Lesson 6: Expressing Numbers in Scientific Notation and Vice Versa

OBJECTIVE: Expresses Numbers in Scientific Notation and Vice Versa

LET'S STUDY THESE

A number is written in scientific notation if a number is expressed as a product of a number from 1 to 10 excluding 10 and a power of 10.

Based on the previous statement, which of the following is/are written in scientific notation?

1. 6.23×10^5

6.23×10^5

Power of ten

Number between 1 and 10, excluding 10.

Therefore, 6.23×10^5 is expressed in scientific notation.

2. 0.65×10^{-4}

0.65×10^{-4}

Power of ten

Number NOT between 1 and 10, excluding 10

Therefore, 0.65 x 10 is not written in scientific notation

Write the following numbers in scientific notation.

1. Express 125,000 in scientific notation.

$1\,2\,5\,,\,0\,0\,0 = 1.25 \times 10^5$

Decimal point (before) *Decimal point (after)*

Notice that the decimal point is moved 5 places to the left. Therefore, the exponent in 10 is 5.

2. Express 0.235000 in scientific notation.

$0\,.0\,0\,2\,3\,5 = 2.35 \times 10^{-3}$

Decimal point (before) *Decimal point (after)*

The decimal point is moved 3 times to the right to get a number between 1 and 10. The exponent of 10 is 3 with a minus sign.

Write the following in standard form.

1. Write 7.25×10^7 in standard form
   - Since the exponent is positive, move the decimal point to the right 7 times. Therefore, $7.25 \times 10^7 = 72{,}500{,}000$

2. Write $9.5 \times 10^{-4} = 0.00095$
   - The exponent is negative so we must move the decimal point to the left 4 times. Thus, $9.5 \times 10^{-4} = 0.00095$

KEY CONCEPTS

1. A number is written in scientific notation if a number is expressed as a product of a number from 1 to 10 excluding 10 and a power of 10. In symbols, $1 \leq a < b \times 10^n$ where a is a whole number and n is an integer.

2. **CHANGING WHOLE NUMBER INTO SCIENTIFIC NOTATION**
   a. Move the decimal point to the left until it becomes a number between 1 and 10.
   b. The number of places moved by the point is the exponent in the power of 10.

3. **CHANGING DECIMAL NUMBER INTO SCIENTIFIC NOTATION**
   a. Move the decimal point of the right until it becomes a number between 1 and 10.
   b. The number of places moved by the point is the exponent in the power of 10 with a minus sign (-).

4. CHANGING SCIENTIFIC NOTATION TO STANDARD FORM

   a. If the exponent in power of 10 is positive, move the decimal point to the right *n* times, where n is the exponent *n* power of 10.
   b. If the exponent in the power of 10 is negative, move the decimal point to the left *n* times, where *n* is the exponent in the power of 10.

LET'S PRACTICE

I. Which of the following is written in a scientific notation? Encircle the number of the correct answer.

1. 4.25×10^{6}
2. 0.25×10^{-1}
3. $\frac{1}{3} \times 10^{4}$
4. 10×10^{5}
5. $1.26 \times 10^{1/2}$
6. 42.36×10^{-10}
7. 5.01×10^{5}
8. 23.6×10^{2}
9. 1×10^{6}
10. 7.77×10^{-1}

Write the following in scientific notation.

1. 0.000000236 _____
2. 2,730,000,000 _____
3. 56 _____
4. 625, 981 _____
5. 98.87 _____
6. 0.0098 _____
7. 0.23006 _____
8. 62,000 _____
9. 25.9817 _____
10. 0.0033 _____

II. Express the following in standard form.

1. 8.23×10^{4}
2. 1.23×10^{-6}
3. 6.02×10^{2}
4. 3.33×10^{-5}
5. 9.75×10^{9}
6. 5.71×10^{-3}
7. 2.96×10^{-8}
8. 4.82×10^{6}
9. 7.28×10^{11}
10. 9.03×10^{-3}

ENHANCE YOUR SKILLS

Find the value of n such that the mathematical statement is true.

1. 0.000000625 = 6.25×10^n
2. 0.025 = 2.5×10^n
3. 613,000,000 = 6.13×10^n
4. 830,000 = 8.3×10^n
5. 625, 758 = 6.25758×10^n
6. 13, 250 = 1.325×10^n
7. 0.00725 = 7.25×10^n
8. 0.333 = 3.33×10^n
9. 0.000974 = 9.74×10^n
10. 9,752,000 = 9.752×10^n
11. 0.23001 = 2.3001×10^n
12. 0.000869 = 8.69×10^n
13. 1,200 = 1.2×10^n
14. 512,000,000 = 5.12×10^n
15. 0.00000402 = 4.02×10^n

APPLY YOUR SKILLS

I. Write the following in scientific notation.

1. $4^3 \times 5^5$
2. $5^{10} \times 2^3$
3. $2^3 \times 2^2 \times 5$
4. 617×10^{-5}
5. 0.1030×10^8
6. $24 \times 10 \times 12$
7. $8^2 \times 5^5$
8. $11 \times 2 \times 20$
9. 0.001×0.0005
10. $4^5 \times 2 \times 5 \times 4$
11. 235267112
12. 0.12108390
13. $(2 \times 10) \times (3 \times 10^2)$
14. 432, 123, 124
15. $(1 + 40) \times (1000)$

CHALLENGE

Write the product in scientific notation.

1. $(3.5 \times 10^3) \times (10 \times 10^2)$
2. $(5 \times 10^4) \times (3 \times 10^2)$
3. $(8 \times 2) \times (10 \times 10^4)$
4. $(2^3 \times 10^3) \times (5 \times 10^{-3})$
5. $(0.00001) \times (0.000003)$