

Name _____

Partner _____

Partner _____

period: ____

lab# ____

date: ____/____/____

d lux

I. Introduction

The further you get from a light bulb, the dimmer the light appears.

The further you get from a planet, the weaker the gravitational force.

Based on the above 2 statements, what is one thing that light and gravity have in common?

In this lab, you will study how light gets weaker with distance d in order to understand gravity.

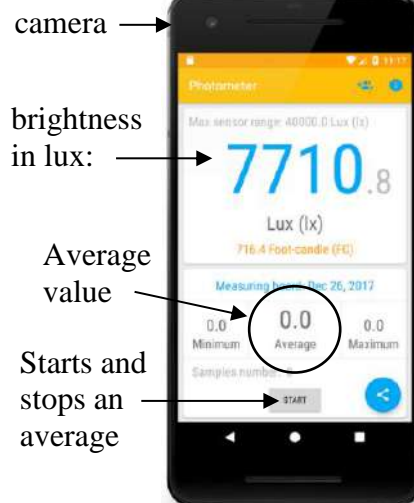
II. Procedure

1. Take out a phone. Download the **Photometer** app from *IT Factory*. The icon looks like:



Install and open it.

2. The app turns your phone into a photometer.
- A photometer measures the brightness of a light.
 - The units of brightness are *lux*.
 - The more the lux, the brighter the light.
 - At right the photometer shows a brightness of 7710.8 lux.



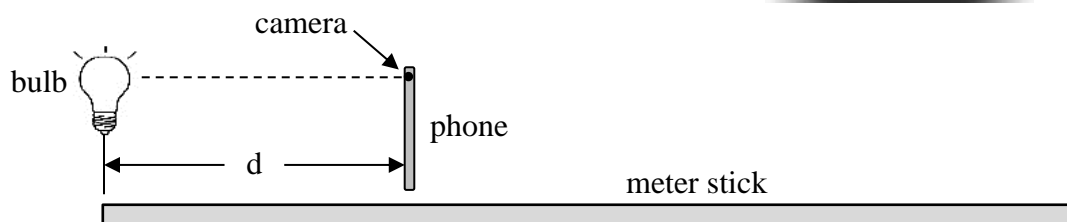
3. Here are the roles of each partner:

Partner 1: Hold the meter stick with end even with middle of bulb.

Partner 2: Hold the phone at the correct distance and read the lux.

Partner 3: Record the same data on all labs.

4. Look at the diagram:



Important!

- A) Hold the phone so that the camera is directly facing the bulb.
- B) Hold it the same way at each distance.
- C) Hold it steady. The lux values should be steady. If needed, press **START** at the bottom to take an average for a few seconds. Then press **STOP** to get your average.

5. Measure the brightness of a light at $d = 20$ cm.
Repeat at 40, 60, 80 and 100 cm. Record data in table.
Use the average button if necessary.

