

ENGINEERING NOTATION

METRIC PREFIXES

Some powers of ten have been given names that are used as prefixes. Some examples are *microamps*, *kilograms*, *millimeters*, and *megahertz*. These are called **metric prefixes**. Metric prefixes are used to express numbers in engineering notation. Here is a list of the most commonly seen prefixes, their meanings and their symbols.

PREFIX	POWER OF 10	SYMBOL	EXAMPLE
mega	10^6	M	Mohm
kilo	10^3	k	kmeter
milli	10^{-3}	m	mliter
micro	10^{-6}	μ	μ amps

Expressing Numbers

A number expressed in **engineering notation** consists of a decimal portion that lies between 1 and 1000, followed by a power of ten that is a multiple of three.

For example, 42×10^{-3} would be the engineering notation for 0.042.

Expressing Quantities

When using **engineering notation** to express a **quantity having units**, the power of ten is expressed as the metric prefix of the units.

For example, 196 Mhertz, 12.6 kmeter, 386 msecond, and 724 μ amp are examples of quantities given in engineering notation.

EXAMPLES

1. Convert 350,000,000 meters into engineering notation.

To express a number in engineering notation, adjust the decimal point so that the decimal portion of the number lies between 1 and 1000 and the corresponding power of ten is a multiple of three.

Move the decimal six times to the left to get 350×10^6 . Replace 10^6 with its symbol, M.

$$350,000,000 \text{ meters} = 350 \times 10^6 \text{ meters} = 350 \text{ Mmeters}$$

2. Convert 89.3 μ meters into decimal notation.

Removing the metric prefix is easy. Replace the prefix with the equivalent power of ten. Use the exponent as a guide to move the decimal point.

$$89.3 \mu\text{meters} = 89.3 \times 10^{-6} \text{ meters} = 0.000\,089\,3 \text{ meters}$$

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<p>1. Convert from decimal notation into engineering notation.</p> <p>a. $0.000\ 452\ \text{grams} = 452 \times 10^{-6}\ \text{grams}$ $\qquad\qquad\qquad = 452\ \mu\text{grams}$</p> <p>b. $720,000,000\ \text{hertz}$</p> <p>c. $0.005\ 3\ \text{grams}$</p> <p>d. $823,000\ \text{meters per sec}$</p>	<p>2. Convert from engineering notation to decimal notation.</p> <p>a. $56.2\ \mu\text{amps} = 56.2 \times 10^{-6}\ \text{amps}$ $\qquad\qquad\qquad = 0.000\ 056\ 2\ \text{amps}$</p> <p>b. $486\ \text{kohms}$</p> <p>c. $83\ \text{Mmeters}$</p> <p>d. $12\ \text{mmeters}$</p>
<p>3. Convert from scientific notation to engineering notation.</p> <p>a. $1.90 \times 10^{-4}\ \text{meters} = 0.\underline{000}\underline{190}\ \text{meters}$ $\qquad\qquad\qquad = 190 \times 10^{-6}\ \text{meters}$ $\qquad\qquad\qquad = 190\ \mu\text{meters}$</p> <p>b. $3.62 \times 10^5\ \text{Newtons}$</p> <p>c. $3.1980 \times 10^{-2}\ \text{grams}$</p>	<p>4. Convert from engineering notation to scientific notation.</p> <p>a. $67.4\ \text{kNewtons} = 67.4 \times 10^3\ \text{Newtons}$ $\qquad\qquad\qquad = 6.74 \times 10^4\ \text{Newtons}$</p> <p>b. $19\ \text{Mohms}$</p> <p>c. $200.4\ \mu\text{meters}$</p>

5. Unscramble these letters:

- A E M G
- I O C M R
- I O P C
- E A R T
- E O T F M

Now unscramble the circled letters to solve the puzzle.

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[Hint: See page A-7 in your text for help.]

ENGINEERING NOTATION

<p>1. Convert from decimal notation into engineering notation.</p> <p>a. 452 grams = 452×10^{-6} grams = 452 μgrams</p> <p>b. 720,000,000 hertz = 720×10^6 hertz = 720 Mhertz</p> <p>c. 0.005 3 grams = 5.3×10^{-3} grams = 5.3 mgrams</p> <p>d. 823,000 meters per sec = 823×10^3 meters per second = 823 kmeters per second</p>	<p>2. Convert from engineering notation to decimal notation.</p> <p>a. 56.2 μamps = 56.2×10^{-6} amps = 0.000 056 2 amps</p> <p>b. 486 kohms = 486×10^3 ohms = 486,000 ohms</p> <p>c. 83 Mmeters = 83×10^6 meters = 83,000,000 meters</p> <p>d. 12 mmeters = 12×10^{-3} meters = 0.012 meters</p>
<p>3. Convert from scientific notation to engineering notation.</p> <p>a. 1.90×10^{-4} meters = 0.000 190 meters = 190×10^{-6} meters = 190 μmeters</p> <p>b. 3.62×10^5 Newtons = 362,000 Newtons = 362×10^3 Newtons = 363 kNewtons</p> <p>c. 3.1980×10^{-2} grams = 0.031 980 grams = 31.980×10^{-3} grams = 31.980 mgrams</p>	<p>4. Convert from engineering notation to scientific notation.</p> <p>a. 67.4 kNewtons = 67.4×10^3 Newtons = 6.74×10^4 Newtons</p> <p>b. 19 Mohms = 19×10^6 ohms = 1.9×10^7 ohms</p> <p>c. 200.4 μmeters = 200.4×10^{-6} meters = 2.004×10^{-4} meters</p>

5. Unscramble these letters:

A E M G	M E G A
I O C M R	M I C R O
I O P C	P I C O
E A R T	T E R A
E O T F M	F E M T O

Now unscramble the circled letters to solve the puzzle.

M E T R I C P R E F I X