

# Units & Dimensions

2



What are **Significant Figures**?

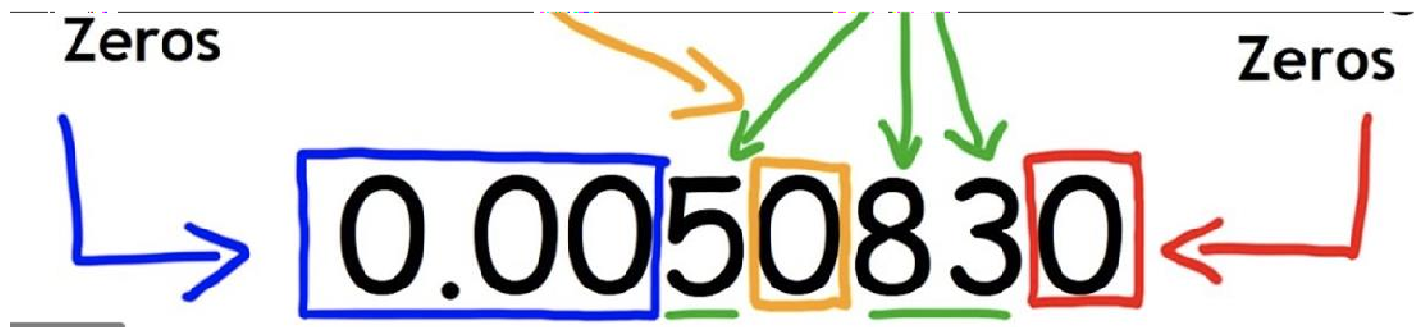
0.04013

1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
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## What are Significant figures?

The significant figures of a number are digits that carry meaningful contribution to its measurement resolution.

It is equal to the number of digits that are known with some degree of confidence.





Actual Weight

76.3 kg



76 Kg



75.17

75.17 Kg

**Rules** to find number of significant figures ?

**RULES**

# Rules to find number of significant figures

## A) Non decimal number

1. Zeros between two non-zero digits are considered significant
1. Leading zeros are insignificant
1. Trailing zeros are generally insignificant, because we don't know if it has been rounded off to nearest hundred, or it's just a coincidence that it's an exact multiple of 100

If its written as

$$2.7 \times 10^3$$

SF  $\rightarrow$  2

$$2.70 \times 10^3$$

SF  $\rightarrow$  3

e.g 2607  
SF  $\rightarrow$  4

e.g 00123  
SF  $\rightarrow$  3

e.g 12300  
SF  $\rightarrow$  3

A) Non Decimal number

001200300000

# Rules to find number of **significant figures**

## B) Decimal number

(i) No's **greater** than 1

All the digits are  
significant

(1) 32.0010

(2) 32.000

insignificant

(ii) No's **less** than 1

(1) 0.002

insignificant

(2) 0.102

(3) 0.00300

significant

Leading zeros are  
insignificant & trailing zeros  
are significant



B) Decimal number



0012.0300000

**Significant Figures** can be done using a set of around 5 rules, With a lot of complications for how to deal with zeroes.

Not significant:

Zero for  
"cosmetic"  
purpose

0

.

Not significant:

Zeros used only  
to locate the  
decimal point

0

0

4

0

0

4

5

0

0

Significant:

All nonzero  
integers

Significant:

All zeroes  
between non  
zero numbers

Significant:

Zeros at the end of a  
number to the right of  
decimal point

Example

Find **significant figures** in **100**

A. 1

B. 2

C. 3

D. 4

Example

Find significant **figures** in **00100.** are

A. 1

B. 2

C. 3

D. 4

Example

Find significant figures in **100.0**

A. 1

B. 2

C. 3

D. 4

Example

Find significant figures in **00.00**

A. 1

B. 2

C. 3

D. 4

How to use significant figures in calculations?

$$6 \times 2 = 12$$



$$6 \times 2 = 10$$

## Calculations considering Significant figures

### (A) Addition/Subtraction Rules (considering SF)

**Rule:** The result cannot have more number of digits in decimal than the least number of digits in decimal of the numbers involved in the operation.



## A) Addition/Subtraction Rules (SF)

$$1 + 1.1 + 2.900 - 3.0 + 0.37$$

### SIGNIFICANT TIP -

1. First compute normally
2. NOW Round Off based on minimum decimal places present in the numbers

### Examples

Calculations considering Significant figures.

(A) Addition/Subtraction Rules (considering SF).

1.  $4 + 16$
2.  $4.2 + 6.18$
3.  $4.00 + 3.162$
4.  $0.92 + 4$

## Solution:

Calculations considering Significant figures

### (A) Addition/Subtraction Rules (considering SF)

(1)  $4 + 16 = 20$

(2)  $4.2 + 6.18 = 10.38 \rightarrow 10.4$

This has to be rounded off

4.2 has only 1 digit in decimal

(3)  $4.00 + 3.162 = 7.162$   
 $= 7.16$

2 decimal

(4)  $0.92 + 4 = 4.92$   
 $= 5$

No decimal

Round off

No decimal

## Calculations considering significant figures

(B) Multiplication/Division Rules (considering SF)

**Rule:** Result will have same significant figure as the least SF in the number involved in the operation.

## D) Multiplication/Division Rules (SF)

$$2 \times 3.21$$

### SIGNIFICANT TIP -

1. First compute normally
2. NOW Round Off based on minimum S.F. present in the numbers

### Examples

Calculations considering Significant figures.

