Name:

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Polarization of Light

1. With the polarizers positioned such that the light meter is reading near maximum intensity, yet is not saturated, record the angle of the rotating polarizer B as the zero angle reference point.

   Zero Angle Reference = 70 ± 0.1

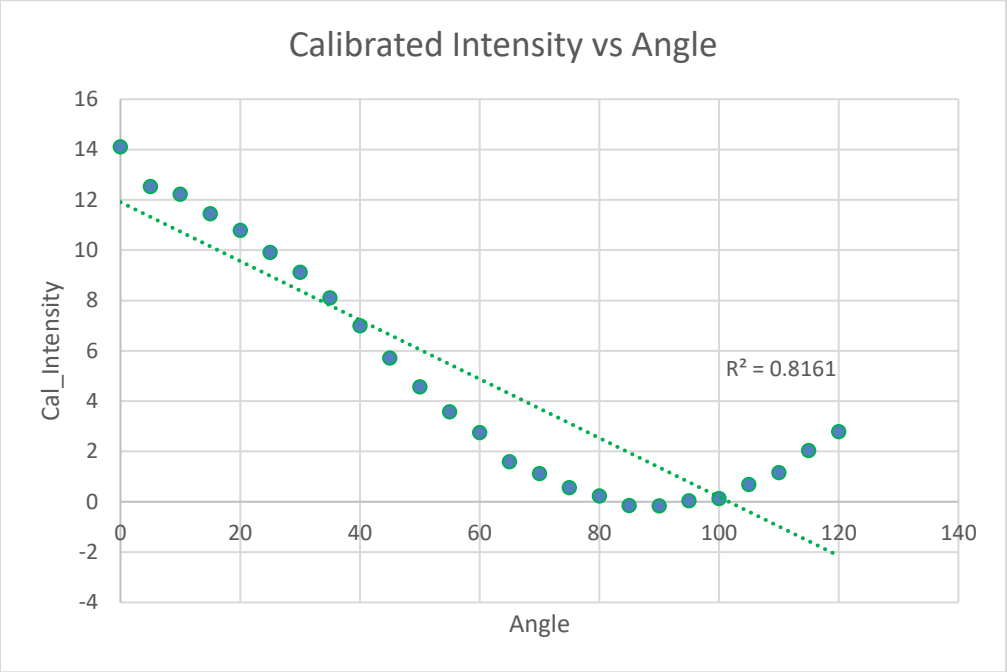
2. After continuously collecting data while adjusting the angle of the rotating polarizer B find the absolute minimum intensity. If plotting in Capstone, this would appear as the bottom of a parabola or sinusoid. Alternatively, it would be the minimum value in the datatable in Capstone. Record this minimum intensity as the background intensity reference point.

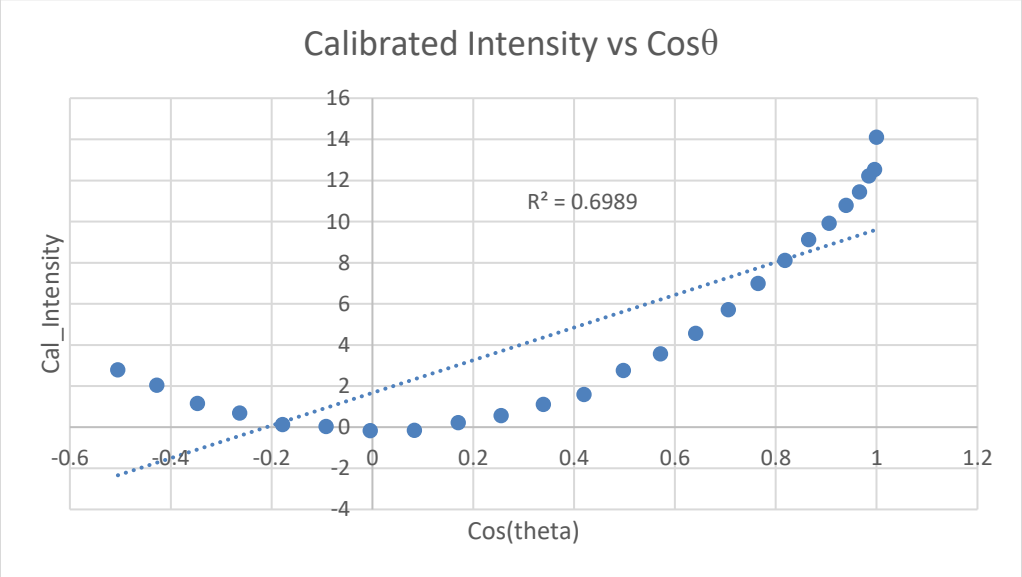
   Background Intensity Reference = 30.67 ± 0.01

3. Complete the following table for all data points collected. The first two columns should be the values collected straight from the equipment (no corrections). The remaining columns should include the corrections for the zero angle offset and the background intensity subtraction.

