Significant Figures

The rules….

1. All non zero numbers are significant

   2778492 has 7 significant figures
   34.21 has 4 significant figures

1. Zeros
   a. Leading zeros, which are zeros before non zero digits are not significant.

      0.00312 none of these zeros are significant, this number has 3 significant figures

   a. Captive zeros, these are zeros between non zero digits, are significant

      12079 the zero is significant, this number has 5 significant figures

   a. Trailing zeros, these are zeros afer non zero digits.
      i. If the number has a decimal point these are significant

         13.400 these zeros are significant, this number has 5 significant figures

      i. If the number does not have a decimal point these are not significant

         123000 these zeros are not significant, this number has 3 significant figures

How many significant figures are in the following numbers?

2.592

4 s.f.

4.093

4 s.f.

1100

2 s.f.

trailing no decimal pt

1430.

4 s.f.

0.0430250

6 s.f.

X

1430.0

5 s.f.

Exact Numbers —— treat these like they have infinite # of Significant figures

Things you can count

12 eggs

Definitions

1 dozen = 12

1 inch = 2.54 cm

When **adding or subtracting**

Count the number of decimal places.

Your answer will have the same number of decimal places as the number in the problem who has the fewest.

$$\begin{array}{rl} & 22.171 \leftarrow 3 \text{ d.p.} \\ + & 8.2 \leftarrow 1 \text{ d.p.} \\ \hline & 30.371 \leftarrow 1 \text{ d.p.} \end{array}$$

answer is 30.4

$$\begin{array}{rl} & 18.94 \leftarrow 2 \text{ d.p.} \\ - & 0.500 \leftarrow 3 \text{ d.p.} \\ \hline & 18.44 \leftarrow 2 \text{ d.p.} \end{array}$$

18.44

When **multiplying and dividing**

Count the number of significant figures in each number

Your answer will have the same number of significant figures as the number with the fewest sig figs.

$14.598 \times 0.0122 = 0.175176$ ← from calculator

5 s.f. 3 s.f. answer 0.175

$1520. \times 13.21 = 20079.2$

4 s.f. 4 s.f. answer 20080

2.008×10^4

PEDMAS

Parentheses
Exponents
÷
×
+
−

3 d.p. 4 d.p.

$37.2\,(2.517 + 13.6752) =$

$= 16.1922$

If I stop here

3 s.f. 5 s.f.

$37.2\,(16.1922) =$

602.34984

16.192 (5 s.f.)

answer = 602

$11.178 + 16.3 \times 8.112 = ?$

3 s.f. 4 s.f.

16.3×8.112

$= 132.2256$ 3 s.f.

3 d.p. 0 d.p. ✱ no decimal places in the # to the previous # to correct s.f.

$11.178 + 132.256$

$= 143.434$

answer = 143

SI Base Quantities and Units		
Quantity	**Unit**	**Unit Abbreviation**
Length	meter	m
Time	second	s
Mass	kilogram	kg
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Base

Table 1.3 Common Decimal Prefixes Used with SI Units

Prefix*	Prefix Symbol	Word	Conventional Notation	Exponential Notation
tera	T	trillion	1,000,000,000,000	1×10^{12}
giga	G	billion	1,000,000,000	1×10^{9}
mega	M	million	1,000,000	1×10^{6}
kilo	k	thousand	1,000	1×10^{3}
hecto	h	hundred	100	1×10^{2}
deka	da	ten	10	1×10^{1}
—	—	one	1	1×10^{0}
deci	d	tenth	0.1	1×10^{-1}
centi	c	hundredth	0.01	1×10^{-2}
milli	m	thousandth	0.001	1×10^{-3}
micro	μ	millionth	0.000001	1×10^{-6}
nano	n	billionth	0.000000001	1×10^{-9}
pico	p	trilliononth	0.000000000001	1×10^{-12}
femto	f	quadrillionth	0.000000000000001	1×10^{-15}

