

Example 1:
1.234 grams has 4 significant figures,

Example 2:
30.07 Liters has 4 significant figures.

Example 3:
 0.012 grams has 2 significant figures.
 0.20 grams has 2 significant figures.

Example 4:
 0.0230 Liters has 3 significant figures,

For problems involving pure mathematics, one seldom takes the point of view that some digits in a stated number are more important than others, however in science where numbers represent measurements, not all digits are created equally!

The examples to the left show the four basic rules of how to count 'significant figures'. The basic rule is that you never state more digits in a number than the precision of your measurement. For example, if you can only measure to an accuracy of one meter, you should never state a measurement as 102.56 meters!

Problem 1 - For the numbers below, indicate how many SFs are involved:

- A) 450.12 B) 450.120 C) 1.234×10^{-11} D) 0.00234500 E) 0.002345

Problem 2 - When multiplying or dividing numbers, the answer must have the same number of significant figures. Pure numbers such as '5' can be written with as many decimal places as needed. Evaluate the following expressions to the correct number of SF.

- A) $M = 3.275 \times 1.3$ grams B) $T = 5(356.19)/8 + 24.0347$ degrees
 C) $S = \pi(1.0850)^2$ meters² D) $Y = [1.03 \times 3.98720] / 1.1087$ kilograms

Problem 3 - The Rydberg Constant is an important number in atomic physics and is given by the formula

$$R_{\infty} = \frac{2\pi^2 m e^4}{ch^3}$$

Evaluate the formula to the correct number of SF where:

- Electron mass: $m = 9.10956 \times 10^{-28}$ grams
 Speed of light: $c = 2.997925 \times 10^{10}$ cm/sec
 Electron charge: $e = 4.80325 \times 10^{-10}$ ESU
 Planck's Constant: $h = 6.62620 \times 10^{-27}$ erg sec

Problem 1 - For the numbers below, indicate how many SFs are involved:

- A) 5 SF B) 6 SF C) 4 SF D) 6 SF E) 4 SF

Problem 2 - When multiplying or dividing numbers, the answer must have the same number of significant figures. Pure numbers such as '5' can be written with as many decimal places as needed. Evaluate the following expressions to the correct number of SF.

- A) M = 3.3 grams B) T = 246.65 degrees
 C) S = 3.6984 meters² D) Y = 3.70 kilograms

Problem 3 - The Rydberg Constant is an important number in atomic physics and is given by the formula

$$R_{\infty} = \frac{2\pi^2 m e^4}{ch^3}$$

Evaluate the formula to the correct number of SF where:

- Electron mass: $m = 9.10956 \times 10^{-28}$ grams
 Speed of light: $c = 2.997925 \times 10^{10}$ cm/sec
 Electron charge: $e = 4.80325 \times 10^{-10}$ ESU
 Planck's Constant: $h = 6.62620 \times 10^{-27}$ erg sec

Answer: First evaluate the function using only the exponents:

$R = (10^{-28})(10^{-10})^4 / (10^{10})(10^{-27})^3 = 10^3$. Now evaluate all the measured constants:

$$R = \frac{2 (3.141592654)^2 (9.10956)(4.80325)^4}{(2.997925)(6.62620)^3}$$

Using a calculator, one obtains the 'answer' $R = 109.7371112$ which has to be combined with the previous calculation for the exponents of 10^3 to get

$$R = 109.7371112 \times 10^3 \quad \text{or in scientific notation} \quad R = 1.097371112 \times 10^5$$

The smallest number of SFs occurs for the constants m, e and h which have 6 SF, so we round the answer to **$R = 1.09737 \times 10^5$** .