

N3 - Sig Figs

Target: I can use sig figs to reflect the level of uncertainty in a measurement.

Link to YouTube Presentation:
<https://youtu.be/L7zg83ZVQJQ>



Uncertainty in Measurement

A digit that must be **estimated** is called **uncertain**.

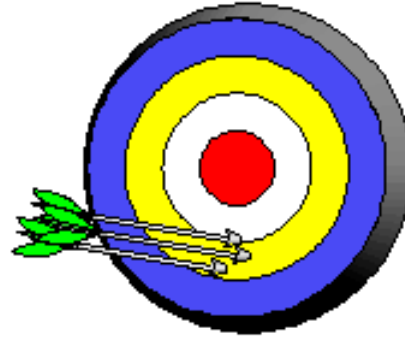
A **measurement** always has some degree of uncertainty.

- Measurements are performed with instruments
- No instrument can read to an infinite # of decimal places

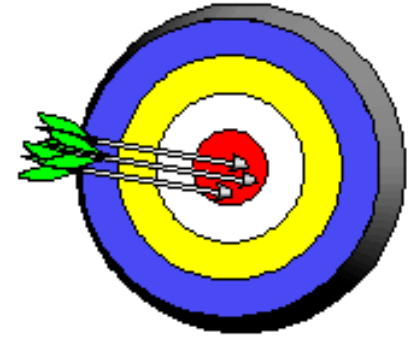
Precision and Accuracy

Accuracy refers to the agreement of a particular value with the **true** value.

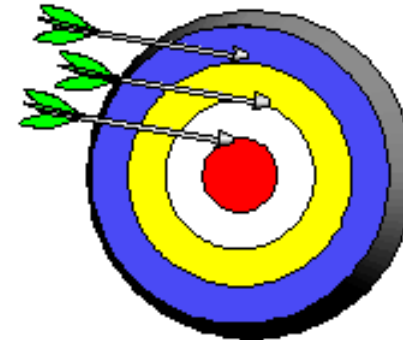
Precision refers to the degree of **agreement** among several measurements made in the same manner.



Precise but not
accurate



Precise AND
accurate



Neither accurate nor precise

Rules for Counting Sig Figs

Nonzero Integers		
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Rules for Counting Sig Figs

Nonzero Integers	ALWAYS COUNT as SIGNIFICANT	
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Rules for Counting Sig Figs

Nonzero Integers	ALWAYS COUNT as SIGNIFICANT	<u>3456</u> has 4 sig figs
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Rules for Counting Sig Figs

Leading Zeros		
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Rules for Counting Sig Figs

Leading Zeros	NEVER COUNT as SIGNIFICANT	
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Rules for Counting Sig Figs

Leading Zeros	NEVER COUNT as SIGNIFICANT	<u>0.0</u> 486 has 3 sig figs
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Rules for Counting Sig Figs

Captive Zeros		
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Rules for Counting Sig Figs

**Captive
Zeros**

**ALWAYS COUNT
as SIGNIFICANT**

Rules for Counting Sig Figs

Captive Zeros	ALWAYS COUNT as SIGNIFICANT	16.<u>0</u>7 has 4 sig figs.
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Rules for Counting Sig Figs

Trailing Zeros		

Rules for Counting Sig Figs

Trailing Zeros		
<i>SOMETIMES COUNT</i> as SIGNIFICANT		

Rules for Counting Sig Figs

Trailing Zeros	AFTER A DECIMAL <i>ALWAYS COUNT</i> as SIGNIFICANT	
<i>SOMETIMES COUNT</i> as SIGNIFICANT		

Rules for Counting Sig Figs

Trailing Zeros	AFTER A DECIMAL <i>ALWAYS COUNT</i> as SIGNIFICANT	
<i>SOMETIMES COUNT</i> as SIGNIFICANT	NO DECIMAL <i>NEVER COUNT</i> as SIGNIFICANT	

