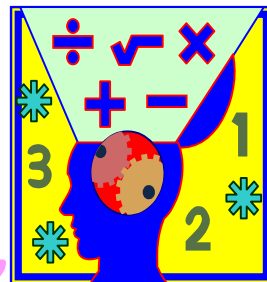


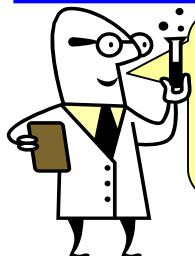
# Algebra Connections



Mr. Breitsprecher's Edition

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Web: [www.clubtnt.org/my\\_algebra](http://www.clubtnt.org/my_algebra)



I now clearly see that it's  $1.32 \times 10^{-24}$  grams

# Scientific Notation

Scientific Notation is a way to write very large or very small numbers in a readable manner. The system is based on the powers of Base Ten. Once a person masters this procedure, it is easy to use.

Scientists developed this method many years ago to provide them with a method to save time and eliminate mistakes by representing numbers with fewer zeros or decimal placeholders.

Numbers are converted to scientific notation by increasing the power of ten by one for each place the decimal point is moved. Some examples follow.

## Scientific Notation Examples:

**Fraction** =  $1/1000$

**Decimal** = 0.001

**Scientific Notation** =  $1 \times 10^{-3}$

(Note: the raised -3 is called the exponent.)

**Fraction** =  $1/100$

**Decimal** = 0.01

**Scientific Notation** =  $1 \times 10^{-2}$

**Number** =  $1/10$

**Decimal** = 0.1

**Scientific Notation** =  $1 \times 10^{-1}$

**Number** = 10

**Scientific Notation** =  $1 \times 10^1$

**Number** = 100

**Scientific Notation** =  $1 \times 10^2$

**Number** = 1000

**Scientific Notation** =  $1 \times 10^3$

Remember, the zeros in these examples are "placeholders." Think of the 0 in terms of money. Would you sooner have \$1 or \$100? You can see how important adding 0's are.

## Decimals and Scientific Notation:

To represent very large or very small numbers, Scientific Notation uses one digit to the left of the decimal point. The number is written with 1 digit to the left of the decimal point ( $>0, <10$ ) and only those digits to the right that give meaningful information are included (significant digits). For example, 1,300,200 would be written as  $1.3002 \times 10^6$ . Note how the last 2 zeros are not significant – they are merely placeholders.

The power of ten (exponent) will show you how many places the decimal point moves. Positive exponents mean a larger number; the decimal is moved to the right. Negative exponents mean a smaller number; the decimal is moved to the left.

The number  $8.2 \times 10^{-6}$  written in decimal format would be 0.0000082 because the decimal point was moved 6 places to the left to form the decimal 0.0000082.

$5.63 \times 10^{-5}$  represented in decimal notation is 0.0000563 Note: The decimal point was moved 5 places.

$$4.11 \times 10^{-6} = 0.00000411$$

$$2000 = 2 \times 1000 = 2 \times 10^3$$

$$631,000,000 = 6.31 \times 10^8$$

## Give It A Try: Scientific Notation

To work with numbers containing many zeros (either very large or very small) in an efficient manner that reduces the chance of making an error, use Scientific Notation or "Powers of Ten." Each value is written as a number between one and ten multiplied by ten raised to some power (positive for large numbers, negative for small ones). Can you write these numbers in scientific notation?

- |                     |                   |                               |
|---------------------|-------------------|-------------------------------|
| 1. 1,000            | 17. 4,875,000     | 33. 30,800,000                |
| 2. 100,000          | 18. 510,000,000   | 34. 1,153,000,000             |
| 3. 0.001            | 19. 784           | 35. 31,000,000,000,000,000    |
| 4. 10               | 20. 2,000,000,000 | 36. 3,000,000,000,000,000,000 |
| 5. 0.000001         | 21. 0.69          | 37. 0.00042                   |
| 6. 1,000,000        | 22. 0.2005        | 38. 0.000183                  |
| 7. 0.1              | 23. 0.00249       | 39. 0.10659                   |
| 8. 1                | 24. 0.06356       | 40. 0.0000025                 |
| 9. 0.000000001      | 25. 0.0000091     | 41. 0.000000128               |
| 10. 10,000          | 26. 0.00000079    | 42. 0.08                      |
| 11. 60,000          | 27. 0.983         | 43. 0.00000000007             |
| 12. 36,000,000      | 28. 0.00001006    | 44. 0.00062504                |
| 13. 1,214,000,000   | 29. 2.21          | 45. 0.000625                  |
| 14. 155,000,000,000 | 30. 555           | 46. 0.040404                  |
| 15. 3,060           | 31. 1,472         | 47. 0.0005                    |
| 16. 520,000         | 32. 29,000        |                               |

# Mr. Breitsprecher's "Tech Connect"

## Scientific Notation & Excel

### MS Excel Knows Scientific Notation Let's Check Your Work With MS Excel

Most spreadsheet software will accommodate Scientific Notation – after all, looking at all the zeros in large and small numbers, even in a computer format, is asking for errors. In MS Excel, when numbers are entered into cells that have a General number format, Excel can only accommodate up to 11 digits, regardless of column width. If the length of the number exceeds 11 digits, Excel automatically converts the number to scientific, or exponential, notation.

