$ = .006897

.01653 / 2 = 8256

$\frac{.4999}{6}$ = 8333

8256
16589
.008250

4303
11689
6| 49927
.008321

4303
5682
12| 9985
8327

4303
2341
6| 6644
8301
~~8310~~
8315

4303
683
6| 4986
8310

8326
8323
16648
.008323

8326
8315
8301
8321
8313

mean of 8304 & 8323 = .008313

$V_1 + V_2$ = .008313 × 1021 = .008488

Log = −3.92888
−1.32145
3.19937
−6.44995
5073 = V = −3.70537
−10.74350

5:35 PM.

$\frac{1}{23.224}$ = .04303 × 1021 = .043934 = V_1

$\log_{4}$ = $\bar{2}$.64326

$\frac{1}{2}$ l. = $\bar{1}$.32146

a
−16.4209
3.7053
−2.64326
−147890
−3.92888
3| −12.8402
−4.2801
1.5246
−3.8047
2.1953

.001914 = a
1908

l
−4.8547
1.5245
−5.3302
−4.2820
−1.0482

.1117 = l
.1120 = $\frac{l}{a}$

156.1 = $\frac{1}{pa}$
156.8

e_1 = 5.539
5530

Corrd for Chromatic e_1 = 5.535

−10.74388
2
3) 19.48776
−7.82925

67.485 = $e^{2/3}$

67.40 (33)

~~.859 % high~~

Error 4%

e_1 = 5529

7426
2
3) 19.4852
−7.8284

$e^{2/3}$ = 67.37

Typical drop might publish

Wednesday, Mar. 20, 1912
Third Observation
5:48

θ = 23.09

$p = \frac{7555}{4178}$ 33.78 $\quad$ 7552 / 4178 3374

Volts at 5:40

830.5 + 14.2
835.0 + 13.6
836.0 + 13.6
815.5 + 15.2
834.0 + 13.8
833.0 + 13.9
4984.0 + 84.3 = 5068.3

G		F	
5.660		45.2 —	
5.694		45.2 —	
5.654		45.4 —	
5.652		45.4 —	
5.666		20.4 —	
5.678		20.4 —	
5.622			
~~5.676~~			
~~5.622~~			
~~5.656~~		20.530	
5.656			
5.900		20.578	
9|5980			
5.653		6:03 P.M.	

$\frac{1}{5.653} = .1769$

$\frac{1}{45.4} = .02203$

$\frac{1}{20.4} = .04902$

$\Big\}$ .02699 ÷ 7 = .003856

Can't find divisor

.1769
.2208
.1990

16) Wednesday Mar. 20, 1912 $\theta = 23.06$

Fourth Observation

6:27 P.M.

G	F
37.912	
38.018	25.118
37.928	
(38.0)	19.686
38.200	
(38.2)	16.168
37.998	
38.012	149.0 —
38.102	56.8 —
37.910	
4) 304080	6:45 P.M.
38.01	

$\frac{1}{25.12} = .03981$ } $\frac{.02048}{2} = .01050$

$\frac{1}{19.69} = .05079$ } .01105

$\frac{1}{16.17} = .06184$ } $\frac{.05513}{5} = .01103$

$\frac{1}{149} = .006711$ } .01090

$\frac{1}{56.8} = .01761$

mean dif = .01097

$\frac{1}{38.01} = .02627 = .026820 = v_1$

corrected here — friction

Log = -2.4284

$\frac{1}{2}$ " = -1.2142

$p = \frac{7563}{4162} \quad \frac{7563}{4161}$
$\quad 3401 \quad 3402$

Volts at 6:05

23

28

830.5 + 14.2
835.0 + 13.6
836.0 + 13.6
815.5 + 15.2
834.0 + 13.8
832.0 + 14.0
4983.0 + 84.4 = 5067.4

Volts at 6:46

830.0 + 14.2
832.0 + 14.0
832.0 + 14.0
815.0 + 15.2
833.5 + 13.9
831.5 + 14.1
4974.0 + 85.4 = 5059.4

2627	2627	2627	2627
1761	671	6184	5079
4) .04388	3) 3298	8) 8815	7) 7706
.01097	1099	1102	1101

mean = 11005

mean of 1097 + 1099 = 1098 × 1021 =

$v_1 + v_2 = .011205$

Log = -2.0492

$\frac{1}{2}$ " = -1.2142

-3.1983

-6.4617 5061 = V

3.7043

-10.7574

e = 5720

e_1 = 5721

~~[illegible]~~

~~e_1 = 5727~~

e_1 = 5714

$e^{\frac{2}{3}}$

-10.7584

2

3) -19.5148

-7.8392

~~6900~~

6906

11

6895

= 6884

7564
2
3) 15138
-7.8379

[illegible] high

Error 3%

a

-16.4270
3.7042
-2.4291
-14.5603
-2.0506
3) -12.5097
-4.1699 .0001479 = a
1.5316
-3.7015
2.2985

1475 = a

l

-4.8547
1.5316
-5.3231
-4.1699
-1.1532

$.1423 = \frac{l}{a}$

$.1429 = \frac{l}{a}$

$19885 = \frac{1}{pa}$ $1998 = \frac{1}{pa}$

Publish

Beauty

①

Monday, Mar. 25th 1912 - $\theta = 23.19$ $p = \frac{7617}{4100}\,3517$ $\frac{7617}{4099}\,3518$

Voltsat 3:30 P.M.

837.5 + 13.5
836.5 + 13.6
841.0 + 13.2
824.0 + 14.7
840.0 + 13.2
841.5 + 13.2
5020.5 + 81.4 = 5101.9

3:42 P.M.

㉔

~~27~~ ~~25~~

G		F
26.860 (short)		
27.066		19.252
26.782		19.388
26.958		16.292
27.142		11.360
26.874		39.424
26.860		39.306
		60.824
	(30.0)	(60.8)
26.906	64.6	134.0
		39.670
26.578		39.728
26.812	(19.6)	(39.7)
26.632		39.458
		(39.6)
26.598	67.4	138.4
26.706		
13)88774		
~~17.235~~		
26.83		

$\frac{1}{19.320} = .05176$

$\frac{.02636}{3} = .08790$

$\frac{1}{39.365} = .02540$

.008950

$\frac{1}{60.8} = .01645$ .008987

= .007463

$\frac{.01778}{2} = .008890$

$\frac{1}{39.62} = .02524$

$\frac{.01802}{2} = .009010$

$\frac{3\,1856}{62}$

.00722

4:13 P.M.

$\frac{1}{26.83} = .03727 \times 1.021 = v_1 = .038010$

3723

Log = -2.5999

$\frac{1}{2} = -1.2899$

Difs

.008790
8950
8987
8890
9010
5)44627
.008925

.03723
732
5).04445
.008890

3723
2524
7)62247
8929

3723
7462
5)44693
8939

3723
1645
6)5368
8947

8890
8924
8939
8947
8947
8899
6)5546
.008925 × 1.021 =

3723
2540
7)6263
8947

3723
5176
10)8899
8899

$v_1 + v_2 = .0091120$

Log = -3.9596
-1.2900
-3.1477
6.4473
3.7067
-10.7406

V = 5089.5

a

-16.4240
3.7067
-2.5804
-14.7141
-3.9118
3)-12.8023
-4.2674
1.5463
-3.8137
2.1863

2493
5460
7953
2047

160.2 = $\frac{1}{pa}$

l

-4.8547
1.5460
-5.3084
4.2678
-1.0494

.1044 = l
~~1102~~ = l
1147 = a

.0001851 = a
~~1845~~ = a
.1777

153.6 = $\frac{1}{pa}$
154 = $\frac{1}{pa}$
1546

5508
4
e_1 5.508

~~reduce to for chain corr~~

~~$e_1 = 5.513$~~

$e_1 = 5.505$

$e_1 = 5.507$

$e^{2/3}$

-107420
2
3)-19.4840
-7.8280
67.30 = $e^{2/3}$
66.13

7409
-14.818
7.8273
67.17

$e^{2/3} = 67.18$

= 6718

any 3rd

Brevity

Publish

(18) Mon. Mar. 25, 1912

Second Observation -
4:44. P.M.

$\theta = \begin{matrix} 23.21 \\ 23.14 \end{matrix}$

$p = \frac{7682 - 4019}{3663} \quad \frac{7683 - 4020}{3663}$

Volts at 4:15 P. M.

836.5 + 13.6
832.0 + 14.0
839.0 + 13.3
822.5 + 14.8
833.0 + 13.9
838.0 + 13.4

5001.0 + 82.0 = 5083.0

G	F	
34.068		31.136
	(16.0)	(31.4)
34.334	83.0	1st Division
	74.4	2nd "
	76.6	3rd "
	77.4	4th "
	82.2	5th "
	91.0	6th "
	104.7	7th "
	10.8.5	8th "
		697.8 —
34.062		86.382
	(44.0)	(86.7)
34.008		86.4 —
34.148		
		5:08 P.M.

Could not hold
but rises slowly so

(19) Mon. Mar. 25, 1912

$\theta = 23.18$
23.14

$p = 7709$
$\underline{3990}$
3719

5.24 (Third Observation) Volts at 5:08 P.M.

835.0 + 13.6
830.5 + 14.2
835.0 + 13.6
822.0 + 14.8
830.0 + 14.2
838.0 + 13.4
4990.5 + 83.8 = 5074.3

25

~~24~~ 26

G		F
12.394		
12.448		12.246
12.452		12.248
12.440		12.326
12.472		220 21.154
12.488		24.282
12.456		24.248
12.466		24.242
12.514		24.152
12.480		224 55.5 —
12.484		55.416
12.442		81.3 —
12.458	40.0	81.3 —
12.364		21.3 —
	(10.6)	(21.2)
12.430		24.370
	(12.6)	(24.6)
12.528		24.194
12.460		24.304
12.442		24.264
12.462		15.022
12.468	79.4	155.9 —
12.598		55.8 —
12.498		55.782

22| 102.~~1~~44
12.466

$\frac{1}{12.273} = .8151$

$\frac{.04024}{7} = 5749$

$\frac{1}{24.231} = .04127$

$\frac{.02322}{4} = 5800$

(55.6) $\frac{1}{55.42} = .01805$

.00575

$\frac{1}{81.3} = .01230$

$\frac{.03476}{6} = 5793$

$\frac{1}{21.25} = .04706$

$\frac{1}{24.283} = .04118$

$\frac{.034566}{6} = 5761$

$\frac{1}{15.02} = .06658$

.006414

$\frac{.011506}{2} = 5753$

(55.8) $\frac{1}{55.8} = .01792$

6:00 P.M.

Differences

5749
~~5800~~
5800
5800
5750
5750
5793
~~5793~~
5793
5793
5761
5761
5761
5761
5753
5753
5753
17| .13124
.005772

080234
01805
17| .098261
.005779

080234
4927
21| .121987
.005784

.080234
8151
28| .16174
.005777

.080234
1792
17| .098154
.005774

.080234
6414
15| .086648
.005776

080234
04118
21| .121414
.005781

080234
01230
16| .092534
.05783

5772
5774
5789
5783
5789
5784
5775
7| 554
.0057790

$\frac{1}{12.466} = .080214 \times 1.021 = .081894 = v_1$

Log = −2.91338
$\frac{1}{2}$ 11 = −1.4566

$v_1 + v_2 = .0057775 \times 1.021 = .005896$

Log = −3.77058
−1.4566
3.1977
−6.4248
3.7033
−10.7215

v = 5090

a

−16.4270 09
3.7039 33
−2.9134 34
−13.0437 76
−3.7709
3| −11.2739 669
−4.4240 223 .002655 = a
1.5794
−3.9945
2.0055

2644 = a

−.4223
5701
9924
0075
1018

l

−4.8547
1.5704
−5.2843
−4.4247
−2.8603

$.07248 = \frac{l}{a}$

$.07270 = \frac{l}{a}$

7263

$101.2 = \frac{1}{pa}$

$101.8 = \frac{1}{pa}$

−10.7217
3| 14.4434
7.8145

$6524 = e^{2/3}$

$e_1^{2/3} = ~~6534~~$

$e_1^{2/3} = 6529$

$e_1 = 5.276$ 5.264

$e^{2/3}$

72332
2
3 − 4.44664
−7.81555
6539

5.266

= 5.260

Publish this one
Error say .2%

~~Interest data~~ ~~curves~~

20 Mon. Mar. 25, 1912

Fourth Observation

6:18 P.M.

$\theta = 23.15$

Volts at 6:00 P.M.

$p = \frac{77.48}{39.47}$ 38.01

832.0 + 14.0
817.0 + 15.1
830.5 + 14.2
816.0 + 15.2
821.5 + 14.8
834.0 + 13.8

4951.0 + 87.1 = 5038.1

G		F
8.504		15.490
8.502		16.922
8.532		16.812
8.526		16.714
8.524		16.914
8.332	(19.0 37.4)	37.308

Last at 6:27

Volts at 6:28

829.5 + 14.2
809.5 + 15.6
829.5 + 14.2
814.0 + 15.3
819.0 + 14.9
830.5 + 14.1

4932.0 + 88.3
= 5020.3

Impossible to make out

7223
2
1.4446
8.8148
$65.27 = e^{\frac{2}{3}}$?

Tuesday Mar. 26th 1912

First Observation.

$\theta = 22.89$

$p = \frac{77.70}{39.19}$ 38.51 ~~$\frac{77.7}{39.1}$~~

Volts at 3:40 P.M.

837.0 + 13.5
841.5 + 13.2
841.5 + 13.2
821.5 + 14.8
840.5 + 13.2
840.0 + 13.2
5022.0 + 81.1 = 5103.1

G		F
38.590	71.6	145.4
38.670		56.234
	{28.4 56.5}	
38.458		55.768
38.376	{17.6 34.4}	34.418
38.358		34.552
38.530		55.956
38.372		
9)33354		
38.479		

$\frac{1}{145.4} = .006878$

} .01095

$\frac{1}{56.17} = .01783$

} .01112

$\frac{1}{34.54} = .02895$

} .01117

$\frac{1}{56.07} = .01784$

3)3318
.01106

4:15 P.M.

$\frac{1}{38.48} = .02595 \times 1.021 = .02649$

Log = $\bar{2}.42308$

$\frac{1}{2}$ " = $\bar{1}.21152$

.02595	2595	2595	2595
.01784	2895	1783	188
4)4379	5)5490	4)4378	3183
.001095	1098	1094	1096

1094
1098
1095
1095

mean = .001095 × 1.021

= $v_1 + v_2$ = .01116

Log = −2.0483
1.2115
3.1977
6.4575
3.7074
−10.7501

V = 5098

a

−16.427009
3.707374
−2.42330
−14.55813
−2.0449
3)−12.5089
−4.1697
1.5856
−3.7552 33
2.2448
2467

l

−4.8547 = const
1.5856 = p
−5.2691 = l
−4.1696 = a
−1.0995

$.1257 = \frac{l}{a}$

$.1263 = \frac{l}{a}$

.001478 = a

1474 = a

1471 =

$1757 = \frac{1}{pa}$ = 17.65

5625
3
56.225

reduce to for chron. corr.

$e_1 = 5.628$

$e_1 = 5.621$

10.7500
2
3)19.5000
7.8333

$e^{2/3}$

10.7515
2
3)19.5038
−7.8343

68.28
10
68.18

$68.12 = e^{2/3}$

no 16

~~23~~

25

Then Publish

This makes
$e_1 = 5.142$
$e^{2/3} = 64.19$

a corrn of .05% for tube here would make and would reduce e_1 2 in last place but hardly worth while

24) Tuesday Mar. 26th 1912. $\theta = 23.00$

Second Observation

~~4~~5:57 P.M.

Volts at 4:16

Note:- Middle point between plates should be at 10538-

Volts at 5:31

$p = \frac{79.18 + 37.41}{41.17}$ $\quad$ $\frac{79.17 + 37.40}{41.77}$

G		F
9.452		
9.462		12.156
9.476		20.842
9.486		20.856
9.454		26.338
9.474		26.200
9.396		26.230
9.470		30.206
9.450	(35.2)	35.548
9.516		35.606
9.452	38.2	76.2—
9.434	37.6	75.4—
9.498	—	75.2—
9.519	(19.0)	18.830
9.518		18.780
9.544		18.876
		35.358
9.492		35.442
9.486		35.478
9.544		121.9—
14 | 91.23	61.0	121.5—
9480		

5:30 P.M.

$\frac{1}{20.85}$ .04797

$\frac{1}{26.26} = .03808$

$\frac{1}{35.58} = .02807$

$\frac{1}{75.6} = .01323$

$\frac{1}{18.83} = .05311$ 2314

$\frac{1}{35.42} = .02819$ 8217

$\frac{1}{121.7} = .008217$

$\frac{.00989}{2} = 4945$

$\frac{.01990}{4} = 4925$

$\frac{.01484}{3} = 4947$

$\frac{.03988}{8} = 4985$

$\frac{.02492}{5} = 4984$

$\frac{.01997^3}{4} = 4993$

5 | 334

4967

836.0 + 13.1
840.0 + 12.7
840.0 + 12.7
820.5 + 14.7
840.0 + 12.7
839.5 + 12.9
5016.0 + 78.8 = 5094.4

835.0 + 13.2
839.5 + 12.8
839.5 + 12.8
820.0 + 14.7
839.0 + 12.8
839.0 + 12.8
5012.0 + 79.1 = 5011.7

Differences
005000
005000
005000
4976
4985
4985
4960
4960
4985
6 | 44851
004983

1055
1323
24 | 11673
4948

1055
822
23 | 11372
4971

1055
2823
27 | 13373
4952

1055
5311
32 | 15861
4957

4971
4952
4957
4948
4949
4951
4958
7 | 34679
4954

1055
2811
27 | 13361
4949

1055
3808
29 | 14358
4951

1055
4797
31 | 15347
4958

~~On acct of difference bet 4983 and 4954 use the mean. This makes very nearly correct the error in v_1 which is .75% if 4983 is correct as it has right to be considered to be. This will raise v_1+v_2 .3% and lower $\sqrt{v_1}$ .38%~~

mean $v_1+v_2 = .004954 \times 1021$

$= v_1+v_2 = .005058$

$\frac{1}{9.495} = .1055 \times 1021 = v_1 = .1077$

Log

Log = −1.03222

$\frac{1}{2}$ = −1.51166

Log = −3.7040
− 1.5166
−3.1983
6.4189 / 5044
3.7070
10.7119

5.154
~~5.163~~
5.145

~~Don't [illegible]~~ e_1 = 5.145

Publish This
Fine illustration
of check[illegible]
sheet

Beauty

Publish

24

$e^{2/3}$
−10.7133
2
3 | 14.4266
7.8089

$e^{2/3} = 6440$
6435
6430

a
−16.4270
3.7070
−1.0322
13.1662
−3.7054
3 | 11.4608
−4.4869
1.6208
−2.1077
.1.8923

l.
−4.8547
1.6208
−5.2339
−4.4869
−2.7470

$.05585 = \frac{l}{a}$ 5601

3060

$.003069 = a$

7826

$78.03 = \frac{1}{pa}$

7114
2
3 | 14.4228
7.8076

$6422 = e^{2/3}$

~~Tuesday~~ Wednesday, Mar. 27, 1912

First ~~Third~~ Observation at 4:35 P.M.

$\theta = 22.94$

Volts at 4:00 P.M.

$p = \frac{66.80}{52.10} \quad \frac{66.75}{52.05}$
14.70 1470

837.0+13.5
842.0+13.1
840.5+13.2
2519.5+39.8=2559.3

Publish this
4% error almost

23

Best 3 for
at reduced
pressures

Beauty

G		F
8.10 10.692		23.238
10.658		24.712
10.664		26.860
10.612		27.034
10.618		27.130
10.614		45.836
10.688	{31.6 63.8}	63.538
10.616	32.4	63.6 —
10.606	—	63.4 —
10.668	31.8	63.4 —
10.606	16.3	~~32.0~~ —
10.698		32.204
10.766	(32.0)	31.960
10.662	(23.0 45.6)	45.570
10.692	(23.2 46.0)	45.632
	(32.0 63.4)	63.130
10.704	(39.6 78.5)	78.352
10.626	39.6	78.0 —
10.708	(38.6 77.9)	78.032
		274.3 —
10.574	70.6	— 1+2 div
19)124.72	69.6	— 3+4 div
10.6565	69.2	— 5+6 div
	69.2	— 7+8 div
		278.6 —

$\frac{1}{27.008}$ .03701

$\frac{.01522}{5} = .003044$

$\frac{1}{45.84} = .02179$

$\frac{.00607}{2} = .003035$

$\frac{1}{63.4845} = .01575$

$\frac{.01541}{5} = .003082$

$\frac{1}{32.058} = .03116$

$\frac{.00926}{3} = .003087$

$\frac{1}{45.601} = .02190$

$= \frac{.00609}{2} = .003045$

$\frac{1}{63.13} = .01584$

$= \frac{.00304}{1} = .003040$

$\frac{1}{78.128} = .01280$

$\frac{.00915}{3} = .003050$

$\frac{1}{274} = .003650$

7)21383
.003054

mean of diffs

.09384
3650
32)09749
3044

9384
1280
35)10664
.3047

9384
1584
36)10968
3047

9384
2193
38)11557
3041

9384
3119
41)12503
3050

9384
1575
36)10954
3044

9384
3703
43)13087
3044

3059
3050
3050
3050
3040
3045
3087
3088
3088
3035
3042
11)625
3057

3044
3047
3047
3041
3050
3044
3044
3045

mean of ~~3045~~ 3045

= 3045 × 1021 = .003109

Log = −3.4926
−1.4907
3.1983
−6.1816
3.4095
−10.7741
5944
e₁ = 5942

5942

$\frac{1}{10.657} = .09384 \times 1021 = v_1 = .09581$

5:20 P.M. Log = −2.9814
−1.4907

a

−16.4270 4204 = −4.8547
3.4075 4075 1.1673
−2.9814 9814 5.6874
−14.8159 8098 −4.4408
−3.4433 4926 −1.2466
3)11.3224 3172
−4.4408 .0002760 = a
1.1673 2779
−3.6081
2.3419 246.6 = 1/2a

2473

.1764 = l/a

$e_1^{2/3}$
−10.7739
3)14.5478
−7.8492
$e_1^{2/3} = 7.067$

4.67 e3″ 7061

5935

24) Wednesday, Mar. 27, 1912 θ = 22.94

Second Obs. 5:50 P.M. Voltat 5.25 P.M.

p = 6723 − 5152 = 1571; 6722 − 5150 = 1572

834.0 + 13.8
840.0 + 13.2
840.0 + 13.2
2514.0 + 40.2

for last Obs. → = 2554.2 = last Obs.

add for this obs. → 820.0
14.9
839.5
13.3
4241.9

Beauty
Publish.

G	F	
18.360		122.2—
18.362		34.224
18.328		45.378
18.444		45.208
18.442		15.574
18.330		
18.330		17.468
18.428	34.0	66.0—
18.390	(66.2)	66.020
18.174	—	122.6—
18.388	(45.6)	45.414
18.392	(45.3)	45.282
18.240	(45.2)	45.110
18.314	(45.4)	45.282
18.324	61.6	121.6—
18.312	—	121.2—

16 | 5558
18.3474

$\frac{1}{45.293} = .02205$ } $\frac{.04216}{6} = .007027$

$\frac{1}{15.57} = .06421$
.00698

$\frac{1}{17.47} = .05723$ } $\frac{.04208}{6} = .007011$

$\frac{1}{66.010} = .01515$ } $\frac{.006993}{1} = .006993$

$\frac{1}{122.6} = .008157$

} $\frac{.013903}{2} = .006951$

$\frac{1}{45.272} = .02206$
8157
2206

} $\frac{.013822}{2} = .006911$

5 | 34893
.006978

mean dif =

Volts at 6:30 P.M.

