

Order (m)	Color	Reading (θ)		Average θ	$\sin(\theta)$	λ (nm)
		Left	Right			
1	Violet 1	14° 15'	194° 12'	14° 13' 30"	$(2.4573 \pm 0.0020) \times 10^{-1}$	416.10 \pm 0.34
1	Violet 2	14° 20'	194° 18'	14° 19'	$(2.4728 \pm 0.0020) \times 10^{-1}$	418.73 \pm 0.34
1	Blue	15° 20'	195° 15'	15° 17' 30"	$(2.6373 \pm 0.0020) \times 10^{-1}$	446.59 \pm 0.34
1	Cyan 1	17° 16'	197° 14'	17° 15'	$(2.9654 \pm 0.0020) \times 10^{-1}$	502.14 \pm 0.33
1	Cyan 2	17° 29'	197° 29'	17° 29'	$(3.0043 \pm 0.0020) \times 10^{-1}$	508.73 \pm 0.33
1	Green	19° 19'	199° 15'	19° 17'	$(3.3024 \pm 0.0019) \times 10^{-1}$	559.21 \pm 0.33
1	Greenish Yellow	20° 0'	200° 0'	20° 0'	$(3.4202 \pm 0.0019) \times 10^{-1}$	579.15 \pm 0.33
1	Yellow 1	20° 20'	200° 20'	20° 20'	$(3.4748 \pm 0.0019) \times 10^{-1}$	588.40 \pm 0.33
1	Yellow 2	20° 30'	200° 29'	20° 29' 30"	$(3.5007 \pm 0.0019) \times 10^{-1}$	592.79 \pm 0.33
1	Orange	21° 0'	201° 0'	21° 0'	$(3.5837 \pm 0.0019) \times 10^{-1}$	606.84 \pm 0.33
1	Red 1	21° 35'	201° 35'	21° 35'	$(3.6785 \pm 0.0019) \times 10^{-1}$	622.90 \pm 0.32
1	Red 2	21° 51'	201° 50'	21° 50' 30"	$(3.7204 \pm 0.0019) \times 10^{-1}$	629.99 \pm 0.32
1	Red 3	22° 0'	201° 57'	21° 58' 30"	$(3.7420 \pm 0.0019) \times 10^{-1}$	633.65 \pm 0.32
2	Violet 1	29° 12'	209° 10'	29° 11'	$(4.8761 \pm 0.0018) \times 10^{-1}$	412.84 \pm 0.15
2	Violet 2	31° 45'	211° 45'	31° 45'	$(5.1877 \pm 0.0018) \times 10^{-1}$	439.23 \pm 0.15
2	Green	41° 7'	221° 5'	41° 6'	$(6.5738 \pm 0.0015) \times 10^{-1}$	556.58 \pm 0.13
2	Yellow 1	44° 0'	224° 0'	44° 0'	$(6.9466 \pm 0.0015) \times 10^{-1}$	588.14 \pm 0.13
2	Yellow 2	44° 12'	224° 10'	44° 11'	$(6.9696 \pm 0.0015) \times 10^{-1}$	590.09 \pm 0.12
2	Red 1	47° 40'	227° 40'	47° 40'	$(7.3924 \pm 0.0014) \times 10^{-1}$	625.89 \pm 0.12
2	Red 2	48° 0'	228° 0'	48° 0'	$(7.4314 \pm 0.0014) \times 10^{-1}$	629.20 \pm 0.12
3	Violet	51° 48'	231° 48'	51° 48'	$(7.8586 \pm 0.0013) \times 10^{-1}$	443.57 \pm 0.07

Order (m)	Color	Reading (θ)		Average θ	$\sin(\theta)$	λ (nm) [Theoretical]	Grating Constant [Lines per Inch]
		Left	Right				
1	Green	19° 19'	199° 15'	19° 17'	$(3.3024 \pm 0.0019) \times 10^{-1}$	546.1	15360.0 \pm 9.0
1	Yellow 1	20° 20'	200° 20'	20° 20'	$(3.4748 \pm 0.0019) \times 10^{-1}$	577.0	15296.4 \pm 8.5
1	Yellow 2	20° 30'	200° 29'	20° 29' 30"	$(3.5007 \pm 0.0019) \times 10^{-1}$	579.1	15354.5 \pm 8.5
2	Green	41° 7'	221° 5'	41° 6'	$(6.5738 \pm 0.0015) \times 10^{-1}$	546.1	15287.8 \pm 3.6
2	Yellow 1	44° 0'	224° 0'	44° 0'	$(6.9466 \pm 0.0015) \times 10^{-1}$	577.0	15289.7 \pm 3.3
2	Yellow 2	44° 12'	224° 10'	44° 11'	$(6.9696 \pm 0.0015) \times 10^{-1}$	579.1	15284.7 \pm 3.2

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import numpy as np
from uncertainties import ufloat
from uncertainties import unumpy as unp
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```
f = np.loadtxt("Data.csv", delimiter = ",", skiprows = 1, usecols = (0, 2, 3, 4, 5))
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```
m = f[:,0] # Order
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# Left Reading
dl = f[:,1]      # Degree Left
ml = unp.uarray(f[:,2], 1) # Minute Left

DL = [dl[i] + (ml[i]/60) for i in range(len(dl))]

# Right Reading
dr = f[:,3]      # Degree Right
mr = unp.uarray(f[:,4], 1) # Minute Right

DR = [dr[i] + (mr[i]/60) for i in range(len(dr))]

# Average Theta
D = [(DL[i] + DR[i] - 180)/2 for i in range(len(DL))]

theta = [(D[i] * np.pi)/180 for i in range(len(D))]

sin_theta = unp.sin(theta)

d = 1 / ((15000/2.54) * 100) #

wavelength = [(d * sin_theta[i] * 1e9) / m[i] for i in range(len(m))] # nm

obj = wavelength
for i in range(len(obj)):
    print("{:.2uP}".format(obj[i]))

# -----
# Calculating d

yellow_1 = 577.0
yellow_2 = 579.1
green = 546.1

yellow_1_index = 7
yellow_2_index = 8
yellow_1_index_2 = 16
yellow_2_index_2 = 17
green_index = 5
green_index_2 = 15

indices = [yellow_1_index, yellow_2_index, yellow_1_index_2, yellow_2_index_2,
green_index, green_index_2]
wavelengths = [yellow_1, yellow_2, yellow_1, yellow_2, green, green]

d = [m[indices[i]] * wavelengths[i] / sin_theta[indices[i]] for i in
range(len(indices))]

gc = [(1e7/d[i]) * 2.54 for i in range(len(d))]

for i in range(len(gc)):
    print("{:.2uP}".format(gc[i]))

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