Excel formats Scientific Notation differently, but the concept is the same – everything is based on a power of 10. Numbers that exceed 11 digits results in a number like 123456789098 being converted to 1.23457E+11. Note that in traditional Scientific Notation, this would be expressed as  $1.23456789098 \times 10^{11}$ . Do you see the relationship between MS Excel's "Scientific Notation" and standard "Scientific Notation"?

Note that MS Excel also rounds the number off in order to display it. It actually does carry the full number for calculations, however. You can't change how Excel expresses numbers, but, when necessary, you can usually convert the scientific notation to a text format that correctly displays the original data. For our purposes, however, the MS Excel number display is fine.

To check your answers for the exercise given earlier, just open MS Excel and enter the numbers that were given in column A. Be sure to use a **GENERAL NUMBER** format. Select Column "A" and pull down the **FORMAT** menu. Choose **CELLS** and be sure the **NUMBER** tab is selected. Use **GENERAL**, which should be the first choice on the list that appears. Click **OK**.

Once you are sure that the cells will display the **GENERAL NUMBER** format, enter the values from our exercise in the range **A1:A47**. Note how when you enter the numbers that exceed 11 characters, Excel returns the number in its version of Scientific Notation, not the standard format that was reviewed in textbooks.

If you see an entry that consists of "#####", this means the number is too wide to fit in the width of that column. Using your mouse, point to the right line at the column heading until you see a **DOUBLE-ENDED** arrow. Click on the mouse and "drag" the column wide enough to display that number.

In order to see the relationship between the original number in conventional decimal form and its value in scientific notation, let's create a formula that copies the contents from Column A to Column B. In cell **B1**, enter **=A1** and then highlight the range **B1:B47**. Pull down the **EDIT** menu and select **FILL**. Another set of choices will appear, choose **DOWN**. This simple formula will just copy the formats from column A into column B.

Next, we want to format column B so that it displays all values in its version of Scientific Notation. Highlight column B, pull down the **FORMAT** menu, and select **CELLS**. Again, be sure the **NUMBER** tab is selected. Look at your choices and select **SCIENTIFIC** – the dialog box will ask you to choose how many decimals to display.

Excel will carry the full value for calculations, but only displays those decimal places you request. For our purposes, it will be fine to round everything that is displayed by accepting the "default," which is 2 decimal places. Click **OK**.

If you have correctly followed these directions, you will have all of the numbers from the previous exercise in column A, cells 1-47. In column B, you should have Excel's version of Scientific Notation. When the numbers are small, you should see negative exponents (after the E) and when numbers are large, you will see positive exponents (after the E). Note that Excel is always referring to a base of 10. In our example, you should see the following in rows 1 and 2, columns A and B:

1000	1.00E+03	Means $1.00 \times 10^3$
100,000	1.00E+05	Means $1.00 \times 10^5$

### Want Some More Help? Check Out These Great Web Resources And Tutorials

#### ChemTutor

<http://www.chemtutor.com/numbr.htm#sci>

#### Fordham Prep

<http://www.fordhamprep.com/gcurr/sho/sho/lessons/lesson25.htm>

#### NYU

<http://www.nyu.edu/pages/mathmol/textbook/scinot.html>

#### U of Michigan

<http://www.astro.lsa.umich.edu/user/s/garyb/Course/WWW/Scinot/scinot.html>

#### U of Maryland

<http://janus.astro.umd.edu/astro/scinote/>

#### Indiana U

<http://carini.physics.indiana.edu/P10/5S98/Scientific-notation.html>

#### U Nebraska – Lincoln

[http://www-class.unl.edu/chem/HTML/lab\\_syllabus/lab\\_week\\_3/Scientific\\_Notation.html](http://www-class.unl.edu/chem/HTML/lab_syllabus/lab_week_3/Scientific_Notation.html)

#### Institute for Energy and Environmental Research

<http://www.ieer.org/clsroom/scinote.html>

#### Logan

<http://members.aol.com/profchm/scinot.html>

#### Widener College (Interactive tutorial to "check" your work

<http://science.widener.edu/svb/tutorial/scinot.html>