832.5 + 13.9
839.0 + 13.3
838.5 + 13.4
819.0 + 14.9
839.0 + 13.3
4168.0 + 68.8
4236.8

$\frac{1}{121.4} = .008238$

.05450
824
4) .06274
.006971

5450
2206
11 | 7656
6963

5450
816
9 | 6266
6962

6971
6963
6962
6965
6962
5 | 323
6965

5450
1515
10 | 6965
6965

5450
2205
11 | 7655
6960

mean dif 6965 6963 6964

$\frac{1}{18.347} = .05450 \times 1.021 = .055644$

Log = −2.74542

$\frac{1}{2}$ " = −1.37271

6:30 P.M.

a
−16.42709
3.6271
−2.7454
−14.7994
−3.8519
3) −12.9456
−4.3138
1.1965
−3.5103
2.4898
4897

l
−4.8547
1.1965
−5.6582
−4.3139
−1.3423
44

.2200 = $\frac{l}{a}$
.2210

.000207 = a
2069

307.6 = $\frac{1}{pa}$
308.8

$v_1 + v_2$ = .006965 × 1.021 = .007110

Log = −3.85191
−1.37271
−3.1983
−6.4229
3.6271
−10.7958
6249
2
e_1 6.247

v = 4238

$e^{2/3}$
−10.7958
2
3) 19.5914
7.8638
$e^{2/3}$ = 7308
$e^{2/3}$ = 7302

finally e_1 = 6.249

ah
−10.46136
3.6271
−6.08846
−3.8519
−4.23656
−4.3138
−1.92276

Log ah
Log k

$\frac{1}{k}$ = .07724 $\frac{1}{k}$ = 1.1947

.2844
3444
9450
.881

Publish

2 ν A =

13

25

Thursday 28th 1912

$\theta = \begin{matrix}22.91\\22.83\end{matrix}$

$p = \cancel{\frac{6347 \quad 5592}{7.55}}$ $\frac{6347 \quad 5592}{0755}$

First Obs at 3:37 P.M.

Volts at 3:08 P.M., 843.5+12.4
849.5+12.9
1693.0+24.5
=1717.5 volts.

G		7
88 45		
29.914		
30.052		
30.146		14.482
30.110		14.420
29.942		42.246
29.936	(Short)	41.994
30.006		42.268
29.980		42.618
29.834	(28.6 57.0)	56.228
29.954	(28.6 56.4)	56.230
29.916	(28.6 56.1)	56.176
29.908	(82.9)	82.878
30.124	(41.3 83.2)	83.614
29.894	110.6 for 5 small div	
4)419.696		
29.978		

$\frac{1}{14.451} = .06920$

$\Big\}\ \frac{.04559}{8} = .005699$

$\frac{1}{42.2815} = .02365$

34 cond.

~~.00586~~

$\frac{1}{42.68} = .02343$ } .005670

$\frac{1}{56.211} = .01776$

} = .005720

32 cond

$\frac{1}{83.02} = .1204$

$\frac{1}{83.246} = .01199$

} $\frac{11362}{2}$ = .005681

$\frac{1}{83.78} = .01193$

$\frac{1}{1760} = .0005682$

4)22760
.005690

Diffs

.00578
~~578~~
~~586~~
~~570~~
~~4)312~~
~~.005780~~

.03335
.01199
8).04532
.005665

3333
1776
9)5109
.005677

3333
2361
10)5694
.005694

5665
5677
5694
5695
4)331
.005683

3333
6920
18)10253 ⌊5695
90
125
108
170
162
80

v_1+v_2 = .005683 × 1021 = .005802

Log = −3.7635
−1.26545
−3.19776
−6.22671
3.23320
10.99351

V = 1711

4:03 P.M.

$\frac{1}{29.98}$ = .03335 × 1021
30

= V_1 = .03403

Log = −2.5319

$\frac{1}{2}$ " = −1.26545

a

−16.4209
3.2332
−2.5319
−14.1860
−3.7635
3)−12.4225
−4.1408
0.8779
−3.0187
3.9813

−4.8547
0.8779
−5.9768
−4.1408
−1.8360

.6855 = $\frac{l}{a}$

e_1 = 9.848

− 9.853 tem corr

.0001383 = a

957.8 = $\frac{1}{pa}$

$e^{2/3}$

−10.9934
2
3)−19.9868
−7.9956

99.00 = $e^{2/3}$

ak

−10.46136
3.2332
−7.69456
3.7635
−5.93106
−5.9312 = log ak
−4.1408
−1.7904 = log k
.2096 = log $\frac{1}{k}$
1.6203 = $\frac{1}{k}$

Log .6203 =
−1.7926
2.9813
−4.8113

−1.7924
−1.8360
−1.9564

A = .9045

.0006479 = b

a Beauty worked up Aug 22.

No 61

Thursday Mar. 28th 1912 $\theta = \frac{22.83}{22.83}$ $p = \frac{6409 - 5527}{8.82}$ $\frac{640 - 5525}{8.82}$

Second Obs. at 4:30 P.M., Volts at 4:05 P.M.

840.0 + 12.7
840.5 + 12.7
1680.5 + 25.4

Last Obs → = 1705.9
Add for this obs. → {838.0, 12.9}
2558.8

[826.0, 14.5] may not use –

G	F	
31.848	(54.4 108.8)	108.606
32.076	(54.4	108.0 —
31.990	(28.7 57.4)	57.436
31.882	28.5	57.6 —
31.856	(28.7 58.0)	57.894
32.124		39.180
31.866	(39.4)	39.466
32.000		39.444
31.904		129.0 — 1st div.
		130.0 — 2nd div.
		129.0 — 3rd div.
		128.0 — 4th div.
	56.0	151.0 —
32.078	56.6	151.8 —
31.794		

11) 21.4188
31.947
1.32
31.98 = .03127 × 1021
= .031927
log = −2.5042
½ " = −1.2521

5:07 P.M.

$\frac{1}{108.0}$ = .009259 } .008116

$\frac{1}{57.55}$ = .017375
57.763 = .01731
$\frac{1}{58.01}$ = .01724 } .008250 omit because under .20

$\frac{1}{39.24}$ = .02548
39.443 .02536
$\frac{1}{39.50}$ = .02532 } $\frac{.024345}{3}$ = .008115

$\frac{1}{1024}$ = .000975 } .008034

$\frac{1}{111}$ = .009009
$\frac{1}{111.4}$ = .008977

4) 265
.008067

.5%

$V_1 + V_2$ = .00808 × 1021
= .008250

Log = −3.9165
−1.2521
−3.19776
−6.36636
3.40756
−10.95880

V = 2556

.03127
.008977
5) .040247
.008049

.03127
.975
4) .32245
.008061

3127
2536
7) 5663
.008090

3127
9731
6) 4858
.008097

3127
9259
5) 40529
.008105

8049
8061
8090
8097
8105
5) 402
.008080

e ⅔
−10.9583
2
3) −19.9166
−7.9722

9095
11
e_1 = 9.084

93.40 = e ⅔

ak
−10.46136
3.40756
−7.86892
−3.9165
−5.95242
1.7 = ten corr.
−5.9526 = log ak
−4.1387
−1.8149 = log k
.1851 = log $\frac{1}{k}$
1.5313 = $\frac{1}{k}$ = .99
Log 5313 = −1.7253
2.9155
−4.8098

−1.7253
−1.7702
−1.9551

A = .9018
b = .0006453

a
−16.4209
3.40756
−2.5042
−14.33266
−3.9165
3) −12.41616
−4.13872
0.94575
−3.08447
2.91553

.0001376 = a

823.2 = $\frac{1}{pa}$

l
−4.8547
.9458
−5.9089
−4.1387
−1.7702

.5892 = $\frac{l}{a}$

No 60

Beauty. worked out Aug 22

Thursday Mar. 28, 1912 θ = 22.83

3rd Obs at 5:28 P.M. Volts at 5:07 P.M.

P = 6448 / 5478 / 9.70 6448 / 5478 / 9.70

839.0 + 12.8
839.5 + 12.8
838.5 + 12.8
2517.0 + 38.4

preceding Obs. → 2555.4 ← also this Obs.

~~823.0~~
~~14.7~~

Best yet

Beauty

Publish

G		F
12.836		11.960
12.994		11.938
12.892		10.704
12.914		29.350
12.930		29.280
12.902		29.108
12.838	(32.0)	32.866
12.808	(32.6)	33.068
12.920	(33.0)	32.894
12.886	(33.0)	32.892
12.908		29.204
12.902		32.950
12.916	45.2	90.2 —
12.850	(90.4)	90.260
12.854	(39.0 67.0)	66.762
12.912	(38.6 66.8)	66.650
12.908	70.6	139.8 —
12.870	71.2	139.4 —
12.882	(67.0)	66.942

$\frac{1}{11.949} = .08367$

$\frac{.04956}{13} = .003812$ Volts at 6:08

$\frac{1}{29.279} = .03411$

$.00378$

$\frac{1}{32.930} = .03034$

$\frac{.01929}{5} = .003858$

$\frac{1}{90.230} = .01108$

$\frac{.003860}{1} = .003860$

$\frac{1}{66.706} = .01498$

$\frac{.007797}{2} = .003898$

$\frac{1}{139.6} = .007163$

$\frac{.007757}{2} = .003878$

$\frac{1}{66.944} = .01492$

14 | 16922
12.891

$\frac{1}{12.89} = .07758 \times 1.021 = .07921 = v_1$

6:08 PM.

Log = −2.8988

$\frac{1}{2}$ 11 = −1.4494

836.0 + 13.6
836.5 + 13.6
833.0 + 13.9
2505.5 + 40.1

2545.6

~~827.0~~
~~14.1~~

~~Differences.~~

Difs
~~3812~~
~~3858~~
~~3858~~
~~3858~~
~~3810~~
~~3803~~
~~3803~~
~~3803~~
~~8|17853~~
~~.003875~~

differences
3812
3858
3860
3898
3878
5 | 1306
3861

7758
1498
24 | 9254
3854

7758
7163
22 | 84743
3852

7758
1499
24 | 9257
3857

7758
1108
23 | 8866
3855

7758
3034
28 | 10792
3854

7758
3415
29 | 11171
3852

7758
8367
42 | 16125
3839

3854
3852
3855
3855
3852
3853

mean = .003854 × 1.021

= $v_1 + v_2$ = .003935

Log = −3.5949
−1.4494
3.1983
6.2426 $\sqrt{\ }$
3.4065
10.8361
6857
4
e_1 = 6.853

6.846

a
−16.4209
3.4065
−2.8988
−14.7252
−3.5456
3 | −11.1334 .03
−4.3711
0.9868
−3.3636
2.63654
0002
2.6362

l
−4.8547
0.9868
−5.8679
−4.3747
−1.4932

.3082 = l/a
3097

.0002342 = a
2380

b
430.6 = $\frac{1}{pa}$
4328

Ad

$e^{2/3}$
−10.8362
2
3 | 19.6718
7.8906

$e^{2/3}$ 77.78 ③ 77.68

#9 21

78) Thursday Mar. 28, 1912 θ = 22.90 θ = 54.54 / 64.65 / 10.11

4th Obs at 6:23 PM.

Volts at 6:08 P.M.

836.0 + 13.6
836.5 + 13.6
833.0 + 13.9
2505.5 + 40.1 = 2545.6

~~821.0~~
~~14.8~~

G		F
24.302		8.564
24.286		8.550
24.260		16.818
24.316		15.388
24.202	(21.2 42.0)	41.832
24.186	(21.0 42.0)	41.796
24.376	(55.6)	55.6 (?)
24.304	(28.0 55.4)	55.354
24378		82.6
24.210	(41.2 82.6)	82.520
24.142	(41.6 82.8)	82.772
24.176		41.898
24.162	(41.8)	41.420

13) 330.05
24.254
13
24.27

$\frac{1}{16.82}$ = .05945

$\frac{1}{15.39}$ = .06498

$\frac{.03553}{6}$ = .005922

$\frac{.04106}{7}$ = .005866

.005894

$\frac{1}{41.814}$ = .02392

.00591

$\frac{1}{55.53}$ = .01808

.00593

$\frac{1}{82.8}$ = .01208

$\frac{.01188}{2}$ = .005945

$\frac{1}{41.77}$ = .02397

5922
5866
591
593
5945
5) 14573
.005915 = dif.

Volts at 6:49 P.M.

835.0 + 13.6
830.5 + 14.1
830.0 + 14.2
2495.5 + 41.9 = 2537.4

.04120
.02401
11) .06521
.005927

.04120
.01208
9) .05328
.005920

.04120
.01803
10) .05923
.005923

4120
2392
11) 6512
.005920

4120
6448
18) 10618
.005894

4120
5942
17) 10062
5919
5894
5920
5923
5920
5927
6) 5503
.005917

6:48 PM.

$\frac{1}{24.27}$ = .04120 × 1.021

= v_1 = .042065

Log = −2.6239

$\frac{1}{2}$ " = −1.31195

$v_1 + v_2$ = .005917 × 1.021

= .006041

Log. = −3.7811
−1.31195
−3.19776
−6.29081
3.40575 − V = 2545.6
−10.88506
16 − tem corr
−10.8849

e_1 = 7.672

$e^{2/3}$
.8849
2
3) 14.7698
−7.9233

$e^{2/3}$ = 8.382

a
−16.42092
3.40575
−2.6239
−14.45057
−3.7811
3) −12.66947
−4.22316
1.00488
−3.22804
2.77196

l
−4.8547
1.0049
−5.8498
−4.2232
−1.6266

.4233 = $\frac{l}{a}$

.0001672 = a

591.5 = $\frac{1}{pa}$

ak
−10.46136
3.4065
−7.86786
−3.5944
−4.27296
−4.3767
−1.89626 =
13
−1.89634 = Log k
.10361 = " $\frac{1}{k}$
1.2694 = $\frac{1}{k}$

Log .2694 = −1.4305
2.6362
−4.7943

b = .0006227

−1.4305
−1.4910
−1.9395
~~.8699~~
A = .8700

exactly
right

Publish
Beauty. m everyway
must compare with
5 sec drop of Apr 15

almost exactly on line

Worked out Aug 23.

ak
−10.46136
3.40575
−7.86711
−3.7811
−4.08601
−4.22316
−1.86285
10
−1.86295 = log k
.13705 = " $\frac{1}{k}$
1.37095 = $\frac{1}{k}$

Log .37095 =
−1.56940
2.77196
−4.79745

−1.56940
−1.6266
−1.9428

A = .8766

b = .0006271

No 55

24) Friday Mar. 29th 1912

$\theta = 23.16$

$p = \frac{65.81 \quad 53.20}{12.61}$

12.603 at 23

First Obs. at 10:40 A.M.

Volts at 10:23 A.M.
824.5 + 14.7
804.0 + 15.9
798.0 + 16.2
~~811.5 + 16.0~~
~~3238.0 + 62.8 = 3300.8~~
2426.5 + 46.8 = 2473.3

	G		F
(17.0 33.6)	33.432	(28.6)	28.494
(16.6 33.4)	33.346	(14.4 28.6)	28.624
(16.4 33.0)	33.172		20.806
(16.6 33.2)	33.310		20.832
(16.6 33.6)	33.380		35.032
(16.6 33.2)	33.306	(14.2 28.3)	28.548
(33.4)	33.346		
(16.8 33.4)	33.328	(56.3 111.9)	111.244
(17.0 33.8)	33.684	200.0	For four divisions only
	33.484	(56.6 112.0)	111.706

$\frac{1}{28.559}$ $\frac{.28}{28.58}$ = .03499

20.819 $\frac{1}{20.83}$ = .04801

$\frac{1}{35.08}$ = .02850

$\frac{1}{28.57}$ = .03499

$\frac{1}{111.47}$ = .008971

$\frac{1}{400}$ = .002500

$\frac{1}{111.93}$ = .008936

$\frac{.01302}{2}$ = .006501

$\frac{.01951}{3}$ = .006503

.006490

$\frac{.026014}{4}$ = .006505

.006471

.006436

6)2906

.006485 mean dif

10)3788
33.3788
40
33.42

.029922
.03499
10).064912
.06491

29922
480
12)77922
.006493

29922
2850
4)025842?
.006491

29922
3499
10)64912

29922
8971
6)38893
.006482

29922
2500
5)32422
.006485

29922
8936
6)38848
.006475
6485
6482
6491
6491
6493
6491
7)608
.006487

$v_1 + v_2$ = .006487 × 1021 = .0066232

$\frac{1}{33.42}$ = .029922 × 1021

= v_1 = .03055

Log = −2.48501

$\frac{1}{2}$ = −1.2425

10.18 A.M.

Log = −3.82107
−1.2425
−3.19776
−6.26133
3.38946 V = 2456
−10.87187
00030 tem corr
−10.87217

a
−16.42092
3.28946
−2.48501
−14.29539
−3.82107
3)−12.47432
−4.15810
1.10048
−3.25858
−2.74142

l
−4.8547
1.10048
−5.75422
−4.15810
−1.59612

.3945 = $\frac{l}{a}$

e_1 = 7.4502

.0001439 = a

551.35 = $\frac{1}{pa}$

$e^{2/3}$
3)14.74434
−2.91478

$e^{2/3}$ = 82.19

ak
−10.46136
3.38946
−7.85082
−3.82107
−4.02975
00018 tem
−4.02957
−4.15810
−1.87147 = log k
.12853 = $\frac{1}{k}$
1.3443 = $(1 - \frac{1}{k})$

log .3443 = −1.5370, −1.5370
−2.7414 −1.5961
−4.7956 −1.9409

b = .0006246

A = .8728

Beauty publish
Worse up Aug 23

no 53

30) Friday Mar. 29, 1912

$\theta = \frac{23.18}{23.19}$

$p = \frac{66.27}{52.72}$ 13.55

Second Obs. at 11:37 AM. Volts at 11:20 am.

823.5 + 14.6
799.5 + 16.2
769.0 + 17.4
810.0 + 15.5
3201.0 + 63.8 = 3264.8

One of the best

cont for chem

23920
482
2440.2

G		F
13.838		10.698
13.906		17.168
13.868		17.242
13.872 ✓	(14.4 28.8)	28.924
14.012 ✓	(14.6 29.0)	28.968
13.870	(14.3 28.7)	28.900
13.900	(24.6 48.3)	48.392
13.932	(25.0 49.2)	48.660
13.888	(24.0 – 48.4)	48.272
13.930	(25.0 – 48.6)	48.470
13.842 ✓	(62.8)	62.480
14.068	(31.4 – 62.4)	(?) 62.042
13.914	(31.4 – 62.6)	62.560
13.870		150.4
13.934	63.0 1st div. 64.0 2nd div	
15) 58644	127.0 × 4 = 508.0	
13.909		

$\frac{1}{17.205} = .05812$

$\frac{1}{28.961} = .03453$

$\frac{1}{48.4485} = .02060$

$\frac{1}{62.360} = .01601$ 48

$\frac{1}{150.4} = .006649$

$\frac{1}{508} = .001969$

$\}\frac{.02356}{5}$ = .004712 = .004643

$\}\frac{.01393}{3}$

$\}\frac{.00459}{1}$ = .00459

$\}\frac{.00936}{2}$ = .004680

$\}\frac{.4680}{1}$

.4680
4) 2630

Mean of best 4 det's = .004648

Volts at 12:00 M.

822.0 + 14.8
792.5 + 16.5
762.5 + 17.6
809.5 + 15.6
3186.5 + 64.5
64.5
3251.0

4643
4540
468
468
4) 2593
4648

7189
197
16) 7386
.004616

7184
665
17) 7854
.004620

7189
1599
19) 8788
.004625

7189
2064
20) 9253
.004627

7189
3456
23) 10645
.004628

7189
5812
28) 13001
4657

$\frac{1}{1341}$ .07189 × 1021 = .07340

12:00 M.

Log = $\bar{2}$.8657

$\frac{1}{21}$ = $\bar{1}$.4329

$V_1 + V_2$ = .004633 × 1021
= .004729

Log 3.6748
$\bar{1}$.4329
3.1983
$\bar{6}$.3060
3.5125
$\bar{10}$.7935

4657
4616
4620
4625
4627
4628
5) 173
.004633

V = 3254.4

a
$\bar{16}$.4290
3.5125
$\bar{2}$.8657
4) $\bar{14}$.8052
$\bar{3}$.6738
3) 11.1314
$\bar{4}$.3771
1.1319
$\bar{3}$.5090
2.4990

l
$\bar{4}$.8547
1.1319
$\bar{5}$.7228
$\bar{4}$.3771
$\bar{1}$.3457
.2216 = l/a
2229 = l/a
2223

.0002383 = a
2376

309.7 = $\frac{1}{pa}$
310.6 = $\frac{1}{pa}$
311.5

136
135
14

1243
3748
1346
5864
4935

33
1646
13 33
48

~~15~~ 20

~~Taking mean of the 4 best 4633~~

6216
5
e_1 2 6.221
e_1 = 6.214
$e^{2/3}$

$e^{2/3}$
10.7930
2
3) $\bar{19}$.5860
$\bar{7}$.8620
$e^{2/3}$ = 72.80
$e^{2/3}$ = 72.88

~~7423~~
19.5846
$\bar{7}$.8615

7434
2
3) 15865
$\bar{7}$.8623
$e^{2/3}$ = 72.83

Saturday Mar. 30th 1912

First Observation
at 5:03 P.M.

θ = 22.81 ?

Volts at 4:45 P.M.:

$p = \frac{5210}{6678}$ 14.68 P.A.M. $\frac{5213}{6679}$ 1466 J.Y.L.

840.0 + 13.7
846.5 + 12.0
846.5 + 12.2
825.0 + 14.5
3358.0 + 51.6
51.6
3409.6

(50)

G		F
25.856	(25.8)	
25.946		10.334
25.890		10.342
25.816		38.604
25.876		53.450
25.818		24.906
25.934		30.248
25.956		30.016
25.876		18.282
26.064		16.216
26.018		24.860
25.907		21.062
25.860		30.126
25.930		20.884
25.994	(21.2)	21.130
*		21.174
25.814	(86.4)	85.922
26.012		84.780 — for 3 div
		(85.4 —) — " "
	114.3	= 226.5 227.0 —
25.904	(86.6)	86.368
25.802	(86.8)	86.406
25.918		
		5:45 P.M.

23)1181868
25.9093
26
25.935

$\frac{1}{25.935}$ = .03856
= v_1 = ~~.03444~~ .03937
Log = −2.59526
$\frac{1}{e_1}$ = −1.29763

$\frac{1}{10.338}$ = .09673

$\frac{1}{38.66}$ = .02587 } $\frac{.07086}{10}$ = .007086

$\frac{1}{53.55}$ = .018675 } $\frac{.007195}{1}$ = .007195

$\frac{1}{24.92}$ = .04013 } $\frac{.021455}{3}$ = .007152

$\frac{1}{30.16}$ = .03315 } $\frac{.02155}{3}$ = .007183

$\frac{1}{18.28}$ = .05470

$\frac{1}{16.216}$ = .06167

$\frac{1}{24.87}$ = .04021

$\frac{1}{21.07}$ = .04746 } .01431 = .007155

$\frac{1}{30.16}$ = .03315 } $\frac{.01431}{2}$ = .007155

$\frac{1}{21.07}$ = .04746 } $\frac{.03585}{5}$ = .007170

$\frac{1}{86.09}$ = .01161 } .007198

$\frac{1}{226.6}$ = .004412

} = .007148

$\frac{1}{86.55}$ = .01156

19 9 8 11 10 13 14 11 12 10 12 7

712121
716159
715754
715652
717472
717674
716159
716361
717068
717471
717068
717067
716554
717974
14)861
.007161

9)14424
.007160 = mean dif

.03856
.01156
9).05012
.007174

.03856
.04412
6).042952
.007159

.03856
.01161
7).05017
.007169

.03856
.04746
12).08602
.007168

.03856
.03315
10).07171
.007171

.03856
.04746
.08602

.03856
.04021
11).07879
.007161

.03856
.09673
19).13529
.007121

.03856
.02587
9).06443
.007159

.03856
.018675
8).057235
.007154

.03856
.04013
11).07869
.007152

.007172

.03856
.05470
13).09326
.007174

.03856
.06167
14).10023
.007159

$\underline{v_1+v_2}$ = .007161 × 1021
v_1+v_2 = .00~~73144~~ 7311
Log = −3.86400
−1.29760
3.19776
−6.35933
3.53159
−10.82773
00039
−10.82734

V = 3408.

e_1 = 6.713

3)19.65468
7.88493

$e_1^{2/3}$ = 76.71

a
−16.42092
3.53154
−2.59539
−14.54785
−3.86418
3)−12.68367
−4.22789
1.1665
−3.39439
2.60561

.0001690 = a

l
−4.85477
1.1665
−5.6882
−4.2779
−1.4603

.2886 = $\frac{l}{a}$

4033 = $\frac{1}{pa}$

Beauty publish
Worked up Aug 23

32)

Saturday Mar. 30, 1912

Second Observation
at 6:11 P.M.

θ = ~~22.8~~ 22.81

$p = \frac{6704}{5169}$ 15.35

Volts at 5.47 P.M.

