Planetary Attraction Project

Name _____ Class Period _____ Due Date _____

Partner(s) _____

In the mid-1600's, Isaac Newton demonstrated to the world that his Law of Universal Gravitation could describe the attraction between any two objects, based on their masses and separation distance. In this project, you will compare the attraction between large and small objects, close together and at a great distance.

Use the website below to examine the sky on the night (or day) you were born.

http://www.fourmilab.ch/cgi-bin/Yoursky

Use the "Explain controls" link for help with navigation. Use the "Help" command to access information about planetary symbols.

You will want to pay particular attention to these settings:

You can "Set for nearby city" to choose a major city near your birthplace. (Do this FIRST)
Date and time: Choose "Universal time" and remember to use a 24-hour clock.
Check the box for "Moon and Planets", at a minimum.
Choose other sky features as you wish. Constellations are fun!
Color scheme: Use whatever you like on the computer, but when you prepare to print your "sky", switch to "Black on White background" if you are using a school printer (saves wear and tear on the printer!)

1. Choose any two planets (other than earth!) that appear in your night sky and calculate the force of gravitational attraction between you (at time of your birth) and the planets. The chart on the website gives planetary distances in Astronomical Units (AU).
   An Astronomical Unit is the average distance between the sun and the earth.
   One AU = 149,597,870,691 meters (give or take a few meters!). You may approximate that value however you like, but keep appropriate significant figures in your calculations.
   Use your birth weight, if you know it. If you don't know your birth weight, 7.5 pounds is a reasonable value to use (2.2 pounds = 1 kilogram is the conversion factor).
2. Calculate the gravitational force between the earth and each of your chosen planets.
3. Calculate the force of gravitational attraction between you at your birth and the moon, using the moon's position on your birthday sky chart. An ER is one Earth Radius. You will need to find the radius of the earth on your own. CITE YOUR REFERENCES!
4. Calculate the force of gravitational attraction between you and your lab partner as you sit side-by-side at your table. If there are THREE people in a group, arrange yourselves at the corners of a right triangle and calculate forces accordingly (what are lengths of each side of the triangle?)
5. Create a table with all of the information used to calculate your forces (mass, distance, radius?)
6. Provide a sketch (Free Body Diagram) with at least 6 forces acting on each lab partner as you sit in the classroom. Include forces between the partner and earth, partner and moon and partner and other partner(s), then use your imagination! Force vectors do not need to be to scale.

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7. Rank the sizes of the forces between you and the planets, you and the moon, you and your lab partner, earth and other planets. Which is largest, which is smallest, and where do the others fit in between?
8. Show your calculations for each section. Make sure you include UNITS! No naked numbers!
9. Include something extra to make your project your own. Add a "Did you know?" text box with something you discovered on your own about planetary motion, the moon, gravity, Newton or…?
10. Present your sky charts, tables, diagrams, calculations and rankings in the form of a poster (Minimum size 24 x 18 inches, maximum size 24 x 36 inches)

Some various information you may need:

Your birth date _____

Exact time of birth if you know it; if you don't know it, state the time you are using _____

Your mass at birth if you know it _____ (converted to kg). Use 7.5 pounds if you don't know.

Your mass now _____ (in kg)

City where you were born (or closest major city) _____

The Universal Gravitation Constant _____

Radius of the earth _____

Mass of the earth _____

Mass of the moon _____

Grading:

Title – 5 points
Overall neatness, attractiveness and imagination – 10 points
Sample calculations, explanation of variables and constants – 15 points
Sky charts – 10 points
Table of information (organization, neatness, proper units) – 10 points
Free Body Diagrams – 15 points
Force rankings – 15 points
References cited – 10 points
"Did you know?" factoid – 10 points