

**Worksheet 2-10: Scientific Notation**

How do you write a very large number or a very small number?

Writing ten thousand billion can take a long time to write.

Mathematicians come up with shortcut: **Scientific Notation**

To write a very “**large size**” number in scientific notation, we write the number as the “**product**” of  
 (1) a **decimal number** greater than  $-10$  and less than or equal to  $-1$  (e.g.,  $-1.00001$ ,  $-1.0$ ,  $-5.7$ ,  $-9.9989$ )  
 or  
 a **decimal number** greater than or equal to  $1$  and less than  $10$  (e.g.,  $1.00001$ ,  $1.0$ ,  $5.7$ ,  $9.9989$ )  
*and*  
 (2) a **power of 10** with a positive exponent (e.g.,  $10^2$ ,  $10^7$ ,  $10^{25}$ ,  $10^{100}$ )

**Practice:**

1. Write the following numerals in scientific notation.

(a)  $120\,000\,000\,000 = 1.2 \times 100\,000\,000\,000 = 1.2 \times 10^{11}$

(b)  $1\,300\,000 =$

(c)  $4\,500\,000\,000 =$

(d)  $7\,800 =$

To write a very “**small size**” number in scientific notation, we write the number as the “**product**” of  
 (1) a **decimal number** greater than  $-10$  and less than or equal to  $-1$  (e.g.,  $-1.00001$ ,  $-1.0$ ,  $-5.7$ ,  $-9.9989$ )  
 or  
 a **decimal number** greater than or equal to  $1$  and less than  $10$  (e.g.,  $1.00001$ ,  $1.0$ ,  $5.7$ ,  $9.9989$ )  
*and*  
 (2) a **power of 10** with a negative exponent (e.g.,  $10^{-2}$ ,  $10^{-7}$ ,  $10^{-25}$ ,  $10^{-100}$ )

**Practice:**

2. Write the following numerals in scientific notation.

(a)  $0.000\,000\,000\,000\,000\,000\,001\,67 = 1.67 \times 0.000\,000\,000\,000\,000\,000\,001 = 1.67 \times 10^{-21}$

(b)  $0.00001 =$

(c)  $0.000\,000\,005 =$

(d)  $0.000\,000\,789 =$

3. Write the following scientific notation as a numeral.

- (a)  $2.3 \times 10^6$  (b)  $5.78 \times 10^5$  (c)  $2.3 \times 10^{-6}$  (d)  $5.78 \times 10^{-5}$

4. Write in scientific notation.

- (a)  $18 \times 10^2$  (b)  $142 \times 10^{-5}$  (c)  $0.16 \times 10^2$  (d)  $0.236 \times 10^{-6}$

5. Simplify, to the nearest hundredth.

- (a)  $3.6 \times 10^{23} \times 5.9 \times 10^6$  (b)  $4.1 \times 10^{26} \times 3.2 \times 10^9$

(c)  $\frac{1.146 \times 10^9}{5 \times 10^{-4}}$

(d)  $\frac{1.98 \times 10^{30}}{2.7 \times 10^7}$

6. All matters is made up of atoms. Atoms are so small that  $6.022 \times 10^{23}$  gold atoms have a mass of approximately 200g. You could hold this many atoms of gold in the palm of your hand. The same number, in grains of sand, takes up the top 2 m of sand in the Sahara Desert. How many atoms of gold are in a 1-kg gold bar?

**Answers:** 1. (b)  $1.3 \times 10^6$ , (c)  $4.5 \times 10^9$ , (d)  $7.8 \times 10^3$ ; 2. (b)  $1.0 \times 10^{-5}$ , (c)  $5.0 \times 10^{-9}$ , (d)  $7.89 \times 10^{-7}$ ;  
 3. (a) 2 300 000, (b) 578 000, (c) 0.0 000 023, (d) 0.0 000 578; 4. (a)  $1.8 \times 10^3$ , (b)  $1.42 \times 10^{-3}$ ,  
 (c)  $1.6 \times 10^1$ , (d)  $2.36 \times 10^{-7}$ ; 5. (a)  $2.12 \times 10^{30}$ , (b)  $1.31 \times 10^{36}$ , (c)  $2.29 \times 10^{12}$ , (d)  $7.33 \times 10^{22}$ ;  
 6.  $3.011 \times 10^{24}$