Objective Statement: Describe the purpose of the lab in a few sentences, and state any hypothesis formed ahead of doing the experiment.

1. Measure the x and y position of the ball for 10 different points. Hint: in order to do so, you will have to establish the origin. I recommend using the x = 0 for the initial point, and y = 0 for the final point. Leave your measurements in units of grids, and do not make any conversions. Also, calculate *vy* and fill the table on the right. Hint: each point is 1 flash.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **t (flashes)** | **x (grids)** | **y (grids)** |  | **t (flashes)** | ***vy* (grids/flash)** |
| 0 |  |  |  |  |  |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |

1. What are your uncertainty estimates for *δx* and *δy* (include explanations):
2. Use the error propagation technique to derive the expression for *δvy*, and calculate its value (show work):
3. On a full-size of graph paper, make a graph of *x vs. t* (*x* on the vertical axis, *t* on the horizontal axis). Please do this step by hand! Include error bars for *x* (*± δx*), but assume that *t* is measured exactly.
4. Do the points seem to describe a straight line? If so, draw the line of best-fit (see pg. 27-28 of manual). Calculate the slope of this line. Show your work! What does this slope represent?

Best fit line:

1. On a separate full-size of graph paper, make a graph (by hand) of *vy vs. t* (*vy* on the vertical axis, *t* on the horizontal axis). Please do this step by hand! Include error bars for *vy* (*± δvy*), but assume that *t* is measured exactly.
2. On your graph, graph the best-fit line, as well as steepest/shallowest fit lines (see pg. 27-28 of manual).
3. List the corresponding equations for each fit line.

Best fit line:

Steepest fit line:

Shallowest fit line:

1. Describe how to calculate *v0y* ± *δv0y* and *ay* ± *δay*, and then actually calculate these values. Show all calculations for uncertainties.
2. Convert *ay* and *δay* to cm/sec2 and apply the parallax correction. Show all work! See Parallax file on Canvas for values of d and D.
3. Calculate % error between your value of ay and the expected value.
4. List all possible reasons for this error, and classify them as random or systematic. Remember, there is no such thing as “human error”! See pg.15-16 of manual.

Conclusion: Summarize your findings (***including relevant numbers******and their uncertainties***) and compare them to your objective statement/hypothesis.