

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

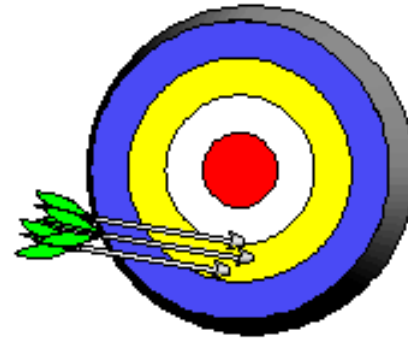
A digit that must be **estimated** is called **uncertain**.
A **measurement** always has some degree of uncertainty.

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

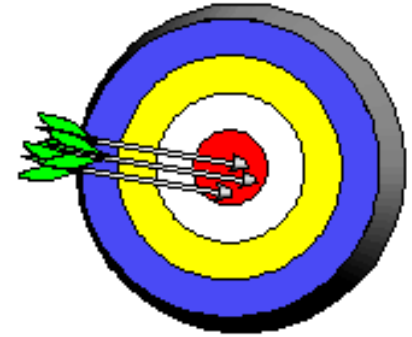
Precision and Accuracy

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

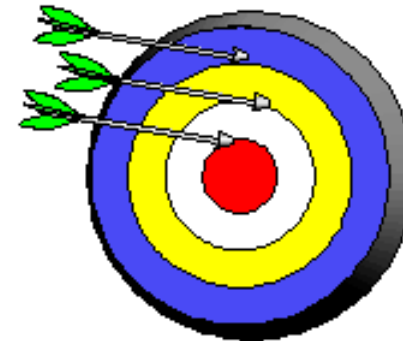
Precision refers to the degree of **agreement** among several measurements made in the same manner.



Precise but not accurate



Precise AND accurate



Neither accurate nor precise

Rules for Counting Sig Figs

| | | |
|-----------------------------|--|--|
| Nonzero Integers | | |
|-----------------------------|--|--|

Rules for Counting Sig Figs

| | | |
|-----------------------------|--|--|
| Nonzero Integers | ALWAYS COUNT as SIGNIFICANT | |
|-----------------------------|--|--|

Rules for Counting Sig Figs

| | | |
|------------------------------------|---|---|
| <p>Nonzero Integers</p> | <p>ALWAYS COUNT as SIGNIFICANT</p> | <p><u>3456</u> has 4 sig figs</p> |
|------------------------------------|---|---|

Rules for Counting Sig Figs

| | | |
|--------------------------|--|--|
| Leading Zeros | | |
|--------------------------|--|--|

Rules for Counting Sig Figs

**Leading
Zeros**

NEVER COUNT as
SIGNIFICANT

Rules for Counting Sig Figs

**Leading
Zeros**

NEVER COUNT as
SIGNIFICANT

0.0**486** has
3 sig figs

Rules for Counting Sig Figs

| | | |
|--------------------------|--|--|
| Captive Zeros | | |
|--------------------------|--|--|

Rules for Counting Sig Figs

| | | |
|---------------------------------|---|--|
| <p>Captive Zeros</p> | <p>ALWAYS COUNT as SIGNIFICANT</p> | |
|---------------------------------|---|--|

Rules for Counting Sig Figs

| | | |
|---------------------------------|---|--|
| <p>Captive Zeros</p> | <p>ALWAYS COUNT as SIGNIFICANT</p> | <p>16.<u>0</u>7 has 4 sig figs.</p> |
|---------------------------------|---|--|

Rules for Counting Sig Figs

| | | |
|---------------------------|--|--|
| Trailing Zeros | | |
| | | |

Rules for Counting Sig Figs

| | | |
|---|--|--|
| <p>Trailing Zeros</p> | | |
| <p><i>SOMETIMES COUNT</i> as SIGNIFICANT</p> | | |

Rules for Counting Sig Figs

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

Rules for Counting Sig Figs

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

Rules for Counting Sig Figs

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

Rules for Counting Sig Figs

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

Rules for Counting Sig Figs

| | | |
|---------------------------------|--|--|
| <p>Exact Numbers</p> | | |
|---------------------------------|--|--|

Rules for Counting Sig Figs

| | | |
|---------------------------------|---|--|
| <p>Exact Numbers</p> | <p>INFINITE NUMBER of sig figs</p> | |
|---------------------------------|---|--|

Rules for Counting Sig Figs

| | | |
|---------------------------------|---|---|
| <p>Exact Numbers</p> | <p>INFINITE NUMBER of sig figs</p> | <p>1in = 2.54cm 12in = 1ft</p> |
|---------------------------------|---|---|

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?

3.29×10^3 sec



4



1



3



5



None of the above

How many significant figures in the following number?

