6.710×10^5 g

Calculations with Scientific Notation

3.50×10^{-3} mm

Powers of Ten

Scientific Notation

Some scientific notation values we'll be using this year.

Name	Symbol	Value
Speed of light in a vacuum	c	3.00×10^{8} m/s
# particles in a mole	*mol*	6.022×10^{23} particles/mol
Charge of an electron	e^-	1.60×10^{-19} C
Planck's constant	h	6.626×10^{-34} J•s
Mass of electron	M_e	9.11×10^{-31} kg
Mass of proton	M_p	1.67×10^{-27} kg
Mass of neutron	M_n	1.67×10^{-27} kg

Scientific Notation

Let's look at some of those numbers!

The mole is something that we will be using a lot this year.

There are:

602200000000000000000000 particles/mol!

It would not be practical to write this every time we need to use this value in a calculation!

Scientific Notation

What about the mass of an electron?

0.00000000000000000000000000911 kg

Scientists use very large numbers and very small numbers. Scientific Notation makes this much easier!

Scientific Notation

Scientific Notation is a method of representing very large or very small numbers in a standard format.

$$M \times 10^{n}$$

M = a number greater than 1, and less than 10 (1-9)

n = any whole number

$$7.50 \times 10^{5}\ m$$

7.50 represents exactly 3 sig figs.

The base number, M, is ONLY made up of significant figures.

Converting to Scientific Notation

Example:

0.0032 mm

3.2×10^{-3} mm

To convert this value to scientific notation:

1. Insert a decimal point at the point where there is only one nonzero to the left of the decimal.
2. Determine the value of *n* by counting the number of spaces the decimal point is moved.

Converting to Scientific Notation

Example:

76,100.m

7.61×10^4 m

To convert this value to scientific notation:

1. Insert an "assumed" decimal point and move it to the point where there is only one nonzero to the left of the decimal.
2. Determine the value of *n* by counting the number of spaces the decimal point is moved.

Converting to Scientific Notation

7.61×10^{4} m 3.2×10^{-3} mm

A negative exponent represents a number that is less than one.

Negative = Less!

A positive exponent represents a number that is greater than one.

Positive = More!

Converting from Scientific Notation

Example:

9.450×10^{-6} L

Don't forget all sig figs!

0.000009450 L

Negative = Less!

For a negative exponent move the decimal in a way that makes the number less than one.

Negative – move the decimal to the left.

Try One!

5.00×10^{-5} cm 0.0000500 cm

Converting from Scientific Notation

Example:

6.2×10^7 mg

62,000,000 mg

Positive = More!

For a positive exponent move the decimal in a way that makes the number greater than one.

Positive – move the decimal to the right.

Try One!

7.3×10^8 mg 730,000,000 mg

Working with Sig Figs

3 sig figs! → 620. mg

→ 6.20×10^{2} mg

3 sig figs! → 7400 g

→ 7.40×10^{3} g

Adjust the final answer to the correct number of sig figs.

4 sig figs! → 45,500 cm

→ 4.550×10^{4} cm

4 sig figs! → 0.02300 kg

→ 2.300×10^{-2} kg

Working with Sig Figs

4 sig figs! → 3.780×10^3 mg

4 sig figs! → 3780. mg

3 sig figs! → 3.78×10^3 mg

3 sig figs! → 3780 mg

3 sig figs! → 5.20×10^4 g

3 sig figs! → $52\overline{0}00$ g

4 sig figs! → 4.500×10^{-3} cm

4 sig figs! → 0.004500 cm

2 sig figs! → 1.0×10^{-3} kg

2 sig figs! → 0.0010 kg

Adjust the final answer to the correct number of sig figs.

Calculations with Scientific Notation

Addition and Subtraction

$$\begin{array}{rl} & 7.3 \times 10^8 \text{ mg} \\ + & 2.4 \times 10^8 \text{ mg} \\ \hline & 9.7 \times 10^8 \text{ mg} \end{array}$$

If the exponents are the same, simply add or subtract the base numbers and bring the exponent down unchanged.

$$\begin{array}{rl} & 7.3 \times 10^8 \text{ mg} \\ - & 2.4 \times 10^8 \text{ mg} \\ \hline & 4.9 \times 10^8 \text{ mg} \end{array}$$

The same for subtraction!

Calculations with Scientific Notation

Addition and Subtraction

$$\begin{array}{r} 7.3 \times 10^{8}\ \text{mg} \\ +\ 2.4 \times 10^{7}\ \text{mg} \\ \hline \end{array}$$

If the exponents are NOT the same, move the decimal to make them the same.