(B) Multiplication/Division Rules (considering SF).

1.  $4.2 \times 0.2$

2.  $2 \times 6$

3.  $\frac{4.2}{2.1}$

4.  $1.6 \times 1.6$

Solution:

## Calculations considering significant figures

### (A) Multiplication/Division Rules (considering SF)

$$\begin{array}{lcl} (1) & 4.2 \times 0.2 & \\ \swarrow \quad \searrow & & \\ \text{SF } 2 & \text{SF } 1 & \\ & (\text{least}) & \\ \hline & = 0.84 & \\ \swarrow & \searrow & \\ & 0.8 & \leftarrow \text{Round off} \\ & (\text{SF} \rightarrow 1) & \end{array}$$

$$\begin{array}{lcl} (2) & 2 \times 6 & = 12 \quad (\text{SF } 2) \\ \swarrow & & \\ \text{SF } 1 & & = 1.2 \times 10^1 \\ & & = 1 \times 10^1 \text{ or } 10 \quad \leftarrow \begin{array}{l} (\text{SF } 2) \\ (\text{SF } 1) \end{array} \end{array}$$

$$\begin{array}{lcl} (3) & \frac{4.2}{2.1} & = 2 \quad (\text{SF } 1) \\ & & = 2.0 \quad (\text{SF } 2) \end{array}$$

$$\begin{array}{lcl} (4) & 1.6 \times 1.6 & = 2.56 \quad (\text{SF } 3) \\ & & = 2.6 \quad (\text{SF } 2) \end{array}$$

Rounding **Off**

*thousands*  
*hundreds*  
*tens*  
*ones*

*Rounding  
Calculator*

**1,000.12345**

*tenths*  
*hundredths*  
*thousandths*  
*ten thousandths*  
*hundred thousandths*



## Rounding Off

NUMBER	No. of decimals
6.422	1
6.4872	2
6.997	2
6.6500	1
7.485	2
6.755000	2
8.995	2
6.6501	1
7.4852007	2

### GOLDEN TIP

If the removed part is

5 or

50 or

500 or

5000 or

50000 or

500000....and so on

ENSURE we are EVEN (Units Place)

## Rounding Off

NUMBER	No. of decimals	
6.422	1	6.4
6.4872	2	6.49
6.997	2	7.00
6.6500	1	6.6
7.485	2	7.48
6.755000	2	6.76
8.995	2	9.00
6.6501	1	6.7
7.4852007	2	7.49

### GOLDEN TIP

If the removed part is 5 or 5000000.... ENSURE we are EVEN (Units Place)

## Rounding Off

NUMBER	Number of places desired	Last figure to be kept	First figure to be kept	Last figure kept and/or number becomes
6.422	1	6.4	6.42	6.4
6.4872	2	6.48	6.487	6.49
6.997	2	6.99	6.997	7.00
6.6500	1	6.6	6.65	6.6
7.485	2	7.48	7.485	7.48

### GOLDEN TIP

If the removed part is 5 or 5000000.... ENSURE we are EVEN (Units Place)

## Rounding **Off**

NUMBER	Number of places desired	Last figure to be kept	First figure to be kept	Last figure kept and/or number becomes
6.755000	2	6.75	6.755	6.76
8.995	2	8.99	8.995	9.00
6.6501	1	6.6	6.65	6.7
7.4852007	2	7.48	7.485	7.49

### **GOLDEN TIP**

If the removed part is 5 or 5000000.... ENSURE we are EVEN (Units Place)

# Order of **Magnitude**

Atto a	$10^{-18}$	0.000 000 000 000 000 001
Femto f	$10^{-15}$	0.000 000 000 000 001
Pico p	$10^{-12}$	0.000 000 000 001
Nano n	$10^{-9}$	0.000 000 001
Micro $\mu$	$10^{-6}$	0.000 001
Milli m	$10^{-3}$	0.001
Centi c	$10^{-2}$	0.01
Deci d	$10^{-1}$	0.1
	$10^0$	1
Deca da	$10^1$	10
Hecto h	$10^2$	100
Kilo k	$10^3$	1 000
Mega M	$10^6$	1 000 000
Giga G	$10^9$	1 000 000 000
Tera T	$10^{12}$	1 000 000 000 000

Order of Magnitude

Squeeze the lemon to MAX



## Examples

Finding **Order** of Magnitude

(1) 32678

(2) 921

Solution:

Finding Order of magnitude

$$(1) \quad 32678 = \underbrace{3.2678}_{\substack{\downarrow \\ \text{less than 5}}} \times 10^4$$

Order of magnitude 4

$$(2) \quad 921 = \underbrace{9.21}_{\substack{\downarrow \\ \text{Greater than 5}}} \times 10^2 \approx 10^3$$

Order of magnitude 3