

Section 5.4 Scientific Notation

Section 5.4 Calculator Exercises

1. 23,920

3. 2×10^{-14}

5. 19,200,000

Section 5.4 Practice Exercises

1. scientific notation

3. $b^5 b^8 = b^{5+8}$
 $= b^{13}$

5. $10^5 \cdot 10^8 = 10^{5+8}$
 $= 10^{13}$

7. $\frac{y^2}{y^7} = y^{2-7} = y^{-5} = \frac{1}{y^5}$

9. $(x^5 y^{-3})^4 = (x^5)^4 (y^{-3})^4$
 $= x^{20} y^{-12}$
 $= \frac{x^{20}}{y^{12}}$

11. $\frac{w^{-2} w^5}{w^{-1}} = \frac{w^3}{w^{-1}}$
 $= w^{3-(-1)}$
 $= w^4$

13. $\frac{10^{-2} \cdot 10^5}{10^{-1}} = \frac{10^3}{10^{-1}}$
 $= 10^{3-(-1)}$
 $= 10^4$

15. Move the decimal point between 2 and 3 and multiply by 10^{-10} ; 2.3×10^{-10}

17. Move the decimal point between 5 and 0 and multiply by 10^4 ; $50,000 = 5 \times 10^4$

19. Move the decimal point between 2 and 0 and multiply by 10^5 ;
 $208,000 = 2.08 \times 10^5$

21. Move the decimal point between 6 and 0 and multiply by 10^6 ;
 $6,010,000 = 6.01 \times 10^6$

23. Move the decimal point between 8 and 0 and multiply by 10^{-6} ;

$$0.000008 = 8 \times 10^{-6}$$

25. Move the decimal point between 1 and 2 and multiply by 10^{-4} ;

$$0.000125 = 1.25 \times 10^{-4}$$

27. Move the decimal point between 6 and 7 and multiply by 10^{-3} ;

$$0.006708 = 6.708 \times 10^{-3}$$

29. Move the decimal point between 1 and 7 and multiply by 10^{-24} ;

$$1.7 \times 10^{-24} \text{ g}$$

31. Move the decimal point between 2 and 7 and multiply by 10^{10} ; $\$2.7 \times 10^{10}$

33. Move the decimal point between 6 and 8 and multiply by 10^7 ; 6.8×10^7 gal

Move the decimal point between 1 and 0 and multiply by 10^2 ; 1×10^2 mi

35. Move the decimal point nine places to the left; 0.0000000031

37. Move the decimal point five places to the left; 0.00005

39. Move the decimal point three places to the right; 2800

41. Move the decimal point four places to the left; 0.000603

43. Move the decimal point six places to the right; 2,400,000

45. Move the decimal point two places to the left; 0.019

47. Move the decimal point three places to the right; 7032

49. Move the decimal point twelve places to the left; 0.000000000001 g

51. Move the decimal point three places to the right; 1600 Cal; move the decimal point three places to the right; 2800 Cal

$$\begin{aligned} \mathbf{53.} \quad (2.5 \times 10^6)(2 \times 10^{-2}) &= 2.5(2) \times 10^6 \cdot 10^{-2} \\ &= 5 \times 10^4 \end{aligned}$$

$$\begin{aligned} \mathbf{55.} \quad (1.2 \times 10^4)(3 \times 10^7) &= 1.2(3) \times 10^4 \cdot 10^7 \\ &= 3.6 \times 10^{11} \end{aligned}$$

$$\mathbf{57.} \quad \frac{7.7 \times 10^6}{3.5 \times 10^2} = \frac{7.7}{3.5} \times 10^{6-2} = 2.2 \times 10^4$$

$$\mathbf{59.} \quad \frac{9 \times 10^{-6}}{4 \times 10^7} = \frac{9}{4} \times 10^{-6-7} = 2.25 \times 10^{-13}$$

$$\begin{aligned} \mathbf{61.} \quad (8.0 \times 10^{10})(4.0 \times 10^3) &= 8(4) \times 10^{10} \cdot 10^3 \\ &= 32 \times 10^{13} \\ &= 3.2 \times 10^1 \times 10^{13} \\ &= 3.2 \times 10^{14} \end{aligned}$$

