

Scientific Notation

A number is written in **scientific notation** when it is represented as the product of a factor and a power of 10. The factor must be greater than or equal to 1 and less than 10.

$$c \times 10^n \qquad 1 \leq c < 10 \text{ and } n \text{ is an integer}$$

When a number is written in scientific notation, you can write the number in standard form using the absolute value of the exponent n . When n is negative, move the decimal point $|n|$ places to the left. When n is positive, move the decimal point $|n|$ places to the right.

Example 1 Write (a) 7.4×10^5 and (b) 3.96×10^{-4} in standard form.

a. $7.4 \times 10^5 = 740,000$ Move decimal point $|5| = 5$ places to the right.



b. $3.96 \times 10^{-4} = 0.000396$ Move decimal point $|-4| = 4$ places to the left.




When a number is written in standard form, you can write the number in scientific notation using the following steps.

Step 1 Move the decimal point so it is located to the right of the leading nonzero digit.


Step 2 Count the number n of places you moved the decimal point. The exponent of the power of 10 is n when you move the decimal point to the left and $-n$ when you move the decimal point to the right.

Example 2 Write each number in scientific notation.

a. 4,025,000,000

$$4,025,000,000 = 4.025 \times 10^9$$

Move decimal point 9 places to the left. The exponent is 9.

b. 0.00000591

$$0.00000591 = 5.91 \times 10^{-6}$$

Move decimal point 6 places to the right. The exponent is -6.

Practice

Check your answers at BigIdeasMath.com.

Write the number in standard form.

- | | | | |
|---------------------------------------|---------------------------------------|---------------------------------|--|
| 1. 2×10^4 20,000 | 2. 8.4×10^1 84 | 3. 7×10^{-3} 0.007 | 4. 5.05×10^{-1} 0.505 |
| 5. 1.8×10^{-7}
0.00000018 | 6. 6.29×10^{-5}
0.0000629 | 7. 5.591×10^0
5.591 | 8. 3.0504×10^9
3,050,400,000 |

Write the number in scientific notation.

- | | | | |
|--|------------------------------------|---|---------------------------------------|
| 9. 400 4×10^2 | 10. 72,000 7.2×10^4 | 11. 0.8 8×10^{-1} | 12. 0.00019 1.9×10^{-4} |
| 13. 100,500,000
1.005×10^8 | 14. 324,900
3.249×10^5 | 15. 0.000002621
2.621×10^{-6} | 16. 0.05008
5.008×10^{-2} |

17. **NEURONS** A study found that the average human brain has 8.6×10^{10} neurons. Write this number in standard form. The cell bodies of neurons have widths between 0.000004 meter and 0.0001 meter. Write this range in scientific notation. $86,000,000,000$; 4×10^{-6} m to 1×10^{-4} m