Rules for Counting Sig Figs

Trailing Zeros	AFTER A DECIMAL <i>ALWAYS COUNT</i> as SIGNIFICANT	<i>9.3<u>00</u></i> has <i>4</i> sig figs.
<i>SOMETIMES COUNT</i> as SIGNIFICANT	NO DECIMAL <i>NEVER COUNT</i> as SIGNIFICANT	

Rules for Counting Sig Figs

Trailing Zeros	AFTER A DECIMAL <i>ALWAYS COUNT</i> as SIGNIFICANT	<i>9.3<u>00</u></i> has <i>4</i> sig figs.
<i>SOMETIMES COUNT</i> as SIGNIFICANT	NO DECIMAL <i>NEVER COUNT</i> as SIGNIFICANT	<i>93<u>00</u></i> has <i>2</i> sig figs.

Rules for Counting Sig Figs

Exact Numbers		
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Rules for Counting Sig Figs

Exact Numbers	INFINITE NUMBER of sig figs	
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Rules for Counting Sig Figs

Exact Numbers	INFINITE NUMBER of sig figs	1in = 2.54cm 12in = 1ft
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Silly little Memory Device

*Done to the
tune of
“I don’t know
what I’ve
been told”*

**If a number starts with 0,
Beginning zeros have to go!**

**If you see no point at all,
Kick the last ones to the wall!**

**Every other number’s cool,
No exception to this rule!**

How many significant figures in the following number?

1.0070 m

A 3

B 2

C 5

D 6

E 4

How many significant figures in the following number?

1.0070 m

A 3

B 2

C 5

D 6

E 4

How many significant figures in the following number?

100,890 L

- A** None of the above
- B** 4
- C** 6
- D** 3
- E** 5

How many significant figures in the following number?

100,890 L

A None of the above

B 4

C 6

D 3

E **5**

How many significant figures in the following number?

$3.29 \times 10^3 \text{ sec}$

A 4

B 1

C 3

D 5

E None of the above

How many significant figures in the following number?

$3.29 \times 10^3 \text{ sec}$

A 4

B 1

C 3

D 5

E None of the above

How many significant figures in the following number?

0.0054 cm

- A** 4
- B** 5
- C** 3
- D** 2
- E** None of the above

How many significant figures in the following number?

0.0054 cm

A 4

B 5

C 3

D 2

E None of the above

How many significant figures in the following number?

0.0056030

A 2

B 7

C 5

D 4

E 3

How many significant figures in the following number?

0.0056030

A 2

B 7

C 5

D 4

E 3

Rules for Using Sig Figs

Multiplication & Division		
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Rules for Using Sig Figs

Multiplication & Division	Answer based on LEAST number of SIG FIGS in the problem	
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Rules for Using Sig Figs

Multiplication & Division	Answer based on LEAST number of SIG FIGS in the problem	$6.38 \times 2.0 =$ $12.76 \rightarrow$
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Rules for Using Sig Figs

Multiplication & Division	Answer based on LEAST number of SIG FIGS in the problem	$6.38 \times 2.0 =$ <i>3 SF 2SF</i> $12.76 \rightarrow 13$ <i>(2 sig figs)</i>
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Which answer has the correct number of sig figs?

$$3.24 \text{ m} \times 7.0 \text{ m}$$

2 SF

A 22.7 m^2

B 23 m^2

C 22.6 m^2

Which answer has the correct number of sig figs?

$$3.24 \text{ m} \times 7.0 \text{ m}$$

2 SF

A 22.7 m^2

B 23 m^2

C 22.6 m^2

Which answer has the correct number of sig figs?

1 SF 0.02 cm x 2.371 cm

A 0.04742 cm²

B 0.047 cm²

C 0.05 cm²

Which answer has the correct number of sig figs?

1 SF 0.02 cm x 2.371 cm

A 0.04742 cm²

B 0.047 cm²

C *0.05 cm²*

Which answer has the correct number of sig figs?

2 SF **710 m ÷ 3.0 s** **2 SF**

- A** 240 m/s
- B** 236.6 m/s
- C** 236 m/s

Which answer has the correct number of sig figs?