837.5 + 13.0
842.5 + 13.5
842.0 + 13.5
821.0 + 14.8 ← not used
3343.0 + 54.8
54.8
3397.8

2572.0 + 39.7 = 2561.7

G		F	
32.366	(32.4) (20.1)	20.330	
32.398	(32.4)		
32.217	(32.2)	23.140	
32.342	(32.4)	23.230	(23.2)
32.358	(32.4)	80.786	(81.0)
32.438	40.6	81.416	
		18.113	
32.412	(16.2) (32.5)	18.144	
32.236		54.490	(54.6)
32.424		81.486	

9) 3191
32.356
42 chron corr

$\frac{1}{20.33}$ = .04914

$\frac{1}{23.185}$ = .04313

$\frac{1}{81.260}$ = .01237

$\frac{1}{18.1285}$ = .05517

$\frac{1}{54.60}$ = .01835

$\frac{1}{81.66}$ = .01224

$\frac{.03082}{5}$ = .006164

$\frac{.04286}{7}$ = .006123

$\frac{.03685}{6}$ = .006142

$\frac{.006080}{1}$ = .006080

mean .006134

Volts at 6.37 P.M.

836.5 + 13.6
841.0 + 13.2
839.5 + 13.3
2517.0 + 40.1
40.1
2557.1

.030854
.01224
7) .043094
.006156

30854
1832
8) 49274
.006159

$\frac{1}{32.406}$ = .03085 × 1021
= v_1 = .03150
Log = −2.4988
$\frac{1}{2}$ l = −1.24945
24945

6:35 P.M.

6159
6150
6144
6169
6165
5) 287
.006157 × 1021 = $v_1 + v_2$ = .006286 =

30854
4313
12) 73984
6165

30854
1237
7) 43167
6166

30850
55170
14) 86024
6143

14 86024 6144

Log = −3.79884
−1.24945
3.19776
−6.24555
3.4080
10.8377
0004
10.83769
~~6.884~~

V = 2559

a
−16.4209
3.4080
−2.4980
−14.3272
−3.79884
3) 12.5288
−4.1763
1.1864
−3.3627
2.6373

l
−4.8547
1.1864
−5.6683
−4.1763
−1.4920

.3087 = $\frac{l}{a}$
.3104

.0001504 = a
1504

431.4 = $\frac{1}{pa}$
4338

e_1 = 6.884

~~reduce to [illegible]~~

e_1 = ~~6.882~~

~~e = 6.885~~

e_1 = 6.888

$e^{2/3}$ = 77.86

finally
Sept 3

−10.8384
2
3) 14.6768
−7.8923

8368
2
3) 16738
−7.8913

77.86

78.04 = ~~$e^{2/3}$~~
8
77.96

~~[illegible]~~

$e^{2/3}$

19

Publish

Fine illustration of
Case in which
$v_1 + v_2$ from diff's
is the smallest
by .6%

$e^{2/3}$

Result would be .3 % lower if
mean of 6 [illegible]

would be .2 % ~~lower if~~
mean had been used ~~but~~

33) Monday, Apr. 1st 1912 – $\theta = 22.98$ $p = \frac{67.82}{\frac{50.86}{16.96}}$ $\frac{67.81}{\frac{50.86}{16.95}}$

First Observation at 5:07 P.M. Volts at 4:50 P.M.

831.0 + 14.0
832.0 + 13.8
830.5 + 14.0
821.0 + 14.7
3314.5 + 56.5 = 3370.5

G		F
50.6		
50.364	(22.3 44.2)	43.998
(25.6 50.7) 50.442	(22.6 44.8)	44.446
(50.7) 50.416	(30.4)	30.254
50.770	(30.3)	30.328
50.178		22.904
(50.4) 50.456	(30.2)	30.396
(50.5) 50.460	(84.2)	83.716
(50.2) 50.118	102.6 – 1st large division	
8)3204	106.8 – 2nd " "	
50.40	97.2 – 3rd " "	
10	89.8 – 4th " "	
5050	101.0 – 5th " "	
	5)497.4	
	99.5 .8	
	99.80	

$\frac{1}{44.510} = .022465$ } .010515

$\frac{1}{30.320} = .03298$ } .01067

$\frac{1}{22.91} = .04365$ } .01079

$\frac{1}{30.43} = .03286$ } $\frac{.02094}{2} = .01047$

$\frac{1}{83.88} = .01192$ } 0

$\frac{1}{496} = .001256$

.010664
3)1649
.01055

.01980
.001256
2).021056
.01053

1980
1192
3)3172
.01057

1980
3286
5)5266
.01053

1980
4365
6)6345
.01058

1980
3298
5)5278
.01055

1980
22465
4)42265
.01056

1053
1057
1053
1058
1055
1057
6)33
.01055

$\frac{1}{50.50} = .01980$

5:49 P.M.

$V_1 = .01980 \times 1021$

$V_1 = .020216$

Log = –2.30590

½ " = –1.15285

$v_1 + v_2 = .010555 \times 1021$

$v_1 + v_2 = .010775$

Log = –2.03242
–1.15285
–3.19776
–6.38303
3.5251
–10.85793

$V = 3351$

$e_1 = 7210$

3)14.71586
–7.90579

$e_1^{2/3} = 80.40$

a
–16.42092
3.5251
–2.3059
–14.25172
–2.03242
3)–12.21930
–4.07310
1.2242
–3.30230
2.69760

l
–4.8547
1.2292
–5.6255
–4.0731
–1.5524

$.3568 = \frac{l}{a}$

$.0001183 = a$

$4985 = \frac{1}{pa}$

ak
–10.46136
3.5251
–7.98646
–2.03242
–5.95404 = log ak
–4.07310
–1.88094 = log k

.11906 = " $\frac{1}{k}$

1.3155 = $\frac{1}{k}$

log .3155 = –1.4990
2.6960
–4.8030

–1.4990
–1.5524
–1.9466

b = .0006353 ∴ A = .8842

no 5

ak
–10.46136
3.5207
–7.98206
–3.8722
–4.10986 = log ak
4.2085
–1.90836 = log k

.09164 = " $\frac{1}{k}$

1.2350 = $\frac{1}{k}$

log .2350 =
–1.3788
2.5613
–4.8098

b = .0006451

–1.3150
4.40

Good one. probably publish worked up Aug 23.

a blunder in computing was made here
the pt is [illegible] after time
this does not affect e
+ I can't change it
without redrawing

Corrected

54 Monday Apr. 1st 1912 t =

Second Observation at PM.

Volts at 5:50 P.M.

$p = \frac{6796}{5069} \; 1727 \qquad \frac{6794}{5067} \; 1727$

828.0 + 14.3
821.0 + 14.7
812.0 + 15.6
820.0 + 14.8
3281.0 + 59.4 = 3340.4
59

Good one

(29.6)	29.666	(41.8)	41.630
(29.8)	29.664		
			9.846
	29.794		18.452
(29.8)	29.790	(58.6) (56.7)	57.152
(29.8)	29.886	(57.0)	56.314
(30.0)	29.864	(58.6) (57.0)	56.688
(29.7)	29.768	(56.8)	56.776
(29.9)	29.738	(57.2)	56.794
	29.686		31.316
		(49.2) (97.9)	97.592
(30.0)	29.806	(50.2) (98.6)	98.322

about 10 min. wasted, because switch sparked.

Volts 6:50 PM

826.0 + 14.5
808.0 + 16.1
790.0 + 18.0
816.0 + 15.2
3240.0 + 63.9 = 3303.9

$\frac{1}{18.45} = .05420$

$\frac{337}{56.7}$ ~~.01463~~

$\frac{.03658}{5} = .07316$

$\frac{1}{56.74} = .01763$

$\frac{.01430}{2} = .00715$

$\frac{1}{31.32} = .03193$

$\frac{.02168}{3} = .007227$

$\frac{1}{97.59} = .01025$ } mean = .01021

$\frac{1}{98.32} = .01017$

} .07360

Dfs
7316
7150
7227
7360
4)11053
7263

.03350
.00281
5).03366
.00727

33550
1021
6)43760
7293

33550
1763
7)51180
.007312

7272
7293
7312
3)877
7292 × 1021

10) 7862
29.776
31

$\frac{1}{29.78} = .03358$ 6

.03354
29.791

89.0 – 1+2 Div. $\frac{1}{357}$ = .002810
89.2 – 3+4 div.

6.49

$\frac{1}{29.81} = .03355 \times 1021 = .03425$

Log = –2.53492
$\frac{1}{2}$ = –1.26756

4 not 3

mean of 7292 and 7263 = 7277 × 1021 = $v_1 + v_2$ = .07430

3355
5220
12)8775
7313
75.20 = $e^{2/3}$

a
–16.4298
3.5207
–2.5350
–14.4766
–3.8722
3)–12.6044
–4.2015
1.2372
–3.4387
2.5613

l
–4.8547
1.2372
–5.6175
–4.2015
–1.4160

.2596 = $\frac{l}{a}$
2604
.0001548 = a
1590

370.9 = $\frac{1}{pa}$
374.2
372.0 = old value
364 = correct value

Log = –3.87100
–1.26736
–3.19776
–6.33612
3.5207
–10.8154

V = 3317

37
e_1 = 6.566

reduce to 6.556 on acct of Chronometer term

$e^{2/3}$
–10.8166
2
3)14.6332
–7.8777
$e^{2/3}$ = 75.45
= 75.37

18

19.6304
7.8768

final

Sept 2

e_1 = 6.594
$e^{2/3}$ = 75.32

16

Saturday Apr. 6, 1912
First Observation
at 4:35 PM

$\theta = 22.97$

$p = \begin{array}{r} 9307 \\ 2070 \\ \hline 72.37 \end{array} \quad \begin{array}{r} 93.09 \\ 20.68 \\ \hline 72.31 \end{array}$

Volts at 4:20 PM.

839.5 + 13.3
841.0 + 13.2
842.0 + 13.1
825.0 + 14.6
843.0 + 13.1
842.0 + 13.1

5032.5 + 80.4 = 5112.9

G		F
10.846		~~27.103~~
10.126		54.206 →
		60.274 } — ½ distance.
10.410		120.6 — } — whole " →
		26.006
10.504		26.364
10.398		26.162
10.384	13.2	26.072 →
10.390	(38.6 75.8)	75.808 →
10.400	(63.0)	62.620 } — ½ dis
10.414		123.0 — } →
	(43.4)	43.462
10.460	(43.6)	43.444
10.390	(22.3 43.4)	43.540
10.366	21.6	43.628 →
10.408	(66.0 128.8)	128.606 →
10.334	(36.4)	36.266 →
10.434	(22.6 44.2)	44.248
10.450	(44.1)	43.888 →
10.422	(40.0 78.6)	78.258
10.432	(78.8)	78.872 →

5:15 PM

Tem. had been
changing. Prob'y see F½ left!
correction. Doubt
wisdom of making up

~~Ha~~ Took apparatus apart
+ changed atomizer inserting
new oil density of which was
det'd as shown in last pages

Saturday Apr. 6, 1912

Second Observation

at.

$\theta =$ $p =$

Volts at 5:17 P.M.

837.5 + 13.4
836.0 + 13.6
837.0 + 13.4
823.0 + 14.7
837.0 + 13.4
837.0 + 13.4

5003.5 + 81.9 = 5085.4

Monday Apr. 8, 1912

$\theta = \left\langle \begin{matrix} 22.99 \\ 23.01 \end{matrix} \right\rangle$

$p = \begin{array}{r} 9318 \\ 2050 \\ \hline 72.68 \end{array}$

First Observation 4:25 P.M.

volts at 4:10 PM
839.5 + 13.3
837.5 + 13.5
840.5 + 13.2
826.5 + 14.5
839.0 + 13.3
839.5 + 13.3
5024.5 + 81.1 = 5105.6

1½ mm. below ~~center~~ of

G	F		
12.826			
12.864			
12.740			
12.814			
12.776			
12.770		13.754	13.775
12.860		13.796	
12.728		22,436	
12.830		19.770	19.816
	$\binom{9.8}{19.8}$	19.862	
12.800	$\binom{11.2}{22.4}$	22,296	22,304
12.816	$\binom{11.2}{22.2}$	22,312	
12.836			

1/3 of a small division, in 60 seconds

4:37 PM.

Can't get difference

38) Monday, Apr. 8, 1912 $\theta = 23.08$. $p = \frac{93.45 \quad 20.20}{73.25}$

Second Observation at 4:50

Volts at 4:38 P.M.

838.5 + 12.6
833.0 + 13.6
836.5 + 13.0
825.0 + 14.5
832.0 + 13.6
839.0 + 12.6
5004.0 + 80.5 = 5084.5
Ave. volts = .5073

Middle of Plates is now 10.689

G.		F	
10 640		19 154	
10 724		17 366	
10 680		24 958	
10 772	(13.6–27.0)	26 972	$\frac{1}{26.897}$ = .03717
10 686	(13.3–26.5)	26 822	
10 638	~~42.6~~ (42.6–84.5)	84. 648	$\frac{1}{84.396}$ = .01183
10 594	(42.6–84.4)	84. 144	
10 718	(29.7–59.0)	58. 828	$\frac{1}{58.95}$ = .016935
10 596	(29.4–59.2)	59. 084	
10 640			
10 584	(——37.0)	36. 890	$\frac{1}{3685}$ = .02710
10 624	(18.6–37.0)	36. 822	
10 558	(22.6–45.4)	45 446	$\frac{1}{45.42}$ = .02202
10 644	(22.8–45.2)	45 382	
10 690	(29.2–58.8)	58 758	$\frac{1}{58.86}$ = .01698
10 618	(42.4–83.6)	83 668	$\frac{1}{83.67}$ = .01192
10 706	(73.6–)	~~146 4~~	$\frac{1}{145.6}$ = .006894
10 816	(72.2 144.4)	145.832	
10 650	(29.0–58.5)	58 562	$\frac{1}{58.7}$ = .01704
	(29.6–58.8)	58. 636	
10 690	(37.2)	36. 934	$\frac{1}{3648}$ = .02705

20) 132687
10.6634

$\frac{1}{10.6634}$ = .09378 × 1021
= .09578 = V_1

Log.. = $\bar{2}$.9818
½ " = $\bar{1}$.49077

5:40 PM

$\frac{.02534}{5}$ = .005068 →
.005105 ←
$\frac{.010175}{2}$ = .00509
.00512
$\frac{.1012}{2}$ = .005060
.00500
.00506
.005076
$\frac{.010192}{2}$ = .005096
$\frac{.01001}{2}$ = .005005

differences

.005064 | .5068
.005115 | 1 5105
5090 | 1 5090
5120 | 1 5080
5000 | 5060
5080 |
5096 | 2 5096
5000 | 2 5096
9) 63.7 | 5095
.005071 | .005070

.01195
.09378
21) .10573
.005035

.03717
.09378
30) .13095
.005037

006868
93780
20) 100648
50324

.01185
.09378
.10563
.005030

01706
9378
22) .11084
.005038

016965
09378
22) .10745
.005034

.02708
9378
24) .12086
.005036

02714
09378
24) .12092
.005038

02202
09378
23) .11580 (.005035
~~.105~~
108

½ Log v_1 = $\bar{1}$.49077
Log $v_1 + v_2$ = $\bar{3}$.71400
$\bar{3}$.19880
$\bar{6}$.40255
3.70520 v = .5073
$\bar{10}$.69730

a -1.64209
+ 3.7053
- 2.9813
-13.1075
- 3.7140
3) -11.3935
- 4.4645
1.8648
- 2.3299
+ 1.6701

-4.8547
1.8648
-6.9899
-4.4645
-2.5254

a = 2931
2974

$\frac{l}{a}$ = .03333
3353 = $\frac{l}{a}$

$\frac{1}{pa}$ = 46.57
46.35 = $\frac{1}{pa}$

4.9810 × 10^{-10}
15
= 4.9825

This uses 5070 → e = 4.984
plate 5036

$e^{\frac{2}{3}}$ =

log $e^{\frac{2}{3}}$ = .6934 -10

3) -19.3944
log $e^{\frac{2}{3}}$ = 7.7981

$e^{\frac{2}{3}}$ = 62.82
nearly 1% low
on 1 diff's
than V_1

5035
50324
5038
5036
5040
5035
5038
5034
5030
5037
3554
.50355 ←
.5061
2) 965
.0050482
4821
.005154 = $v_1 + v_2$
log = $\bar{3}$.7121

.7% diff longest period

01702
09378
20) 10080
.05040

17a

take mean

39 Monday, Apr. 8, 1912

Third Observation
at 5:55 P.M.

$t = 23.06$

$p = 93.50 - 20.03 = 73.47$

Volts at 5:41 P.M.

8

837.0 + 13.0
829.5 + 14.3
831.0 + 14.0
823.0 + 14.6
828.5 + 14.3
831.5 + 14.1
4980.5 + 84.3 = 5065.4

~~Ave volts = 5070~~

G		F
18 402		
18 556		
18 350		14 966
18 470		14 870
18 412	(18.7–37.4)	37 376
18 318	(37.6)	37 594
18 388	(18.4–37.2)	37 368
18 376	(25.0–50.1)	50 228
18 406	(37.6–76.2)	76 154
18 392	(	155.6 —
18 492		
11) 14562		
18.415		

6:12 P.M.

$\frac{1}{14.918} = .06703$

$\frac{1}{37.446} = .02667$

$\frac{.04032}{6} = .006727$

$.006780$

$\frac{1}{50.23} = .01989$

$.006780$

$\frac{1}{76.15} = .01317$

$.006682$

4) 27002

$\frac{1}{155.6} = .006428$

mean = .006742

Volts at 6:13

836.0 + 13.6
826.0 + 14.5
830.0 + 14.2
823.0 + 14.7
824.0 + 14.7
830.0 + 14.2
4969.0 + 85.9 = 5054.9

.5431
643
9) 6074
.006749

5431
1317
10) 6744
6742

5431
1989
11) 7420
6749

5431
2667
12) 8098
6748

5431
6703
18) 12134 (6752

6749
6742
6748
6748
6752
5) 739
6748

$\frac{1}{18415} = .05431 \times 10^{-1} = v_1 = .05545$

Log = −2.7439

$\frac{1}{2}$ " = −1.3720

$v_1 + v_2 = 6748 \times 10^{-2} \cdot 1$

= .0068896

Log = −3.8382
−1.3720
3.1983
−6.4085
7042
10.7043

v = 5060

$e_1 = 5061$

$e_1 = 5062$

$e_1 = 5.054$

$e^{2/3}$

10.7044
2
3) 19.4088
−7.8029

63.50 = $e^{2/3}$

$e^{2/3} = 63.45$

a

−16.4270
− 2.7439
3.7042
−14.8751
− 3.8382
3) −11.0369
−4.3456
1.6661
−3.2117
1.7883

l

−4.8547
1.8661
−6.9886
−4.3456
−2.6430
~~.04403~~ = $\frac{l}{a}$
.04395 = $\frac{l}{a}$

~~.00002216~~ = a
.00002216 a
.2 7 2206 = a

~~54.92 = $\frac{1}{pa}$~~

~~54.76~~ = $\frac{1}{pa}$

6141

6154 = $\frac{1}{pa}$
69

16a

Beauty
perfect. Therm. conds
convection No
Publish

40) Tuesday, Apr. 9, 1912

First Observation at =

θ = 23.46

Volts at 4:[illegible] P.M.

p = 9363 / 1994 — 73.69   9363 / 1992 — 73.71

839.0 + 12.8
842.0 + 12.5
842.0 + 12.5
823.5 + 14.7
843.5 + 12.3
843.0 + 12.4
5033.0 + 77.2 = 5110.2

Volts at 5:49 P.M.

837.0 + 13.0
838.0 + 12.9
840.5 + 12.7
822.0 + 14.7
839.0 + 12.4
840.5 + 12.7
5017.0 + 78.8 = 5095.8

G	F		
		54.0	5 small div. (From 1½ to 2)
		57.4	From 2 to 2½
		57.0	From 2½ to 3
		56.2	From 3 to 3½
		54.6	From 3½ to 4
		50.2	From 4 to 4½
9.826		50.2	From 4½ to 5
9.934	(47.9)	47.652	
9.880	(48.0)	47.536	
	(31.9)	32.278	
9.822	(32.6)	32.482	
9.914	(32.8)	32.472	
9.938	(35.0)	32.180	
10.044	(16.2 32.0)	32.270	
9.954	(16.2 32.2)	32.218	
9.854	(16.2-32.2)	32.274	
9.966	(19.0-38.2)	38.140	
9.918	(19.2-38.1)	38.098	
9.878	(19.2-38.3)	38.108	
9.844	(24.-47.2)	47.080	
9.996	(24-47.7)	46.836	
9.900	(23.6-47.3)	47.164	
9.854	(31.0-61.0)	60.986	
9.874	(31.2-~~61.0~~)	60.902	
9.898	(44-87)	86.950	
9.836	(7~~8~~6-151.4)	~~152.363~~	(133.318 = 7 div.)
9.890		27.654	
9.996		18.138	
21) 208016			
9.906			

$\frac{1}{80.02}$ = .001250

$\frac{.019725}{4}$ = .004931

$\frac{1}{47.594}$ = .020975

$\frac{.009945}{2}$ = .004972

$\frac{1}{32.31}$ = .03092

$\frac{.00970}{2}$ = .004850

$\frac{1}{38.115}$ = .02620

.00498

$\frac{1}{47.03}$ = .02122

.00484

$\frac{1}{60.94}$ = .01638

.00490

$\frac{1}{86.95}$ = .01148

.004899

$\frac{1}{154.4}$ = .00661

$\frac{.02961}{6}$ = .004931

$\frac{1}{27.65}$ = .03619

mean of = .004893 × 1021 =

v_2 = .004996

Log = -3.6986
-1.50667
3.1483
6.40353
3.7076
10.69593
4966
4977

V = 5100

a
-16.4270
3.7076
-1.01333
-13.1489
-3.6996
3) -11.4488
-4.4829

l
-4.8547
1.8675
-6.9872
-4.4827
-2.5043
.03193 = l/a
.0003094 = a
.0003028 = a
1.8675
-2.3505
1.6495
44.88 = 1/pa
44.62 = 1/pa

5:48

$\frac{1}{9.901}$ = .1010 × 1021 = .10312 = v

Log = -1.01334

1/21 = -1.50667

(15 a)

corr't lang 27

e_1 = 4.971 = e_1 4.977

Difs

.004941 4931
4968 4879
4845 490
4850 484
4910 485
4921 4972
4899 4931
4899 4900
4931
4931
10) 9095
.0049095

1009 8
3095
27) 13190
4887

10098
21015
27) 121965
.004879

10098
1425
21) 10220
.004870

.10098
660
22) .10755
.004890

10098
1150
23) 11245
4890

10098
1641
24) 11739
.004892

10098
2126
25) .12224
4890

10098
2624
26) 12719
4894
4890
4892
4890
4890
4887
4879
4870
8) 692
.004887
4
4891

$e^{2/3}$

-10.6970
3) 14.3940
-7.7980
62.80
62.75
62.75 = $e^{2/3}$

3% low

Would be average of Difs determined

(4)

Wednesday, Apr. 10th 1912 $\theta = 22.96$

$p = \frac{9366 - 1993}{7367}$ $\frac{9366 - 1990}{7376}$

First Observation at 3:55

Volts at 3:38 P.M.

839.5 + 13.3
839.0 + 13.3
841.5 + 13.2
824.0 + ~~14.7~~
837.5 + 13.5
839.5 + 13.3
5021.0 + 81.3
= 5102.3

	G		F
(10.2–21.0)	20.868		
(–20.8)	20.804		
(10.6–20.9)	20.944	(13.2–26.1)	25.806
(10.3–20.8)	20.788	(16.0–31.8)	31.995
(10.2–20.6)	20.888	(15.6–31.4)	31.654
(10.3–20.6)	20.860	(21.2–41.5)	41.152
(10.2–20.6)	20.760	(21.0–40.9)	40.926
(21.0–41.2)	20.944		
	8)6856		
	20.857		

$\frac{1}{25.81} = .03875$
$\frac{1}{31.82} = .03143$ } .00700 Of

$\frac{1}{41.04} = .02437$

$\frac{1}{20.857} = .04795 \times 1.021 = .048956 = v_1$

Log = –2.6898

4:15 P.M. $\frac{1}{2.11} =$ –1.3449

.04795
3.143
18).07938
.007216

4795
2437
10)7232
.007232

4795
3875
12)8670
7225

.007216
.007232
7232
7216
7225
5)121
.007224 × 1.021

$= v_1 + v_2 =$ .007376

Log = –3.8679
–1.3449
3.1983
–6.4111
3.7070
–10.7041

$V = 5093$

5059

$e^{2/3}$

7041
2
3)–19.4082
7.8027
6349

a

–16.4270
3.7070
–2.6898
2)14.8238
–3.8679
3)12.9559
–4.3186
1.8679
–2.1865
1.8135

l

–4.8547
1.8679
–6.9868
–4.3186
–2.6682

$.04658 = \frac{l}{a}$

$.0002082 = a$

$65.08 = \frac{1}{pa}$

Can't check
Two methods of
getting $v_1 + v_2$
Hence can't use

42) Wed. Apr. 10, 1912

Second Observation
at 4:37 P.M.

