What You Need to Know

There are many different units used in measurement. You are probably familiar with inches, feet, yards, and miles because those units of measurement are commonly used in the United States. But the **metric system** relies on centimeters, millimeters, meters, and kilometers. Pounds and tons measure weight in the same way grams and kilograms do. Scientists use even more units for measurements, like **astronomical units** and **newtons**. When solving real-world math problems, you will often need to convert units of measurement. What happens if you are using a recipe that calls for grams but you only have teaspoons? It is necessary for you to convert!

For example, astronauts are allowed to bring a small personal preference kit to the International Space Station (ISS) that contains a few of their favorite things from home. One astronaut's kit weighs 4 kilograms. How much does it weigh in pounds? There are 2.2 lbs. in 1 kg.

2.2 lbs. × 4 kg = 8.8. The container weighs 8.8 lbs.

A **ratio** is a way to compare two amounts or items. For example, if there are 3 spiders and 6 butterflies on the space station, we can say that the ratio of spiders to butterflies is 3:6.

A **proportion** is when two ratios are equal to each other, and you can solve for an unknown number.

For example, a space shuttle travels at a constant speed of 35,000 miles every 2 hours. How long will it take for it to travel 175,000 miles?

cross multiply

$$\frac{35{,}000 \text{ miles}}{2 \text{ hours}} = \frac{175{,}000 \text{ miles}}{x \text{ hours}}$$

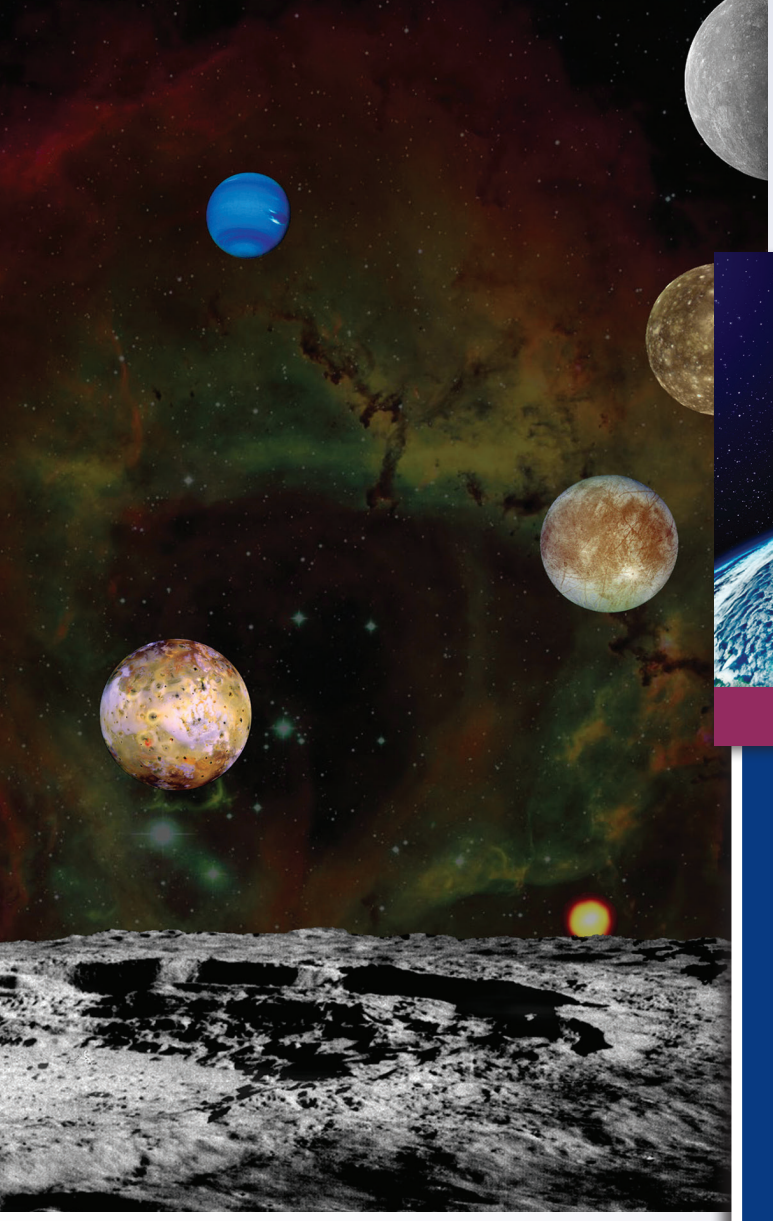
$$35{,}000x = 350{,}000$$

$$x = \frac{350{,}000}{35{,}000}$$

$$x = 10 \text{ hours}$$

Scientists can calculate the gravity of other objects in space by using what they know about the mass and density of each location. Once they estimate the surface gravity of a location, they can use the following formula to calculate weight:

Weight = mass x surface gravity



Work It Out

A dog weighs 70 pounds on Earth. He takes a rocket ride into space and explores different locations in the solar system. Complete the chart below to estimate how much he would weigh at each stop on his journey. Round to the nearest whole number.

Hint: Weight = mass x surface gravity.
1 kilogram equals about 2.2 pounds.
The dog's mass is 70 pounds.

Location	Surface Gravity	Weight (kilograms)	Weight (pounds)
Earth	1.0	32	70
Moon	.166		
Venus	0.91		
Mars	0.38		
Jupiter	2.34		

While most equations in math need to be precise, the equation for gravity is always an estimate. Gravity varies slightly depending on things like elevation and distance from the equator.