**Name: Robert Seth Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Physics X- Y**

**Universal Law of Gravitation Lab**

**Background:** We already know that things with mass experience a force that pulls the object towards the Earth - we call this “the force due to gravity”. However, this phenomena is only one example of a larger universal law. All things that have mass are gravitationally attracted to each other. In this lab you will determine the factors which affect the force of gravity as well as their specific relationship.

**Part 1 – Qualitative Observations**

**\*Open the Gravity Force Lab PhET Simulation\* http://bit.ly/1hiKjfz**

1. What can you change about the simulation?

***You can change the distance away from each body and the mass of each body.***

1. Change each variable and record what happens to the gravitational force as you change it. Be specific and use scientific language (i.e. use terms like increase, decrease, remains constant).
2. How does the gravitational force that a small mass has towards a large mass compare to the force that a large mass has towards a small mass? What physics law could you have used to predict the answer?

**Part II - Quantitative analysis**

1. Design an experiment to find the best equation for the relationship for mass and the gravitational force
   1. Record your procedure
   2. Include a spreadsheet and chart with a trendline from Excel (or google sheets that you share with me)
   3. Describe how you chose whether mass or force should be used on the x - axis
   4. What law of physics did you use to help you chose an appropriate trendline? How do your results compare to the expected curve.
2. Design an experiment to find the best equation for the relationship for gravitational force and distance
   1. Record your procedure
   2. Include a spreadsheet and chart with a trendline from Excel (or google sheets that you share with me)
   3. Describe how you chose whether distance or force should be used on the x - axis
   4. What law of physics did you use to help you chose an appropriate trendline? How do your results compare to the expected curve.

**Questions:**

1. Explain why varying the second mass had the same effect on the force as varying the first mass.

2. What is the relationship (proportionality) between Mass and force? What happens to the force if you double the

mass of the blue object? What happens to the force if you then triple the red object’s masses?

3. What is the relationship between distance and the force of gravity? What happens if you triple the distance

between the objects? Half the distance between them?

4. Combine your proportions between Mass 1 (m1), Mass 2 (m2) distance (r) into a single proportion to the Force of

gravity (Fg).

5. Make a graph of Force vs. your proportionality

6. Determine the gravitational constant (**G**) that will satisfy your units

G=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part III - Going Further**

1. What are some advantages to using a computer simulation in order to study this concept? (be specific)
2. What are some disadvantages to using a computer simulation in order to study this concept? (be specific)
3. What equipment or materials would you need to conduct a hand-on investigation to determine the relationship between the force of gravity to mass and distance? (actually think about this and write a theoretical procedure)
4. Do some research - is there an experiment that was done where this law was determined experimentally? If so - describe the experiment (how it was set up, the variables, etc), the results of the experiment and why it was important.