2 SF **710 m** $\div$ **3.0 s** **2 SF**

A ***240 m/s***

B **236.6 m/s**

C **236 m/s**

Rules for Using Sig Figs

Addition & Subtraction		
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Rules for Using Sig Figs

**Addition &
Subtraction**

**Answer based on
LEAST number of
DECIMAL PLACES
in the problem**

Rules for Using Sig Figs

**Addition &
Subtraction**

**Answer based on
LEAST number of
DECIMAL PLACES
in the problem**

**$6.8 + 11.934 =$
 $18.734 \rightarrow$**

Rules for Using Sig Figs

**Addition &
Subtraction**

**Answer based on
LEAST number of
DECIMAL PLACES
in the problem**

6.8 + 11.934 =
1DP *3DP*
18.734 →

Rules for Using Sig Figs

Addition & Subtraction	Answer based on LEAST number of DECIMAL PLACES in the problem	$6.8 + 11.934 =$ <i>1DP</i> <i>3DP</i> $18.734 \rightarrow 18.7$ <i>(3 sig figs)</i>
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Which answer has the correct number of sig figs?

$$3.24 \text{ m} + 7.0 \text{ m}$$

1 DP

A 10.24 m

B 10.2 m

C 10 m

Which answer has the correct number of sig figs?

$$3.24 \text{ m} + 7.0 \text{ m}$$

1 DP

A 10.24 m

B *10.2 m*

C 10 m

Which answer has the correct number of sig figs?

2 DP **0.02 cm + 2.371 cm**

- A** 2.4 cm
- B** 2.391 cm
- C** 2.39 cm

Which answer has the correct number of sig figs?

2 DP **0.02 cm + 2.371 cm**

- A** 2.4 cm
- B** 2.391 cm
- C** *2.39 cm*

Which answer has the correct number of sig figs?

3 DP

2.030 mL – 1.870 mL

3 DP

- A** 0.16 mL
- B** 0.160 mL
- C** 0.1600 mL

Which answer has the correct number of sig figs?

3 DP

2.030 mL – 1.870 mL

3 DP

A 0.16 mL

B *0.160 mL*

C 0.1600 mL

Some slightly more complicated rules...



Some slightly more complicated rules...

We will talk about this one:

- Multiple Operations

Just open the PDF or look at your Reference Sheet for these when you have to do a question about them:

- Logarithms
- Multiplying and dividing with scientific notation
- Adding and subtracting with scientific notation

Rules for Using Sig Figs

Multiple Operations	Use ORDER of OPERATIONS as you go PEMDAS	$\begin{aligned} &2.0000(1.008) + 15.99 = \\ &\quad \times 1^{\text{st}} \text{ } 4 \text{ SF} \\ &= 2.016 + 15.99 \\ &\quad + 2^{\text{nd}} \text{ } 2 \text{ DP} \\ &18.006 \rightarrow 18.01 \\ &\quad (2 \text{ DP}) \end{aligned}$
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“Please Excuse My Dear Aunt Sally”

Parenthesis, Exponents, Multiplication, Division, Addition, Subtraction

Rules for Using Sig Figs

Answers to Logarithm Calculations	Only the numbers AFTER the DECIMAL PLACE in the answer - these are called “the mantissa”	$\text{Log } (2.4 \times 10^3) =$ <i>2 SF</i> $3.3802 \rightarrow 3.38$ <i>(2 sig figs)</i>
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Rules for Using Sig Figs

