

Universal Gravitation Lab

Name: _____

Purpose: to learn how the distance between objects affects the force of gravity between the objects.

NOTE: Make sure you measure distance from the center of mass m_1 to the center of mass m_2 .

Procedure:

1. Open the PhET Gravity Force Lab found here: https://phet.colorado.edu/sims/html/gravity-force-lab/latest/gravity-force-lab_en.html.
2. Set up object m_1 and object m_2 to any mass that you want, but once they are set, you cannot change them for the remainder of the lab. Note the values: $m_1 = \underline{\hspace{2cm}}$, $m_2 = \underline{\hspace{2cm}}$
3. Set the Force Values to “Scientific Notation”. What do you notice about “force on m_1 by m_2 ” compared to “force on m_2 by m_1 ”, no matter the distance apart?
4. Move the objects around to test 10 different distances apart and record the distance (centre to centre!) and the corresponding force in a table like the one started below

| Distance, r (m) | Force, F (N) | |
|-------------------|----------------|--|
| | | |

5. Graph your data (F vs r) on graph paper. Is it a straight line? (It should NOT be.) Change one of the variables (square, cube, inverse, ...??) and graph again until you get a straight line. Find the slope and write an equation of the straight line that relates force of gravity to the distance between the objects. ($y=mx+b$)
6. If the formula for the force of gravity is: $F = \frac{Gm_1m_2}{r^2}$ (Note how similar this formula is to Coulomb’s Law!!) What does the slope of the line represent? Calculate a value for G using your slope.

Sections to have in your lab:

- Title & Purpose: as given above.
- Procedure:
 - A sketch of the PhET lab set up.
 - A brief summary of what you did. (Do NOT re-write the whole procedure!)
- Data:
 - A data table.
 - Graphs, at least 2, with all the things a good graph should contain. The straight-line graph should have a “line of best fit” – not connect the dots!
- Analysis:
 - Answer to question in procedure 3.
 - The equation of the graph. Discussion of slope. Calculation of G .
- Conclusion:
 - Summarize what you learned or would have learned if you didn’t already know it. Do NOT say that “the lab was fun and you learned lots.” Refer to the purpose. 😊