

# Understanding Scientific Notation

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

**Scientific notation** writes a number as  $a \times 10^n$ , where  $a$  is at least 1 and less than 10, and  $n$  is an integer. It is a tidy way to handle very large or very small numbers. For a *large* number, the exponent  $n$  is **positive** and counts how many places the decimal moves left:  $52,000 = 5.2 \times 10^4$ . For a *small* number,  $n$  is **negative** and counts how many places the decimal moves right:  $0.0007 = 7 \times 10^{-4}$ . To go back to standard form, just slide the decimal the other way. Keeping  $a$  between 1 and 10 is the part students forget — check it every time.

◇ **Example:** Write 0.00041 in scientific notation.

⇒ We need the form  $a \times 10^n$  with  $a$  between 1 and 10. Start at the decimal point in 0.00041 and slide it right until you get a number in that range: moving 4 places gives 4.1. Because the original number was *small*, the exponent is **negative**, and it equals the number of places we moved:  $-4$ . So the answer is  $4.1 \times 10^{-4}$ . A quick check: a negative exponent always means a number less than 1, which matches.

**Answer:**  $4.1 \times 10^{-4}$

## PRACTICE

Convert between standard form and scientific notation.

- |   |   |
|---|---|
| 1. Write 7000 in scientific notation _____      | 11. Write $2.5 \times 10^3$ in standard form _____            |
| 2. Write 41000 in scientific notation _____     | 12. Write $6.04 \times 10^5$ in standard form _____           |
| 3. Write 360000 in scientific notation _____    | 13. Write $1.7 \times 10^6$ in standard form _____            |
| 4. Write 9200000 in scientific notation _____   | 14. Write $9 \times 10^4$ in standard form _____              |
| 5. Write 58000000 in scientific notation _____  | 15. Write $3.2 \times 10^{-2}$ in standard form _____         |
| 6. Write 0.0006 in scientific notation _____    | 16. Write $7.5 \times 10^{-4}$ in standard form _____         |
| 7. Write 0.00029 in scientific notation _____   | 17. Write $4 \times 10^{-5}$ in standard form _____           |
| 8. Write 0.000051 in scientific notation _____  | 18. Write $6.1 \times 10^{-1}$ in standard form _____         |
| 9. Write 0.0000072 in scientific notation _____ | 19. Is $47 \times 10^3$ in proper scientific notation? _____  |
| 10. Write 0.83 in scientific notation _____     | 20. Is $0.6 \times 10^5$ in proper scientific notation? _____ |

### ◆ Word Problems

21. Light travels about 300,000,000 meters per second. Write this speed in scientific notation. \_\_\_\_\_
22. A red blood cell has a diameter of about 0.000008 meters. Write this diameter in scientific notation. \_\_\_\_\_
23. A country's national park system covers about  $5.2 \times 10^7$  acres. Write this area in standard form. \_\_\_\_\_
24. The mass of a grain of fine sand is about  $1.5 \times 10^{-5}$  grams. Write this mass in standard form. \_\_\_\_\_



## Answer Keys

- |                          |                                       |
|--------------------------|---------------------------------------|
| 1. $7 \times 10^3$       | 13. 1700000                           |
| 2. $4.1 \times 10^4$     | 14. 90000                             |
| 3. $3.6 \times 10^5$     | 15. 0.032                             |
| 4. $9.2 \times 10^6$     | 16. 0.00075                           |
| 5. $5.8 \times 10^7$     | 17. 0.00004                           |
| 6. $6 \times 10^{-4}$    | 18. 0.61                              |
| 7. $2.9 \times 10^{-4}$  | 19. no; $4.7 \times 10^4$             |
| 8. $5.1 \times 10^{-5}$  | 20. no; $6 \times 10^4$               |
| 9. $7.2 \times 10^{-6}$  | 21. $3 \times 10^8$ meters per second |
| 10. $8.3 \times 10^{-1}$ | 22. $8 \times 10^{-6}$ meters         |
| 11. 2500                 | 23. 52,000,000 acres                  |
| 12. 604000               | 24. 0.000015 grams                    |

### Step-by-Step Explanations

- |   |  |
|---|--|
| <p>1. Move the decimal 3 places left to get 7; large number, so exponent is +3.</p> <p>2. Slide the decimal 4 places left to reach 4.1; the exponent is +4.</p> <p>3. Move the decimal 5 places left to get 3.6, so the power is <math>10^5</math>.</p> <p>4. The decimal moves 6 places left to reach 9.2, giving <math>10^6</math>.</p> <p>5. Slide the decimal 7 places left to 5.8; exponent is +7.</p> <p>6. Move the decimal 4 places right to get 6; small number, so exponent is -4.</p> <p>7. Slide the decimal 4 places right to reach 2.9; the exponent is -4.</p> <p>8. Move the decimal 5 places right to 5.1, so the power is <math>10^{-5}</math>.</p> <p>9. The decimal moves 6 places right to 7.2, giving <math>10^{-6}</math>.</p> <p>10. Move the decimal 1 place right to get 8.3; exponent is -1.</p> <p>11. A positive exponent moves the decimal 3 places right: 2500.</p> <p>12. Slide the decimal 5 places right: 604,000.</p> <p>13. Move the decimal 6 places right: 1,700,000.</p> <p>14. A power of <math>10^4</math> moves the decimal 4 places right: 90,000.</p> | <p>15. A negative exponent moves the decimal 2 places left: 0.032.</p> <p>16. Slide the decimal 4 places left: 0.00075.</p> <p>17. Move the decimal 5 places left: 0.00004.</p> <p>18. Move the decimal 1 place left: 0.61.</p> <p>19. The factor 47 is not between 1 and 10; rewrite as <math>4.7 \times 10^4</math>.</p> <p>20. The factor 0.6 is less than 1; rewrite as <math>6 \times 10^4</math>.</p> <p>21. Move the decimal 8 places left to get 3. Since the number is large, the exponent is positive: <math>3 \times 10^8</math>.</p> <p>22. Slide the decimal 6 places right to reach 8. The number is small, so the exponent is negative: <math>8 \times 10^{-6}</math>.</p> <p>23. A positive exponent of 7 moves the decimal 7 places right, giving 52,000,000 acres.</p> <p>24. A negative exponent of 5 moves the decimal 5 places left, giving 0.000015 grams.</p> |
|---|--|



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