8.2C Convert between Standard Decimal and Scientific Notation Lesson

Defintions

Decimal notation – a representation of a real number, not including counting (natural) numbers, which uses a decimal point to show place values that are less than one, such as tenths and hundredths. Ex: 0.023

Scientific notation – a representation of a number by using a method to write very large or very small numbers using powers of ten that is written as a decimal with exactly one nonzero digit to the left of the decimal point, multiplied by a power of ten. Ex: 2.3×10^{-2}

Examples	Non-Examples
5.287×10^{2} Written in correct scientific notation with 5.287 as the coefficient multiplied by 10 to the power of 2.	52.87×10^{2} Not written in correct scientific notation because there is not exactly one nonzero digit to the left of the decimal point
5.287×10^{-2} Written in correct scientific notation with 5.287 as the coefficient multiplied by 10 to the power of -2.	$.5287 \times 10^{-2}$ Not written in correct scientific notation because there is not exactly one nonzero digit to the left of the decimal point.
-2.368×10^{3} Written in correct scientific notation with -2.368 as the coefficient multiplied by 10 to the power of 3	-23.68×10^{3} Not written in correct scientific notation because there is not exactly one nonzero digit to the left of the decimal point.
-2.368×10^{-3} Written in correct scientific notation with -2.368 as the coefficient multiplied by 10 the power of -3.	$-.2368 \times 10^{-3}$ Not written in correct scientific notation because there is not exactly one nonzero digit to the left of the decimal point.

Powers – denoted by a number or variable in the superscript place of the base, which designates how many times the base will be multiplied by itself if it is a positive or by its inverse if it is negative. If the power is 1, the base will be multiplied by 1 and will not change. If the power is 0, the simplified form will equal 1.

Ex: $\quad\quad 6^2 = 36 \quad\quad\quad\quad 6^1 = 6 \quad\quad\quad\quad 6^0 = 1 \quad\quad\quad\quad 6^{-2} = \frac{1}{6^2} = \frac{1}{36}$

Ex: $\quad\quad 2^2 = 4 \quad\quad\quad\quad 2^1 = 2 \quad\quad\quad\quad 2^0 = 1 \quad\quad\quad\quad 2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

Ex: $\quad\quad 3^3 = 27 \quad\quad\quad\quad 3^1 = 3 \quad\quad\quad\quad 3^0 = 1 \quad\quad\quad\quad 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$

Base – the number in an expression or equation which is raised to a power or exponent.

E – a symbol used in a calculator to indicate that the preceding number should be multiplied by ten raised to the number that follows.

Ex: $\quad\quad$ 5 E 6 = 5 X 10^6 $\quad\quad\quad\quad$ 8 E 4 = 8 X 10^4 $\quad\quad\quad\quad$ a E b = a x 10^b

1) The distance that light travels in one year is called a light year. In one year, light will travel 5,880,000,000,000 miles. Using scientific notation, how many miles are in one light year?

Move the decimal to the left until the decimal is between the 5 and the 8, counting the number of digits as you move the decimal to the left.

There are 12 digits to the right of the 5, so 5.88 will be multiplied by ten raised to a power of 12.
5.88×10^{12}

So one light year is equal to 5.88×10^{12} miles.

2) Samuel read the following number 3.87×10^6 in a scientific journal and is wondering what the number would be written in standard notation. What is the number written in standard notation?

The power of 6 indicates that the decimal should be moved 6 places to the right starting from the decimal's initial position in 3.87.

Therefore, the number in the scientific journal would read as 3,870,000 in standard notation.

3) The diameter of an oxygen nucleus is given in scientific notation as 6.05×10^{-15} meters. Express the diameter of an oxygen nucleus in decimal notation.

The power of -15 indicates that the decimal should be moved 15 places to the left starting from the decimal's initial position in 6.05.

The diameter of an oxygen nucleus is 0.00000000000000605 meters.

4) A microscopic cell measures .0000634 centimeter in diameter. What is this number in scientific notation?

Move the decimal to the right until the decimal is between the 6 and the 3, counting the number of digits as you move the decimal to the right.

You would move the decimal five spaces to the right, so 6.34 will be multiplied by ten raised to a power of -5.
6.34×10^{-5}

So the microscopic cell measures to 6.34×10^{-5} in scientific notation.