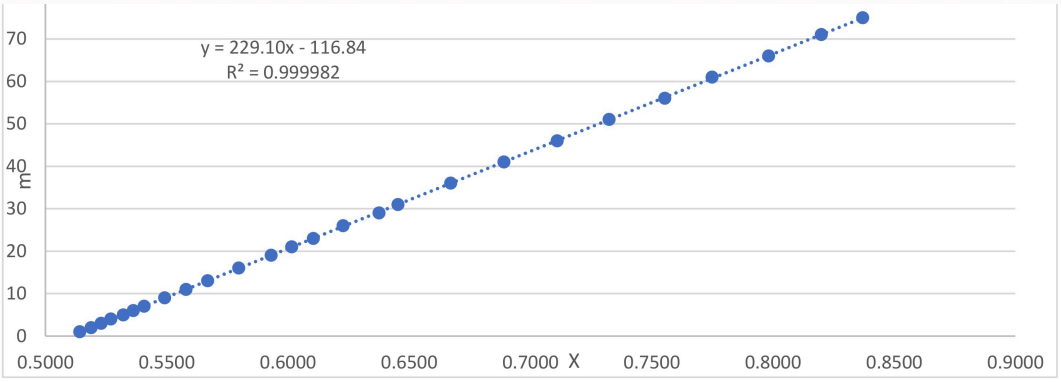
A.1

번호	m	θ_m (도)	$\sqrt{n^2-\sin^2\theta_m}-\cos\theta_m$
1	1	9.00	0.5142
2	2	13.00	0.5188
3	3	15.75	0.5229
4	4	18.00	0.5270
5	5	20.50	0.5322
6	6	22.25	0.5362
7	7	24.00	0.5406
8	9	27.00	0.5491
9	11	29.75	0.5579
10	13	32.25	0.5668
11	16	35.50	0.5798
12	19	38.50	0.5931
13	21	40.25	0.6015
14	23	42.00	0.6105
15	26	44.25	0.6228
16	29	46.75	0.6375
17	31	48.00	0.6453
18	36	51.25	0.6671
19	41	54.25	0.6891
20	46	57.00	0.7110
21	51	59.50	0.7325
22	56	62.00	0.7555
23	61	64.00	0.7750
24	66	66.25	0.7982
25	71	68.25	0.8200
26	75	69.75	0.8371

