PhyzSpringboard: Numeric Notation

SCIENTIFIC NOTATION

1. Consider the following values.

√ 6.7×10^{2}	X 36×10^{4}	√ $\pi \times 10^{7}$	X $2 \times 10^{7.61}$
X 0.67×10^{3}	X 382	? -5.24×10^{-8}	X $^{4}/_{3} \times 10^{5}$
√ 4×10^{36}	X $7 \times 10^{\pi}$	√ 7.61×10^{0}	X $5 \times 10^{4/3}$

a. In the blank preceding each value, mark all those that are in correct scientific notation with a √ and mark those that are not in correct scientific notation with an X.

b. What are the rules for correctly expressing a value in scientific notation?

A x 10^{n} : A is a rational number between 1 and 10 ($1 \leq A < 10$) expressed in decimal form, n is a whole number.

2. a. Rewrite each value below in scientific notation.

i. The mass of the sun is 1,990,000,000,000,000,000,000,000,000,000 kg.

1.99 x 1030 kg

ii. The mass of an electron is 0.000 000 000 000 000 000 000 000 000 000 911 kg.

9.11 x 10-31 kg

b. What is the advantage of using scientific notation?

Saves space and writing effort.

c. Rewrite each value below in scientific notation.

i. The charge on a proton is 0.000 000 000 000 000 000 16 C.

1.6 x 10–19 C

ii. The mass of the earth is 5,980,000,000,000,000,000,000,000 kg.

5.98 x 1024 kg

iii. The width of the classroom is 9 m.

9 x 100 m

iv. Some charge I just thought up is 1.000 000 000 000 000 16 C.

1.000 000 000 000 000 16 x 100 C

d. Does using scientific notation **always** have the advantage mentioned in part b above?

No.

ENGINEERING NOTATION

3. A close relative to scientific notation is engineering notation. Examine the values on the the list prepared below.

Value	SCIENTIFIC NOTATION?	ENGINEERING NOTATION?
1.6×10^{3}	√	√
2.5×10^{-6}	√	√
3.6×10^{4}	√	X
4.9×10^{-7}	√	X

Value	SCIENTIFIC NOTATION?	ENGINEERING NOTATION?
64×10^{9}	X	√
256×10^{-12}	X	√
0.511×10^{-6}	X	X
$1{,}024 \times 10^{12}$	X	X

a. What are the rules for correctly expressing a value in engineering notation?

B x 10m : B is a rational number between 1 and 1000 (1 ≤ A < 1000) expressed in decimal form, m is a whole number multiple of 3.

b. Rewrite each value below in engineering notation.

i. 5,897,000,000 — 5.897 x 10^{9}

ii. 897,000,000 — 897 x 10^{6}

iii. 0.511 — 511 x 10^{-3}

iv. 0.000 051 1 — 51.1 x 10^{-6}

v. 4.17×10^{4} — 41.7 x 10^{3}

vi. 4.17×10^{-4} — 417 x 10^{-6}

SI PREFIX NOTATION

4. The International System (SI) of units employs a collection of prefixes to denote powers of ten used in conjunction with units. See your reference sheet on those prefixes and complete the table below.

Raw Value	Engineering	SI Prefix Notation	Written Out
96,740 m	**96.74×10^{3} m**	**96.74 km**	**96.74 kilometers**
500,000,000 Hz	500 x 106 Hz	500 MHz	500 megahertz
0.000 06 C	**60×10^{-6} C**	60 µC	60 microcoulombs
227,000,000,000 B	227 x 10^{9} B	**227 GB**	**227 gigabytes**
0.000 000 008 42 s	8.42 x 10^{-9} s	8.42 ns	**8.42 nanoseconds**

CALCULATOR EXERCISE

5. It is your responsibility to learn how to enter values in any format into your calculator correctly. You must also learn to perform calculations involving numbers in any format. Examine the worked example, then complete the exercise.

a. What is the area in m^2 of a 3.7 mm by 820 µm rectangle?

My calculator entry (TI-30): 3 . 7 EXP +/- 3 x 8 2 0 EXP +/- 6 =

My calculator's displayed result: 0.000003034 -or- 3.034 -06

My written answer: 3.034 x 10-6 m2. (Actually, it's 3.0 x 10-6 m2. More on that later)

b. What is the speed in m/s of a body that moves 25 Gm in 400 Ms?

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