Mass and Weight Name: _____ Per.____
Integrated Science: Physics/Design

1. A physical science textbook has a mass of 2.2 kilograms.
   a. What is its weight on Earth?

$$W = m \cdot g = 2.2\,kg \cdot 9.8\,N/kg = 22\,N.$$

   b. What is its weight on Mars? (g = 3.7 N/kg)

$$W = m \cdot g = 2.2\,kg \cdot 3.7\,N/kg = 8.1\,N.$$

   c. If the textbook weighs 19.6 newtons on Venus, what is the strength of gravity on that planet?

$$g = W/m = \frac{19.6\,N}{2.2\,kg} = 8.9\,N/kg.$$

2. An astronaut weighs 104 newtons on the moon, where the strength of gravity is 1.6 newtons per kilogram.
   a. What is her mass?

$$m = W/g = \frac{104\,N}{1.6\,N/kg} = 65\,kg.$$

   b. What is her weight on Earth?

$$W = m \cdot g = 65\,kg \cdot 9.8\,N/kg = 640\,N.$$

   c. What would she weigh on Mars?

$$W = m \cdot g = 65\,kg \cdot 3.7\,N/kg = 240\,N.$$

3. Of all the planets in our solar system, Jupiter has the greatest gravitational strength.
   a. If a 0.500-kilogram pair of running shoes would weigh 11.55 newtons on Jupiter, what is the strength of gravity there?

$$g = W/m = \frac{11.55\,N}{0.500\,kg} = 23.1\,N/kg$$

   b. If the same pair of shoes weighs 0.3 newtons on Pluto (a dwarf planet), what is the strength of gravity there?

$$g = W/m = \frac{0.3\,N}{0.500\,kg} = 0.6\,N/kg$$

c. What does the pair of shoes weigh on Earth?

$W = m \cdot g = 0.500\ kg \cdot 9.8\ N/kg = 4.9\ N$

4. A tractor-trailer truck carrying boxes of toy rubber ducks stops at a weigh station on the highway. The driver is told that the truck weighs 250,000 N. *(Be sure your answer has the correct number of significant digits.)*

a. What is the mass of the toy-filled truck?

$m = \frac{W}{g} = \frac{250{,}000\ N}{9.8\ N/kg} = 26{,}000\ kg.$

b. The truck drops off its load of toys, and then stops at a second weigh station. Now the truck weighs 147,000. N. What is the new mass of the truck?

$m = \frac{W}{g} = \frac{147{,}000\ N}{9.8\ N/kg} = 15{,}000\ kg$

c. Find the total mass of the rubber duck-filled boxes that were carried by the truck

$$\begin{array}{r} 26{,}000\ kg - \text{truck} + \text{boxes} \\ -\ 15{,}000\ kg - \text{truck} \\ \hline 11{,}000\ kg - \text{boxes} \end{array}$$

$g = 9.8\ m/s^2 = 9.8\ N/kg$

ACCEL. STRENGTH

$1\ N = 1\ kg \cdot m/s^2$

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