6. Turn off your phone and put it away.

7. Sit with your group and finish the lab.

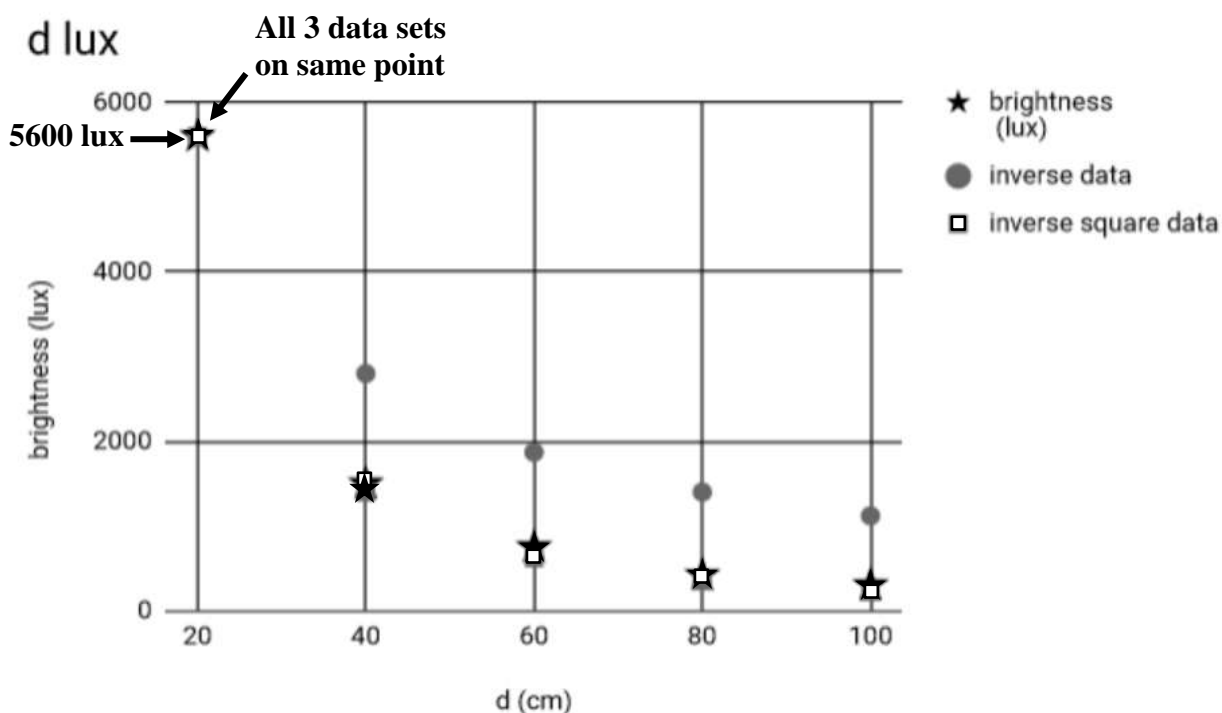
d (cm)	brightness (lux)
20	
40	
60	
80	
100	

III. Graphing: *Each partner must do their own chart.*

1. Sign out a Chromebook. Go to your Google Drive. Choose *New... Google Sheet*.
2. Click on *Untitled spreadsheet* at the top. Replace it with the new title: **d lux**
3. Copy the entire table (column headings and data) from Step 5 above into the spreadsheet.
4. Use the cursor to highlight the entire table including the headings. All cells should be light blue.
5. A) Choose *Insert*, then *Chart*. The Chart editor appears.
B) In the Data tab, expand *Chart Type*, and choose *Scatter*.
6. A) Click on the *Customize* tab. Expand the *Series* arrow. Check *Trendline*.
B) Change the Type from *Linear* to *Power Series*. You should see a smooth curve fitting your data.
7. Under *Trendline*, find *Label*. Change the *None* to *Use Equation*. The equation will appear on your chart.
8. Re-size your chart and place it next to your two data columns.
9. Submit your chart to *Google Classroom*. See **myMPS** for the link and password.
10. Log out. Return the Chromebook to the cart. Plug it in to charge it.

IV. Analysis

1. Based on your graph, as the distance d increases, what happens to the brightness?
2. The graph shown below has 3 sets of data. Each set has 5 points: At $d = 20, 40, 60, 80$ and 100 cm.
All three data sets begin with a brightness of 5600 lux at $d = 20$ cm.
The stars are the experimental **brightness (lux)** data that you just graphed in a Google Sheet.
If you divide the 5600 lux by 1, 2, 3, 4 and 5, you get the **inverse** (circle) points.
If you divide the 5600 lux by 1, 4, 9, 16 and 25, you get the **inverse square** (square) points.



Remember that the brightness (lux) data is the result of the experiment.

Which set of data points (*inverse* or *inverse square*) fits the experimental data better?

3. *Circle the answers:* As the distance from a light increases, the brightness (*decreases/increases*). The relationship is (*inverse/inverse squared*). Gravity weakens like light. As the distance from a planet increases, the strength of gravity (*decreases/increases*). The relationship is (*inverse/inverse squared*).