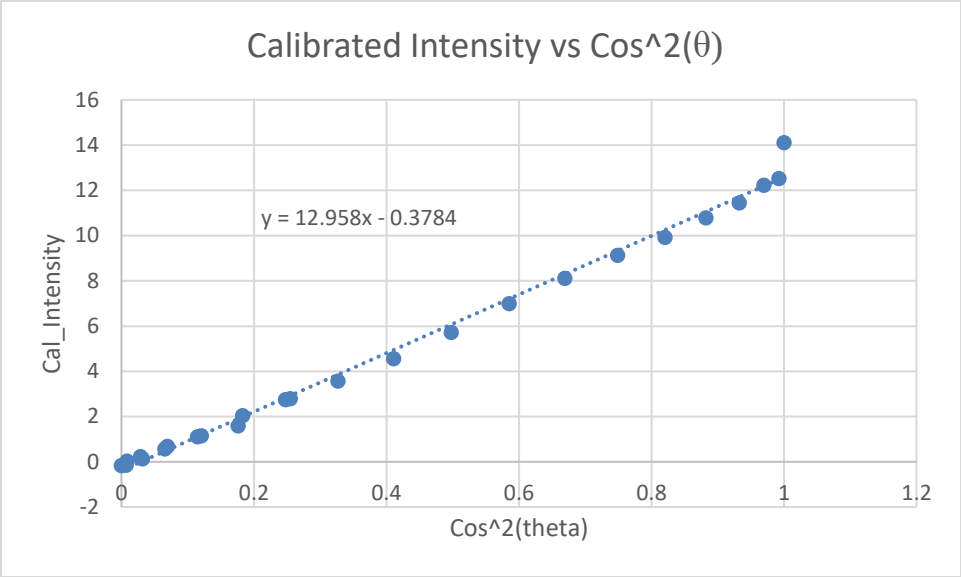
Instrument Angle [deg]	Instrument Intensity [ ]	Angle [deg]	Calibrated Intensity [ ]	$\cos\theta$ [radians]	$\cos^2\theta$ [radians]
70	44.78	0	14.11	1	1
65	43.20	5	12.53	0.996174317	0.992363269
60	42.90	10	12.23	0.984726539	0.969686356
55	42.12	15	11.45	0.965744257	0.932661971
50	41.46	20	10.79	0.939372713	0.882421094
45	40.59	25	9.92	0.905813683	0.820498429
40	39.80	30	9.13	0.865323942	0.748785524
35	38.78	35	8.11	0.818213289	0.669472987
30	37.67	40	7	0.764842187	0.584983571
25	36.39	45	5.72	0.705618997	0.49789817
20	35.24	50	4.57	0.640996858	0.410876972
15	34.25	55	3.58	0.571470217	0.326578209
10	33.43	60	2.76	0.497571048	0.247576948
5	32.27	65	1.6	0.41986478	0.176286434
0	31.79	70	1.12	0.338945974	0.114884373
5	31.24	75	0.57	0.255433767	0.065246409
10	30.90	80	0.23	0.169967143	0.02888883
15	30.53	85	-0.14	0.083200038	0.006922246
20	30.51	90	-0.16	-0.004203661	1.76708E-05
25	30.71	95	0.04	-0.091575196	0.008386017
30	30.81	100	0.14	-0.178246056	0.031771656
35	31.36	105	0.69	-0.263553089	0.069460231
40	31.83	110	1.16	-0.346843582	0.12030047
45	32.71	115	2.04	-0.427480247	0.182739362
50	33.46	120	2.79	-0.504846105	0.254869589

4. **Produce two plots and include here**: Calibrated Intensity vs Angle, and Calibrated Intensity vs $\cos\theta$. Remember and follow the guidelines for producing good plots. Although we would not expect either plot to be linear from our background physics, include in each plot a linear 'fit' with the equation and R^2 value displayed. Consider making the fit line dashed to indicate it is only preliminary.





5. **Produce one final plot and include here**: Calibrated Intensity vs $\cos^2\theta$. Follow the guidelines for producing good plots. Include in the plot a linear fit with the equation and R^2 value displayed.



6. Of the three different mathematical models fit in the three plots, which one comes closest to truly representing the behavior of unpolarized light after it is transmitted through two linearly polarizing sheets? Note: An R^2 value of 1 would be a perfect linear fit to data.

   The First plot shows the closet representation of unpoloarized light as it travels through two linearly polarzing filters

7. Is your result from (6) what you would expect from the background physics?

   Yes it is what is expected because as the light travels through filters the amount of light on the other side changes as a result and then if another is added the light is percentage based so I different amount will make it through

8. From what you've learned, what would the intensity be if you transmitted unpolarized light through only a single linearly polarizing sheet? Consider the initial intensity is I_o.

   The intensity would be 50% of the initial intensity because only half of the light will be able to pass through the filter

9. If you have transmitted light through two ideal linearly polarizing sheets when their polarization axes are crossed (rotated 90° to each other) what is the final transmitted intensity?

   The final intensity after passing through the two filters would be 0 because the light that made it through the first filter will get blocked by the second filter thereby not allowing any light to pass through the two filters

10. Starting with the situation outlined in (9), you add a 3rd linear polarizer between the other two with its polarization axis at 45° to the first while leaving the other two unchanged. Now what is the final transmitted intensity? Consider the initial intensity is I_o.

    The final intensity is about 20% of the initial intensity because 50% is blocked by the first one and then a smaller is blocked by the second and then finally a small amount can make it through the last one