



How many stars are there in the universe?

Scientists estimate there to be _____ stars in the universe! (22 zeros!) Numbers like this are so large that scientists have invented a method called _____ to write these very, very large numbers (and very, very small numbers).



Recall

Powers of 10

$10^1 = \underline{\hspace{2cm}}$

$10^2 = \underline{\hspace{2cm}}$

$10^3 = \underline{\hspace{2cm}}$

$10^{-1} = \underline{\hspace{2cm}}$

$10^{-2} = \underline{\hspace{2cm}}$

$10^{-3} = \underline{\hspace{2cm}}$

When we multiply a decimal by a _____ power of ten, we move the decimal to the _____.

When we multiply a decimal by a _____ power of ten, we move the decimal to the _____.

Examples:

$1.58 \cdot 10^1 = 1.58 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

$1.58 \cdot 10^2 = 1.58 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

$1.58 \cdot 10^3 = 1.58 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

Examples:

$1.5 \cdot 10^{-1} = 1.5 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

$1.5 \cdot 10^{-2} = 1.5 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

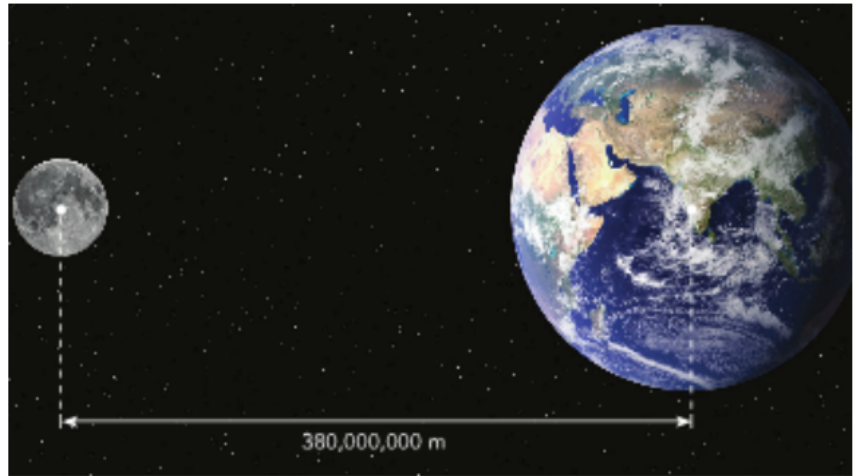
$1.5 \cdot 10^{-3} = 1.5 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

Quick Check

- $1.8 \cdot 100 = \underline{\hspace{2cm}}$
- $0.28 \cdot 10^3 = \underline{\hspace{2cm}}$
- $1.3 \cdot 10^4 = \underline{\hspace{2cm}}$

Scientists, like Astronomers, work with very large and very small numbers.

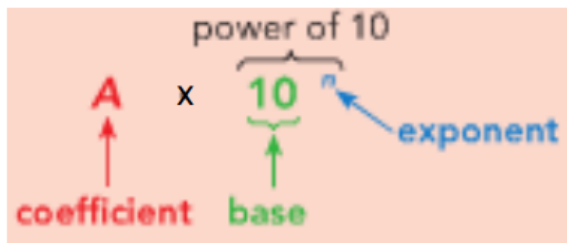
For example, the average distance from the Earth to the moon is approximately 380,000,000 meters. Sometimes it's hard to keep track of so many zeros in such a large number. This is why scientific notation is very helpful!



What other things can you think of that we might want to represent very large or very small numbers with?

Scientific Notation can be used to represent a positive, finite decimal s as the product $d \times 10^n$, where d is a finite decimal greater than or equal to 1, but less than 10 (i.e. $1 \leq d < 10$), and n is an integer.

Scientific Notation



For numbers greater than or equal to 10, use a _____ exponent.

Example 1

The finite decimal 584.392 is equal to every one of the following:

$$5.84392 \times 10^2 \quad 584.392 \times 10^0 \quad 58439.2 \times 10^{-2} \quad 5843.92 \times 10^{-1}$$

$$0.584392 \times 10^3 \quad 5843920 \times 10^{-4} \quad 58.4392 \times 10^1 \quad 0.00584392 \times 10^5$$

However, there is only one that is written in scientific notation. Why is this the only one written in scientific notation?