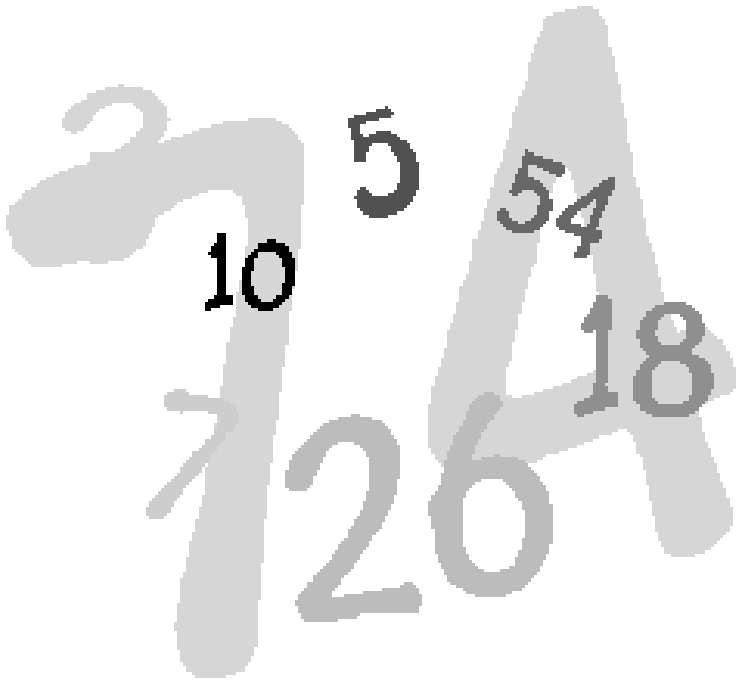


3.2
Significant Figures and Scientific Notation

SIGNIFICANT FIGURES

RULES FOR COUNTING SIGNIFICANT FIGURES

Rule #1:

All Non-zero integers always count as significant figures.

3456 has

4 significant figures

RULES FOR COUNTING SIGNIFICANT FIGURES

Rule #2:

Leading zeros do not count as significant figures.

0.0486 has

3 significant figures

RULES FOR COUNTING SIGNIFICANT FIGURES

Rule #3:

All zeros between non-zeros numbers always count as significant figures.

16.007 has

5 significant figures

RULES FOR COUNTING SIGNIFICANT FIGURES

Rule #4:

Trailing zeros are significant only if the number contains a decimal point.

9.300 has 4 significant figures

9300 has 2 significant figures

RULES FOR COUNTING SIGNIFICANT FIGURES

Pacific Ocean . ---------- Atlantic Ocean

SIG FIG PRACTICE

How many significant figures in each of the following?

1.0070 m →	5 sig figs
17.10 kg →	4 sig figs
100,890 L →	5 sig figs
3.29×10^3 s →	3 sig figs
0.0054 cm →	2 sig figs
3,200,000 →	2 sig figs

RULES FOR SIGNIFICANT FIGURES IN MATHEMATICAL OPERATIONS

Addition and Subtraction:

The number of decimal places in the result equals the number of decimal places in the least precise measurement.

6.8 + 11.934 = 18.734 → 18.7 (3 sig figs)

SIG FIG PRACTICE

Calculation	Calculator says:	Answer
3.24 m + 7.0 m	10.24 m	10.2 m
100.0 g - 23.73 g	76.27 g	76.3 g
0.02 cm + 2.371 cm	2.391 cm	2.39 cm
713.1 L - 3.872 L	709.228 L	709.2 L
1818.2 lb + 3.37 lb	1821.57 lb	1821.6 lb
2.030 mL - 1.870 mL	0.16 mL	0.160 mL

RULES FOR SIGNIFICANT FIGURES IN MATHEMATICAL OPERATIONS

Multiplication and Division:

 # sig figs in the result equals the number in the least precise measurement used in the calculation.

6.38 x 2.0 = 12.76 → 13 (2 sig figs)

SIG FIG PRACTICE

Calculation	Calculator says:	Answer
3.24 m x 7.0 m	22.68 m^2	23 m^2
100.0 g ÷ 23.7 cm^3	4.219409283 g/cm^3	4.22 g/cm^3
0.02 cm x 2.371 cm	0.04742 cm^2	0.05 cm^2
710 m ÷ 3.0 s	236.6666667 m/s	240 m/s
1818.2 lb x 3.23 ft	5872.786 lb·ft	5870 lb·ft
1.030 g ÷ 2.87 mL	2.9561 g/mL	2.96 g/mL

SCIENTIFIC NOTATION

Scientific Notation:

In science, we deal with some very LARGE numbers:

1 mole = 602000000000000000000000

In science, we deal with some very SMALL numbers:

Mass of an electron = 0.00000000000000000000000000000091 kg

Imagine the difficulty of calculating the mass of 1 mole of electrons!

