**29:006.—Notes on Scientific notation**

In physics we often deal with very small and very large numbers. For example the speed of light is approximately 300,000,000 m/s. The size of an atom is roughly 0.0000000001 m. Rather than writing out all of the zeros, we express these numbers in scientific notation – a decimal number followed by the factor 10 raised to some power.

In scientific notation then the speed of light is roughly \( 3 \times 10^8 \) m/s (or more precisely \( 2.99 \times 10^8 \) m/s). Small numbers (numbers less than 1) are handled using negative exponents on the 10. The size of the atom would be written as \( 1 \times 10^{-10} \) m.

Examples:

- \( 4,500,000 \rightarrow 4.5 \times 10^6 \)
- \( 0.000789 \rightarrow 7.89 \times 10^{-4} \)

**big numbers (greater than 1)**

- \( 10 = 10^1 \)
- \( 100 = 10 \times 10 = 10^2 \)
- \( 1,000 = 10 \times 10 \times 10 = 10^3 \)
- \( 1,000,000 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^6 \)
- \( 1,000,000,000,000 = 10^{12} \) (trillion)
- \( 2000 = 2 \times 1000 = 2 \times 10^6 \)
- \( 2500 = 2.5 \times 1000 = 2.5 \times 10^6 \)

**small numbers (less than 1)**

- \( 0.1 = \frac{1}{10} = 10^{-1} \)
- \( 0.01 = \frac{1}{100} = \frac{1}{10^2} = 10^{-2} \)
- \( 0.02 = \frac{2}{100} = \frac{2}{10^2} = 2 \times 10^{-2} \)
- \( 0.0057 = 5.7 \times 10^{-3} \)
29:006 – Practice Problems on Scientific Notation

1. Express the following numbers in scientific notation.
   
   (a)  2,530,000
   (b)  0.0000072
   (c)  859
   (d)  0.001
   (e)  300,000,000

2. Express the following in standard notation.

   (a)  $7.35 \times 10^4$
   (b)  $8.6 \times 10^{-5}$
   (c)  $1.87 \times 10^5$
   (d)  $6.67 \times 10^{-12}$
   (e)  $6 \times 10^8$

3. Given $A = 6 \times 10^8$, $B = 2 \times 10^6$, find:

   (a)  $A + B$
   (b)  $A - B$
   (c)  $A \div B$
   (d)  $B \div A$

4. Given $C = 3 \times 10^{17}$, $D = 9 \times 10^9$, find:

   (a)  $A \times B$
   (b)  $A \div B$
   (c)  $B \div A$

5. Given $G = 5 \times 10^{-6}$, $H = 2 \times 10^{-7}$, find:

   (a)  $G + H$
   (b)  $G - H$
   (c)  $G \div H$
   (d)  $H \div G$
Answers:

1. (a) \(2.53 \times 10^6\)
   (b) \(7.2 \times 10^{-6}\)
   (c) \(8.59 \times 10^2\)
   (d) \(3 \times 10^8\)

2. (a) \(73,500\)
    (b) \(0.000086\)
    (c) \(187000\)
    (d) \(600,000,000\)

3. (a) \(6.02 \times 10^8\)
    (b) \(5.98 \times 10^8\)
    (c) \(3 \times 10^2\)
    (d) \(3.33 \times 10^{-3}\)

4. (a) \(2.7 \times 10^{27}\)
    (b) \(3.33 \times 10^7\)
    (c) \(3 \times 10^8\)

5. (a) \(5.2 \times 10^{-6}\)
    (b) \(4.8 \times 10^{-6}\)
    (c) \(25\)
    (d) \(4 \times 10^{-2}\)