$\theta = 23.01$

$p = \frac{9375}{19.79}$ 73.96

Volts at 4:17

839.0 + 12.8
835.0 + 13.2
832.5 + 13.8
823.0 + 14.6
834.0 + 13.8
839.0 + 13.8
5003.5 + 81.0 = 5084.5

	G		F
		(20.3-39.5)	~~38.334~~
(7.9-15.4)	15.142	(38.0-76.0)	~~75.796~~
	15.172	(25.6-51.9)	~~51.614~~
(7.6-15.2)	15.248	(37.6-76.0)	75.752
(15.3)	15.184	(37.4-75.4)	75.650
	15.290	(37.6-75.4	75.298
	15.210	(69.0)	139.8 —
	15.164		123.4 — 1st div.
			116.2 — 2nd "
			107.2 — 3rd "
			102.2 — 4th "
			100.0 — 5th "
			549.0
	15.136	(19.3-38.8)	38.980
	15.186	(-51.6)	51.440
(?)	~~15.392~~	(25.6-51.5)	51.380
	15.184	(25.6-51.4)	51.350
	15.198	(37.6-75.0)	74.918
	15.202	(70.4-	139.2
	15.188		
	2896		117.0 - 1st div.
	392	not uniform	112.6 2nd "
	13) 2504	field	112.0 - 3rd "
	15.193	shape	112.0 - 4th "
			104.0 - 5th "
			112.0 - 6th "
			112.0 - 7th "
			117.4 - 8th "
			898.4

$\frac{1}{38.33} = .02609$

$\frac{1}{75.8} = .01319$

$\frac{1}{51.6} = .01938$

$\frac{.01290}{2} = .00645$

.006190

.006150

$\frac{1}{75.57} = .01323$

.006057

$\frac{1}{139.8} = .007153$

.006014

$\frac{1}{878} = .001139$

$\frac{.02447}{4} = .006110$

$\frac{1}{38.98} = .02561$

.006190

$\frac{1}{51.34} = .01942$

.006100

$\frac{1}{74.92} = .01332$

.006136

$\frac{1}{139.2} = .007184$

.006070

$\frac{1}{898.4} = .001114$

Difs
~~.006140~~
.006058
6074
6110
6100
6136
6070
~~6070~~
6) 487
.006081
~~.006091~~

6085
6084
6088
6087
6080
5) 424
.006084

mean = 6088

.06582
.001114
11) .066934
.006085

6582
7184
12) 73004
6084

06582
01942
14) 08524
6088

6582
114
11) 6696
.006087

6582
1321
13) 7903
.006080

6087 × 1021

= $v_1 + v_2$ = .006215

$\frac{1}{15.143}$ = .06582 × 1021

v_1 = .06720

Log = -2.8274

$\frac{1}{2}$ " = -1.4137

5:35 P.M.

a
-16.4290
3.7047
-2.8274
-14.9591
-3.7932
3) -11.1659
-4.3886
.0002446 = a
.0002436 = a

-4.3885
1.8690
~~-6.8145~~
-2.2575
-1.7425

l
-4.8547
1.8690
-6.9857
-4.3885
-2.5972
.03955 = $\frac{l}{a}$
~~3466~~ = $\frac{l}{a}$
3973

5554 = $\frac{1}{pa}$
55.28 = $\frac{1}{pa}$

Log = -3.7932
-1.4137
3.1483
6.4052
3.7047
10.7005

V = 5066

e_1 = 5.048
e_1 = 5.015

$e^{2/3}$
-10.7005
2
3) 19.4010
-7.8003
63.87 = $e^{2/3}$
63.10 = $e^{2/3}$

.5% low

Publish
Beauty

14a

43/ Wed. Apr. 10, 1912

Third Observation
at 5:50 P.M.

$\theta = 23.05$

$p = \frac{938\cancel{5}6}{1968}$ $\frac{9388}{1969}$

74.15

Volts at 5.38 P.M. – 834.5 + 13.~~30~~3
829.5 + 14.3
823.0 + 14.6
821.0 + 14.7
827.0 + 14.4
834.0 + 13.8
4970.0 + 85.1
= 5055.1

G	F		
17.306		19.180	
17.228		19.278	
17.182	(75.6-151.6)	150.768	
		(113.076) for 3/4 of the distance	
		6:00 P.M.	

44/ Wed. Apr. 10, 1912

Fourth Observation
at 6:17 P.M.

θ = 23.08

$p = \frac{9391 - 1959}{74.32}$

Volts at 6:02 P.M.

834.5 + 13.8
827.5 + 14.4
822.5 + 14.8
821.0 + 14.8
819.0 + 14.9
830.5 + 14.2
4955.0 + 86.8 = ~~5041.8~~ /5041.8

6:50

831.5 + 14.1
819.0 + 14.9
812.5 + 15.4
820.5 + 14.9
808.5 + 15.6
820.5 + 14.9
4912.5 + 89.8 = 6002.3

← Taken in order left to bottom but balanced speed not correct

G			F
(— -35.2)	35.080		17.605
	35.140	(— 18.0)	17.688
(17.3-35.2)	35.154	(— 17.8)	17.602
(— -35.2)	35.198	(53.4-106.4)	105.796
	35.260	(13.2-26.2)	26.312
(17.6-35.4)	35.386	(-21.0)	20.980
(17.6-35.3)	35.276	(17.4-34.9)	35.132
	35.268		26.216
(17.6-35.12)	35.330	(52.4-104.8)	104.642
	35.414	(26.4-52.6)	52.426
	35.174	(26.6-52.6)	52.258
	35.358	(53.2-	105.0
	12) 3038		
	35.253		

Balanced speed
no motion ~~for~~ in
80 second.

$\frac{1}{17.63} = .05672$ } $\frac{.04786}{5} = .09457$

$\frac{1}{105.8} = .009452$ } $\frac{.02856}{3} = .09508$

$\frac{1}{26.31} = .03796$ } .00967

$\frac{1}{20.98} = .04767$ } $\frac{.09230}{2} = .09600$

$\frac{1}{35.13}$ .02843 } .0967

$\frac{1}{26.22} = .03812$ } $\frac{.02856}{3}$ .09529

$\frac{1}{104.8} = .009546$ } .09530

$\frac{1}{52.34} = .01907$ .09568

= .009506 .09546
9524

$\frac{1}{105.0}$

.09457
.09507
.09529
.09530
.09546
.09516
7) 135279
.09504

9452
9444
9474
9500
9482
9494
9470
9482
9466
9461

.02834 / 9524 / 41.03786 / .009466

2834 / 1907 / 5) 4747 / 9494

4) 3791 / 9478

wt last column 2 & 1st col 1

get weighted mean = 9479

$\frac{1}{35.253} = .02834 \times 1021$

$= v_1 = .028435$

Log = −2.4613

$\frac{1}{2}$ " = −1.2307

.009485 × 1021 =

$v_1 + v_2 = .009684$

Log = −3.9863 9858 2307

−1.2310

3.1983

−6.4156

v = 5018

3.7005

−10.7151

5.189

$e_1 = 5.191$

~~$e_1 = 5.176$~~

last $e_1 = 5.166$

$v_1 + v_2 = 9.461 \times 1021$
= 9660

6:49 P.M.

a	l
−16.4270	−4.8547
3.7005	1.8711
−2.4619	−6.9836
−14.5894	−4.7998
−3.9860	−2.7845
3) −12.6034	
−4.20915	
1.8711	
−2.07025	
1.92975	

.42146
7005
4613
−14.58326
.9978
3) 59746
.19915

.0606 = $\frac{l}{a}$

.06088 = $\frac{l}{a}$

.0001589 = a

.00015815

85.08 = $\frac{1}{pa}$

This is largest diff but 2 ways of getting $v_1 + v_2$ but Browne come

$e^{2/3}$

−10.7153
2
3) −14.4306
7.8102

7140
2
3) −14.4280
7.8093

$e^{2/3} = 64.60$

~~64.45 = $e^{2/3}$~~

64.36 = $e^{2/3}$

45

Thursday Apr. 11th 1912.

First Obs. at [illegible] 4:28

$\theta = 23.64$
23.73

4:13 P.M.

$p = \frac{~~74.92~~}{74.60}$

~~94.08~~
19.40
74.68

837.0 + 13.5
842.5 + 13.1
841.0 + 13.2
821.5 + 14.8
842.0 + 13.2
841.5 + 13.2
5025.5 + 81.0 = 5106.5

G		F		
watch	chronograph	watch	chronograph	
	18.638			
	18.686			
	18.680	17.8)	17.756	
	18.730	18.0	17.778	
	18.686		45.978	
	18.726	46.1	45.870	
	18.772	45.9	45.716	
	18.740	23.3-46.0	45.758	
	18.724	95.2	94.654	1st div.
			88.2	2nd "
			88.2	3rd "
			83.4	4th "
			80.0	5th "
			85.3	6th "
			85.3	7th "
			90.6	8th "
			695.6	
	~~18.854~~	27.8	27.950	
	18.720	59.0-118.6	118.388	
	18.816	22.4-45.2	45.030	
	18.816		~~45.274~~	
	18.716	17.0-	34.564	
	18.804	22.6- 44.9	44.826	
	18.746	59.0-117.2	117.198	
	18.746	45.2	44.784	
	18.790			
	17)12536			
	18.737			

Note time
No evidence of convection at all here. Drop doesnt move .05 mm to right or left in an hour. Field must be hour glass shape

$\frac{1}{17.778} = .05628$

$\frac{.03454}{5} = .006908$

$\frac{1}{45.60} = .02174$
2178

$\frac{1}{45.81} = .021826$

$\frac{.020385}{3} = .006795$

$\frac{1}{694} = .001441$

$\frac{.034299}{5} = .006860$

$\frac{1}{27.98} = .03574$

$\frac{.027301}{4} = .006825$

103.590 for 7 div $\frac{1}{118.5} = .008439$

$\frac{.013731}{2} = .006866$

$\frac{1}{45.10} = .02217$

$\frac{.04330}{}$

~~.06549~~

$\frac{1}{34.60} = .02890$

$\frac{1}{44.90} = .02227$

$\frac{.013752}{2} = .006876$

$\frac{1}{117.4} = .008518$

$\frac{.013777}{2} = .006889$

$\frac{1}{44.85} = .022295$

7)6019
.006860

$v_1 + v_2 = .006861 \times 1021$
$= .007005$

Log = −3.8454
−1.36815
−3.19776
−6.41131 √ = 5103
3.7079
7034

.05337
.05628
16).10965
.006853

5337
2178
11)7515
6832

.05337
1441
8).054811
.006851

5337
3574
13)8911
.006855

5337
844
9)6181
.006868

5337
2217
11)7554
.006867

5337
2890
12)8227
6856

5337
2227
11)7564
6876

5337
851.8
9)61888
6876

5337
2230
11)7567
6879

6853
6832
6851
6855
6868
6867
6856
6876
6876
6879
10)613
6861

$\frac{1}{18.74} = .05337 \times 1021$
$= v_1 = .05449$
Log = −2.7363
½ " = −1.36815

a
−16.42146
3.7079
−2.7363
−14.86566
−3.8454
3)−11.02026
−4.34009
1.8727
−2.21229
1.78971

.002188 = a

l
−.48547
1.8732
−6.9815
−4.3401
−3.6414
.04347 = l/a

33
61.49 = 1/pa

$e_1 = 5.051$
.14
$e_1 = 5.065$

$e^{2/3}$
7046
2
3)−19.24092
7.8031
63.54 = e_1

5:13 P.M.

(12a)

Perfect
Publish

#1 Thursday Apr. 11, 1912
Second Observation
at 5:33 P.M.

$\theta = \frac{23.76}{\cancel{\text{[illegible]}}}$

(5:14)

$p = 94.20 - 19.35 = 74.85$

836.5 + 13.6
841.5 + 13.2
840.0 + 13.2
820.0 + 14.9
841.0 + 13.2
840.0 + 13.2
5019.0 + 81.3 = 5100.3

G	F		
	25.4-50.8	51.537	(?)
26.418	25.0-51.0	50.980	} 50.756
26.606	26.0-50.8	50.532	
26.580	43.4-87.2	87.066	
26.568			
4) 2172			
26.543			

5:45 P.M.

47) Thursday Apr. 11, 1912

Third Observation

6:00 PM

$\theta = 23.79$

$p = \frac{9428}{1918} \over 75.10$

5:47 PM.

11.958		16.286
11.880		16.382
11.966		~~16.676~~
11.828	29.4	29.092
11.964	18.0	17.628
11.918	16.4	16.346
11.928	17.2-34.4	34.496
11.946	22.2	22.202
11.926	39.0-77.6	77.446
12.020	78.0	77.594
12.072	14.6-29.4	29.020
11.942	27.4-54.6	54.388
12.000		
12348		6:23
13 | 955		
~~11.9499~~		
11.950 =	.08368 × 1021 =	

$\frac{1}{16.34} = .06120$

$\frac{1}{29.12} = .03434$

$\frac{1}{16.34} = .06118$

$\frac{1}{34.53} = .02896$

$\frac{1}{22.20} = .04505$

$77.53 = .012894$ (77.68)

$\frac{1}{29.05} = .03442$

$\frac{1}{54.50} = .01835$

$\frac{.02686}{5} = .005372$

$\frac{.02684}{5} = .005368$ $\boxed{6:25}$

$\frac{.03227}{6} = .005380$

$\frac{.03216}{6}$ } $.005363$

$\frac{.02154}{4} = .005386$

$\frac{.1607}{3} = .005357$

$6 \,|\, 3.2216$

$.005369$

836.0 + 13.6
839.5 + 12.7
840.0 + 12.7
820.0 + 14.8
840.5 + 12.6
840.0 + 12.6
5016.0 + 78.5 = 5094.5

835.0 + 13.2
838.0 + 12.9
837.5 + 13.0
820.0 + 14.8
838.0 + 12.9
840.0 + 12.9
5008.5 + 79.7 = 5088.

.08368
1835
19 | .10203
.005370

8368
3442
22 | 11810
.005368

8368
12874
18 | 9655
.005364

8368
2896
21 | 11264
.005364

8368
3434
22 | 11802
.005366

mean = 5367

$v_1 + v_2 = .005367 \times 1021 = .005480$

$\text{Log} = -3.7388$
-1.46585
3.1983
-6.40295
3.7067
10.69595 (6963)

$v = 5090$

$v_1 = 0.8544$

$\text{Log} = -2.9317$

$\frac{1}{2} \text{ " } = -1.46585$

$e_1 = 4.9669$
18
$e_1 = 4.9847$
$e_1 = 4.981$

a
-16.4209
3.7070
-2.9317
-13.0657
-3.7388
$3 \,|\, -11.3269$
-4.4403
1.8756 .0002769 = a
2757 = a
-2.3179
1.6857
$4810 = \frac{1}{pa}$
$48.44 = \frac{1}{pa}$

-4.8547
1.87565
-6.9892
-4.4403
-2.5369
5399
$.03442 = l/a$
~~3452~~ = l/a
3466

$e^{2/3}$
10.6974
$3 \,|\, 14.3948$
7.7983
$62.85 = e^{2/3}$
6973
$3 \,|\, 14.3946$
7.7982
$62.82 = e^{2/3}$

Publish
Perfect conditions
Same for high or low

Ⓐ 11 a

48) Thursday Apr. 11th 1912

θ = 23.81
23.85

p = 94.34
19.10
75.24

Fourth Observation
at 6:38

7:25 PM

834.0 + 13.4
836.0 + 13.1
832.0 + 14.0
819.0 + 14.4
833.0 + 13.6
834.0 + 13.4
4988.0 + 82.4
5071.0

G		F
18.908		
18.948		14.348
18.958		14.352
18.950		
18.904	22.4-44.8	45.070
18.988	17.3-34.6	34.338
18.896	17.9-34.2	34.432
(?) 19.094	17.3-34.4	34.334
18.936	22.6-44.8	44.864
18.980	17.6-34.6	34.430
19.030		74.2 — 1
		67.8 - 2
		66.6 - 3
		64.8 - 4
		65.0 - 5
		68.0 - 6
		71.8 - 7
		71.5 - 8
		549.9
18.872	17.2-34.5	34.143
18.808	22.0-44.4	44.654
18.910	22.6-44.7	44.520
18.946	22.6-44.6	44.526
18.936	63.2	64.280
18.950	57.3-114.6	114.404
19.030	57.0-113.6	113.452
19.018	64.2	63.934
19.116	11.6-23.0	23.260
1488 20) 179178	10.2-20.2	~~20.212~~
18959	11.8-23.4	23.350

Field shape

Publish

Perfect conditions [illegible]

1/14.350 = .06968

.04759/7 = .006790

1/45.14 = .02215

3 .006905
6754

1/34.384
34.42
= .02905

.006766

1/44.94 = .02225

3 .006805

.02405
1825

.027229/4 = .006807

1/548 = .001825

.027472/4 = .006858

1/34.18 = .02926

.007046

1/44.567
64
= .02240

.006890

1/64.41 = .01553

.006866

1/114.1 = .008764

.006851

1/64.05 = .015615

.027305/4 = .006808

1/23.30 = .04292

Difs.

6828
6851
6796
6858
6807
6790
6817 mean

2nds

5274
4292
14) 9566
6832

5274
15645
10) 68385
6835

5274
8764
9) 61500
6834

5274
2240
11) 7514
6831

5274
24054
12) 81794
6816

5274
1825
8) 54565
6820

5274
2220
11) 7494
6813

5274
6968
18) 12242
6801

6832
6835
6834
6831
6820
6816
6813
6801
8) 182
6829

$v_1 + v_2$ = 6829 ×1021
= .006966

log = $\bar{3}$.8430
-1.3656
3 1983
26.4069
13.7057
-10.7012

v = 5078

5.036
20
e_1 = 5.046

e_1 = 5.049

$e^{2/3}$
-10.7032
2
3) -19.4064
-7.8021
$e^{2/3}$ = 63.40
63.31

10a

1/1896 = .05274 ×1021 =

v_1 = .05385

log v_1 = $\bar{2}$.7312

½ = -1.3656

7:24 PM

a
-16.4290
3.7057
-2.7312
-14.8639
-3.8439
4) -11.0204
-4.3400
1.8764

l
-4.8547
1.8764
-6.9783
-4.3401
2.6382

2178
.0002188 = a
~~2182~~ = a
.2165
1.7835

.04347
~~4350~~
4360 = l/a

61.03
60.74 = 1/pa
60.42 = 1/pa

47) Thursday Apr. 11, 1912
Third Observation
6:00 PM

$\Theta = 23.79$ $p = \frac{9428 \; 1918}{75.10}$

5:47 PM.

11.958		16.286
11.880		16.382
11.966		~~16.676~~
11.828	29.4	29.092
11.964	18.0	17.628
11.918	16.4	16.346
11.928	17.2-34.4	34.496
11.946	22.2	22.202
11.926	39.0-77.6	77.446
12.020	78.0	77.594
12.072	14.6-29.4	29.020
11.942	27.4-54.6	54.388
12.000		

13) 12348
955
~~11.9499~~
11.950 = .08368 × 1021 =

6:23

$\frac{1}{16.34} = .06120$ } $\frac{.02686}{5} = .005372$

$\frac{1}{24.09} = .03434$ } $\frac{.02684}{5} = .005368$ $\boxed{6:25}$

$\frac{1}{16.34} = .06118$ } $\frac{.03227}{6} = .005378$

$\frac{1}{34.53} = .02896$

$\frac{1}{22.20} = .04505$ } $\frac{.03216}{6}$ } .005363

77.53 (77.68) = .01284 } $\frac{.02154}{4} = .005386$

$\frac{1}{29.05} = .03442$ } $\frac{0.1607}{3} = .005357$

$\frac{1}{54.50} = .01835$

6) .32216
.005369

836.0 + 13.6
839.5 + 12.7
840.0 + 12.7
820.0 + 14.8
840.5 + 12.6
840.0 + 12.6
5016.0 + 78.5 = 5094.5

835.0 + 13.2
838.0 + 12.9
837.5 + 13.0
820.0 + 14.8
838.0 + 12.9
840.0 + 12.9
5008.5 + 79.7 = 5088.2

.08368
1835
19) .10203
.005370

8368
3442
22) 11810
.005368

8368
12874
18) 9655
.005364

8368
2896
21) 11264
.005364

8368
3434
22) 11802
.005366

mean =
5367

$v_1 + v_2 = .005367 \times 1021 = .005480$

$v_1 = 0.8544$

Log = -2.9317

$\frac{1}{2}$ " = -1.46585

Log = -3.7388
-1.46585
3.1983
-6.40295
3.7067
10.6959
6963

$V = 5090$

$e_1 = 4.9669$
18
$e_1 = 4.9847$
$e_1 = 4.9881$

a
-16.4209
3.7070
-2.9317
-13.0657
-3.7388
3) -11.3269 08
-3.4423
1.8756 .0002769 = a
2797 = a

1.8779
-2.3179
1.6857
48.10 = $\frac{1}{pa}$
14
48.14 = $\frac{1}{pa}$

-4.8547
1.87565
-6.9892
-4.4423
-2.5369
5999
.03442 = b/a
~~3452~~ = b/a
3466

$e^{2/3}$
10.6974
2
3) 14.3948
7.7983
6285 = $e^{2/3}$
6282 = $e^{2/3}$

6973
2
3) 14.3946
7.7982

Publish
Perfect ~~[illegible]~~
[illegible]

11 a

48) Thursday Apr. 11th 1912

$t =$ 23.81
23.85

$p =$ 94.34
19.10
75.24

Fourth Observation
at 6:38

7:25 PM

834.0 + 13.4
836.0 + 13.6
832.0 + 14.0
819.0 + 14.4
833.0 + 13.6
834.0 + 13.4
4988.0 + 82.4
5071.0

G		F
18.908		
18.948		14.348
18.958		14.352
18.950		
18.904	22.4-44.8	45.070
18.988	17.3-34.6	34.338
18.896	17.3-34.2	34.432
(?) 19.094	17.3-34.4	34.334
18.936	22.6-44.8	44.864
18.980	17.6-34.6	34,430
19.030		74.2 — 1
1		67.8 = 2
		66.6 - 3
Field shape		64.8 - 4
		65.0 - 5
		68.0 - 6
		71.8 - 7
		71.5 = 8
		549.9
18.872	17.2-34.5	34.143
18.808	22.0-44.4	44.654
18.910	22.6-44.7	44.520
18.946	22.6-44.6	44.526
18.936	63.2	64,280
18.950	57.3-114.6	114,404
19.030	57.0-113.6	113.452
19.018	64.2	63.934
19.116	11.6-23.0	23.260
14.88 20) 179178	10.2-20.2	20.212
18959	11.8-23.4	23.350

$\frac{1}{14.350} = .06968$ } $\frac{.04759}{7} = .006790$

$\frac{1}{45.14} = .02215$ } .006905 6754

$\frac{1}{34.384}$ 34.42 $= .02905$ } .006766

$\frac{1}{44.94} = .02225$ } .006805

.024054
1825

$\frac{.027229}{4} = .006807$

$\frac{1}{548} = .001825$

$\frac{.027472}{4} = .006858$ .2%

$\frac{1}{34.18} = .02926$ } .007046

$\frac{1}{44.567}$ 64 $= .02240$ } .006870

$\frac{1}{64.41} = .01553$ } .006766

$\frac{1}{114.1} = .008766$ } .006851

$\frac{1}{64.05} = .015615$ } $\frac{.027305}{4}$ .006828

$\frac{1}{23.30} = .04292$

Difs.
6828
6851
6796
6858
6807
6790
6817 mean
2wb

6800

5274
4292
14) 9566
6832

5274
15645
10) 68385
6835

5274
8764
9) 61504
6834

5274
2240
11) 7514
6831

5274
24054
12) 81794
6816

5274
1825
8) 54565
6820

5274
2220
11) 7494
6813

5274
6968
18) 12242
6801

6832
6835
6834
6835
6820
6816
6813
6801
8) 182
6829

$v_1 + v_2 = 6829 \times 1021$
$= .06966$

$\log = \bar{3}.8430$
-1.3656
3.1983
86.4069
13.7057
-10.7012

v = 5078

5.036
20
$e_1 = 5.046$
$e_1 = 5.049$

10a

$e^{2/3}$
-10.7034
2
3) -19.4064
-7.8021
$e^{2/3} = 63.40$
63.31

Publish

Perfect conditions

$\frac{1}{18.96} = .05274 \times 1021 =$

7.24 PM

$v_1 = .05385$
$\log v_1 = \bar{2}.7312$
$= -1.3656$

a
-16.4290
3.7057
-2.7312
3) -14.8639
-3.8439
4) -11.0208
-4.3400
1.8764

l
-4.8547
1.8764
-6.9783
-4.3401
2.6382

.0002188 = a
2178
2.2165
1.7835

.04347
4360 $= \frac{l}{a}$

61.03
$60.74 = \frac{1}{pa}$
$60.42 = \frac{1}{pa}$

49

Friday Apr. 12. 1912
First Obs. at 9:45 PM.