*The prefixes most frequently used by chemists appear in bold type.

length meter m

mass grams g

Volume liters l

Smaller Stuff

1 cm = 0.01 m

centi	c	1 m = 100 cm	or	1×10^{-2} m = 1 cm
milli	m	1 m = 1000 mm	or	1×10^{-3} m = 1 mm
micro	μ	$1 \text{ m} = 1 \times 10^{6}$ μm	or	1×10^{-6} m = 1 μm
nano	n	$1 \text{ m} = 1 \times 10^{9}$ nm	or	1×10^{-9} m = 1 nm
pico	p	$1 \text{ m} = 1 \times 10^{12}$ pm	or	1×10^{-12} m = 1 pm

If I have 7024 m, how cm is that?

$$7024 \text{ m} \times \frac{100 \text{ cm}}{1 \text{ m}} = 702400 \text{ cm}$$

4 (7024)

exact

4 s.f.

Bigger Stuff

kilo	k	1000 m = 1 km	or	1 m = 1 x 10^{-3} km
mega	M	1 x 10^{6} m = 1 Mm	or	1 m = 1 x 10^{-6} Mm
giga	G	1 x 10^{9} m = 1 Gm	or	1 m = 1 x 10^{-9} Gm
tera	T	1 x 10^{12} m = 1 Tm	or	1 m = 1 x 10^{-12} Tm

how many km is 30.008 m?

$$30.008\,\text{m} \times \frac{1\,\text{km}}{1000\,\text{m}} = 0.030008\,\text{km}$$

5 s.f. (30.008) × exact (1/1000) = 5 s.f. (0.030008)

$$30.008\,\text{m} \times \frac{.001\,\text{km}}{1\,\text{m}} = 0.030008\,\text{km}$$

Converting SI units:

Convert 1218 meters into kilometers

3.7EE-4

1000mL = 1L 1000L = 1kL

Convert 371.4 milliliters into kiloliters

L

$371.4\ \text{mL} \times \frac{1\ \text{L}}{1000\ \text{mL}} \times \frac{1\ \text{kL}}{1000\ \text{L}} = 0.0003714$

4 s.f.

exact

or

3.714×10^{-4}

Squared and Cubed Units:

how many mm^2 are in 4.2 km^2?

$$4.2\ km \times km \times \frac{1000\ m}{1\ km} \times \frac{1000\ m}{1\ km} \times \frac{1000\ mm}{1\ m} \times \frac{1000\ mm}{1\ m} =$$

4200000000000

4.2×10^{12}

you have 475 cm^2 of paper. how many mm^2 is that?

$$475\ cm \times cm \times \frac{10\ mm}{1\ cm} \times \frac{10\ mm}{1\ cm} = 47500\ mm^2$$

$$475\ cm^2 \times \left(\frac{10\ mm}{1\ cm}\right)^2 =$$

How many yd^2 are equivalent to 10.0 km^2?

m → cm → in → ft → yd

exact

$$10.0\ km \times km \times \left(\frac{1000\ m}{1\ km}\right)^2 \times \left(\frac{100\ cm}{1\ m}\right)^2 \times \left(\frac{1\ in}{2.54\ cm}\right)^2 \times \left(\frac{1\ ft}{12\ in}\right)^2 \times \left(\frac{x\ d}{3\ ft}\right)^2 =$$

1.196×10^7

1.20×10^7

11959900.463

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Length : 1 inch = 2.54 cm (exactly)
Volume : 1 liter = 1.057 quarts
Mass : 1 kg = 2.205 pounds

Convert 2479 millimeters into feet

Convert 43.9 feet per minute into kilometers per hour :

A fighter jet takes off travelling 62 m/s. What is the speed in miles per hour? There are 5280 feet in a mile.

An infant ibuprofen suspension contains 200.0 mg ibuprofen/5.0 mL of suspension. The recommended dose is 15.0 mg/kg of body weight. How many mL of this suspension should be given to an infant that weighs 15 lb?