Multiplying or Dividing Scientific Notation	Answer based on LEAST number of SIGNIFICANT FIGURES in the problem	$(2.0 \times 10^{12}) / (8.330 \times 10^8) =$ $\begin{matrix} 2 \text{ SF} & 4 \text{ SF} \\ = 2.40096 \times 10^3 \rightarrow \\ & 2.4 \times 10^3 \\ & (2 \text{ SF}) \end{matrix}$
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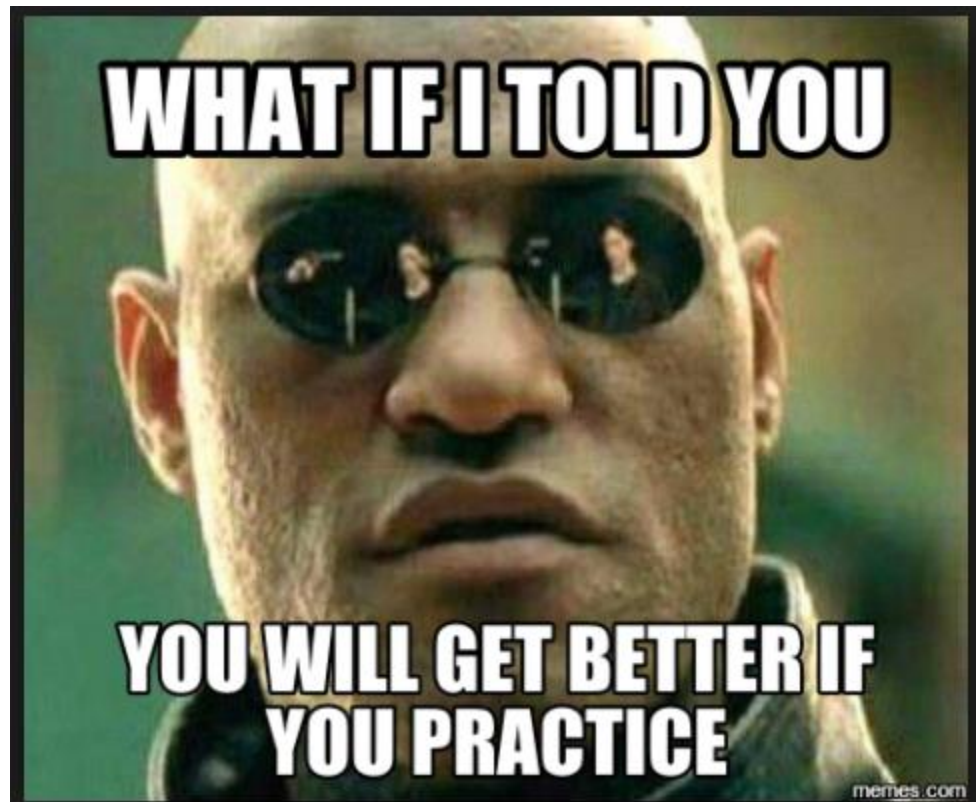
Rules for Using Sig Figs

Adding Subtracting with Scientific Notation	Must have the SAME EXPONENT before you do the problem	$(2.113 \times 10^4) + (9.2 \times 10^4) =$ <i>1 DP</i> $11.313 \times 10^4 \rightarrow 11.3 \times 10^4$ <i>1 DP</i> <i>Put back in good sci. not. Form</i> <i>$= 1.13 \times 10^5$</i>
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Rules for Using Sig Figs

Adding Subtracting with Scientific Notation	Must have the SAME EXPONENT before you do the problem	$(1.032 \times 10^4) + (2.672 \times 10^5) =$ Convert to same exponent $(1.032 \times 10^4) + (26.72 \times 10^4)$ 2 DP $27.752 \times 10^4 \rightarrow 27.75 \times 10^4$ 2 DP <i>Put back in good sci. not. Form</i> $= 2.775 \times 10^5$
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Some Extra Practice Problems



How many significant figures in the following number?

17.10 Kg

A 3

B 4

C 5

D 2

E None of the above

How many significant figures in the following number?

17.10 Kg

A 3

B 4

C 5

D 2

E None of the above

How many significant figures in the following number?

3,200,000

A 2

B 7

C 5

D 4

E 3

How many significant figures in the following number?

3,200,000

A 2

B 7

C 5

D 4

E 3

Which answer has the correct number of sig figs?

$$100.0 \text{ g} \div 23.7 \text{ cm}^3 \quad \text{3 SF}$$

- A** 4.22 g/cm³
- B** 4.219 g/cm³
- C** 4.2 g/cm³

Which answer has the correct number of sig figs?

$$100.0 \text{ g} \div 23.7 \text{ cm}^3 \quad \text{3 SF}$$

A *4.22 g/cm³*

B 4.219 g/cm³

C 4.2 g/cm³

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