$\theta = 22.97$
23.02

9:36 P.M.

P = 94.29
19.15
75.14

832.0 + 13.9 + 13.8
837.0 + 12.6 + 13.0
838.0 + 12.2 + 12.9
818.5 + 15.0 + 15.0
838.0 + 12.8 + 12.9
837.5 + 12.7 + 13.0
5001.0 + 806
= 5081.6

G	F	
16.024		19.684
15.974	13.2 - 26.2	26.352
15.886		19.694
15.950	40.3 - 78.4	78.4 ~~stat. bal.~~
15.984	26.0 - 52.4	52.404
15.948	- 39.2	39.142
15.946	19.4 - 39.0	39.050
16.078	26.0 - 52.0	52.080
15.964	38.6 - 77.0	77.084
16.006	22.3	22.498
15.996	26.2	26.162
15.968	36.0	26.064
15.982	39.0 - 76.9	76.550
16.030	38.4 - 76.4	76.860
16.040		

15 | 239.7776
15.985

$\frac{1}{15.985} = .06244 \times 1.021$
$= v_1 = .06375$
Log = -2.8044
$\frac{1}{2}$ " = -1.4022

10:22 P.M.

New corrections for voltmeter readings

$\frac{1}{26.37} = .03792$
$\frac{1}{19.69} = .05080$ } $\frac{.02512}{4} = .006280$
$\frac{1}{78.1} = .01280$ } $\frac{.03800}{6} = .006333$
$\frac{1}{52.51} = .01905$ } $\frac{.00624}{1} = .006240$
$\frac{1}{39.16} = .02555$ } ← too small dif. to use
$\frac{1}{52.18} = .01917$ } $= \frac{.00622}{1} = .006220$
$\frac{1}{77.23} = .01295$ } $= \frac{.03149}{5} = .006298$
$\frac{1}{22.50} = .04444$ } $\frac{.02530}{4} = .006325$
$\frac{1}{26.14} = .03825$ } $\frac{.02521}{4} = .006303$
$\frac{1}{76.705} = .01304$ new dif.

7 | .043999
.006285

.03792 + 6244 = 16 | .10036 → .006291
5080 + 6244 = 18 | .11324 → .006291
01280 + 6244 = 12 | .07524 → 6270
1905 + 6244 = 13 | .08149 → 6269
2555 + 6244 = 14 | .08799 → .006285
1917 + 6244 = 13 | .08161 → 6278
1295 + 6244 = 12 | .07539 → 6283
4444 + 6244 = 17 | .10688 → 6287
3825 + 6244 = 16 | .10069 → 6294
1304 + 6244 = 12 | .07548 → .6290

6291
6291
6270
6269
6285
6278
6283
6287
6294
6290
10 | 838
.006284

.07 dif.

$v_1 + v_2 = .006284 \times 1.021$
$= .0064116$

Log = -3.8073
-1.4022
3.1983
6.4078
3.7059
10.7019

$e_1 = 5.034$
$e_1 = 5.028$

$e^{2/3}$
10.7019
2
3 | -19.4038
-7.8013

63.29 = $e^{2/3}$
63.24 = $e^{2/3}$

a	l
-16.4270	-4.8547
3.7059	1.8758
-2.8044	-6.9789
-14.9373	-4.3767
-3.8073	-2.6022
3 | -11.1300	$.04001 = \frac{l}{a}$
-4.3767	
1.8758	
-2.2525	
1.7475	

.0002380 = a
.0002373 = a $.04013 = \frac{l}{a}$

$55.91 = \frac{1}{pa}$
$56.15 = \frac{1}{pa}$

$\left(1 + .849\frac{l}{a}\right) = 1.03397$
Log = .014508
3
2 | .043524
.02176

7019
02176
68014

e = 4.788

3 % low

Brant in every particular

9a

50) Friday Apr. 12, 1912 $\theta = 23.09$ $p = \frac{94.31 - 19.03}{75.28}$

Second Observation at 10:35 10:25 PM.

832.0 + ~~13.9~~ + 13.8
836.0 + ~~13.1~~ + 13.1
838.0 + ~~12.9~~ + 12.9
817.5 + ~~15.2~~ + 15.0
837.5 + ~~12.7~~ + 13.0
837.0 + ~~12.6~~ + 13.0
4998.0 + 80.8 = 5078.8

This and 5 are among the ver best

G		F
18.606		
18.732		
18.784		14.654
18.700		13.198
18.730	18.0	17.968
18.652	23.4 - 46.3	46.172
18.656	17.8	17.896
18.730		17.818
18.762	23.6 - 46.8	46.328
18.760	46.2	46.258
18.708	23.6 - 46.4	46.266
18.658	67.2	67.473
18.668	34.0 - 67.4	67.148
18.826	67.0	67.148
18.710		17.896
18.802		15.868
18.778		15.854
18.790		96.6 - (1)
		97.4 - (2)
		94.0 - (3)
		92.0 - (4)
		93.3 - (5)
		89.0 - (6)
		85.6 - (7)
		86.8 - (8) - shift
		85.0 - (9)
		84.4 - (10)
		82.2 - (11)
		75.0 - (12)
18.846		
18.804	11.6 - 23.4	23.376
18.662	33.4 - 65.6	23.504
18.704		65.416
	119.4	118.970

within $1\frac{1}{2}$ of small divisions from lower plate

$\left(1 + .844\frac{l}{a}\right) = 1.03676$
Log = .01568
3
2) .04704
.02352
= 730!

1.0??
.02352
.68188 $e = 4.807$

22) $1606^{8}8^{7}$
18.730 $\frac{1}{18.73} = .05339$ × 1021 = v_1 = .05451
Log = -2.7365
½ log = -1.3682

$\frac{1}{46.24} = .02163$
} $\frac{.03437}{5} = .006874$
$\frac{1}{17.857} = .05600$
} $\frac{.03443}{5} = .006886$
$\frac{1}{46.36} = .02157$
$\frac{1}{46.34} = .02158$
$\frac{1}{67.60} = .1478$
} $.00680 = .006800$
$\frac{1}{67.39} = .01484$
} $\frac{.04104}{6} = .006840$
$\frac{1}{17} = .05588$
$\frac{.04821}{7} = .006887$
$\frac{1}{15.86} = .06305$
} $= \frac{.06168}{9} = .006853$
$\frac{1}{730} = .001370$
} $\frac{.04129}{6} = .006882$
$\frac{1}{23.44} = .04266$
} $.02740 = .006850$
$\frac{1}{65.55} = .01526$
} .006871
$\frac{1}{1192} = .008389$
} .006784
$\frac{1}{622.8} = .001605$

12.00 Midnight

831.0 + 14.1
835.0 + 13.2
836.5 + 13.1
816.5 + 15.1
836.5 + 13.1
836.0 + 13.1
4991.5 + 81.7
81.7
5073.2

Diffs	$v_1 + v_2$ in order down
6874	6820
6886	6833
6800	6815
6840	6823
6887	6831
6853	6850
6882	6845
6850	6861
6784	6865
mean .006851	6864
	6874
	6844

.1%

G	F
5 minutes after the last set of long time	77.4 - (1) div
	76.0 (2) "
	79.6 (3) "
	77.8 (4) "
	76.6 (5) "
	77.4 (6) "
	77.6 (7) "
	80.4 (8) "
18.830	622.8
	80.6 (1) div.
	75.0 (2) div.

11:59 P.M

$v_1 + v_2 = 6844 \times 1021$
= .006988
Log = -3.8444
-1.3682
3.1977
-6.4109
-3.7056
-10.7045
5.0665
2
e = 5.064
$e_1 = 5.067$
e^{3}
7045
2
3) -14.4090
-7.8030
$e^{2/3} = 63.62$
h error $e^{2/3} = 63.53$

a	l
-16.4209	-4.8547
3.7054	1.8767
-2.7365	-6.9780
-14.8689	-4.3415
-3.8444	-2.6365
3) -11.0245	
-4.3415	
1.8767	
-2.2182	
1.7818	

$.04343 = \frac{l}{a}$
$.04330 = \frac{l}{a}$
.0002196 = a
2188 = a
$60.50 = \frac{1}{pa}$
$~~60.68~~ = \frac{1}{pa}$
60.78

(8a)

Saturday Apr. 13, 1912 $\theta = 22.76$ $p = \frac{9442}{\frac{1902}{75.40}}$

First Observation at 3:40 P.M. Volts at 3:15 P.M.

G	F	
~~39.510~~	31.4 - 62.1	61.970
39.816	19.0 - 37.4	37.536
39.978	14.6 -	27.154
39.876	14.0 - 27.4	27.146
39.836		21.0 (1)
		21.6 (2)
		23.3 (3)
		20.5 (4)
		21.2 (5)
		22.0 (6)
		20.4 (7)
		19.0 (8)
		169.0 -
39.994		
~~40.462~~		
5)450.00		
39.90		
6		

$\frac{1}{39.96}$ = .02502 × 1021 =

V_1 ~~=~~ .025545

Log = -2.4072

$\frac{1}{2}$ " = -1.20364

4:00 P.M.

$\frac{1}{62.09}$ = .01610

$\frac{1}{37.59}$ = .02661

$\frac{0.2063}{2}$ = .01031

3:22

$\frac{1}{27.180}$ = .03673

578

$\frac{.030813}{3}$ .010273

$\frac{1}{169}$ = .005917 = mean

mean = .01029

→ Chronograph gives 129.696 for six divisions = 173.0

837.0 + 13.0
843.0 + 12.4
841.0 + 12.6
821.0 + 14.8
841.5 + 12.6
840.5 + 12.7
5024.0 + 78.1
781
5102.1

.02502
01610
4)04112
01028

2502
2661
5)5163
.01033

02502
03673
6)06175
.010293

2502
5917
3)3 0937
01031
1029
1.033
1028
4)4127
010294

$V_1 + V_2$ = .010294
× 1021

$V_1 + V_2$ = .01051

Log = -2.0216
-1.20364
3.1983
-6.42364
3.7074
-10.71624

V = 5098

a	l
-16.4270	-4.8547
3.7074	1.8774
-2.4075	-6.9773
-14.5419	4.1734
-2.0216	-2.8039
3)-12.5203	
-4.1734	
1.8774	
-2.0508	
1.9492	

-5.202
6
e_1 = 5.196

e_1 = 5.190

.06367 = $\frac{l}{a}$

.06395 = $\frac{l}{a}$

.0001491 = a

.0001485 = a

8896 = $\frac{1}{pa}$

8933 = $\frac{1}{pa}$

$e^{2/3}$

10.7157
2
3)-19.4314
-7.8105

64.64 = $e^{2/3}$

~~64~~.59 = $e^{2/3}$

.2% low

$\left(1 + .844 \frac{l}{a}\right)$ = 1.05406

Log = .022866
3
2).068598
.0343

7157
0343
.6814

e = 4.802

(7a)

52

Saturday Apr. 13, 1912
Second Observation
at

$\theta = 22.83$

Volts at
4:00 P.M.

$p =$ 94.47
18.93
75.54

836.5 + 13.1
842.0 + 12.5
840.0 + 12.7
820.0 + 14.9
840.0 + 12.7
840.0 + 12.7
5018.5 + 78.6
−78.6
5097.1

G		F
25.980		14.756
26.216		14.796
26.198	18.6 − 37.2	36.984
26.102	18.6 −	
(13.2 / 26.2) 26.090	47.6 − 94.2	94.054
(13.0 / 26.2) 26.062	11.5 − 23.0	23.062
(26.2) 26.192	46.4 − 91.6	91.764
25.988	18.0 − 36.4	36.610
26.200		46.3 (1)
		47.3 (2)
9) 55028		46.0 (3)
26.114		46.4 (4)
13		46.4 (5)
26.13		45.2 (6)
		47.4 (7)
		45.0 (8)
		370.0

~~26.382~~ (long)
~~61 41603~~
~~26.14~~
~~2~~
~~26.16~~

4:48 P.M.

$\frac{1}{26.13} = .03827 \times 1021$
$= v_1 = .039073$
Log = −2.5915
$\frac{1}{2}$ '' = −1.29575

$\frac{1}{14.78} = .06766$
$\frac{.04074}{5} = .008148$
$\frac{1}{37.15} = .02692$
$\frac{.1631}{2} = .008155$
$\frac{1}{94.25} = .01061$
$\frac{.03266}{4} = .008165$
$\frac{1}{23.06} = .04337$
$\frac{.03250}{4} = .008125$
$\frac{1}{91.95} = .01087$
$\frac{.01641}{2} = .008205$
$\frac{1}{36.66} = .02728$
2703
$\frac{.02442}{3} = .008140$
6) .48938
Mean dif = .008156

$\frac{1}{370} = .002703$

3827
6766
13) 10593
.008149

3827
2692
8) 6519
.008149

3827
1061
6) 4888
8147

3827
4337
10) 8164
8164

3827
1087
6) 4914
.008190

3827
2728
8) 6555
8194

3827
2703
5) 40973
8194

8140
8147
8149
8164
8190
8194
8194
7) 478
8168

$\frac{1}{10}$ % dif

$v_1 + v_2 = .008168 \times 1021$
$= .0083394$
Log = −3.9212
$\frac{1}{2}$ '' −1.29575
−3.1983
−6.41525
3.7070
−10.70825

$v = 5093$

5.108
4
$e_1 = 5.104$
$e_1 = 5.098$

$e^{2/3}$
.7074
2
3) −1.94148
7.8049
$63.81 = e^{2/3}$
~~$63.80 = e^{2/3}$~~

3.9 % low

$1 + .849\frac{l}{a} = 1.04338$
Log = .01845
3
2.05535
.02767
7076
02767
67993
$e = 4.785$

a	l
−16.4270	−4.8547
3.7070	1.8781
−2.5915	−6.9766
−14.7255	−4.2682
−3.9209	−2.7084
3) −12.8046	
−4.2682	
1.8781	
−2.1463	

$.05110 = \frac{l}{a}$
~~$.05135 = \frac{l}{a}$~~
.0001854
$.0001845 = a$
$71.40 = \frac{1}{pa}$
$71.61 = \frac{l}{pa}$

6a

53) Saturday Apr. 13, 1912 $\theta = 22.82$ $p = \frac{9450 \atop 18.88}{75.62}$ 7566

Third Obs. at 5:05 ~~Publish~~ Volts at 4:50 P.M.

Best one yet for all purposes

834.5 + 13.4
840.5 + 12.6
839.0 + 12.8
819.0 + 14.8
839.5 + 19.8
839.0 + 12.8
5011.5 + 79.2 = 5090.7
5366
5371

G		F
11.848	39.9-80.2	80.708
11.890	11.2-22.4	22.366
11.908	-22.0	22.390
11.904	11.2-22.4	22.368
11.882	70.6-140.5	105.424
		(140.565)
11.906	39.9-79.6	79.600
11.838		34.798
11.816		34.762
11.776 (?)	34.4	34.846
11.840	14.8-	29.286
11.904	14.6-29.3	29.236
11.870	69.3-137.4	137.308
11.952	17.6-34.9	34.638
11.860		
11.846		22.104
11.912		22.268
11.910		~~380~~
		63.3 (2)
		62.6 (3)
		63.6 (4)
		61.8 (5)
		61.6 (6)
		61.4 (7)
11.918		374.3 for 6
	21.6	499.08 " 8
		19.704
11.870		19.668
11.888		
11.894	29.4- (3 div)	77.630
11.878	38.9-77.6	77.806
11.880	21.0-42.6	42.302
3) 2019 10.04		
11.838		

$\frac{1}{80.87} = .01236 + .08419 = .09655 \div 18$

$\}\frac{.03234}{6} = .005390$

$\frac{1}{22.37} = .04470 + .08419 \div 24$ —— 5371

$\}\frac{.037508}{7} = .005358$

(forb div.)

$\frac{1}{140.8} = .007192 + 8419 \div 17$ —— 5375

$\}.005348 = .005348$

$\frac{1}{79.76} = .01254 + 8419 \div 18$ —— 5374

$\} = \frac{.01616}{3} = .005387$

$\frac{1}{34.84} = .02870 + 8419 \div 21$ —— 5376

$\frac{1}{29.29} = .03414 + 8419 \div 22$ —— 5379

$\}\frac{.026872}{5} = .005375$

$\frac{1}{137.56} = .007268 + 8419 \div 19$ —— 5380

$\}\frac{.021572}{4} = .005393$

$\frac{1}{34.68} = .02884 + 8419 \div 21$ —— 5382

$\}\frac{.01623}{3} = .005410$

$\frac{1}{22.19} = .04507 + 8419 \div 24$ —— 5386

$\left(1 + .849\frac{l}{a}\right) = 1.0290$
Log = .012415
3
2.037245
.01862
6988
.0186
6802
e = 4.789

$\frac{.04307}{8} = .005384$

$\frac{1}{500} = .002000 + 8419 \div 16$ —— 5387

$\}\frac{.04879}{9} = .005421$

$\frac{1}{19.69} = .05079 + 8419 \div 25$ —— 5399

$\}\frac{.03784}{7} = .005401$

$\frac{1}{77.69} = .01285 + 8419 \div 16$ —— 5399

$\}\frac{.01079}{2} = \underline{.005395}$

mean = .005386

$\frac{1}{42.30} = .02364 + 8419 \div 20$ —— 5392

mean = 5384

$v_1 + v_2 = 5384 \times 1021$
= .005497
Log = -3.7402

11.88 = .08419 × 1021 = .08584 = v_1 Log = -2.9337
-1.46685

5a

Log -3.7402
$\frac{1}{2}$ " = -1.46685
3.1983
-6.40535
3.7063
-10.69905

50004
3
$e_1 = 4.9974$
$e_1 = 4.991$

e^3
-10.6988
2
-14.3976
7.7992
$62.98 = e^{\frac{2}{3}}$
$62.43 = e^{\frac{2}{3}}$

a
-16.4299
3.7063
-2.9337
-13.0600
-3.7402
3) -11.3198
-4.4399
1.8788
-2.3862
1.6813

l
-4.8547
1.8786
-5.9761
-4.4399
-2.5362
$.03418 = \frac{l}{a}$
$.03428 = \frac{l}{a}$
.0002769 = a
.0002754 = a
$47.76 = \frac{1}{pa}$
6813 $47.90 = \frac{1}{pa}$
48.11

.35%
low

5a

54)

Saturday Apr. 13, 1912
~~Fount Obs. A.~~ 9:20 P.M.

Start, $\theta = 22.95$
End, $\theta = 23.0$

5.58 P.M.

$p = \frac{94.60}{18.73} \over 75.87$

832.5 + 13.8
838.0 + 13.4
837.0 + 13.0
817.5 + 15.1
837.0 + 13.0
838.0 + 12.9
5000.0 + 81.2
= 5081.2

G	A	
28.456	32.2 – 63.2	62.938
~~14.3 – 28.4~~		
28.562	31.6 – 62.8	62.634
~~14.2 – 28.5~~	31.4 – 62.8	
28.468		
~~14.2 – 28.6~~	20.6 – 41.0	40.734
28.560	– 62.6	62.308
~~– 28.4~~		
28.610	31.0 – 62.2	62.870
~~– 28.7~~	12.2 – 24.3	24.480
28.634		
~~14.3 – 28.8~~	15.2 – 30.4	30.424
28.624		
~~14.2 – 28.6~~		
28.628		

$8)\,45^{4}4^{3}2^{3}$
28.57
3
2860

$\frac{1}{2860} = .03497 \times 1021 =$

$v_1 = .035704$

Log = −2.55275
$\frac{1}{2}$ " = −1.2764

$\frac{1}{62.90} = .01590$
} .008610
4.55 P.M.

$\frac{1}{40.80} = .02451$
} .008560

$\frac{1}{62.7} = .01595$
} $\frac{2490}{3}$ = .008300

$\frac{1}{24.48} = .04085$ } $\frac{1687}{2}$
= .008435
$4\,\underline{|1905}$
~~mean~~ dif = .008476

$v_1 + v_2 = .008473 \times 1021$
= .008651

Log = −3.93705
−1.27638
3.1983
6.41173
3.7019 $\sqrt{5033}$
−10.70983

.03%

$e_1 = 5.126$
$e_1 = 5.120$

$e^{2/3}$
−10.70983
2
$3\,|\,{-14}.41966$
7.8066

64.05 = $e^{2/3}$
64.00 = $e^{2/3}$

.3% low.