A.2



A.3

$B = 229.1$

$A = -116.8$

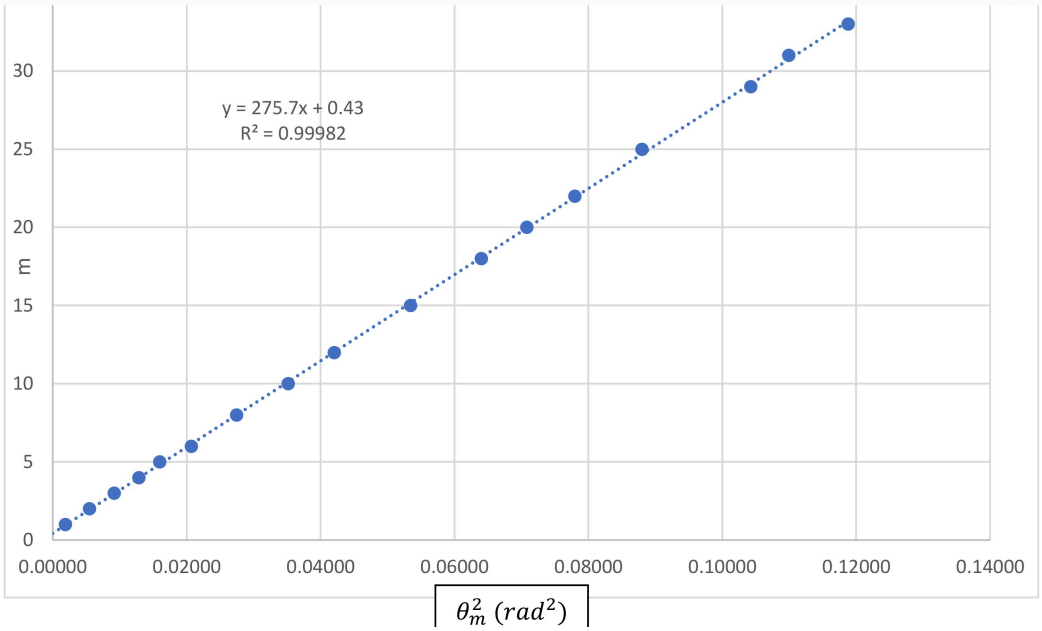
A.4

$h = (148.9 \pm 0.1)\ \mu\mathrm{m}$

B.1

번호	m	θ_m (도)	$\theta_m^2\ (\mathrm{rad}^2)$
1	1	2.50	0.00190
2	2	4.25	0.00550
3	3	5.50	0.00921
4	4	6.50	0.01287
5	5	7.25	0.01601
6	6	8.25	0.02073
7	8	9.50	0.02749

B.3



B.4

$B = 275.7$

$A = 0.43$

B.5

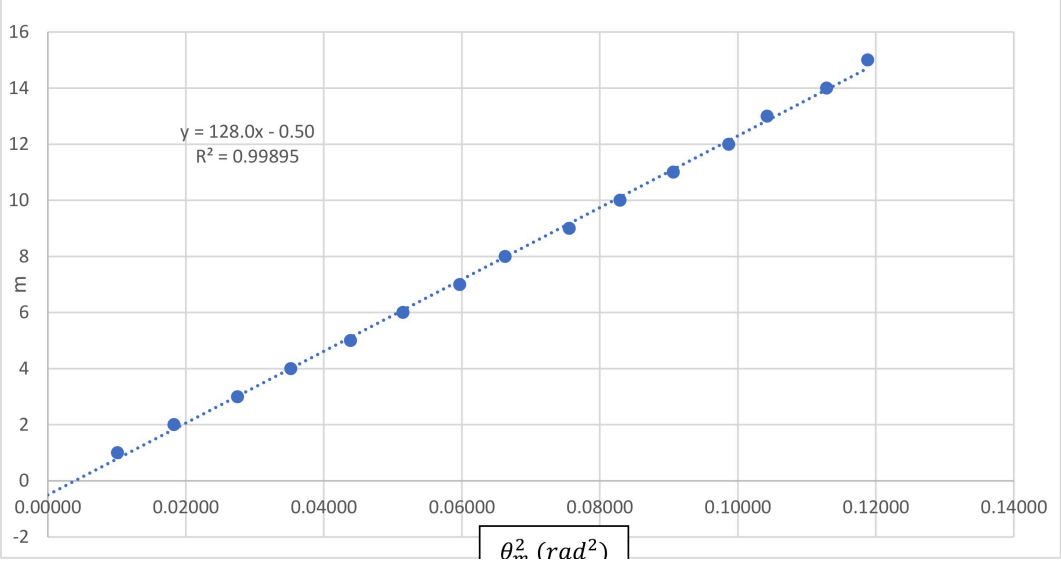
$H = (1.061 \pm 0.004)\ \text{mm}$

C.1

번호	m	θ_m (도)	$\theta_m^2\ (\text{rad}^2)$
1	1	5.75	0.01007
2	2	7.75	0.01830
3	3	9.50	0.02749
4	4	10.75	0.03520
5	5	12.00	0.04386
6	6	13.00	0.05148
7	7	14.00	0.05971
8	8	14.75	0.06627
9	9	15.75	0.07556
10	10	16.50	0.08293
11	11	17.25	0.09064
12	12	18.00	0.09870
13	13	18.50	0.10426
14	14	19.25	0.11288
15	15	19.75	0.11882