You can change either one.

$$\begin{array}{r} 7.3 \times 10^{8}\ \text{mg} \\ +\ 0.24 \times 10^{8}\ \text{mg} \\ \hline 7.54 \times 10^{8}\ \text{mg} \end{array}$$

OR

$$\begin{array}{r} 73. \times 10^{7}\ \text{mg} \\ +\ 2.4 \times 10^{7}\ \text{mg} \\ \hline 75.4 \times 10^{7}\ \text{mg} \end{array}$$

But, it's easier to change the smaller exponent.

7.5×10^{8} mg

Correct # of sig figs &
Correct Scientific Notation

Calculations with Scientific Notation

Addition and Subtraction

Try One!

$$\begin{array}{r} 4.3 \times 10^{7}\ \text{mg} \\ -\ 2.4 \times 10^{5}\ \text{mg} \\ \hline \end{array}$$

$$\begin{array}{r} 4.3 \times 10^{7}\ \text{mg} \\ -\ 0.024 \times 10^{7}\ \text{mg} \\ \hline 4.276 \times 10^{7}\ \text{mg} \end{array}$$

4.3×10^{7} mg

Calculations with Scientific Notation

Multiplication & Division

4.3×10^{7} m

x 2.4×10^{5} m

10.32×10^{12} m^2

1.0×10^{13} m^2

$\frac{4.3 \times 10^{7}\ g}{2.4 \times 10^{5}\ mL} =$

1.79×10^{2} g/mL

1.8×10^{2} g/mL

For multiplication, add the exponents, then adjust for the correct scientific notation format, and the correct number of sig figs.

Calculate the units!

For division, follow the same process, except subtract exponents instead.

Calculations with Scientific Notation

Scientific Notation & the Calculator

For Power of 10, use the EE button! Not the ^ button!

Example Problems:

4.34×10^{7} cm x 5.1×10^{4} cm =

Enter: 4.34 [2ND] [EE] 7 x 5.1 [2ND] [EE] 4 [ENTER] 2.2134E12

2.2×10^{12} cm^2

4.34×10^{-7} cm x 5.1×10^{-4} cm =

Enter: 4.34 [2ND] [EE] [(–)] 7 x 5.1 [2ND] [EE] [(–)] 4 [ENTER]

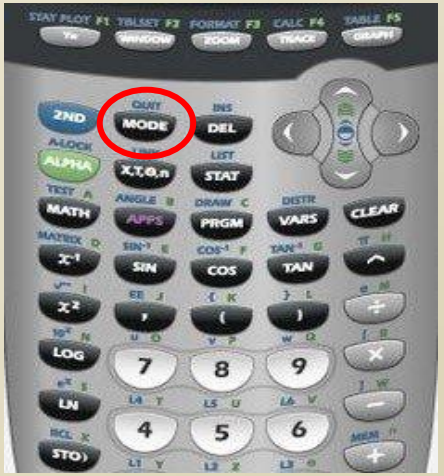
2.2134E-10 **2.2×10^{-10} cm^2**

Calculations with Scientific Notation

Scientific Notation & the Calculator

TIP!

To change a number to scientific notation in your calculator:



Enter Number: 235,000,000

MODE → **SCI** ENTER CLEAR ENTER

2.35E8

2.35×10^{8}

Be sure to adjust for sig figs!

Example: 0.00630 (still in SCI mode)

Enter 0.00630 ENTER

6.3E-3

6.30×10^{-3}

Change back to Normal Mode

$(5.7 \times 10^{6}\ m) \times (2.80 \times 10^{9}\ m) =$

$1.6 \times 10^{16}\ m^{2}$

$(7.7 \times 10^{-12}\ g)/(2.5 \times 10^{5}\ mL) =$

$3.1 \times 10^{-17}\ g/mL$

Partner Challenge!

$$\frac{(9.008\ x\ 10^{4}\ cm)x(6.5227\ x\ 10^{7} cm)}{(6.53\ x\ 10^{-4}\ cm)} =$$

(8.997929801E15 cm) 9.00 x 10^{15} cm

3 sig figs

Division = least # of sig figs

Units:

$$\frac{cm\ x\ cm}{cm} = \frac{cm^{2}}{cm} = \text{cm}$$

Putting It Altogether Partner Challenge!

$$\frac{(7.1\ x\ 10^2 g + 924\ g)}{7.508\ x\ 10^4\ mL} =$$

(0.0217634523 g/mL) 2.18 x 10^{-2} g/mL

Units:

$$\frac{g+g}{mL} = \frac{g}{mL}$$

Division = least # of sig figs

Note: Don't round to # of sig figs until the end of the problem.

Use this slide to add anything that you may need to add. Then drag it to its position in the slide show.

Need more than one new slide? Just right click on this slide and click duplicate slide.

Everything is good? Just delete this slide.