Math Tutor SCIENTIFIC NOTATION

Any value expressed in scientific notation, whether large or small, has two parts. The first part, the *first factor,* consists of a number greater than or equal to 1 but less than 10, which may have any number of digits after the decimal point. The second part consists of a power of 10.

$$\underbrace{6.02}_{\text{first factor}} \times \underbrace{10^{\overbrace{23}^{\text{exponent}}}}_{\text{power of ten}}$$

To write the first part, move the decimal point to the right or the left so that there is only one nonzero digit to the left of the decimal point. The second part is written as an exponent, which is determined by counting the number of places the decimal point must be moved. If it is moved to the right, the exponent is negative. If it is moved to the left, the exponent is positive.

Problem-Solving TIPS

- In addition and subtraction, all values must first be converted to numbers that have the same exponent of 10. The result is the sum or the difference of the first factors, multiplied by the same exponent of 10. Finally, the result should be rounded to the correct number of significant figures and expressed in scientific notation.
- In multiplication, the first factors are multiplied and the exponents of 10 are added.
- In division, the *first factors* of the numbers are divided and the exponent of 10 in the denominator is subtracted from the exponent of 10 in the numerator.

SAMPLE 1

Write 299 800 000 m/s in scientific notation.

The decimal must move to the left 8 places, which indicates a positive exponent.

$$\underbrace{299\,800\,000.}_{8\ 7\ 6\ 5\ 4\ 3\ 2\ 1}\ \text{m/s}$$

The value in scientific notation is 2.998×10^8 m/s.

SAMPLE 2

Solve the following equation and write the answer in scientific notation.

$$(3.1 \times 10^3)(5.21 \times 10^4)$$

Multiply the first factors, and then add the exponents of 10.

$$(3.1 \times 5.21) \times 10^{(3+4)} = 16 \times 10^7 = 1.6 \times 10^8$$

PRACTICE PROBLEMS

1. Rewrite the following numbers in scientific notation.

a. 0.0000745 g
b. 5984102 nm

2. Solve the following equations, and write the answers in scientific notation.

a. $1.017 \times 10^3 - 1.013 \times 10^4$
b. $\dfrac{9.27 \times 10^4}{11.24 \times 10^5}$