3497
3284
$8\,\underline{|6781}$
8476

3497
4085
$9\,|\,\underline{7582}$
8425

3497
1595
$6\,\underline{|5092}$
8487

3497
2451
$7\,\underline{|5948}$
8497

3497
1590
$6\,\underline{|5087}$
8478

8478
8487
8425
8476
$5\,\underline{|\,1363}$
8473

830.0 + 14.2
831.0 + 14.0
820.5 + 14.8
814.5 + 15.3
827.5 + 14.4
830.0 + 14.2
4953.5 + 82.9
82.9
5036.4

a
−16.4270
3.7019
−2.5528
−14.6817
−3.9370
$3\,|\,{-12}.7447$
−4.2482
1.8801
−2.1283
1.8717

.0001771 = a
5
1766 = a

l
−4.8547
1.8801
−6.9746
−4.2482
−2.7264

$.05326 = \frac{l}{a}$
.6
$.05390 = \frac{l}{a}$

74.42
.22
$74.77 = \frac{1}{pa}$
72

4a

$\left(1 + A\frac{l}{a}\right) = 1.0452$
Log = .0192
3
$2\,|\,.0576$
.0288
70983
0288
.68103
e = 4.798

4a

57) Saturday, April 13, 1912. Fifth observation

θ = 23.0 °C.

p =

$P = \frac{9471 \quad 1665}{76.06}$

9.48 P.m.

10:00 P.M

G	F	
9.2 18.5 18.626	12.6-24.7	24.722
9.2 18.8 18.716		
18.602		21.206
18.634	-21.0	21.110
18.696		
18.678	-72.8	72.590
18.598	-36.6	36.454
18.612	24.6-49.1	48.870
18.622		
18.795	72.0-143.1	142.838
18.732	36.6-72.4	72.428
18.780	-37	36.722
18.736	-36.4	36.652
18.754		
	-36.7	36.602
18.712	140.6	140.891
18.760	70.3 -	
18.716	23.6-48.4	48.302
18.740	48.4	48.266
8) 125098	10.6	20.942
18.695		
~~+8.71~~		

10:55 P.M

$\frac{1}{24.74}$ = .04042

$\frac{1}{21.175}$ = .04723

} $\frac{03348}{5}$ = .006696

$\frac{1}{72.73}$ = .01375

} $\frac{01364}{2}$ = .006820

$\frac{1}{36.51}$ = .02739

} .006930

$\frac{1}{48.92}$ = .02046

} $\frac{.01347}{2}$ = .006735

$\frac{1}{143.1}$ = .006988

} $\frac{.006792}{1}$ = .006792

$\frac{1}{72.57}$ = .01378

} $\frac{01346}{2}$ = .006730

$\frac{1}{36.71}$ = .02724

} $\frac{.020158}{3}$ = .006719

$\frac{1}{141.2}$ = .007082

} $\frac{.013598}{2}$ = .006799

$\frac{1}{48.36}$ = .02068

} $\frac{.02703}{4}$ = .006756

8) 16028
.0067535

$\frac{1}{20.96}$ = .04771

830.0 + 14.2
829.0 + 14.3
820.0 + 14.8
813.5 + 15.5
822.0 + 14.7
829.5 + 14.3
4944.0 + 87.8
87.8
5031.8

.05351
04771
15) .10122
.006747

5351
2068
11) .07419
006745

5351
7082
9) 60592
6732

5351
2724
12) 8075
6729

5351
1378
10) 6729

5351
699
9) 6050
6722

5351
2739
12) 8090
6742

5351
1375
11) 6726
6726

5351

5351
4723
15) 10074
6716
6726
6742
6722
6729
6729
6732
6745
6749
9) 288
.006732

$v_1 + v_2$ = 6732 × 1021
= .006873
Log = -3.8372
-1.3687
3.1983
-6.4042
3.7010
-10.7032
e_1 = 5.049
e_1 = 5.043
$e^{2/3}$
7032
2
3) -14.4064
7.8021
6395 = $e^{2/3}$
/ 6335 = $e^{2/3}$
4% low

v = 5024

1/3 90

$\left(1 + A\frac{l}{a}\right)$ = 1.0363
Log = 01549
3
2.04647
.02323
7032
.02327
-10.67993
e = 4.786

a
-16.4270
3.7010
-2.7374
-14.8654
-3.8372
3) -11.0282
-4.3427
1.8811
-2.2238
3.7762

l
-4.8547
1.8811
-69736
-43427
-26309

.04275 = l/a
.0002281 = .04280 = l/a
.0002148
5994 = $\frac{1}{pa}$
59.73 = $\frac{1}{pa}$

$\frac{1}{1869}$ = .05351 × 1.021 = 05463
Log = -2.7374
$\frac{1}{2}$ " = -1.3687

Beauty
Publish

(30)

Saturday Apr. 13, 1912 θ = 23.25

$p = \frac{9480}{\frac{1853}{76.27}}$

Sixth Observation at 11:05 Volts at 10:55

G	F	
15.404		
15.314		14.544
15.372		
15.358		
15.356	37.6 — 74.9	74.640
15.344	37.1 — 75.2	74.872
15.380	35.6 — 51.2	51.412
15.436	36.0 — 51.4	51.186
15.356	37.2 — 74.4	74.130
15.292	— 74.2	74.058
15.386	1 — 38.8	38.930
	36.9 — 73.4	73.142
15.474	36.6 — 73.2	73.122
15.420		19.974
15.424		20.004
14) 53.1745		
15.38		11:34

829.0 + 14.3
826.0 + 14.5
818.0 + 14.9
812.5 + 15.6
817.0 + 15.0
827.0 + 14.4
4929.5 + 88.7
88.7
5018.2

.06871

$\frac{1}{74.8}$ = 1337 } $\frac{.05534}{9}$ = .006149

$\frac{1}{74.9}$ = .01335

$\frac{1}{75.01}$ = .01333 } .006090
$\frac{1}{51.51}$ = 1942

$\frac{1}{51.49}$ = 1944 } .006030
$\frac{1}{74.27}$ = 1346

$\frac{1}{74.2}$ = 1348 } $\frac{.01216}{2}$ = .00608
$\frac{1}{39.0}$ = 2564 } $\frac{.01200}{2}$ = .006000

$\frac{1}{73.27}$ = 1364 } $\frac{.03636}{6}$ = .00606

$\frac{1}{20}$ = .05000

6504 6504
6871 1336
22) 13375 13) 7840
.06078 .06031

6504 6504
1946 1347
14) 8448 13) 7851
6035 6038

6504 6504
2564 1364
15) 9068 13) 7868
6041 6051

6504
5000
19) 11504
6055

Difs

.00606
.00600
.00608
.00603
.00609
.00615
6) 41
.006068

6078
6031
6035
6038
6041
6051
6055
7) 329
.006047

.3% dif.

omit this because so long time elapsed

$v_1 + v_2$ = .006047 × 1021
= .006174

Log = $\bar{3}$.7906
−1.4111
3.1983
−6.4000
3.7002
−10.6998

$v = 5015$

$\frac{1}{15.38}$ = .06504 × 1021
= v_1 = .066406
Log = −2.8222
$\frac{1}{2}$ = −1.4111

l
−4.8547
1.8824
−6.9723
−4.3863
−2.5860

.03871 = $\frac{l}{a}$

a
−16.42209
3.7002
−2.8222
−14.9494
−3.7906
3) −11.1588
−4.3843
1.8824
−2.2687
1.7313

.0002423 = a

5010
6
e₁ = 5016
e₁ = 5010

54.08 = $\frac{1}{pa}$

$e^{2/3}$
−10.7003
2
3) −19.4006
−7.8002

63.08 = $e^{2/3}$

4.2% low

$\left(1 + .849\frac{l}{a}\right)$ =

$1 + .849\frac{l}{a}$ = 1.0336
Log = .0140
3
2) .0420
.0210

7.003
.0210
.6793

e = 4.779

2a

57)

Saturday, Apr. 13, 1912
Seventh Obs. at:

$\theta = 23.22$

Volts at 11:35 a.m.

$p = 94.88 - 18.46 = 76.42$

827.0 + 14.4
825.0 + 14.5
818.0 + 14.9
~~812.5~~
813.0 + 14.9
814.5 + 15.3
826.5 + 14.5
4924.0 + 89.0
89.1
5013.0

G		F
40,518		17.760
(40.6) (40.8) 40,522	32,0 – 63,2	63,100
40.382	96.4 – 174.4	~~127.07/4~~ ~~3) 50828 1694 1/3~~
40,542	14,8	15,138
(40.9) 40,650	14,0 – 28,0	27,716
(40.6) 40,696		15,060
(40.4) 40,478	38.4	38,606
(40.3) 40,458	38.4	38,382
(40.7) 40,494	86.4 – 172,2	172.626
40,802		
10) 5424		

40.54
6
40.60

12:28 A.M.

$\frac{1}{17.76} = .05631$ } $\frac{.04049}{4} = .01012$
$\frac{1}{63.23} = .01582$
(127.077 for 6 div.) } $\frac{.05041}{5} = .010082$
~~$\frac{1}{169.7} = .005894$~~ } .050338 ÷ 5 .01007
$\frac{1}{15.1} = .06623$ } .03018 ÷ 3 = .01006
$\frac{1}{27.78} = .03605$ } $\frac{.04028}{4} = .01007$ – 3
$\frac{1}{15.06}$ .06641
$\frac{1}{38.53} = .02595$ } $\frac{.020166}{2} = .010083$ 4
$\frac{1}{172.9} = .005784$

(Use 2/3 speed of chronograph)

3 1007
2 10082
1 1012
4) 40335
Mean Dif = .01009

12:30 →

826.5 + 14.5
825.0 + 14.6
817.0 + 15.0
812.0 + 15.6
809.0 + 16.0
821.5 + 14.7
4911.0 + 90.4
90.4
5001.0

1012
1015
10096
10116
10138
5) 50620
.01012

02463 + 5784 = 3) 030414 = .010138
2463 + 2595 = 5) 5058 = 10116
2463 + 6623 = 4) 9086 = 10096
2463 + 1587 = 3) 3045 = 1015
2463 + 5631 = 8) 8094 = 1012

$\frac{1}{40.6} = .02463 \times 1021 = .025147$
Log = –2.40005
$\frac{1}{2}$ " = –1.20025

$v_1 + v_2 = .01012 \times 1021 = .01033$
Log = –2.01420
–1.20025
3.1983
–6.41275
3.69940
–10.71335
5.16785
5
$e_1 = 5.1735$
$e_1 = 5.168$

$\Delta = 5003$

a	l
–16.4290	–4.8547
3.6991	1.8832
–2.4002	–6.9715
–14.5263	–4.1707
–2.0141	–2.8008
3) –12.5122	
–4.1707	
1.8832	
+2.0539	
1.9461	

$.06321 = \frac{l}{a}$
$.06340 = \frac{l}{a}$
.0001481 = a
.0001477 = a
$8856 = \frac{1}{pa}$
~~$1135 = \frac{1}{pa}$~~

$\left(1 + .849 \frac{l}{a}\right) = 1.05367$
Log = .022705
3
2) .068115
.034057

7137
0340
6797

e = 4.783

$e^{2/3}$

–10.7137
3) 19.4274
7.8091
~~7133~~ 3) 194266
–7.8089
6443
64.40
~~64.38~~ $= e^{2/3}$ "
64.405 % low

1a

Beauty for velocity of $v_1 + v_2$

$e_0^{2/3} = 61.01$

1a

58) Monday Apr. 15, 1912 θ = 23.23 p = 61.43 − 58.31 = 3.12   61.41 − 58.31 = 3.10

First Observation at 5:00 PM.   Volts at 5:00 P.M. 840.0 + 12.7 = 852.7

G	F	G	F
10.6 (2) 15.4 (4) 12.6 (6) 12.8 (8) 51.4	14.8	52.4	{21.6, 41.8} ½
13.0 (2) 12.4 (4) 13.6 (6) 12.0 (8) 51.0	14.6	51.6	{20.6, 41.4} = ½
13.0 (2) 12.6 (4) 12.0 (6) 13.0 (8) 50.6	21.6	51.32	
12.4 (2) 12.8 (6) 12.6 (8) 12.6 (10) 50.4	21.6		
13.0 (2) 13.0 (4) 12.0 (6) 13.4 (8) 51.4	21.9		
13.2 (2) 13.6 (4) 12.8 (6) 13.0 (8) 51.6	116.0 (2) 117.2 (4) 117.2 (6) 110.3 (8) 460.7		
13.0 (2) 12.6 (4)	110.0 for (2) div.		
52.4	{21.4 for ½ distance 41.9 for whole dist.}		
50.4	{21.0 = ½ 41.8 = 1} 14.8		

time taken together ÷ 2

$\frac{1}{51.32}$ = .01948 corr = .01944 × 1021

5:40 P.M.

$\frac{1}{4.72}$

$\frac{1}{14.73}$ = .06789 } .02185

$\frac{1}{21.7}$ = .04604

$\frac{.04387}{2}$ = .02194

$\frac{1}{460.7}$ = .002170 corr = .002166

$\frac{1}{41.72}$ = .02397 corr = .02392

Difs
.02175
.02185
.02194
3)06554
.02185

v_1 = .01985
Log = −2.2978
½ " = −1.1489

at 5:41 P.M.
volts = 837.5 + 13.0 = 850.5

.01944 + .00217 = .02161

.01944 + .02392 = 2).04336 = .02168

1944 + 4604 = 3).06548 = .02183

1944 + 6789 = 4)8733 = .02183

02183
2168
2183
2161
4)1295
.02174

$v_1 + v_2$ = .02174 × 1021 = .02220

Log = −2.3464
½ log v_1 = −1.1489
−3.1983
−6.6936
2.9296
9.7640

v = 850.5

58.07
6
e_1 = 58.13
e_1 = 58.06

$e^{2/3}$
−9.7644
3)−17.5288
−6.5096
323.4 or 5
3
323.1 = $e^{2/3}$

ak
−10.46136
2.9296
−7.39096
−2.3464
−5.04456
.0003
−5.0443 = log ak
−5.7673
−1.2770 = log k
.7230 = log $\frac{1}{k}$
5.284 = $\frac{1}{k}$
4.284 = $(1 - \frac{1}{k})$
log = .6318
3.7344
−48924
.02179 .6318
.5943
.0375
b = .0007805
A = 1.090

a
−16.4209
2.9296
−2.2978
−15.6483
−2.3464
3)−13.3019
−5.7673
.4928
−4.2601
3.7398

l
−4.8547
.4928
−4.3619
−5.7673
0.5946
3.932
3.929 = $\frac{l}{a}$
.00005851 = a

5493 = lem corr.
5488. = $\frac{1}{pa}$

No 70

5/ Monday, Apr. 15, 1912
Second Observation
6:05

$\theta = 23.21$ $p = \frac{6204}{5758} \ 4.46$

Volts at 5:50 P.M. 837.5
13.0
839.5
12.8
1702.8

G.		
5.092		19.480
5.010	19.6	19.356
5.082	19.4	19.374
5.044		19.202
	14.6 -29.0	29.214
5.044	14.6 -28.9	29.022
5.030	-28.9	28.686
	19.6-39.0	38.688
5.066	19.6-38.6	38.620
	37.7-75.2	75.136
5.120	37.0-73.8	73.754
	37.0-72.8	72.758
5.046	16.6-33.2	33.034
5.128	16.3-32.8	32.788
	-39.8	39.956
4.912	24.0-47.1	46.790
5.036	40.6-80.9	80.830
	-80.0	80.152
5.080	27.0-55.2	55.206
5.122	17.2-34.4	34.398
64		
70812		
5058		
19		
5039		

$\frac{1}{19.33} = .05173$

$\frac{1412}{353} = .05204$ } .01783 ÷ 9 = .0019

.03437

$\frac{1}{29.02} = .03446$

3482
.2581 } .009010 ÷ 5 = .001802

922
31

$\frac{1}{38.73} = .02580$ } $\frac{.01250}{7} = .001786$

$\frac{1}{75.19} = .01330$

$\frac{1}{72.90} = .01372$ } $\frac{.01653}{9} = .001837$

$\frac{1}{33.06} = .03025$

$\frac{1}{32.82}$ .03047 } .00549 ÷ 3 = .001830

$\frac{1}{40.03} = .02498$ } $\frac{.00365}{2} = .001825$

$\frac{1}{46.88} = .02133$ } $\frac{.00898}{5} = .001796$

$\frac{1}{80.98} = .01235$

$\frac{1}{80.31} = .01245$ } $\frac{.00563}{3} = .001877$

$\frac{1}{55.32} = .01808$ } $\frac{.01094}{6} = .001823$

$\frac{1}{34.46} = .02902$

Volts at 6:40 P.M. 836.0
13.1
837.0
13.0
1699.1

136

127 .1982
.2902
.22722

122
117
126
123
121
116
114
125

Difs
1823
1877
1796
1837
1786
5 | 9119
1824

34	1818
55	1810
80	1816
46	1814
40	1814
33	1814
75	1811
38	1839
29	1832
19	1837

mean = 1821
Corr'd " 1823
$v_1 + v_2 = 1823 \times 1021$
= .001861

Log = -3.2697
-1.6533
3.1978
-6.1208
3.2304
-10.8904

6:40 P.M.

$\frac{1}{5039} = .1984 \times 1021 = .20256$

Log = -1.3065
$\frac{1}{2}$ " = -1.6533

a
-16.4299
3.2304
-1.3065
-14.9578
-3.2697
3 | -11.6881
-4.5627
.6493
-3.2120
2.7880

l
-4.4547
.6493
-4.2054
-4.5627
-1.6427

.0003653

.4392 = $\frac{l}{a}$
.4396 = Tm corr
4396 = $\frac{l}{a}$

~~613.7~~
~~629.4~~ = $\frac{1}{pa}$
~~630.2~~ = Tm corr
614.2
614.2 = $\frac{1}{pa}$

ak
-10.46136
3.2304
-7.69176
-3.2697
-4.42206
.0002 Tm corr
-4.4278 = log ak
-4.5627
-1.8591 = " k
.1409 = " $\frac{1}{k}$
1.3830
13830 = $\frac{1}{k}$
Log 3830 =
-1.5832
~~2.7464~~ 2.7880
~~-1.7830~~ -1.7952
~~6069~~
b = .0006240
5834
6428
~~9386~~
.9405
~~8686~~
A = .8720

7770
~~7.766~~
7
$e_1 = 7.777$ = ~~7.779~~ 7.777
~~7773~~
$e^{2/3}$
-10.8908
2
3 | -19.7816
-7.9272
8457 = $e^{2/3}$
8457 = $e^{2/3}$

This is exactly on the line

Publish
Beauty for comparison
of different ways of getting $v_1 + v_2$

No 56

60/ Monday Apr. 15, 1912
Third Observation
at 8:55 P.M.

$\theta = 23.05$

Volts at 8:45

$p = 6221$
5738
~~5.1~~
4.83

824.5
14.6
832.0
13.8
1684.9

G	7	
17.236	~~8.6 = 17.2~~ 20.5	20.118
16.990	10.6 - 20.5	20.346
16.992		20.298
		20.386 11.48
16.972		
17.012		25.104
16.912	25.0	25.256
17.130	25.6-50.4	50.384
17.184	25.6-50.2	50.152
17.048	25.3-50.0	50.620
16.924	12.6-25.4	25.368
16.994	97.6-194.8	194.8—
17.062	33.9-66.9	66.662
17.030	66.9	66.654
17.022	40.6	40662
17.022	40.2	40130
		50.2 (2) 49.1 (4) 48.4 (6) 48.6 (8)
		196.2
17.106	25.6-50.2	50.206

$16 / 2728^{6}3^{7}.6^{4}$
17.053

$\frac{1}{17.053} = .05866 \times 1021$

~~9:45~~

$v_1 = .05989$
log = -2.7774
$\frac{1}{2}$" = -1.3887

Beauty to show agreement between the two methods of getting $v_1 + v_2$
Publish surely.

No 63

$\frac{1}{20.30} = .04926$
} .00958
$\frac{.02445}{6} = .004908$
$\frac{1}{25.20}$ .03968
} $\frac{.01987}{4} = .004967$
$\frac{1}{50.48} = .01981$
} $\frac{.01956}{4} = .004890$
$\frac{1}{25.40} = .03937$
} $\frac{.034237}{7} = .004891$
$\frac{1}{194.8} = .005133$
} $\frac{.009857}{2} = .004929$
$\frac{1}{66.71}$ .01499
} $\frac{.00991}{2} = .004855$
$\frac{1}{40.48}$ .02470
} $\frac{.019605}{4} = .004901$
$\frac{1}{196.2} = .005095$
} $\frac{.014835}{3} = .004942$
$\frac{1}{50.21} = .01992$
8 | 39283
.004910

.05866
.01992
16 | .07858
.004911

5866
5095
13 | 63755
.004904

5866
2470
17 | 8336
.004904

5866
1499
15 | 7365
.004910

5866
5133
13 | 63793
.004907

5866
3937
20 | 9803
.004901

5866
1981
16 | 7847
4905

5866
3968
20 | 9834
4917

5866
4926
22 | 10792
4906
4917

4906 mean 20 time
4912 25 "
4905 50 "
4905 195 "
4910 66 "
4904 40 "
6 | 42
.004907

$v_1 + v_2 = .004907 \times 1021$
= .005010
Log = -3.6998
-1.3887
3.1977
-6.2862 v = 1684
3.2264
-9.0598

$e_1 = 11.485 \times 10^{-10}$

$e^{2/3}$
-9.0598
2
3 | -18.1196
-6.0399
$109.6 = e^{2/3}$

a
-16.4299
3.2264
-2.7774
-14.4247
-3.6998
3 | -12.7249
-4.2416
.6839
-4.9255
+3.0745

l
-4.8547
.6839
-4.1708
-4.2466
-1.9292 ← .8496

$.8496 = \frac{l}{a}$

.0001745 = a

1187
$1189. = \frac{1}{pa}$

ak
-10.46136
3.2264
-7.68776
-3.6998
log ak -5.98796
-4.2486
-1.74636 = log k
$.25364 = \log \frac{1}{k}$
$1.793 = \frac{1}{k}$
$.793 = 1 - \frac{1}{k}$

log = -1.8993
3.0745
-4.8248

b = ~~.0006546~~
b = .0006680

-1.8993
-1.9292
-1.9701

A = .9335

Aug 22nd.

No 63

~~6~~ Monday Apr. 15, 1912

θ = 23.06

$p = \frac{6249}{5705}$ 5.44

~~Fourth~~ Observation.

at 10:00 P.M

Volts at 9:45 824.0

832.0
14.6
13.8
1684.4

G	F
43.534 (21.6 43.4)	16.670 (16.4)
43.512 (22.4 43.8)	16.594 (16.6)
44.010 (21.6 44.0)	20.566 (20.4
3)131056	
43.685	
21 64	
43.75	

10:10 P.M.

$\frac{1}{43.75} = .02286 \times 10^{21}$

$= v_1 = .02334$

Log = −2.3681

$\frac{1}{2}$ 11 = −1.1841

$\frac{1}{16.63} = .06013$ } .01152

$\frac{1}{20.57} = .04861$

.02286
.06013
7)08299
.01185

2286
4861
6)7147
01191

1141
1185
1152
3)3528
1176

$v_1 + v_2 = .011\overset{76}{88} \times 10^{21} = .01200$

Log = −2.0792
−1.1841
−3.1978
−6.4611
3.2264
−9.2347 v = 1684

~~e₁ = 17.37~~

$e_1 = 17.37$

$e^{2/3}$

a

−16.42009
3.2264
−2.3681
−14.0154
−2.0792
3)−13.9362
−5.9787
7356
−4.7143
3.2857

l

−4.8547
7356
−4.1191
−5.9787
~~.1322~~
.1404
1.381 = l/a

.00009573 = a

1937 = $\frac{1}{pa}$

−9.2347
2
3)−18.4694
−6.1565

~~$1560 \times 10^{-17} = e^{2/3}$~~

~~1559 = $e^{2/3}$~~

~~1444.1~~ = $e^{2/3}$
1434

ak

−10.46136
3.2264
−7.68776
−2.0792
Log ak −5.60856
−5.9787
log k −1.62986

$\log \frac{1}{k} = .37014$

$\frac{1}{k} = 2345$

$1 - \frac{1}{k} = 1.345 = \frac{b}{pa}$

Log = .1287
3.2857
−4.8430

b = .00006969

.1287
.1417
−1.9870

A = .9705

No 67

Aug 21st

Monday Apr. 15, 1912
Fifth Gas at 10:24

$\theta = 23.07$

$p = \frac{~~6262~~ \; ~~5642~~}{~~6.00~~}$ $\frac{6262 \; 5692}{570}$

Volts at 10:12
824.0
831.5
14.6
14.0
1684.1

G	F	
(12.6 / 24.8) 25.058		
(12.6 / 25.0) 24.550	18.5–36.9	37.120
25.036	36.8	36.794
25.070	24.2–47.8	
(12.6 / 25.2) 24.468	23.6–47.4	47.414
24.918	56.0–111.4	110.034
(12.6 / 24.8) 24.544	112.0	
(25.2) 24.690	23.6–47.1	46.980
(24.8) 25.010	56.3–111.0)	110.194
(12.2 / 25.0) 24.987	29.9	30.178
(25.2) 25.194	15.2–29.4	29.750
(25.2) 25.162	47.4	47.176

12)58687
24.89
2 Chron. Corr.
24.91

10:52

$\frac{1}{24.91} = .04014 \times 1021$

$= v_1 = .04098$

Log = –2.6126

$\frac{1}{2}$ " = –1.3063

$\frac{1}{37.00} = .02703$
} .00598 ÷ 1 = .005980

$\frac{1}{47.5} = .02105$
} .01975 ÷ 2 = .005988

$\frac{1}{110.2} = .009075$
} .012125 ÷ 2 = .006062

$\frac{1}{47.17} = .02120$
9059 } .01214 ÷ 2 = .006070

$\frac{1}{110.4}$ .009059
} .02427 ÷ 4 = .006068

$\frac{1}{30.00}$ .03333
} .01218 ÷ 2 = .006090

$\frac{1}{47.27} = .02115$

6)36258
.006043

$v_1 + v_2 = .006216$ ~~54~~

Mean = 6088

Log = –3.7935
–1.3063
3.1978
–6.2976
3.2256
–9.0720

v=1681

e₁ = 11.80

.04014
.02115
12)6129 2
.006129

4014
3333
12)7347
.006123

4014
9059
8)49199
.006150

4014
2120
6134

4014.
9075
8)49215
6152

2703
4014
11)6717
.006101

4014
2105
6119
6129
6123
6150
6134
6152
6101
7)208
6130

·l

a
–16.42099
3.2256
–2.6126
–14.26991
–3.7935
3)–12.47666
–4.15861
7559
–4.91156
3.08744

–4.8547
7559
–4.0988
–4.15861
–1.94227

.87562 = $\frac{l}{a}$

.0001424 = a

1223 = $\frac{1}{pa}$

$e^{2/3}$
–9.07210
2
3)–18.14440
–6.04480

111.7 = $e^{2/3}$

ak
–10.46136
3.2256
–7.68696
–3.7935
log ak –5.89346
" –4.15375
log k –1.7360
" $\frac{1}{k}$ = 0.2640
$\frac{1}{k}$ = 1.8375
$1 - \frac{1}{k}$ = .8375

Log .8375 = –1.92227
3.0866
–4.83687

~~b = .0006946~~

b = .0006857

–1.92227
1.9413
–1.98147

A = 956

Corrd Aug 21st

No 64

63)

Monday Apr. 15, 1912 Θ = 23.09

Sixth Obs. at 11:07 PM.

p = 62.70
56.74
5.96

62.76
56.80
5.96

11:03 P.m.

