Name_____________________________________ Period_________ Date_________

CONCEPTUAL PHYSICS	Activity

6.3 Newton's Second Law of Motion: Mass and Weight

THE WEIGHT

Purpose
In this activity, you will investigate the relationship between weight and mass.

Required Equipment and Supplies
spring scale (10-newton capacity)
slotted masses (one 100 g, two 200 g, one 500 g)
mass hanger
table clamp
support rod
rod clamp
crossbar (short rod)
collar hook
graph paper

Discussion
Mass and weight are different quantities. Mass is a measure of an object's inertia, the extent to which an object resists changes to its state of motion. Weight is a measure of the interaction between an object and the planet the object is nearest to. Usually that planet is the earth. The weight of an object is related to its mass. In this activity we will find out what that relationship is.

Procedure
Step 1: Check the calibration of the spring scale and adjust it if necessary. The spring scale needs to read zero when there is no load on it. Ask your instructor for instructions on how to calibrate the spring scale.

Step 2: Arrange the apparatus as shown in Figure 1.

Step 3: Determine the mass (in grams) and the weight (in newtons—as shown on the spring scale) of the mass hanger. Record those values on the second row of the data table.

Step 4: Add 100 grams of slotted mass to the mass hanger. The total mass of the load on the spring scale is now one hundred grams plus the mass of the mass hanger. Record the total mass and the weight value (shown on the spring scale) on the next row of the data table.

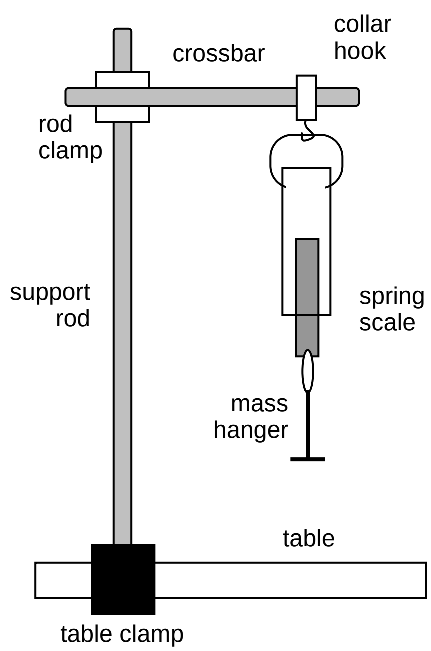

Figure 1

Step 5: Repeat the previous step with 200 g, 300 g, 400 g, 500 g, 600 g, 700 g, and 800 g of slotted mass. Remember that the total mass in each case is the sum of the slotted mass and the mass of the mass hanger. When you are done, column of mass values (in grams) and the corresponding of weight values (in newtons) will be filled.

Data

Total hanging mass m (grams)	Total hanging mass m (kilograms)	Weight of mass W (newtons)
0	0	0

Step 6: Convert the mass values to kilograms (1000 grams = 1 kilogram, so 237 grams = 0.237 kg, etc.).

Step 7: Make a plot of weight versus mass, using the mass values in kilograms. As is always the case, the first variable listed in the title of the graph constitutes the vertical axis and the second variable constitutes the horizontal axis. Generally speaking, the first variable listed is the dependent variable (the one you measure during the activity) and the second variable is the independent variable is the independent variable (the one you control during the activity).

Step 8: Title the graph, label the axes to correctly indicate the quantity, units, and scale of each axis.

Step 9: Draw a straight line of best fit through the data points plotted on your graph.

1. Determine the slope of your best-fit line and record it below.

   Slope: ________________________________

2. What are the units of the slope you found? The slope does have units! Show the units in your answer to the previous question.

The slope of the graph is the relationship between weight and mass. The slope tells how many newtons of weight pull down on each kilogram of mass.

Summing up

1. What would have been the weight of 1.0 kg? Extend your best-fit line or use a ratio to determine the answer.

2. On the moon, each kilogram of mass is pulled down with 1.6 newtons of weight. Add a dashed line to your graph showing the results if this activity had been done on the moon. How does the slope of the moon line compare to the slope of the earth line? Is it steeper (more vertical) or shallower (more horizontal)?

3. If the activity had been done on Jupiter, the resulting line would have had a steeper (more vertical) slope. What does this tell you about the strength of Jupiter's gravitational field as compared to Earth's?