Chapter 3 Project

What Would You Weigh on the Moon?

An activity to demonstrate the use of decimal numbers in real life.

The following table contains the surface gravity of each planet in the same solar system as the Earth, as wells Earth's moon, and the sun. The acceleration due to gravity g at the surface of a planet is given by the formula

$$g = \frac{GM}{R^2},$$

where M is the mass of the planet, R is its radius, and G is the gravitational constant. From the formula you can see that a planet with a larger mass M will have a greater value for surface gravity. Also the larger the radius R of the planet, the smaller the surface gravity.

If you look at different sources, you may find that surface gravity varies slightly from one source to another due to different values for the radius of some planets, especially the gas giants: Jupiter, Saturn, Uranus, and Neptune.

Planet	Surface Gravity (m/s^2)	Relative Surface Gravity	Fractional Equivalent
Earth	9.78	1.00	
Jupiter	23.10	2.36	
Mars	3.72		
Mercury	3.78		
Moon	1.62		
Neptune	11.15		
Saturn	9.05		
Sun	274.00		
Uranus	8.69		
Venus	9.07		

1. Compare the surface gravity of each planet or celestial body to the surface gravity of the Earth by dividing each planet's surface gravity by that of the Earth's, as listed in the table above. (This is referred to as **relative surface gravity**.) Round your answer to the nearest hundredth and place your results in the third column of the table. The values for Earth and Jupiter have been done for you. (**Note:** Comparing Earth to itself results in a value of 1.)

2. For Jupiter, the relative surface gravity value of 2.36 means that the gravity on Jupiter is 2.36 times that of Earth; therefore, your weight on Jupiter would be approximately 2.36 times your weight on Earth. (Although mass is a constant and doesn't change regardless of what planet you are on, your weight depends on the pull of gravity). Explain what the relative surface gravity value means for Mars.

3. Calculate your weight on the moon by taking your present weight (in kg or pounds) and multiplying it by the moon's relative surface gravity.

4. Approximately how many times larger is the surface gravity of the sun compared to that of Mars? Round to the nearest whole number.

5. Convert each value in column three to a mixed number and place the result in column four. Be sure to reduce all fractions to lowest terms.

   a. Which is larger, the relative surface gravity of Mercury or $\frac{2}{5}$?

   b. Which is smaller, the relative surface gravity of the moon or $\frac{4}{25}$?

   c. Write the fractional equivalent of Jupiter's relative surface gravity as an improper fraction in lowest terms.