824.0
837.0
14.6
14.4
1680.0

	G	F		
x		10.2 - 30.1	20.170	1/20.19 = .049515
15.2 30.1	29.978	11.6 - 23.4	23.476	1/23.50 = .04255
30.2	30.258	14.3 - 28.0	27.784	1/27.80 = .03597
15.2 29.8	30.092	17.6 - 34.6	34.400	1/34.43 = .02905
14.9 30.2	30.112	32.2 - 64.8	64.658	1/65.02 = .01538
15.0 30.0	30.124	32.4 - 65.2	65.132	
	30.076	17.6 - 34.4	34.218	1/34.25 = .02920
	29.836		~~x~~	

7)210.478
30.07
3 comp for chan.
30.10

.006955
.00658
.020465 ÷ 3 = .006822
11:28
.01367 ÷ 2 = .006835
.01382 ÷ 2 = .006910
mean dif = .006856

824.5
822.0
14.6
14.7
1675.8

11:25

1/30.1 = .03322 × 1021

v_1 = .03392

Log = -2.5305

$\frac{1}{2}$ = -1.2653

.03322
.02920
9).06242
.006936

.03322
.1538
7).04860
.006943

.03322
.02905
9).06227
.006919

3322
3597
10)6919
.006919

3322
4255
11)7577
.006890

6919
6919
6943
6936
6894
6)41501
.006917

19 differences

.03322
.49515
12).082735
.006894

$v_1 + v_2$ = .06917 × 1021
= .007062

Log = -3.8489
-1.2653
3.1978
-6.3120
3.2245
-4.0875

v = 16775

e_1 = 12.23

ak
-10.46136
3.2245
-7.68586
-3.8489
Log ak -5.83696
-4.1090
Log k -1.72796
$\frac{1}{k}$ = .2720
$\frac{1}{k}$ = 1.871
$1 - \frac{1}{k}$ = .871

Log .871 = -1.9400
3.1143
-4.8257

b = .0006695

-1.9400
-1.9690
-1.9710
A = .9384

a
-16.4209
3.2245
-2.5305
-14.1759
-3.8489
3)-12.3271
-4.1090
.7767
-4.8857
3.1143

l
-4.8547
.7767
-4.0780
-4.1090
-1.9690

.9310 = l/a

.0001285

1301. = 1/pa

$e^{2/3}$

-9.0875
2
3)-18.1750
-6.0583

11.44 × 10⁻⁷ = $e^{2/3}$

Aug 21

No 65

(W) Tuesday, Apr. 16, 1912
First Observation at 5.27

$\theta = 20.00$ $p = 6.56$
Volts at 4.24 P.M.

836
836.
13.1
13.1
1698.2

Three puffs were made since last nights reading and this observation was made after the second puff - Reading now is 6317
5621
6.96

Taking 2/3 of the diff - add to last night's reading gives 6.56 cm.

	G	F	
{15.6 31.0}	31.0 —		43.0 —
(15.2 30.8)	30.8 —	30.4 — 60.0	60.0 —
		30.0 — 60.1	60.1 —
		30.0 — 59.6	59.932
	31.282		42.494
	31.272		42.006
			43.300 = 1 division
	31.210		59.686
	31.194		59.176
	31.438		59.070
	31.194		26.460
	31.214		26.546
	31.286		22.296

$\frac{1}{43.0} = .02326$
}00659 ÷ 1 = ~~X~~
Volts at 5.55 P.M.
$\frac{1}{60.01} = .01667 = 01664$
}006996 ÷ 1 = 006996
$\frac{1}{42.25} = .02367 = 023634$
}020754 ÷ 3 = 006918
$\frac{1}{34.64} = .002886 = 002880$
}013977 ÷ 2 = 006993
$\frac{1}{59.31} = .01683 = 01683$
}02087 ÷ 3 = 006957
$\frac{1}{26.5} = .03774 = 03770$
~~}.00710 ÷ 1 = 007100~~
$\frac{1}{22.30} = .04484$
mean dif = .006961

830
835
142
- 132
1692.4

8|2090
31.261
31 Corrn fiche
31.292

5.55

$\frac{1}{31.29} = .03196 \times 1021 = v_1$
$v_1 = 03263$
Log = -2.5136
$\frac{1}{2}$ " = -1.2568

.0319.6
07664
7|.04860
006943

03196
023634
8|.055594
006949

3196
288
5|.03484
006968

3196
1683
7|.04879
006970

3196
3770
10|.06966
.006966

6966
6968
6949
6943
5|296
6959

$v_1 + v_2 = 006960 \times 1021$
= .007106
Log = -3.8517
-1.2568
3.1978
-6.3063 v = 16934
3.2288
-9.0775
$e_1 = 11.95$
.6
$e_1 = 11.79$
$e^{2/3}$
-9.0789
3|-18.1438
-6.0479
111.7 = $e^{2/3}$
No

a
-16.4209
3.2288
-2.5136
-14.1633
-3.8517
3|-12.3116
-4.1039
8169
-4.9208
+3.0792 = 1200 or 5 = $\frac{1}{pa}$
1185 corrd for temp
Aug 21st

l
-4.8547
.8169
-4.0378
-4.1039
-1.9339
.8588 = $\frac{l}{a}$
.110
.8477 = $\frac{l}{a}$ corrd for temp
.0001270 = a

ak
-10.46136
3.2288
-7.69016
-3.8517
-5.83846
0033 = Corrn
Log ak = -5.8418
-4.1039
Log k -1.7379
$\frac{a}{k}$ = 0.2621
$\frac{1}{k}$ = 1.828
$\frac{1}{k} - 1 = .828 = \frac{b}{pa}$

A = $\frac{.828}{.8477}$ = 977
b = $\frac{.828}{1185}$ = 000699

Very thankful for multiple relations & very convincing. All times are corrected for chron. error

65

Tuesday Apr. 16, 1912 $\theta = 20.00$ $p = \frac{61.00}{58.72}$ 2.28

Second Observation at 6:45 Volts at 6:45 834.0+ 13.4 847.4

Volts at 7:10 833.5+ 13.9 857.4

G	F	X
7.904	10.194	
7.980	10.190	
8.188		
8.062	14.440	
8.024	14.330	
8.082	17.780	
8.066	17.970	
7.994	17.786	
8.060	23.598	
8.110	23.518	
8.094	23.530	
8.170	31.492	
8.080	31.438	
8.022	125.794	
~~82.08~~	80.180	
7.994	64.804	
8.078	46.976	
8.052	~~47.281~~	

098
208
13689 0
8.052

$\frac{1}{10.19} = .09814$

$\Big\} \frac{.02860}{19} = .001505$

$\frac{1}{14.38} = .06954$

$\Big\} \frac{.01340}{9} = .001489$

$\frac{1}{17.845} = .05604$

$\Big\} \frac{.01358}{9} = .001509$

$\frac{1}{23.55} = .04246$

$\Big\} \frac{.01070}{4} = .001529$

$\frac{1}{31.465}$ 90 $= .03176$

$\Big\} \frac{.023823}{16} = .001489$

$\frac{1}{125.8}$ 60 $= .007939$

$\Big\} \frac{.004513}{3} = .001504$

$\frac{1}{80.18}$ 34 .01245

$\Big\} = \frac{.00295}{2} = .001475$

$\frac{1}{64.8}$ 93 .01540

$\Big\} \frac{.00586}{4} = .001465$

$\frac{1}{46.98}$ 47.03 $= .02126$

8) .011965
.0014956

of interest only to compare with .001498 above

Most Probable diff. − 14.38 to 31.46
= mean of .001510
.001489
.001507
.001470 − 80 to 46.4
= .001494

.1243 7937 89) .13237 .001486	1243 3176 105) 15608 .001486	1243 4246 112) 16676 .001489	1243 5604 121) 18034 .001490
1243 1247 92) 13677 .001487	1243 1543 94) 13973 1486	1243 2129 98) 14559 1485	
1243 6954 130) 19384 1491	1243 9814 144) 22244 .001493		

mean of 1494 & 1488 = 1491

1493
1491
1490
1489
1486
1486
1487
1486
1486
9) 13394
.001488

in order taken

$v_1 + v_2 = 1491 \times 1.021 = .001522$

Log = −3.1824
−1.5518
−3.1978
−7.9320
2.9306
−9.0014

V = 852.4

$e_1 = 10.093 \times 10^{-10}$
.135
$= 9.898 \times 10^{-10}$

7:10

$\frac{1}{8052} = .01242 \times 1021 = .1268$

~~.01240 or Sum corrected for chron.~~

v_1 corrected for chron = .1269

Log = −1.1035

$\frac{1}{2}$ " = −1.5518

a
−16.4299
2.9306
−1.1035
−14.4550
3.1824
3) −11.2726
−4.4242
3579
−4.7821
3.2179

b
−4.8547
.3579
−4.4968
−4.4242
.0726
$1.182 = \frac{b}{a}$
= 1.166 corrected for ℓ ...
.0002656 = a

$1652 = \frac{1}{pa}$

$1630 = \frac{1}{pa}$ won't fit

w

$e^{2/3}$
−10.9956
2
3) 19.9912
−7.9971
$99.34 \, 10^{-7} = e^{2/3}$

Publish fine for showing 2 methods of getting e

Something wrong with them

Won't work

68) Tuesday Apr. 16, 1912 $\Theta = 20.30$ $p = \frac{61.43}{58.20}$ 3.23

Third Observation at 8:45   Volts at 8.45   830.0 + 14.2 = 844.2

Volts at 9.25   827.5 + 14.4 = 841.9

G	F
50.842	~~31.358~~
	49.920
51.164	50.662
51.776	16.934
52.276	16.962
50.890	52.516
51.682	51.542
6)308.630	
51.44	Balanced Speed

doesnt fit

$\frac{1}{31.36} = .03189$ corr = .03186 } $\frac{.01202}{2}$ = .06010

$\frac{1}{50.29} = .01988$ corr = .01984 } $\frac{.03916}{2}$ = .01958

$\frac{1}{16.95} = .05900$ corr } $\frac{.03982}{2}$ = .01991

$\frac{1}{52.03} = .01922$ corr = 1918 } .01918

.0 0

Difs

.06010

.01958

.01991

.06468

.01918

$\frac{.01914}{\text{mean}}$ = .01956

$v_1 + v_2$

.01940 / .01918 / 2).03858 / .01929

1940 / 5900 / 4)7840 / .01960

1940 / 1984 / 2)3924 / .01962

.01940 / 8).1423

1960 / 1929 / 1940 / 4)191 / 1948

$v_1 + v_2$ = .01948 × 1021 = .01989

Log = −2.2986

−1.1484

3.1983

−6.6453   V = 842

2.9253

−9.7200

52.49

61

$e_1 = 51.88$

$\frac{1}{51.44} = .01944$

corr = .01940 × 1021 = .01981 = v_1

Log = −2.2969

$\frac{1}{2}$ " = −1.1484

9:23

a

−16.4209

2.9253

−2.2969

−15.6431

−2.2986

3)13.3445

−5.7815

5092

−4.2907

3.7093

l

−4.8547

.5092

−4.3455

−5.7815

.5640

3.664 = $\frac{l}{a}$

= 3.620 corr'd for kin

.000006046

.5120 = $\frac{1}{pa}$

50

.5070 = $\frac{1}{pa}$ corrd for kin

.5070

$e^{2/3}$

1−19.7151

2

3)−17.4302

−6.4767

299.7 × 10^{-7} = $e^{2/3}$

ak

$\bar{1}$0.46136

2.9306

−7.39196

−3.1824

−4.20956

.0030 = ten corr

Log ak = −4.2126

−4.4242

" k −1.7884

" $\frac{1}{k}$ = .2116

$\frac{1}{k}$ = 1.628

$\frac{B}{pa} = A\frac{l}{a} = .628$

Log .628 = $\bar{1}$.7980

ak

$\bar{1}$0.46136

2.9253

−7.38666

−2.2965

−5.09016

.000001230 7

92

ak = .00000012399

−5.09345

−5.7822

Log k −1.31427

" $\frac{1}{k}$ = 0.68881

$\frac{1}{k}$ = 4.900

.5911

.5377

.0334

or A = 1.080

$\frac{l}{\frac{b}{pa}}$ = 3.884

Log = .5911

−3.7629

−4.8882

b .000

B = 7730

No. 69

Dr C V Raman Indian assn for the Cultivation of Science Calcutta India ..nW
Prof The Svedberg Nobel Institute. Stockholm Sweden ~~Sweden~~. ~~Denmark~~ ..nW
Dr N Bohr 35 Gersonvej Hellerup Copenhagen Denmark ~~Sweden~~ ..nW
Dr R Sievert. Nobel Institution Stockholm Sweden, (..nW
Prof. Satyendra ~~Ray~~ Ray. Canning College Lucknow India ..nW
c/o London City & Midland Bank Ltd 117 Finsbury Pavement London
Professor Q. Majorana Polytechnic School Turin Italy ..nWAB
Dr C. G. Darwin Christs College Cambridge Eng ..nWAB
Prof E. C. C. Baly University of Liverpool. Eng ..nWAB
" Frank Horton University of London ..nWAB
Dr F. W. Aston Univ of Cambridge Cambridge Eng ..nWAB
Prof R Whiddington D Sc. University of Leeds Leeds Eng ..nWAB
Dr L. Silberstein Eastman Kodak Co. Rochester NY.
A Dauvillier 29 Rue Chateaubriand Paris France
Prof Dr K Stöckl Regensburg Aegydienpl 2 I Germany
Director Dr. Georgio Abetti Osservatorio Arcetri-Firenzi Florence Italy

Books on Electrons given to

J. J. Carty
R. W. Wood
G. B. Millikan
Ch. Fabry
H. Abraham
C. E. Mendenhall
Carl Snyder
H. Walker
A. A. Michelson
M. A. Ryerson
11 T. C. Chamberlin

✓ M le duc de Broglie .. NWC
24 rue Chateaubriand
✓ " " duc de Guiche
42 bis Av. Henri Martin Paris Fr
Cambridge Eng Sir E Rutherford .. NW
Bur Standards Washington Prof S W Stratton
✓ " Th Svedberg .. NW
Uppsala Sweden
✓ " " Svante Arrhenius .. NW Nobel Institute Stockholm Sweden
18 ✓ Dr L. William Öholm .. NW
Nobel Institute
Stockholm
✓ Prof Kamerlingh Onnes .. NW
Leiden Holland
✓ " W H Bragg .. NW University College Gower St London
B I R London Eng.
~~Lord Rayleigh~~
~~Terling Place Witham~~
~~Essex. Eng.~~
✓ Dr Gustaf. Granqvist
Swedish Royal Acad of Sci
Stockholm Sweden
✓ Dr N Bohr. .. NW
46 Oster. Sogade
Copenhagen. Denmark
✓ Prof J H Jeans. .. NW
8 Ormonde Gate
Chelsea SW London
Dr H F Osborn Am Mus. Nat Hist
Dr G E Hale .. NW

Russia. Sweden etc

Prof A Joffé Physik. Laboratorium d. Polytechnikums St Petersburg Russia v2⊙ ⊡·X ↙

Dr L William Öholm. Nobelinstitut Stockholm Sweden ⊙ ⊡·X = ·NW

Krakow. ~~Sebastiana~~ Studencka 27 Austro Hungary. Inz Univ'y
~~Prof. M DeS. Smoluchowski~~ ~~Lemberg~~. ~~Austrian Poland University~~ ⊙ ⊡·X
√ " Dr Tadeusz Godlewski. Physical Laboratory Technical High School Lemberg Austria

Prof Dr A Landé Frankfurt a M Institut für Theoretische Physik ··NW
Prof Dr A Sommerfeld. Munich Germany. Physical Institute Univ'y x = ·NW
Prof Dr Wiechert Landstr 180. Göttingen Germany = ··NW
Dr Walter Gerlach Phys~~ikalisches Institut der Universitat Tubingen~~ Lab. ~~Farbenfabriken Fredr. Bayer~~ & Co Elberfeld Germany ⊙ ⊡·X··NW
Prof. Wolfgang Ostwald. Leipzig Germany. The University v⊙ ⊡ X
Prof. Felix Ehrenhaft Physikalisches Institut der K K Univ'y Wien Austria v2⊙ ⊡·X··NW
Dr E Grüneisen ~~Charlottenburg Berlinerstr 49~~ Phys.-Tech. Reichsanstalt Charlottenburg Berlin Germany ⊡·X··NW
Prof P Weiss Polytechnikum. Zurich Switzerland ⊡·X·NW Strassbourg Univ. of Strassbourg: Strasbourg France
~~Prof Friedrich Hasenöhrl University of Vienna. Vienna Austria~~ ⊡X
Prof Dr A Wehnelt. Reichstagsufer 7 Berlin Germany. ·⊡·X·NW Reichstagsufer 7 Berlin Germany ·⊡X
√Dr Wm H Westphal Physik. Institut der Universitat ~~Reichstagsufer~~ ··NW
~~Prof Dr Edgar Meyer Tübingen ~~Lauterstr~~ Str 23 Germany~~ ⊡·X·NW
~~Prof J. Elster Wolfenbüttel Germany~~ ⊡·X·NW
" H Geitel " " ⊡ ··NW
" F Himstedt Freiburg i B Germany ⊡·X·NW
" F Paschen Tübingen Germany ⊡·X·NW
" O Hahn. Kaiser Wm Inst. Dahlem Berlin Germany ·⊡X·NW
Dr Bucherer University Bonn Germany ⊡ ·NW
Prof W Kaufmann Konigsberg Germany (University) ⊡·X ·NW
·Dr H Geiger Reichsanstalt Berlin Germany ⊡ ·NW
~~Prof Max Abraham Polytech. Inst. Milan Italy~~ ⊡ = ·NW
" E R v Schweidler Innsbruch Univ. Innsbruch Austria ⊡ ·NW
~~" F Braun Univ. of Strasbourg. Strasburg Germany~~ ⊙ ⊡X
√" J.D. van der Waals Univ. of Amsterdam Holland ⊙ ⊡ ·X = ··NW
√" P Zeeman " " " ⊙ ⊡ ·X = ··NW
√" H Kammerlingh Onnes. Leiden Holland. Univ. of Leiden. ··NW

English Physicists contd from next to last page

Prof W Peddie Univ'y College Dundee Scotland
~~" John Perry FRS Imperial College of Science London~~ ✓1 ⊙ □·X·NW
K ~~Right Hon Lord Rayleigh FRS Terling Place Witham Essex~~ ✓1 ⊙ □=·NW
Prof R A Sampson Royal Observatory Edinburgh ✓ ⊙ ⊡·X =
" F Soddy The University Glasgow ✓1 ⊙ □ =
~~Prof W F G Swann 62 Carnegie Institution Wash'n D.C. Dep't Terrestial magnetism~~ ✓1 ⊙ □·X =·NW
~~" S P Thomson FRS Morland Chislett Road West Hampstead NW~~ ✓1 ⊙ □X
~~" F T Trouton FRS University College Gower St London~~ ✓1 ⊙ □·X
Mr W C D Whetham FRS Trinity College Cambridge
~~" R Whiddington St. Johns College~~ ✓1 ⊙ □X =·NW
" J Robinson Physics Dept. The University Sheffield ✓1 ⊙ □·X·NW
Prof J S Townsend " " Oxford Univ. Oxford Eng □ ·X·NW
Dr E N DaC. Andrade Ordnance College Woolwich ~~University~~ College London ⊙ □·X=·NW
~~Prof Henry E Armstrong FRS City & Guilds College London~~ ⊙ □·X·NW
~~Dr~~ Oliver Heaviside FRS Homefield Lower Warberry Torquay Eng □·X·NW
Dr G F C Searle FRS Cavendish Lab'y Cambridge Eng □ =·NW
Dr Kaye, Teddington Middx. England (Nat'l Phys. Lab'y) ⊙⊡□·X=·NW
~~Dr N Bohr 96 Ostersøgade Copenhagen Danmark~~ ⊙⊡·X=
Mr S B McLaren Univ'y of Birmingham England
" C G Darwin ~~Cavendish Lab'y % Sir E R~~ □ Victoria Univ'y Manchester England □ ·X =·NW
Professor A Gray FRS Univ'y of Glasgow □·NW
" ~~Kuehnen~~ Kuenen Leiden Holland University □=
" J.H. Jeans → 8 Ormonde Gate Chelsea S.W. London ~~Chaucer Road Cambridge England~~ □ ·X = ··NW
" W J. Pope FRS Cambridge University Cambridge Eng. ⊡ X =·NW
" Wm Barlow The Red House Stanmore Middlesex Eng □
Prof W Lefèval College Municipal Secondary School for Boys New North Road Huddersfield Eng. ·NW

Prof Gilbert N Lewis. Univ. of California Berkeley Cal ⊙ ☐ X "NWAB
~~Prof A C Maclaurin Mass. Inst. of Technology Boston Mass~~ ⊙ ☐ X =
Prof E B Wilson " " " " " " ⊙ ☐ X = "NWAB
" H N Davis Harvard Univ, Cambridge Mass ⊙ ☐ X "NWAB
" R C Tolman. Chemical Warfare Service. Washington DC "NW "NWAB
" Theo. Lyman Harvard Univ. Cambridge Mass ⊙ ☐ X "NWAB
" P W Bridgman " " " " ⊙ ⊡ X = "NWAB
" ~~Wm Duane~~
" G. W. Pierce " " " " ⊙ ☐ X = "NWAB
" Elihu Thomson G E Co. Lynn Mass "NWAB
⊙ ⊡ X = "NWAB
" A W Duff. Worcester Polytechnic Inst Worcester Mass ⊙ ☐ X = "NWAB
" A G. Webster Clark Univ'y. Worcester Mass ⊙ ⊡ X = "NWAB
" ~~K E Guthe Univ. of Michigan Ann Arbor Mich~~ ⊙ ☐
" John Zeleny " " Yale Univ'y New Haven Conn ~~Minn. Minneapolis Minn~~ = "NWAB ⊙ ☐ X =
" O M Stewart " " Missouri Columbia Mo ⊙ ☐ X =
" C A Skinner " " Nebraska ~~Lincoln~~ Lincoln Neb ⊙ ☐ X =
" G F Hull Dartmouth. Hanover N H ⊙ ☐ X =
Pres E F. Nichols Nela Research Lab'y Nela Park Cleveland O "NWAB ⊡ X =
Prof W F Magie Princeton N J "NWAB ☐ X =
" O W Richardson Kings College. London. England "NWAB ⊙ ☐ X =
" A Trowbridge Princeton " " "NWAB ⊙ ☐ X
" E Merritt Cornell Univ. Ithaca N.Y. "NWAB ☐ X =
" E L Nichols " " " " "NWAB ⊙ ⊡ X =
Dr C. G. Abbot ~~Smithsonian Institution~~ Washington DC "NWAB ⊙ ☐ X =
" W F Hildebrand Bureau of Standards Wash. DC ⊡ e = 4.777 X
" W. F. G. Swann University of Minnesota Minneapolis Minn "NWAB

4971	61.04
4979	61.03
4981	60.98
4982	61.26
4991	61.20
5001	61.24
5010	61.01
5012	60.98
5016	61.16
5017	61.24
5028	61.09
5040	61.08
5041	61.06
5056	61.09
5065	61.20
5069	61.25
5098	61.09
5120	61.15
5145	61.20
5166	61.11
5168	61.01
5190	61.18
	61.111

Determination of A & K

In formula $X = 6\pi\mu a v\left(1+A\frac{l}{a}\right)^{-1}$

or " $\left(1+\frac{K}{pa}\right)$

so $K = \frac{e^{2/3}-e_0^{2/3}}{\frac{1}{pa}e_0^{2/3}}$ or $A = \frac{e^{2/3}-e_0^{2/3}}{\frac{l}{a}e_0^{2/3}}$

$\therefore K = \frac{79.00-61.14}{467.5 \times 61.2} = \frac{17.85}{28526} = .0006251$

when p = cm Hg at 23° & a = cm

since $A = \frac{K}{pl}$ & log K = -4.7960

∴ pl = -4.8547

-1.9413

Whence A = .8736

instead of .817 by former value

.77 Knudsen's value

"NWAB
Dr Silberstein Research Dept Eastman K Co Rochester N Y
" R. W. Wood Johns Hopkins Baltimore Md ☐ X
"NWAB
~~" Wm Duane St Davids Pa.~~ ☐ X =
" R K McClung Univ. of Manitoba Winnipeg Canada ☐
" H A Wilson Rice Inst. Houston Texas ☐ X =
"NWAB
" E W Washburn Urbana Ill ⊙ ☐ X =
"NWAB
" E. H. Hall. Harvard Univ. Cambridge Mass ⊙ ⊡ X
~~" M I Pupin Columbia " New York City~~ ⊡
~~" G C Pickering Harvard " Cambridge Mass~~ ⊡ X =
" D L Webster X
~~" Elihu Thomson Swampscott Mass~~ ☐ X
" ~~Martin A Ryerson~~ 1345 ~~La Salle St~~ Chicago ⊙ ☐
"NWAB
Prof T. W. Richards. Harvard Univ'y Cambridge Mass X
"NWAB
" Otto Stuhlmann Univ of Penn. Philadelphia Pa X
" K T Compton Princeton. N J = "NWAB
" F R Moulton Univ of C X = "NWAB
"NWAB