$$m = \frac{H}{2\lambda}\left(N - \frac{N^2}{n}\right)\theta_m^2$$

C.3



C.4

$B = 128.0$

$A = -0.50$

C.5

$N = 1.332 \pm 0.002$

D.1 D.3

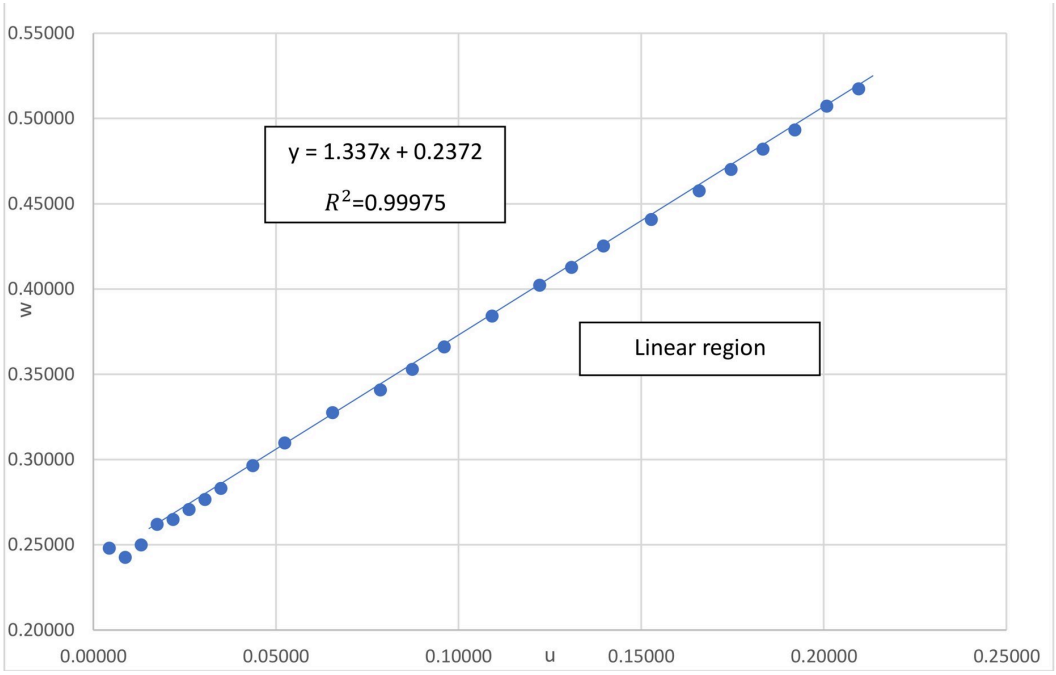
번호	m	θ_m (도)	u	w
1	1	13.25	0.00436	0.24795
2	2	19.00	0.00873	0.24265
3	3	23.00	0.01309	0.24981
4	4	26.00	0.01746	0.26200
5	5	29.00	0.02182	0.26474
6	6	31.50	0.02619	0.27069
7	7	33.75	0.03055	0.27653
8	8	35.75	0.03492	0.28307
9	10	39.25	0.04365	0.29637
10	12	42.25	0.05238	0.30973
11	15	46.25	0.06547	0.32743
12	18	50.00	0.07857	0.34076

14	22	53.75	0.09603	0.36608
15	25	56.25	0.10912	0.38415
16	28	58.50	0.12222	0.40213
17	30	60.00	0.13095	0.41261
18	32	61.25	0.13968	0.42517
19	35	63.25	0.15277	0.44072
20	38	65.00	0.16587	0.45761
21	40	66.00	0.17460	0.47008
22	42	67.00	0.18333	0.48193
23	44	68.00	0.19205	0.49320
24	46	68.75	0.20078	0.50715
25	48	69.75	0.20951	0.51739

D.2

$$u = \frac{m\lambda}{h} \qquad w = \frac{\frac{m\lambda}{h}\left(n + \frac{m\lambda}{2h}\right)}{1 - \cos\theta_m}$$

D.4



(앞의 세 점을 제외하여)

