# Lab 7: Gravity Force Lab: Basics

PHYS 213L 01

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Date: 10/6/2020

## Brief Theory:

The law of universal gravitation by Newton, is mostly focused on the universality of gravity. This implies that Gravity is universal, and the force of gravitational attraction is directly dependent on the masses of both objects and inversely proportional to the square of the distance that separates their centers.

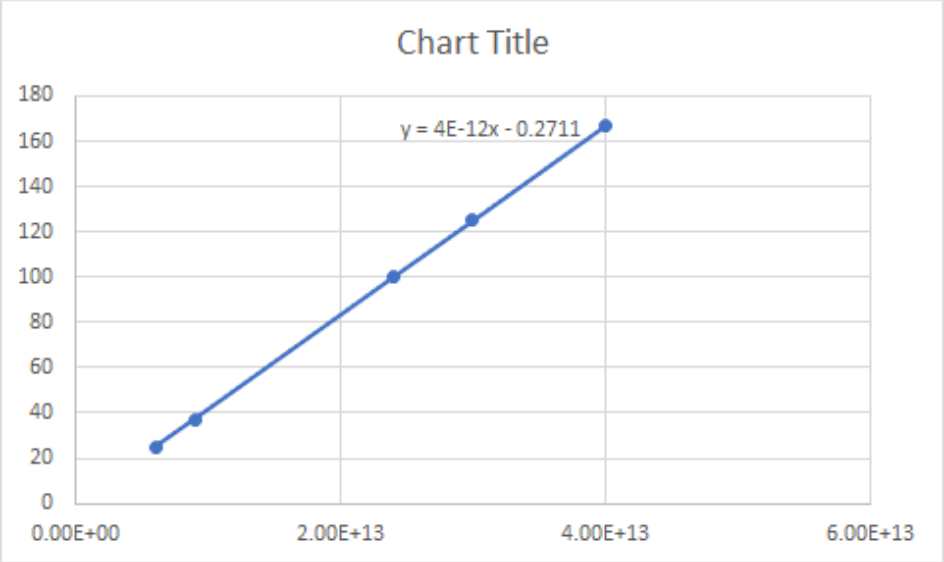
The magnitude of the attractive force F is equal to G (gravitational constant, a number the size of which depends on the system of units used and which is a universal constant), in symbols. When multiplied by the product of the masses (m1 and m2) and divided by the square of the distance R: F = G(m1m2)/R2. The unit for Gravitational Constant is Newtons kg-2 m2.

## Data Presentation:

### Method 1 to Find G

using the same R and having different masses.

| M1(x10^12) | M2(x10^12) | M1 x M2(x10^24) | Force |
|---|---|---|---|
| 2E+12 | 3E+12 | 6E+12 | 25 |
| 3E+12 | 3E+12 | 9E+12 | 37.1 |
| 4E+12 | 6E+12 | 2.4E+13 | 100.1 |
| 5E+12 | 6E+12 | 3.0E+13 | 125.1 |
| 5E+12 | 8E+12 | 4.0E+12 | 166.9 |




**Method 2 to Find G**

using the same masses and having different values of R.

| R(m) | 1/R2 | Force |
|---|---|---|
| 1900 | 2.77008E-07 | 295.8N |
| 2200 | 2.06612E-07 | 220.6N |
| 2500 | 0.00000016 | 170.9N |
| 2900 | 1.18906E-07 | 127.0N |
| 3200 | 9.76563E-08 | 104.3N |

## Calculations:

**Calculation for G, 1st method**

slope/ R^2 = G

= 4E-12 / 4000 = 1e-15 Newtons kg-2 m2

**Calculation for G, 2nd method**

m1=m2= 4 x 10^12 kg

m1 x m2 = 1.6 x 10^25 kg

G = slope/m1 x m2

## Sample Prompt Questions:

• Identify two ways you can change the amount of gravitational force that the objects experience. How could you increase gravitational force using each factor? How could you decrease gravitational force using each factor?

- By changing the mass and distance. Recall that the force of gravity depends upon the mass of the both objects, and inversely on the square of their distance. This implies that to decrease gravitational force, we must increase the distance and lessen the mass (changing the mass and distance).

• If gravity is a force of attraction between objects, why aren't objects like your pencil being pulled towards you? Explain your reasoning.

- Newton's third law states that "for every action there is an equal and opposite reaction", therefore If I didn't make any action towards the pencil then the pencil won't come to me; unless I reach out and grab it.

• Select two different values for mass 1 and mass 2. How does the force that the smaller mass exerts on the larger mass compare to the force that the larger mass exerts on the smaller mass?

- The larger the mass, the larger the gravitational force.

• Predict what happens to the gravitational force as the distance between the masses is doubled.

- The gravitational force between two objects will become one-fourth if the distance between the two objects is doubled.

## Conclusion:

I studied the relationship between gravitational force, mass, and distance; I also understood the definition and relationship between them. The larger the mass, the larger the gravitational force. If the gravitational force increases by four, that means the mass was doubled. And if the gravitational force becomes one-fourth, that implies the distance was doubled. The simulations helped me visualize and understood more in finding the value of the G using slop in two ways.