$$\begin{aligned} \mathbf{63.} \quad (3.2 \times 10^{-4})(7.6 \times 10^{-7}) \\ &= 3.2(7.6) \times 10^{-4} \cdot 10^{-7} \\ &= 24.32 \times 10^{-11} \\ &= 2.432 \times 10^1 \times 10^{-11} \\ &= 2.432 \times 10^{-10} \end{aligned}$$

$$\begin{aligned} \mathbf{65.} \quad \frac{2.1 \times 10^{11}}{7 \times 10^{-3}} &= \frac{2.1}{7} \times 10^{11-(-3)} \\ &= 0.3 \times 10^{14} \\ &= 3 \times 10^{-1} \times 10^{14} \\ &= 3 \times 10^{13} \end{aligned}$$

$$\begin{aligned} \mathbf{67.} \quad \frac{5.7 \times 10^{-2}}{9.5 \times 10^{-8}} &= \frac{5.7}{9.5} \times 10^{-2-(-8)} \\ &= 0.6 \times 10^6 \\ &= 6 \times 10^{-1} \times 10^6 \\ &= 6 \times 10^5 \end{aligned}$$

$$\begin{aligned} \mathbf{69.} \quad 6,000,000,000 \times 0.0000000023 \\ &= (6 \times 10^9)(2.3 \times 10^{-9}) \\ &= 13.8 \times 10^{9+(-9)} \\ &= 1.38 \times 10^1 \times 10^0 \\ &= 1.38 \times 10^1 \end{aligned}$$

$$\begin{aligned}
 71. \quad \frac{0.0000000003}{6000} &= \frac{3 \times 10^{-10}}{6 \times 10^3} \\
 &= 0.5 \times 10^{-10-3} \\
 &= 5 \times 10^{-1} \times 10^{-13} \\
 &= 5 \times 10^{-14}
 \end{aligned}$$

73. (thickness of paper)(no. of pieces)

$$\begin{aligned}
 &= (3 \times 10^{-3})(1.25 \times 10^3) \\
 &= 3(1.25) \times 10^{-3+3} \\
 &= 3.75 \times 10^0 \\
 &= 3.75 \text{ inches}
 \end{aligned}$$

75. (number of shares)(price per share)

$$\begin{aligned}
 &= (1,100,000,000)(27) \\
 &= (1.1 \times 10^9)(27) \\
 &= 29.7 \times 10^9 = 2.97 \times 10^1 \times 10^9 \\
 &= \$2.97 \times 10^{10} \text{ or } \$29,700,000,000
 \end{aligned}$$

77. (a) 65 million = 65,000,000

$$= 6.5 \times 10^7$$

(b) 6.5×10^7 years

$$\begin{aligned}
 &= (6.5 \times 10^7 \text{ years})(365 \text{ days}) \\
 &= (6.5 \times 10^7 \text{ years})(3.65 \times 10^2 \text{ days}) \\
 &= 23.725 \times 10^9 \\
 &= 2.3725 \times 10^1 \times 10^9 \\
 &= 2.3725 \times 10^{10} \text{ days}
 \end{aligned}$$

(c) 6.5×10^7 years

$$\begin{aligned}
 &= (2.3725 \times 10^{10} \text{ days})(24 \text{ hours}) \\
 &= (2.3725 \times 10^{10} \text{ days})(2.4 \times 10^1 \text{ hours}) \\
 &= 5.694 \times 10^{11} \text{ hours}
 \end{aligned}$$

(d) 6.5×10^7 years

$$\begin{aligned}
 &= (5.694 \times 10^{11} \text{ hours})(3600 \text{ seconds}) \\
 &= (5.694 \times 10^{11} \text{ hours})(3.6 \times 10^3 \text{ seconds}) \\
 &= 20.4984 \times 10^{14} \\
 &= 2.04984 \times 10^1 \times 10^{14} \\
 &= 2.04984 \times 10^{15} \text{ seconds}
 \end{aligned}$$