DATE: NAME: CLASS:

GENERAL

Using Scientific Notation

BLM G-36

Goal • Develop your understanding of scientific notation.

What to Do

• Read about scientific notation and answer the questions that follow.

Powers

You can write repeated multiplication as a power. Powers are named after their bases, so 10^3 is called a power of 10. $10^3 = 10 \times 10 \times 10$.

Writing Scientific Notation

Scientific notation is a way of writing very large or very small numbers so they are easier to work with. A number written in scientific notation is the product of a number between 1 and 9, and a power of 10. Large numbers have a power of 10 with a positive exponent. Small numbers have a power of 10 with a negative exponent.

Example 1

Mercury is about 58 000 000 km from the Sun. Write 58 000 000 in scientific notation.

Solution

The number will have two parts: a number between 1 and 10, including 1, and a power of 10. The first number will be 5.8. What do you need to multiply 5.8 by to get 58 000 000?

$58\,000\,000 = 5.8 \times 10\,000\,000$ Write 10 000 000 as a power of 10.

$= 5.8 \times 10^7$

Check: Move the decimal in 5.8 seven places to the right and you get 58 000 000.

Example 2

The diameter of a helium atom is about 0.000 000 000 256 m. Write 0.000 000 000 256 in scientific notation.

Solution

The number will have two parts: a number between 1 and 10, including 1, and a power of 10. The first number will be 2.56. What do you need to multiply 2.56 by to get 0.000 000 000 256?

$0.000\,000\,000\,256 = 2.56 \times 0.000\,000\,000\,1$ Write 0.000 000 000 1 as a power of 10.

$= 2.56 \times 10^{-10}$

Check: Move the decimal in 2.56 ten places to the left and you get 0.000 000 000 256.

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Using Scientific Notation

Write each of the following in scientific notation.

1. The approximate diameter of an electron is 0.000 000 000 000 005 6 cm.

2. The approximate diameter of Saturn is 120 500 km.

3. Neptune is about 4 500 000 000 km from the Sun.

4. The mass of a dust particle is 0.000 000 001 023 kg.

Calculating with Scientific Notation

You can multiply and divide with numbers in scientific notation without writing them in standard form.

Example 1

Convert 9.7×10^7 AU to light years. (1 AU = 1.58×10^{-5} light years)

Solution

If you are multiplying powers with the same base, you can add the exponents. $a^m \times a^n = a^{m+n}$

$$\begin{aligned} 9.7 \times 10^7 \times 1.58 \times 10^{-5} &= 9.7 \times 1.58 \times 10^7 \times 10^{-5} \\ &= 15.326 \times 10^{7+(-5)} \\ &= 15.326 \times 10^2 \end{aligned}$$

Check: The first number is not between 1 and 10. Change the number to proper scientific notation.

$15.326 \times 10^2 = 1.5326 \times 10^3$ light years

Example 2

Convert 2.1×10^8 light years to astronomical units. $\left(1 \text{ l y} = \dfrac{1}{1.58 \times 10^{-5}} \text{ AU}\right)$

Solution

If you are dividing powers with the same base, subtract the exponents. $a^m \div a^n = a^{m-n}$

$$\begin{aligned} \frac{2.1 \times 10^8}{1.58 \times 10^{-5}} &= 1.329 \times 10^{8-(-5)} \\ &= 1.329 \times 10^{13} \text{ AU} \end{aligned}$$

Check: The first number is between 1 and 10 and the second number is a power of 10, so the number is written in proper scientific notation.

Solve the following. Express your answers in proper scientific notation.

1. $(5.75 \times 10^9) \times (1.4 \times 10^2)$ **2.** $(2.6 \times 10^4) \times (3.5 \times 10^3)$

3. $\dfrac{9.3 \times 10^7}{4.8 \times 10^8}$ **4.** $\dfrac{7.3 \times 10^2}{1.3 \times 10^{-6}}$

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