

13.7 SCIENTIFIC NOTATION

Mathematicians have developed a compact method to write very large and also very small numbers that contain many zeros. This method is known as **scientific notation**. The examples below show how we would write a number in scientific notation given its standard form.

Standard Form	Scientific Notation	To convert any number into scientific notation, we must first locate the decimal and then move the decimal behind the first non-zero digit . We then count the number of places we have moved the decimal and this becomes the exponent. If we moved the decimal to the left, the exponent will be positive, if we moved the decimal to the right, the exponent will be negative. Numbers greater than one have positive or zero exponents, and numbers less than one, have negative exponents.
1. 95 000 000 000	9.5×10^{10}	
2. 865 000 000	8.65×10^8	
3. 0.000 000 035	3.5×10^{-8}	
4. -156 200 000 000 000	-1.562×10^{14}	
5. 0.000 808	8.08×10^{-4}	

A. Multiply the following by the powers of ten indicated by moving the decimal the required number of spaces.

- 5.4778×10^6 5 477 800 .
- 0.087844706×10^8 8 784 470 . 6
- $389.8116798 \times 10^{13}$ 3 898 116 798 000 000 .
- $842121094.22 \times 10^{-7}$ 84 . 212 109 422
- 486×10^{-9} 0 . 000 000 486
- 56.7×10^0 56 . 7
- 8.34×10^4 83 400 .
- 7.6×10^{-5} 0 . 000 076
- 8.3652×10^3 8365 . 2
- 76.35×10^8 7 635 000 000 .

B. Write each of the following in standard form.

- 3.45×10^6 3 450 000
- -6.786×10^5 - 678 000
- 5.7429×10^9 5 742 900 000
- 8.54×10^{-7} 0 . 000 000 854
- 7.951×10^{-3} 0 . 007 951

C. Write the following as powers of ten. (The first one is done for you.)

1. $1000 = 10^3$

2. $100 = 10^2$

3. $10\ 000 = 10^4$

4. $1\ 000\ 000 = 10^6$

5. $1\ 000\ 000\ 000 = 10^9$

6. $10 = 10^1$

7. $10\ 000\ 000\ 000 = 10^{10}$

8. $100\ 000 = 10^5$

9. $100\ 000\ 000 = 10^8$

10. $100\ 000\ 000\ 000\ 000 = 10^{14}$

11. $\frac{1}{100} = 10^{-2}$

12. $\frac{1}{1000} = 10^{-3}$

13. $\frac{1}{100\ 000} = 10^{-5}$

14. $\frac{1}{1\ 000\ 000\ 000} = 10^{-9}$

15. $\frac{1}{10} = 10^{-1}$

16. $\frac{1}{1\ 000\ 000\ 000\ 000\ 000\ 000} = 10^{-18}$

17. $\frac{1}{10\ 000} = 10^{-4}$

18. $\frac{1}{100\ 000\ 000} = 10^{-8}$

19. $\frac{1}{1} = 10^0$

20. $\frac{100}{1000} = \frac{10^2}{10^3} = 10^{-1}$

D. Write each of the following in scientific notation.

1. $866\ 000 = 8.66 \times 10^5$

2. $58\ 700 = 5.87 \times 10^4$

3. $4\ 700\ 000 = 4.7 \times 10^6$

4. $0.000\ 687\ 3 = 6.873 \times 10^{-4}$

5. $0.000\ 84 = 8.4 \times 10^{-4}$

6. $156\ 800\ 000 = 1.568 \times 10^8$

7. $0.000\ 35 = 3.5 \times 10^{-4}$

8. $-6\ 536\ 000\ 000 = -6.536 \times 10^9$

9. $500\ 000\ 000 = 5 \times 10^8$

10. $55\ 000\ 000 = 5.5 \times 10^7$

11. $-0.000\ 000\ 000\ 792 = -7.92 \times 10^{-10}$

12. $0.000\ 000\ 000\ 600\ 05 = 6.0005 \times 10^{-10}$

13. $-4\ 790\ 000\ 000 = -4.79 \times 10^9$

14. $500 = 5 \times 10^2$

15. $6\ 306\ 000 = 6.306 \times 10^6$

16. $54\ 000\ 000\ 000 = 5.4 \times 10^{10}$

17. $763\ 000\ 000 = 7.63 \times 10^8$

18. $-300\ 700\ 000\ 000 = -3.007 \times 10^{11}$

19. $0.000\ 000\ 67 = 6.7 \times 10^{-7}$

20. $5\ 632.87 = 5.63287 \times 10^3$