D.5

$B = 1.337$

$A = 0.2372$

$$N_B = 1.337 \pm 0.005$$
$$N_A = 1.3319 \pm 0.0005$$

이론적 계산:

B.2 및 C.2:

$$m = \frac{H}{\lambda}\left(\sqrt{n^2 - N^2\sin^2\theta_m} - N\cos\theta_m\right) - \frac{H}{\lambda}(n-N)$$

$$\theta_m \ll 1: \qquad \sin\theta_m \approx \theta_m\ ; \qquad \cos\theta_m \approx 1 - \frac{\theta_m^2}{2}$$

$$m = \frac{H}{\lambda}\left(n\sqrt{1 - \frac{N^2\theta_m^2}{n^2}} - N\left(1 - \frac{\theta_m^2}{2}\right)\right) - \frac{H}{\lambda}(n-N)$$

$$m = \frac{H}{\lambda}\left(n\left(1 - \frac{N^2\theta_m^2}{2n^2}\right) - N\left(1 - \frac{\theta_m^2}{2}\right)\right) - \frac{H}{\lambda}(n-N)$$

$$m = \frac{H}{2\lambda}N\left(1 - \frac{N}{n}\right)\theta_m^2$$

$$N = 1: \quad m = \frac{H}{2\lambda}\left(1 - \frac{1}{n}\right)\theta_m^2$$

D.2:

$$m = \frac{h}{\lambda}\left(\sqrt{n^2 - N^2\sin^2\theta_m} - N\cos\theta_m\right) - \frac{h}{\lambda}(n-N)$$

$$\frac{m\lambda}{h} + n - N(1-\cos\theta_m) = \sqrt{n^2 - N^2\sin^2\theta_m}$$

$$\left(\frac{m\lambda}{h}\right)^2 + 2n\left(\frac{m\lambda}{h}\right) + n^2 + N^2(1-\cos\theta_m)^2 - 2N(1-\cos\theta_m)\left(\frac{m\lambda}{h} + n\right) = n^2 - N^2\sin^2\theta_m$$

오차 계산:

직선의 기울기와 절편의 불확도:

$$\Delta B = B\sqrt{\frac{1}{n-2}\left(\frac{1}{r^2} - 1\right)} \qquad ; \qquad \Delta A = \Delta B\sqrt{\overline{x}^2 + \sigma_x^2}$$

C.5:

$$B = \frac{H}{2\lambda}\left(N - \frac{N^2}{n}\right) \Rightarrow \left(N - \frac{N^2}{n}\right) = \frac{2\lambda}{H}B \equiv c$$

$$\Rightarrow \frac{\Delta c}{c} = \sqrt{\left(\frac{\Delta B}{B}\right)^2 + \left(\frac{\Delta H}{H}\right)^2}$$

$$\left(N - \frac{n}{2}\right)^2 = c \Rightarrow N = \frac{n}{2} \pm \sqrt{\left(\frac{n}{2}\right)^2 - cn}$$

이 식에서 음의 부호는 받아들일 수 없다.

$$N = \frac{n}{2} + \sqrt{\left(\frac{n}{2}\right)^2 - cn} \Rightarrow \Delta N = \frac{n}{2\sqrt{\left(\frac{n}{2}\right)^2 - cn}}\Delta c$$

D.6:

$$N_A(n - N_A) = A \Rightarrow N_A = \frac{n}{2} \pm \sqrt{\left(\frac{n}{2}\right)^2 - A}$$

이 식에서 음의 부호는 받아들일 수 없다.

$$N_A = \frac{n}{2} + \sqrt{\left(\frac{n}{2}\right)^2 - A} \Rightarrow \Delta N_A = \frac{\Delta A}{2\sqrt{\left(\frac{n}{2}\right)^2 - A}}$$

물론 이는 u 와 w 의 오차를 무시하고 계산한 것이다. u 와 w 에 h 값이 들어 있으므로, h 의 오차가 이 양에 오차를 일으키지만 여기에는 포함되어 있지 않다.