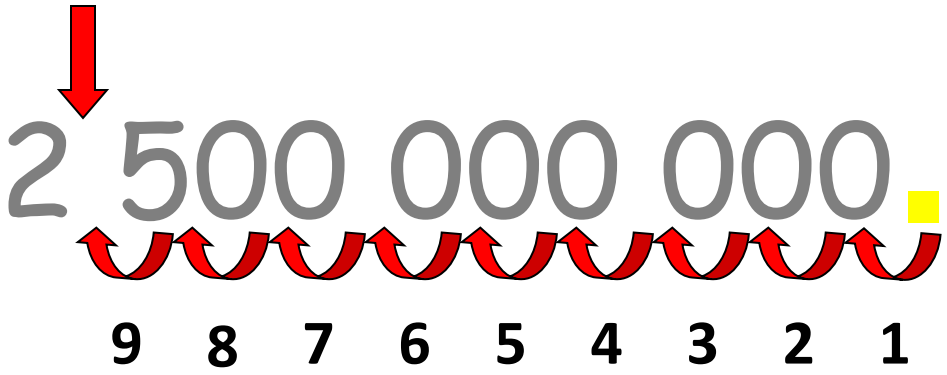
0.000000000000000000000000000091 kg
x 602000000000000000000
??????????????????????????????????

Scientific Notation:

A method of representing very large or very small numbers in the form:

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

- ✓ **M is a number between 1 and 10**
- ✓ **n is an integer**



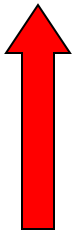
Step #1: Insert an understood decimal point

Step #2: Decide where the decimal must end up so that one number is to its left

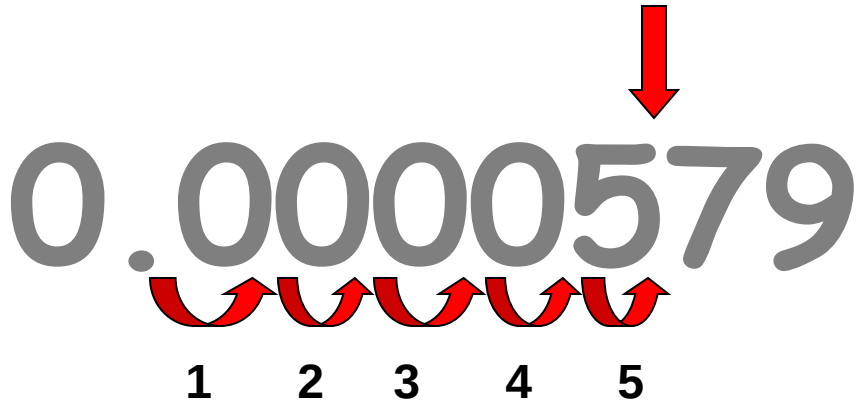
Step #3: Count how many places you bounce the decimal point (This is equal to n)

Step #4: Re-write in the form $M \times 10^n$

2.5×10^{9}



The exponent is the number of places we moved the decimal.

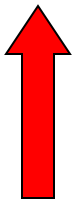


Step #2: Decide where the decimal must end up so that one number is to its left

Step #3: Count how many places you bounce the decimal point

Step #4: Re-write in the form $M \times 10^n$

5.79×10^{-5}



The exponent is negative because the number we started with was less than 1.

Practice Problems:

- $98{,}500{,}000 = 9.85 \times 10^{?}$

  9.85×10^{7}

- $64{,}100{,}000{,}000 = 6.41 \times 10^{?}$

  6.41×10^{10}

- $279{,}000{,}000 = 2.79 \times 10^{?}$

  2.79×10^{8}

EXAMPLE

The Distance From the Sun to the Earth is 93,000,000 miles

93,000,000 Standard Form

9.3×10^7 Scientific Notion

Scientific Notation to Standard Form

Move the decimal to the right - The number to the power of 10.

Example:

- **3.4×10^5 in scientific notation**
- **3.4 = 340000 (Move the decimal right five places)**
- **340,000 in standard form**

Practice Problems:

- 6.27×10^6

  6,270,000

- 9.01×10^4

  90,100

- 4.56×10^3

  4,560

Adding and Subtracting using Scientific Notation:

- **Whenever you add or subtract two numbers in scientific notation, you must make sure that they have the same exponents.**

Practice Problems

- $4.2 \times 10^6 + 3.1 \times 10^5 =$??

Make the exponents the same (either 5 or 6)

- $42 \times 10^5 + 3.1 \times 10^5 =$

$45.1 \times 10^5 = 4.51 \times 10^6$

Practice Problems

- $7.3 \times 10^{-7} - 2.0 \times 10^{-8} = ??$

$71 \times 10^{-8} = 7.1 \times 10^{-7}$

Multiplying and Dividing using Scientific Notation:

- When you multiply two numbers in scientific notation, you must **add** their exponents.

- When divide two numbers, you must **subtract** denominator's exponent from the numerator's exponent

Practice Problems:

$(4.5 \times 10^{12}) \times (3.2 \times 10^{36}) = ??$

$(4.5)(3.2) \times 10^{(12+36)}$

14.4×10^{48}

Practice Problems:

$(5.9 \times 10^{9}) \times (6.3 \times 10^{-5}) = ??$

$(5.9)(6.3) \times 10^{(9+(-5))}$

37.17×10^{4}

Practice Problems:

$(2.8 \times 10^{14}) / (3.2 \times 10^{7}) = ??$

$(2.8) / (3.2) \times 10^{(14-7)}$

0.875×10^{7}

Practice Problems:

$(5.7 \times 10^{19}) / (3.1 \times 10^{-9}) = ??$

$(5.7) / (3.1) \times 10^{(19-(-9))}$

1.84×10^{28}