**Sample Analysis O-4**

The Excel worksheet on the opposite page is for Experiment O-4, but illustrates the pattern you should follow in all labs. Details are described in the list below. **The data in this sample is not real,** so don't worry if it differs from yours! The sample spreadsheet is based on the following data:

| | |
|---|---|
| Single slit width | a = (.077 ± .002) mm |
| 2-slit separation | d = (.236 ± .002) mm |
| Slit to wall distance | L = (1.253 ± .002) m |
| min to min distance | $2*Y_m$ = (value in worksheet ± .1) cm |

**Note:** The notation A4:E9 means all worksheet cells in columns A to E, rows 4 to 9.

| Cell(s) | Description |
|---|---|
| Row 1 | Type in descriptive headings where appropriate. |
| Row 2 | Use short column headings to keep columns narrow and save paper. Include units. |
| Row 3 | Uncertainty: Use a separate row, rather than adding width to the headings, to save paper. |
| A4:D9 | Enter your "best" values for lab measurements, each trial in a separate row. |
| E4:E9 | Calculated wavelengths. After the data is entered, click on Cell E4 and enter the Excel formula, **=1000*C4*B4/(2*A4*D4)**. When the calculated result appears, use the "fill handle" to drag cell E4 down thru cell E9. |
| F6:F42 | Type in descriptive comments where appropriate. |
| B10:B11 | Type in descriptive labels where appropriate. |
| E10 | Excel formula: **=AVERAGE(E4:E9)**. |
| E11 | Excel formula: **=(E8 - E6)/2**. Note: Always make uncertainties positive! Since there are fewer than ten trials, the standard deviation technique isn't used. |
| A12:F16 | Partial uncertainty analysis for m = 1 trial (Row 4). First, [Copy] cells A4:E4 and [Paste] in cells A12:E12. Use the fill handle to drag row 12 down through row 16, giving you five identical rows. Then do the following: |
| C13 | Replace contents with minimum slit width, **a**. Cell E13 will change automatically. |
| C14 | Replace contents with maximum **a**. Cell E14 will change automatically. |
| D15 | Replace contents with min **L**. Cell E15 will change automatically. |
| D16 | Replace contents with max **L**. Cell E16 will change automatically. |
| B17:B19 | Type in descriptive labels where appropriate. |
| E17 | Excel formula: **=(E14 - E13)/2**. Note: Uncertainties are always positive! |
| E18 | Excel formula: **=(E15 - E16)/2**. Note: Always make uncertainties positive! |
| E19 | Excel formula: **=E11 + E17 + E18**. |
| A20 | Type in the final result, using the average in cell E10 and the uncertainty in E19, retaining only significant figures and including appropriate units. |
| A22:G46 | The pattern here is the same as that described above except: |
| E37 | Excel formula: **=STDEVP(E25:E35)/SQRT(11)** which gives the partial unc wrt 2*Ym |

## Sample Analysis O-4

| | | | | | | |
|---|---|---|---|---|---|---|
| Single Slit "A" | | | | | | |
| m | 2*Ym (mm) | a (mm) | L (m) | Lambda (nm) | | |
| | (+/- 1) | (+/- .002) | (+/- .002) | | | |
| 1 | 21 | 0.077 | 1.253 | 645.3 | | |
| 2 | 41 | 0.077 | 1.253 | 629.9 | | |
| 3 | 61 | 0.077 | 1.253 | 624.8 | min | |
| 4 | 83 | 0.077 | 1.253 | 637.6 | | |
| 5 | 106 | 0.077 | 1.253 | 651.4 | max | |
| 6 | 126 | 0.077 | 1.253 | 645.3 | | |
| | Average Wavelength = | | | 639.0 | | |
| | Partial Uncertainty wrt 2*Ym = | | | 13.3 | | |
| 1 | 21 | 0.077 | 1.253 | 645.3 | best everything | |
| 1 | 21 | 0.075 | 1.253 | 628.5 | min a | |
| 1 | 21 | 0.079 | 1.253 | 662.0 | max a | |
| 1 | 21 | 0.077 | 1.251 | 646.3 | min L | |
| 1 | 21 | 0.077 | 1.255 | 644.2 | max L | |
| | Partial uncertainty wrt a = | | | 16.8 | | |
| | Partial uncertainty wrt L = | | | 1.0 | | |
| | Total Uncertainty = | | | 31.1 | | |
| Final Result: Lambda = (640 +/- 30) nm | | | | | | |
| Double Slit "C" | | | | | | |
| m | 2*Ym (mm) | d (mm) | L (m) | Lambda (nm) | | |
| | (+/- 1) | (+/- .002) | (+/- .002) | | | |
| 30 | 205 | 0.236 | 1.253 | 633.0 | | |
| 28 | 191 | 0.236 | 1.253 | 631.1 | | |
| 26 | 178 | 0.236 | 1.253 | 632.6 | | |
| 24 | 164 | 0.236 | 1.253 | 630.4 | | |
| 22 | 151 | 0.236 | 1.253 | 632.0 | | |
| 20 | 137 | 0.236 | 1.253 | 629.4 | | |
| 18 | 124 | 0.236 | 1.253 | 631.2 | | |
| 16 | 110 | 0.236 | 1.253 | 627.8 | | |
| 14 | 97 | 0.236 | 1.253 | 630.0 | | |
| 12 | 84 | 0.236 | 1.253 | 632.8 | | |
| 10 | 70 | 0.236 | 1.253 | 627.8 | | |
| | Average Lambda = | | | 630.7 | | |
| | Partial uncertainty wrt 2*Ym = | | | 0.5 | | |
| 30 | 205 | 0.236 | 1.253 | 633.0 | best everything | |
| 30 | 205 | 0.234 | 1.253 | 627.6 | min d | |
| 30 | 205 | 0.238 | 1.253 | 638.3 | max d | |
| 30 | 205 | 0.236 | 1.251 | 634.0 | min L | |
| 30 | 205 | 0.236 | 1.255 | 632.0 | max L | |
| | Partial uncertainty wrt d = | | | 5.4 | | |
| | Partial uncertainty wrt L = | | | 1.0 | | |
| | Total uncertainty = | | | 6.9 | | |
| Final result for Lambda = (630 +/- 10) nm | | | | | | |