Name:

Skill Sheet 31-A Gravity Problems

An easy way to solve problems is to set them up as proportions. In this skill sheet, you will practice using proportions and learn more about the force of gravity on different planets.

1. Comparing the force of gravity on the planets

Table 1 lists the force of gravity on each planet in our solar system. We can see more clearly how these values compare to each other using proportions. First, we assume that Earth's gravity is equal to "1." Then, we set up the proportion where "x" equals the force of gravity on another planet (in this case, Mercury) as compared to Earth.

$$\frac{1}{\text{Earth gravity}} = \frac{x}{\text{Mercury gravity}}$$

$$\frac{1}{9.8\ \text{N}} = \frac{x}{3.7\ \text{N}}$$

$$(1 \times 3.7\ \text{N}) = (9.8\ \text{N} \times x)$$

$$\frac{3.7\ \text{N}}{9.8\ \text{N}} = x$$

$$0.38 = x$$

Therefore, Mercury's force of gravity is a little more than a third of Earth's gravity.

Now, calculate the proportions for the remaining planets.

Table 1: The force of gravity on planet in our solar system

Planet	Force of gravity in Newtons (N)	Value compared to Earth's gravity
Mercury	3.7	0.38
Venus	8.9	
Earth	9.8	1
Mars	3.7	
Jupiter	23.1	
Saturn	9.0	
Uranus	8.7	
Neptune	11.0	
Pluto	0.6	

2. How much does it weigh on another planet?

Use Table 1 to solve the following problems.

1. A cat weighs 8.5 pounds on Earth. How much would this cat weigh on Neptune?

2. A baby elephant weighs 250 pounds on Earth. How much would this elephant weigh on Saturn? Give you answer in Newtons (4.48 Newtons = 1 pound).

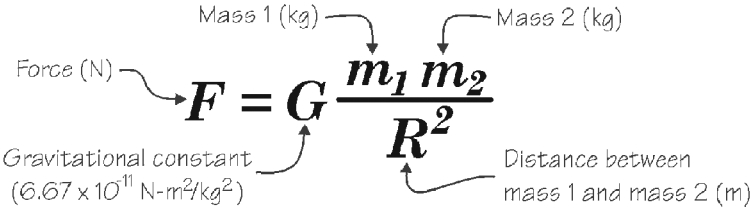
3. On Pluto, a baby would weigh 2.7 Newtons. How much would this baby weigh on Earth? Give your answer in Newtons and pounds.

4. Imagine that it is possible to travel to each planet in our solar system. After a space "cruise," a tourist returns to Earth. One of the ways he recorded his travels was to weigh himself on each planet he visited. Use the list of these weights on each planet to figure out the order of the planets he visited. On Earth he weighs 720 Newtons. List of weights: 655 N; 1,697 N; 792 N; 44 N; and 661 N.

3. Using the Universal Law of Gravitation

Use the equation for Universal Gravitation to solve the following problems. The first problem is done for you.

Equation of Universal Gravitation:



1. What is the force of gravity between Pluto and Earth? The mass of Earth is 6.0×10^{24} kg. The mass of Pluto is 1.3×10^{22} kg. The distance between these two planets is 5.76×10^{12} meters.

$$\text{Force of gravity between Earth and Pluto} = \left(\frac{6.67 \times 10^{-11}\text{N-m}^2}{\text{kg}^2}\right)\frac{(6.0 \times 10^{24}) \times (1.3 \times 10^{22})}{(5.76 \times 10^{12})^2}$$

$$\text{Force of gravity} = \frac{52.0 \times 10^{35}}{33.2 \times 10^{24}} = 1.57 \times 10^{11}\text{N}$$

2. What is the force of gravity between Jupiter and Saturn? The mass of Jupiter is 6.4×10^{24} kg. The mass of Saturn is 5.7×10^{26} kg. The distance between Jupiter and Saturn is 6.52×10^{11} m.