Final value of e

$$e_0^{2/3} = e_1^{2/3} - d\tan\alpha = \left(e_1^{2/3} - d\,\frac{79.00-61.14}{467.5}\right)\times10^{-8} = \left(e_1^{2/3} - d\times.03820\right)\times10^{-8}$$

$$\begin{array}{r} 7900 \\ 6115 \\ \hline 4665)\,17850\,(3826 \\ 13995 \\ \hline 38550 \\ 37320 \\ \hline 12300 \\ 9330 \\ \hline 2970 \end{array}$$

1. d = 88.56 $e_1^{2/3} = 64.40$ $e_1 = 5.168$ Log d = 1.9472 " tan α = 2.5838 .5310 log⁻¹ = 3.396 64.40 − 3.396 = 61.004 $e_1^{2/3} = 6.101$

9 2\. d = 54.01 $e_1^{2/3} = 63.08$ $e_1 = 5.010$ Log d = .7325 5838 .3163 2071 63.08 2071 61.009 6.101

	3	d = 59.91	6335	5041	7775 5838 3613	6335 2298 61052	6.1062
	4	d = 74.64	6400	5.120	8729 5838 4567	6400 2854 61.136	6.115
6	5	47.90	6293	4.991	6803 5838 2641	6293 1832 61098	6.110
	6	71.40	63.82	5.098	85.37 5838 4375	6382 2738 61082	6.109
	7	89.23	64.59	5.190	95.05 5838 5343	6454 3422 61168	6.115
	8	60.68	63.57	5.069	7831 5838 3669	6357 2327 61243	6.125
11	9	56.04	63.24	5.028	7487 5838 3325	6324 2150 61089	6.109
	10	60.92	63.33	5.040	7847 5838 3685	6333 2336 60994	6.100
7	11	48.28	62.82	4.981	6837 5838 2695	6282 1851 60969	6.098
	12	61.19	63.54	5.065	7867 5838 3705	6354 2347 61193	6.120
	13	85.07	64.36	5.166	9298 5838 5136	6436 3253 61103	6.111
10	14	55.44	63.10	5.012	7438 5838 3276	6310 2126 60974	6.098
3	15	44.75	62.75	4.971	6508 5838 2346	6275 1716 61034	6.104
	16	61.59	63.45	5.056	7895 5838 3733	6345 2362 61088	6.109
5	17	46.71	62.82	4.979	6694 5838 2532	6282 1791 61029	6.103
	48	49.44	63.13	5.017	6941 5838 2779	6313 1896 61234	6.124
4	47	46.09	63.00	5.001	6636 5838 2474	6300 1768 61232	6.124
8	46	51.65	63.13	5.016	7130 5838 2968	6313 1980 61150	6.116
2	45	40.78	62.82	4.982	6105 5838 1943	6282 1564 61258	6.126
	24	78.26	64.19	5.145	8935 5838 4793	6419 3009 61189	6.120

6.129

22 | 134.47

$e_0^{2/3} = 6.111$

$e_0 = 4.777$

American Physicists

Dr Irving Langmuir. Schenectady N.Y. G.E. Research Lab. ..NWAB
Prof A E Kennelly Harvard Univ'y ⊙ ☐X = ..NWAB
~~Laboratory of Physical Chemistry (Prof Washburn) U of Ill.~~ ⊙
Prof Geo B Pegram. Columbia New York City ⊙ ☐X = ..NWAB
" M I Pupin " " ⊙ ☐X = ..NWAB
~~" Wm Hallock~~
" W.S Nelms Emery University Emery Ga. ⊙ ..NWAB
" D. C. Miller Case School. Cleveland O ⊙ ☐·X = ..NWAB
" A D Cole Ohio State U. Columbus O ⊙ ☐·X = ..NWAB
" A W Goodspeed Univ. of Pa Philadelphia Pa ⊙ ☐·X = ..NWAB
" W S. Franklin Mass. Inst. of Tech'y Cambridge Mass ~~Lehigh Univ. South Bethlehem~~ Pa ⊙ ☐.X ..NWAB
" Carl Barus Brown " Providence R I ⊙ ☐ X = ..NWAB
" W J Humphreys. Weather Bureau Wash D C ⊙ ☐ X = ..NWAB
" C E. Mendenhall Univ. of Wis. Madison Wis ⊙ ☐·X = ..NWAB
" E Percival Lewis " " Cal. Berkeley Cal ⊙ ☐X = ..NWAB
" Geo E Hale Mt Wilson Cal. ⊙ ☐ X = ..NWAB
" A S Eve McGill Univ. Montreal Canada ⊙ ☐·X ..NWAB
" H T Barnes " " " " ⊙ ☐·X = ..NWAB
" J C McLennan Toronto Univ. Toronto Can ⊙ ☐·X = ..NWAB
" Frank Allen Univ. of Manitoba Winnipeg Canada ⊙ ☐X = ..NWAB
" W G Cady Wesleyan Univ. Middletown Conn ⊙ ☐·X = ..NWAB
" B.B. Boltwood New Haven Conn ⊙ ☐X = ..NWAB
" H A Bumstead 1701 Mass Ave Wash DC " " ⊙ ☐X = ..NWAB
" L A Bauer Carnegie Institution Wash D.C ⊙ ☐·X = ..NWAB
" W W Coblentz Bureau of Standards Wash DC ⊙ ☐·X = ..NWAB
" A L Day Geophysical Lab'y Wash D.C ⊙ ☐X = ..NWAB
" E B Rosa Bureau of Standard Wash D.C. ⊙ ☐X = ..NWAB
" S W Stratton " " " " ⊙ ☐·X = ..NWAB
Pres R. S Woodward Carnegie Institution Wash DC ⊙ ☐·X = ..NWAB
Prof Henry Crew Evanston Ill Northwestern Univ ⊙ ☐·X = ..NWAB
" J F Hayford " " " ⊙ ☐·X = ..NWAB
" A L Foley Univ. of Ind Bloomington Ind ⊙ ☐X = ..NWAB
" G W Stewart " " Iowa Iowa City Iowa ⊙ ☐·X = ..NWAB
" Jos S Ames Johns Hopkins Baltimore Md ⊙ ☐·X = ..NWAB
" A L Kimball Amherst College Amherst Mass ☐·X ..NWAB
" H M Goodwin Mass. Inst. of Technology Boston ⊙ ☐·X = ..NWAB
" ~~D F Comstock " " " "~~ ⊙ ☐·X =

~~Irving Langmuir Schenectady N.Y.~~ "
" A W Hull ..NWAB " "
~~Dr Richard Tolman U of Ill Urbana~~ ..NWAB Chemical Warfare Service Wash D.C. "
" A P Carman ..NWAB " " "

Density of Clock Oil

Taken by R A Millikan April 5/12

Weight of empty bottle = 10.9181
" " Bottle & oil 20.1536
" " " water 20.9338

Temperature of both oil & water exactly 23°

" " of oil alone = .9235 5
" " " water " = 10.0157

Relative densities = .9221

abs density of oil = .9221 × .9976 = .9199

$\mu = .0001825$ 9
2|.0016425
.00082125

$$e_n = \tfrac{4}{3}\pi\left(\frac{9\mu}{2}\right)^{\frac{3}{2}}\frac{1}{g(\sigma-\rho)}^{\frac{1}{2}}\frac{d(v_1+v_2)v_1^{\frac{1}{2}}}{PD} = \frac{4.\pi}{3}\left(\frac{9\cdot.0001825}{2}\right)^{\frac{3}{2}}\left(\frac{1}{980.3(.9199-.0012)}\right)^{\frac{1}{2}}1{,}6\,\frac{(v_1+v_2)v_1^{\frac{1}{2}}}{PD}$$

$$= \frac{\pi\times 6.4\times(.00082125)^{\frac{3}{2}}\times 100}{(980.3\times .91873)^{\frac{1}{2}}}\times\frac{(v_1+v_2)v_1^{\frac{1}{2}}}{PD\text{ volts}}$$

$$= \frac{\pi\cdot 640.\times(.00082125)^{\frac{3}{2}}}{(980.3\times .9187)^{\frac{1}{2}}}\;\frac{(v_1+v_2)v_1^{\frac{1}{2}}}{PD\text{ volts}}$$

Calc'n of the constant coef. of $\frac{(v_1+v_2)v_1^{\frac{1}{2}}}{PD}$

Log ( ) = 4.91447 6
3
2|-10.74342 8
-5.371714

Log π = .49715
" 640 = 2.80618
" ( )$^{\frac{3}{2}}$ -5.371714
-2.67504
+1.47728
-3.19776

This is .12% smaller than number used before
it is 1.5768 × 10^{-3}

Log 980.3 = 2.99136
" .9187 - 1.96319
2|2.95455
1.47728

Thus
$\log\mu_{10^{24}} = \bar{4}.26103$
½ " $\bar{2}.130515$
3
$\bar{6}.391545$

Calc'n of a

$$\frac{v_1}{v_2} = \frac{mg}{Fe_1-mg} \therefore e_1 = \frac{mg}{F}\,\frac{v_1+v_2}{v_1}$$

$$e_1 = \frac{\tfrac{4}{3}\pi a^3(\sigma-\rho)g}{F}\left(\frac{v_1+v_2}{v_1}\right) \therefore a^3 = \frac{3Fe}{4\pi g(\sigma-\rho)}\,\frac{v_1}{(v_1+v_2)}$$

$$a^3 = \frac{3e}{4\pi g d 300(\sigma-\rho)}\;\frac{v_1\,PD_{\text{volts}}}{v_1+v_2} = \frac{4.777}{4\pi\, g\, 160.\,.9195}\;\frac{v_1\,PD}{v_1+v_2}$$

log e = -10.67916
6.25824
-16.42092

2.6361 × 10^{-16}

.60206 = log 4
.49715 = " π
2.99136 = " g
2.20412 = " 160
-1.96355 = .9195
6.25824

This is just .14% lower than value used in first calc'n which means that a must be reduced .47%

Calc'n of ak

$$e = \frac{mg}{F}\left(\frac{v_1+v_2}{v_1}\right)$$

$$e = \frac{6\pi\mu a k}{F}\,\frac{v_1(v_1+v_2)}{v_1}$$

$$\therefore ak = \frac{eF}{6\pi\mu(v_1+v_2)} \quad \text{but } F = \frac{PD}{300d}$$

$$\therefore ak = \left(\frac{PD}{v_1+v_2}\right)\frac{e}{300d\,6\pi\mu_{23}}$$

$$\therefore ak = \log^{-1}\bar{10}.46136\times\frac{PD}{v_1+v_2}\{1-(t-23).0027\}$$

Log e = -10.67916
.21780
-10.4613

4.777

Log 480 = 2.68124
" 6 = 0.77815
" π = 0.49715
" μ_{23} = $\bar{4}$.26126
.21780

Calibration of Hipp Chronoscope

30 sec interval		20 sec interval	10 sec. interval	16 sec. Int.	Duplicate 20 sec.
14981	14995	9979	5003	.8012	9976
14994	14979	9996	4980	.7980	9996
14991	14960	9987	4992	.8003	10074
14993	14986	9962	5011	.8013	10002
14965	14988	9981	4995	.8015	10006
14982	15003	9999	4996	.8005	10023
15001	14989	10012	5014	.8011	9994
14970	15009	9983	4990	.8001	10008
14999	14963	9972	5019	.8005	9977
14965	4) 44872	9983	5009	.7996	10005
9836	14.986	9964	50009	.0041	100001
14.9836	2	11) 918	50009	.80041	100.001
2	29.972	9.98345	2	2	2
29.9672		2	10.0018	16.0082	20.0001
Corr = ±.1%		19.96690	Corr = 0	Corr = 0	
		Corr = .08%			

6 sec.	40 sec.	60 sec
3001	19991	29969
3031	19985	29950
3037	19984	29962
3008	19955	29939
2995	19984	29948
3017	19950	5) 149768
3003	19960	29.9536
2980	19954	2
2989	19996	59.9072
2988	19959	
3026	-9718	
3013	19.9718	
36088	2	
3.00733	39.9436	
2	+.15%	
6.0146		
+.25%		

112 sec.	
111.864	-.13

116. sec	
115.722	-.24%

120. sec	
119.782	-.14%

+.20%

/ German Physicists

~~Prof~~ R. J. Strutt FRS Prof of Phys Imperial College of Science S Kensington London ✓ ⊙ ■ ·X = ·NW

Prof C. G. Barkla ~~University of London~~ University of Edinburgh Scotland. 12 ⊙ ■·X = ·NW

✓ " E Rutherford Manchester England Univ ✓ 12 ⊙ ◘ X = ··NW

✓12 " Sir J J Thomson Cavendish Lab'y Cambridge Eng ✓12 ⊙ ◘ ·X = ··NW

✓ " Joseph Larmor St Johns College " " ✓12 ⊙ □ X = ··NW

✓ Prof Sir James Dewar Royal Institution London 12 ⊙ □ ·X = ·NW

" ~~Sir Wm Ramsay University College Gower St London~~ 12 ⊙ ◘ X

✓ " A W Porter " " " " " ✓1 ⊙ □ ·X = ·NW

✓ " F T Trouton FRS " " " ✓1 ⊙ □ ·X =

✓ Mr A O Rankine BSc Imperial College of Science & Technology London □ ·X =

✓ " C. T. R. Wilson Cavendish Lab'y Cambridge ✓1 ⊙ □ ·X = ·NW

✓ " E. Cunningham St Johns College " □ = ·NW

✓ " A L Hughes ~~Rice Institute Houston Texas~~ Queens College Kingston Ont 12 □·X·NW

✓ " McClower Manchester Phys Lab'y U of M ✓1 □

✓ " Todd Cavendish " " → Cambridge Eng □ ✓1

Prof Wm H Bragg ~~Leeds~~ University College Eng London ✓12 ⊙ □ X = ·NW

" W L Bragg Manchester Univ y. Manchester Eng ·NW

" J. A. Harker Nat'l Lab'y Bushy Park London ✓1 ⊙ □ =

~~H Geiger Reichsanstalt, Charlottenburg Berlin~~ ✓1

~~Sir William Crookes~~ Ordnance Bd London Eng

✓ H. A. Lorentz University of Amsterdam ✓ 1.2 ⊙ □ = ·NW

✓ Norman Campbell Research Lab'y Gen. Elec Co Ltd 12 ⊙ □ ·X =

~~J H Poynting Birmingham. Univ'y~~ ✓1 ⊙ □

H H Turner Dir Univ. Obs'y Oxford Eng. ✓ ⊙ □ =

Sir Oliver Lodge. DSc LLD FRS. Birmingham Eng Univ'y ✱ 1.2 ⊙ □·X = ·NW

Prof John Joly Dublin Ireland University - - - - ✓ ⊙ □ = ·NW

" F W Dyson Greenwich Eng □ =

" Henry E Armstrong 55 Granville Park Lewisham London ✓2 ⊙ □·X =

" Hugh L Callendar LLD FRS Imperial College of Science London ⊙ □·X = ·NW

" E G Coker DSc FRSE City & Guilds of London Technical Col. Finsbury E.C ✓1

Dr Chas Crowther Ph.D. The University Leeds ~~(Royal Hall)~~ □

" J A Fleming FRS ~~University College London W. C~~ University College London W. C □ ✓1 □X

Prof Chas H Lees FRS. Greenacres Woodlands Road Woodford Green Essex ✓ ⊙ □ X = ✓ ⊙ □ X

~~Sir Oliver Lodge D Sc LLD FRS The University Birmingham~~ ✓1

~~Prof J A McClelland~~ FRS University College Dublin ✓1 ⊙ □ X =

" H M Macdonald " Aberdeen ✓ □ =

~~J R Rydberg Univ of Lund Sweden ✓12 ⊙ □ X =~~

Major P A MacMahon FRS 27 Evelyn Mansions Carlisle Place London ✓ ⊙ □ X =

Prof W. C. Duffield D Sc Univ y College Reading ✓1 ⊙ ■ X

" J. Milne FRS Shide Newport Isle of Wight ✓ ⊙ ✓1

Dr S R Milner The Univ y Sheffield ✓

" J W Nicholson Kings College □ ✓ = ·NW

P did not send

Pop Sci ✓
Vested 1
Coll Inf 2
Atomic Theories
Brownian movement
Elementary charge & Quantum Loss
Viscosity air
Plancks h
Einstein & Contin
Em F
Selection Manual
e Phil Mag
Radiation
4 cbb
Sub e
not Sent to all = { Modern Phys / Sci in Sec Sch / Harrington Thes
·· Goodchild Kelly
~ 1st Sawyer
W 1st Gas Str & Phys
A 20th Century
B. Opp'y in Science

Le Radium Masson et Cie Editeurs 120 Boulevard St Germain Paris ☐ E
Science abstracts E + F. N Spon Li 57 Haymarket SW London ☐ ·NW
Journal de Physique. 44 Rue de Rennes Paris ☐ ·NW
Fortschritte der Physik. Prof Karl Scheel Wilmersdorf Günzel Str 46 Berlin Germ ☐

France Paris France

Prof ~~MM~~ D Arsonval Prof. Physique College de France ✓12 ⊙ ☐ X
" Mme Dr P Curie Laboratoire de Radium de la Sorbonne Rue Pierre Curie Paris ✓12 ⊙ ☐ ·X = ·NW
" ~~MM~~ ch. Ed. Guillaume Bureau Internationalle Sevres ✓12 ⊙ ☐ ·X = ·NW
" M ch. Ed. Guye Genève Univ. Switzerland ✓12 ⊙ ☐ X = ·NW
" " Swyngedauw Lille ⊙ ☐ =
" " Roché Nancy ⊙ ☐ =
" " Blanc Caen ⊙ ☐ =
" " Henri abraham Prof de la Sorbonne Paris ✓12 ⊙ ☐ ·X = ·NW
" " M A Cotton Ecole Normale Superieure Paris ✓12 ⊙ ☐ ·X = ·NW
" " Charles Fabry Univ. of Paris. Laboratoire de Physique 1 rue Victor Cousin Paris France ~~Marseilles France~~ ✓12 ⊙ ☐ X = ··NW
~~Prof A Righi Bologna Italy~~ ✓1 ⊙ ☐ X =
M. Le Duc de Broglie 29. rue Chateaubrand Paris ✓ ⊙ ☐ X = ··NW
" H Buisson Marseilles " ⊙ ☐ X = ·NW
" Ed Bouty Bureau du Journal de Physique 5 Rue de la Santé ⊙ ☐ = ·NW

Prof Jean Perrin Sorbonne Paris France ⊙ ☐ ·X = ··NW
" P Langevin College de France Paris " ☐ ·X = ··NW
" ~~G Lippmann University of Paris.~~ " " ⊙ ☐ ·X = ·N.W.
" M. Marcel Brillouin College de France Paris France. ☐ X = ·NW

German Physicists

– Herr Geheimrat Prof W Nernst, Bunsenstr 1 ² Berlin W 35 Karlsbad 26A VI · ⊡ X ·· NW

X Prof Dr F Haber Konigen Luisen Str 14 Dahlem Berlin VI ⊙ ⊡ X ·· NW

– Prof Max Planck Wangenheim Str 21 Grunewald " VI · ⊡ X ·· NW

– Prof W Kossel Phys. Inst. d Tech. Hochschule München Germany · NW

– Prof Dr H Rubens Physikalisches Institut Univ of Berlin VI ⊙ ⊡ · X ·· NW

– " O v Baeyer Landwirtschaftliche Hochschule Berlin Germany I · ⊡

– Dr Robert Pohl ↗ Göttingen Physikal. Institut " " VI · ⊡ · NW

– Dr Peter Pringsheim ~~Dr Martin Knu~~ " " " " ~~VI~~ ⊙ ⊡

– Dr Erich Regener Stuttgart Germany Technische Hochschule ~~Univ~~ I 2 ⊙ ⊡ ·· NW

– Dr J Franck – Göttingen Physikalisches Institut ~~Kaiser Wilhelm Institut Dahlem bei Berlin~~ I V 2 ⊙ ⊡ ·· NW

– Prof E Gehrcke Reichsanstalt March Str Charlottenburg Berlin I · ⊡ · X ·· NW

~~Dr Hupka~~ " " I · ⊡

– Prof Dr Karl Scheel Berlin – Dahlem Werderstrasse 28 Germany ~~Berlin Wilmersdorf Güntzel Str 46~~

– Dr A Eucken ~~Breslau~~ Physiko-chemisches Institut ~~Bunsen Str 1 Berlin~~ Germany ⊡ · X = · NW

– Dr R Ladenburg Breslau Physik. Institut der Univ. I V ⊡ X · NW

– Prof O Lummer " " " " I V ⊙ ⊡ X

" ~~E Pringsheim~~ " " " " ~~I~~ ⊡ VI 2 ⊙ ⊡

– Herr Geheimrat Prof Wm Hallwachs Technische Hochschule Dresden VI 2 ⊙ ⊡ ·· NW

– Dr H J van der Bijl Dept Mines and Industries Union South Africa Pretoria S.A. VI 2 ⊙ ⊡ · X ·· NW

– Dr H Dember Dresden

– Prof. O Wiener – Physik. Institut der Univ. Leipzig I V ⊙ ⊡

– " Theo. DesCoudres " " " " VI ⊙ ⊡ · X

I V 2 ⊙ ⊡ · X

– Dr Erich Marx " " " " I V ⊙ ⊡ · NW

– Dr Karl Przibram Wien I ~~Austria~~ ~~Phys. Institut der Univ.~~ Institut für Radium Forschung I 2 ⊙ ⊡ ·· NW

" W Gaede – – ~~Charlottenburg~~ Freiburg Baden Austria Kaiser-Wilhelmring ⊙ ⊡

~~Dr Max Reinganum~~ in Freiburg i. B. Univ. Technische Hochschule I V ⊙ ⊡

– Prof P Lenard Heidelberg Radiologisches Institut d. Univ VI 2 ⊙ ⊡ X ·· NW

" ~~A Joffe St Petersburg Laboratorium d. Polytechnikums~~ I V 2

– Dr Adolph G Smekel, Vienna Technische Hochschule. Vienna austria ·· NW

" ~~The Svedberg Uppsala Sweden Chemisches Universitätslaboratorium~~ I V ⊙ ⊡ · X =

" S Arrhenius Stockholm Nobel Institut

– Dr Karl Herrmann Charlottenburg Phys Inst d Techn Hochsch I 2 ⊙ ⊡ X = ·· NW

~~Prof H Kamerlingh Onnes~~ ~~Leiden~~ Univ of Leiden ~~Leiden Holland~~ I ☐

– " C A Crommelin I 2 ⊙ ⊡ · X ≡

– " Carl Runge Göttingen Universität " " I 2 ⊙ ⊡ X

– " K Fajans München Chem. Lab. d Bay. Akad d Wiss I 2 ⊙ ⊡ ·· NW

– " Martin Knudsen Kobenhavens Universitet Danemark I 2 ⊙ ⊡ · X = · NW

X " A Einstein I Berlin Germany ~~Universität~~ VI 2 ⊙ ⊡ · X = ·· NW

– " J Stark ~~Aachen~~ Würzburg Germany ~~Universität~~

– " M Laue ~~München~~ ~~Zürich, Plattenstr 15~~ I V 2 ⊙ ⊡ · X · NW Berlin Universität

X " W C Röntgen " VI ⊙ ⊡ X · NW

– " W Wien München Univ VI ⊙ ⊡ X · NW

– " Dr W Ostwald Grossbothen – Leipzig V I 2 ⊙ ⊡ · X · NW

– " ~~Dr~~ Erich Schmid II Lehrkanzel d Technische Hochschule Wien Austria

" K Schwarzschild K. Obs. Potsdam – – 21 ⊙ ⊡ X

– " S Valentiner K. Bergakademie zu Clausthal i. H ⊙ ⊡

– " H Kayser Bonn University Bonn Germany VI ⊙ ⊡ X · NW

Dr F Lindemann ~~Sidmouth~~ Oxford Physical Chemical England VI ⊡ X = · NW

~~R A Sommerfeld München Univ Institut~~

W
A