

## Newton's Law of Gravity Activity

Before beginning this activity read the information at:

Universal Law of Gravity, <http://www.astronomynotes.com/gravappl/s3.htm>

Newton's Universal Law of Gravity is:

$$F = \frac{GM_1M_2}{R^2}$$

where

$M_1$  = mass of first object in kg

$G$  = gravitational constant,  $6.672 \times 10^{-11} \text{ m}^3/\text{kg s}^2$

$M_2$  = mass of second object in kg

$F$  = force in newtons

$R$  = distance between the objects in meters (**not cm**)

You will need to work with another member of the class to complete this activity. **You must include the correct units on all numbers to receive credit.**

1. Access the Newton's Law of Gravity Simulator (source: Astronomy Education at the University of Nebraska-Lincoln)
2. Click on the **person** icon in the rows labeled  $M_1$  and  $M_2$ . Click on the **social spacing** icon in the row labeled  $R$ . The masses  $M_1$  and  $M_2$  should change to  $7.20 \times 10^1 \text{ kg}$  and  $R$  should change to 2.00 m.
3. **Before** continuing, **use your calculator** to work through the  $F_{21} = F_{12}$  calculations shown at the top of the module. Indicate each of the values below and don't forget to include the correct units. Be sure you get the same answer as the module. If not redo your calculations and/or get help from your instructor.

$M_1 =$  \_\_\_\_\_

$M_1M_2 =$  \_\_\_\_\_

$M_2 =$  \_\_\_\_\_

$GM_1M_2 =$  \_\_\_\_\_

$R =$  \_\_\_\_\_

$R^2 =$  \_\_\_\_\_

$F_{21} = F_{12} =$  \_\_\_\_\_

4. Using the module, select different objects for  $M_1$  and  $M_2$  and  $R$ , other than 1 meter, and those used above. Indicate each of the values below based on your selections and don't forget to include the correct units. Check your answer using the module.

$M_1 =$  \_\_\_\_\_

$M_1M_2 =$  \_\_\_\_\_

$M_2 =$  \_\_\_\_\_

$GM_1M_2 =$  \_\_\_\_\_

$R =$  \_\_\_\_\_

$R^2 =$  \_\_\_\_\_

$F_{21} = F_{12} =$  \_\_\_\_\_

5. What is your weight in lbs? \_\_\_\_\_

What is your mass in kg? \_\_\_\_\_

6. What is your classmate's weight in lbs? \_\_\_\_\_

What is your classmate's mass in kg? \_\_\_\_\_

7. Determine the gravitational attraction in newtons between you,  $M_1$ , and your classmate,  $M_2$ . You will need to ask your classmate for his or her mass,  $M_2$ , in kg. R is the measured distance between you and your classmate in meters. Check your answer by adjusting the values in the module.

$M_1$  = \_\_\_\_\_  $M_1M_2$  = \_\_\_\_\_

$M_2$  = \_\_\_\_\_  $GM_1M_2$  = \_\_\_\_\_

$R$  = \_\_\_\_\_  $R^2$  = \_\_\_\_\_

$F_{21} = F_{12}$  = \_\_\_\_\_

8. Select an object that you frequently carry with you, such as your cell phone, calculator, pencil, etc. and determine its mass  $M_2$  in **kg** using one of the balances in the classroom. You will need to convert the mass from grams to kg to get  $M_2$ . What object did you select?

$M_2$  = \_\_\_\_\_

9. Determine the gravitational attraction in newtons between you,  $M_1$ , and the object that you carry with you,  $M_2$ . R is the measured distance between you and your object in meters. Check your answer by adjusting the values in the module.

$M_1$  = \_\_\_\_\_  $M_1M_2$  = \_\_\_\_\_

$M_2$  = \_\_\_\_\_  $GM_1M_2$  = \_\_\_\_\_

$R$  = \_\_\_\_\_  $R^2$  = \_\_\_\_\_

$F_{21} = F_{12}$  = \_\_\_\_\_