

Using Scientific Notation

Scientific notation is a special way of writing numbers that makes it easier to write big and small values

Like this: $700 \rightarrow 7 \times 10^2$

Or this: $4,900,000,000 \rightarrow 4.9 \times 10^9$

Or even this: $0.0000000000258 \rightarrow 2.58 \times 10^{-11}$

The number is written in two parts:

- Just the digits (with the decimal point placed after the first digit), followed by
- X 10 to a power that puts the decimal point where it should be (it shows how many places to move the decimal point)

To figure out the power of 10, think “ how many places do I move the decimal point?”

Positive powers of 10 mean the number is greater than 1

Negative powers of 10 mean the number is less than 1

Remember: you always need one non-zero digit to the left of the decimal

Try some!

Number	Scientific notation
36000	3.6×10^4
150000000	1.5×10^8
0.0000210	2.10×10^{-5}
0.000044	4.4×10^{-5}
0.0000085	8.5×10^{-6}
2200000	2.20×10^6
0.00135	1.35×10^{-3}

Scientific notation and your calculator

Make sure that the number in scientific notation is put into your calculator correctly.

Read the directions for your particular calculator. For inexpensive scientific calculators:

1. Punch the number (the digit number) into your calculator.
2. Push the EE or EXP button. Do NOT use the x (times) button!!
3. Enter the exponent number. Use the +/- button to change its sign.
4. Voila! Treat this number normally in all subsequent calculations.

To check yourself, multiply 6.0×10^6 times 4.0×10^7 on your calculator. Your answer should be 2.4×10^{14} .

Rounding Rules

- If the first digit removed is less than 5 - round down
- If the first digit removed is greater than 5 - round up
- If the first digit removed is 5 and following numbers are nonzero - round up
- If the first digit removed is 5 and following numbers are zero - round to even

Round all numbers to 2 sig figs and write the number using scientific notation:

- | | | | |
|----|---------------|---------------|-------------------|
| a) | 1209 | 1200 | 1.2×10^3 |
| b) | 33.6 | 34 | 3.4×10^1 |
| c) | 375 | 380 | 3.8×10^2 |
| d) | 365 | 360 | 3.6×10^2 |
| e) | 1,729,304,059 | 1,700,000,000 | 1.7×10^9 |

In mathematical operations involving significant figures, the answer is reported in such a way that it reflects the reliability of the least precise operation. Let's state that another way: a chain is no stronger than its weakest link. An answer is no more precise than the least precise number used to get the answer. Let's do it one more time: imagine a team race where you and your team must finish together. Who dictates the speed of the team? Of course, the slowest member of the team. Your answer cannot be MORE precise than the least precise measurement.

Can you figure out the multiplication/division rules for sig figs?

Multiplication & Division	Answer
a) 1.1×3.09	3.4
b) 0.447×0.8899	0.400
c) 1100×25.1	2.8×10^4
d) 0.4×0.55	0.2
e) 2.00×3.00000	6.00
f) $25.0 / 25.0$	1.00
g) $524 / 41$	13
h) $3.00 / 1.5 \times 10^2$	0.020

Rule for multiplying or dividing sig figs:

The LEAST number of significant figures in any number of the problem determines the number of significant figures in the answer.

This means you MUST know how to recognize significant figures in order to use this rule!!

Can you figure out the addition/subtraction rule for sig figs?

(It is Much harder to figure out. I recommend rewriting the #'s with the decimals lined up.)

Addition/Subtraction	Answer
a) $6.1 + 3.09$	9.2
b) $0.847 + 0.8899$	1.737
c) $122.9 + 1113.81$	1236.7
d) $2455.26 - 22.76$	2432.50
e) $4.0 + 2.00$	6.0
f) $8300 + 1225$	9500
g) $32550 - 20800$	11800

For addition and subtraction, look at the significant PLACES (hundreds, tens, ones, tenths, hundredths, thousandths etc.) of the numbers ONLY.

Here is what to do for decimal numbers:

- 1) Count the number of significant figures in the decimal portion of each number in the problem. (The digits to the left of the decimal place are not used to determine the number of decimal places in the final answer.)
- 2) Add or subtract in the normal fashion.
- 3) Round the answer to the LEAST number of places in the decimal portion of any number in the problem.

Round to the same place as the LEAST precise number.