**Experiment 1:**

Excel Practice

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**Purpose**: The goal of this experiment is review basic functions in Excel such as graphing, functions/formulas. The simulated experiment is to show the relationship between angle and intensity of light.

**Data**:

|  |  |  |
| --- | --- | --- |
| r | I | (i) |
| cm | lux | lux |
| 7.32 | 249.76 | 0.06 |
| 10.20 | 134.63 | 0.09 |
| 20.12 | 34.1 | 0.17 |
|  |  |  |
| 59.45 | 3.87 | 0.51 |
| 70.00 | 2.85 | 0.59 |
| 80.33 | 2.19 | 0.68 |
| 89.98 | 1.73 | 0.76 |
|  |  |  |
|  |  |  |
| 28.95 | 8.64 | 0.34 |

Table 1: data collection of distance, intensity

|  |  |  |  |
| --- | --- | --- | --- |
| theta | I-theta | theta | cos(theta)2 |
| degrees | lux | rads |  |
| 0.00 | 24.45 | 0.00 | 1.00 |
| 10.00 | 23.71 | 0.17 | 0.97 |
| 20.00 | 21.59 | 0.35 | 0.88 |
| 30.00 | 18.34 | 0.52 | 0.75 |
| 40.00 | 14.35 | 0.70 | 0.59 |
| 50.00 | 10.10 | 0.87 | 0.41 |
| 60.00 | 6.11 | 1.05 | 0.25 |
| 70.00 | 2.86 | 1.22 | 0.12 |
| 80.00 | 0.74 | 1.40 | 0.03 |
| 90.00 | 0.00 | 1.57 | 0.00 |

Table 2: measurement of angel and intensity, calculated radians

|  |  |  |
| --- | --- | --- |
| I-theta | cos(theta)2 | **N** |
| lux |  | 10 |
| 24.45 | 1.00 | **slope** |
| 23.71 | 0.97 | **(units)** |
| 21.59 | 0.88 | 0.040901 |
| 18.34 | 0.75 | **intercept** |
| 14.35 | 0.59 | **(units)** |
| 10.10 | 0.41 | -1.3E-05 |
| 6.11 | 0.25 | **R2** |
| 2.86 | 0.12 | 1 |
| 0.74 | 0.03 | **Sy** |
| 0.00 | 0.00 | **(units)** |
|  |  | 8.71E-05 |
|  |  | **Sslope** |
|  |  | **(units)** |
|  |  | 3.04E-06 |
|  |  | **Sintercept** |
|  |  | **(units)** |
|  |  | 4.62E-05 |

Table 3: I-theta vs cos(theta)2 with 2d stats

**Calculations**:

Iθ = I0cos2 θ

**Discussion**:

The results of the experiment are quite conclusive. The results are intuitive and align with observations in daily life. The sources of error would be limited to the precision of the measurement tools as well is interference if the experiment was not done in darkness. However, because the data was extremely predictable is was not a worthwhile variable to compensate for. Since the R2 values were never below .98 (aside from a single obviously intentional bad datapoint) the errors in the data were insignificant.

**Conclusion & results** :

With a percent difference of only .5% the results of the experiment are reliable. The experimental results line up with the expected values. Most values were predictable and are well within expected boundaries. Any error was overall negligible for this reason.

**Questions**:

1.) If the photometer was not properly calibrated, then there would be systematic error introduced.

2.)

3.)

4.) The percent error was greater because the measurement was taken incorrectly. It does not fall in line with the trendline and is significant far from the expected value.

5.) Iθ = I0cos2 θ

6.) The value calculated falls in line with the experimental data, this validates the equation.

7.) There is one point that falls quite out of line in figure 7 but the trendlines for both have very acceptable R2values. This suggests there aren’t other major measurement errors.

8.)

|  |  |
| --- | --- |
| cm | **N** |
| 20.12 | 5 |
| 20.15 | **`x** |
| 20.18 | **cm** |
| 20.08 | 20.126 |
| 20.1 | **Sx** |
|  | **cm** |
|  | 0.039749 |
|  | **S`x** |
|  | **cm** |
|  | 0.017776 |