3.29×10^3 sec



4



1



3



5



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



4



5



3



2



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 | | |
|--|--|--|

Rules for Using Sig Figs

| | | |
|---|---|--|
| <p>Multiplication & Division</p> | <p>Answer based on LEAST number of SIG FIGS in the problem</p> | |
|---|---|--|

Rules for Using Sig Figs

| | | |
|--|--|--------------------------------------|
| Multiplication & Division | Answer based on LEAST number of SIG FIGS in the problem | 6.38 x 2.0 = 12.76 → |
|--|--|--------------------------------------|

Rules for Using Sig Figs

| | | |
|---|---|--|
| <p>Multiplication & Division</p> | <p>Answer based on LEAST number of SIG FIGS in the problem</p> | <p>6.38 x 2.0 = 3 <i>SF</i> 2<i>SF</i> 12.76 → 13 <i>(2 sig figs)</i></p> |
|---|---|--|

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 $710 \text{ m} \div 3.0 \text{ s}$ **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 ÷ 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 | | |
|---------------------------------------|--|--|

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**

$$\begin{array}{r} 6.8 + 11.934 = \\ \text{1DP} \qquad \qquad \text{3DP} \\ 18.734 \rightarrow \end{array}$$

Rules for Using Sig Figs

**Addition &
Subtraction**

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

$$\begin{array}{r} 6.8 + 11.934 = \\ \text{1DP} \quad \quad \quad \text{3DP} \\ 18.734 \rightarrow 18.7 \\ \text{(3 sig figs)} \end{array}$$

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

| | | |
|-----------------------------------|--|---|
| <p>Multiple Operations</p> | <p>Use ORDER of OPERATIONS as you go PEMDAS</p> | $2.0000(1.008) + 15.99 =$ <p>x 1st 4 SF</p> $= 2.016 + 15.99$ <p>+ 2nd 2 DP</p> $18.006 \rightarrow \mathbf{18.01}$ <p>(2 DP)</p> |
|-----------------------------------|--|---|

“Please Excuse My Dear Aunt Sally”

Parenthesis, Exponents, Multiplication, Division, Addition, Subtraction

Rules for Using Sig Figs

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

Rules for Using Sig Figs

| | | |
|---|--|--|
| <p>Multiplying or Dividing Scientific Notation</p> | <p>Answer based on LEAST number of SIGNIFICANT FIGURES in the problem</p> | <p>$(2.0 \times 10^{12}) / (8.330 \times 10^8) =$ <i>2 SF</i> <i>4 SF</i> $= 2.40096 \times 10^3 \rightarrow$ <i>2.4 x 10³</i> <i>(2 SF)</i></p> |
|---|--|--|

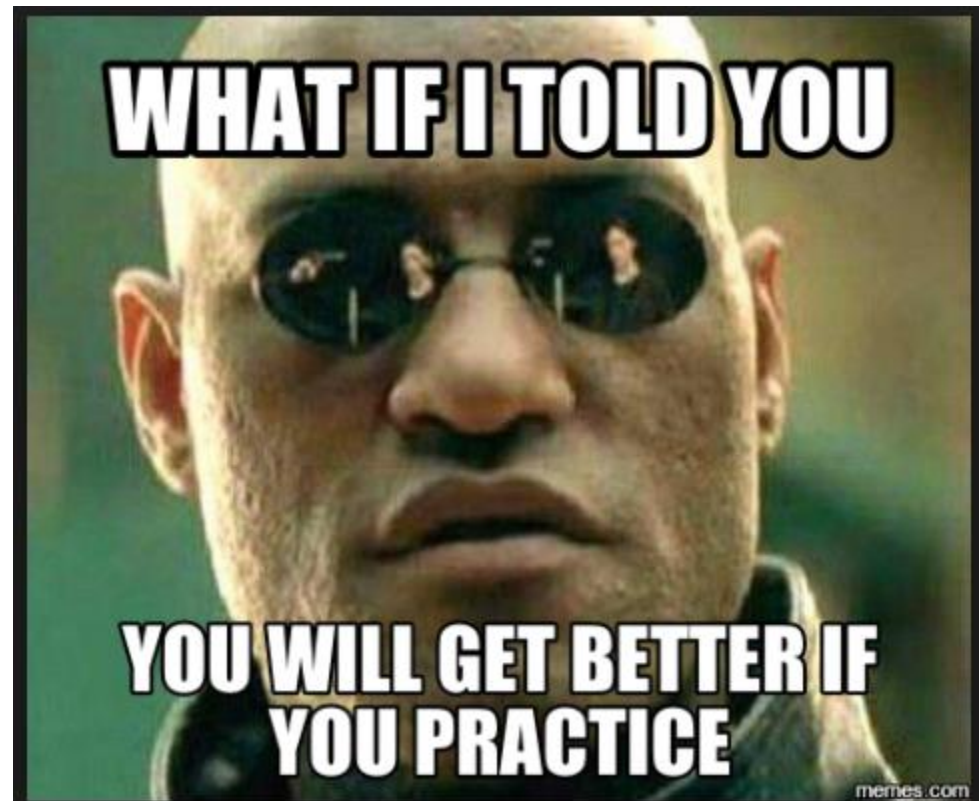
Rules for Using Sig Figs

| | | |
|--|--|--|
| <p>Adding Subtracting with Scientific Notation</p> | <p>Must have the SAME EXPONENT before you do the problem</p> | <p>$(2.113 \times 10^4) + (9.2 \times 10^4) =$ <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 x 10⁵</i></p> |
|--|--|--|

Rules for Using Sig Figs

| | | |
|--|--|--|
| <p>Adding Subtracting with Scientific Notation</p> | <p>Must have the SAME EXPONENT before you do the problem</p> | <p>$(1.032 \times 10^4) + (2.672 \times 10^5) =$ 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> $= 2.775 \times 10^5$</p> |
|--|--|--|

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



3



4



5



2



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?

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

A 4.22 g/cm^3

B 4.219 g/cm^3

C 4.2 g/cm^3

Link to YouTube Video of Presentation:

<https://youtu.be/L7zg83ZVQJQ>