Unit 03 Outcomes

LPT

Define significant figures

Those digits in a measurement which show the degree of certainty or precision.

Define the uncertain or doubtful digit in a measurement

The last digit on the right of a measured quantity is understood as an estimate.

Determine the number of significant figures in a measured quantity

Begin with the first nonzero digit and end with the doubtful digit.

The location of the decimal point has nothing to do with significant figures.

Nonzero digits

78.391 km   (5 figures)   422.8 gal (4 figures)

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Convert measurements to scientific form to show the correct significant digits.

Re-write the quantity   400,000 mg

to show 1 sig. fig. 4×10^4 mg
to show 2 sig. fig. 4.0×10^4 mg
to show 3 sig. fig. 4.00×10^4 mg
to show 4 sig. fig. 4.000×10^4 mg

Re-write the quantity   934,000,000,000 ps
to show 3 sig. fig. 9.34×10^{12} ps
to show 4 sig. fig. 9.340×10^{12} ps
to show 5 sig. fig. 9.3400×10^{12} ps
to show 6 sig. fig. 9.34000×10^{12} ps

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Identify whether a zero in a measurement is or is not significant

Leading zeros - never

0.000391 m (3 figures)   0.00255 g (3 figures)

Captive zeros

7,503 lbs   (4 figures)   100,038 cm (6 figures)

Trailing decimal point zeros

14,000 kg (2 figures)   15.60 mL (4 figures)   160. mm (3 figures)

Round off the mathematical result to the proper number of significant digits.

If the first digit to be dropped is less than 5, leave the digit before it unchanged.

If the first digit to be dropped is 5 or more, increase the digit before it by 1.

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Add or subtract measured quantities
express the result in standard exponential form
with the proper number of significant figures and correct unit label

Round off the answer to the first column that has a doubtful digit.

$$
\begin{array}{r}
2.22 \quad \text{cm} \\
3.9 \quad \text{cm} \\
+ \quad 8.9382 \quad \text{cm} \\
\hline
15.0582 \quad \text{cm}
\end{array}
$$

$$
\begin{array}{r}
15.85 \quad \text{g} \\
- \quad 9.4052 \quad \text{g} \\
\hline
6.4448 \quad \text{g}
\end{array}
$$

(15.1   cm)
1.51×10^1 cm

(6.44   g)
6.44×10^0 g

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Multiply or divide measured quantities
express the result in standard exponential form
with the proper number of significant diigits & correct unit label

Multiplication & Division
Round answer to the smallest number of sig. fig. in any factor

4.62 m x 3.1 m = 14.322 m^2 (14 m^2 ; 1.4 x 10^1 m^2)

$\dfrac{248.37 \text{ g}}{18.3 \text{ mL}}$ = 13.572131 g/mL (13.6 g/mL; 1.36 x10^1 g/mL)

LPT

Determine significant figures for non-measured numbers & defined conversion factors

exact (non-measured quantities) numbers & defined conversion factor

have an infinite number of significant figures
(not used in determining # of significant digits)

Given any 2 of the following, calculate the third: mass; volume; density

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

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Given a quantity expressed in a metric unit, express that quantity in an appropriate English unit and vice versa.

The Process
1. **What is being asked?**
2. **What do I know?**
3. **Can I get from 2 ➔ 1 ? ("per" expressions")**
4. **"Turn the crank" (Do the math)**

USE UNITS
Units wrong, most likely have wrong answer
Units can provide means to solution

1 inch $\equiv$ 2.54 cm

1 pound = 454 g

1 liter = 1.06 quarts

LPT

List the number of significant figures:

0.00000000001010 sec	4
267400 grams	4
121 apples	∞
2.54 cm = 1 in	∞
16.046 m	5
3,000 km	1
3,000. mg	4
0.000667 L	3
90.800 tons	5
35	∞
35 mL	2
0.0500700 g	6
9.360×10^4 s	4
8,628,000 cm	4
499.00 mL	5
1 mL 1 cm	∞

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Round each of the following to 3 significant figures:

16.8498 L	16.8 L
5.63962 g	5.64 g
0.14992 L	0.150 L
861.652 kg	862 kg
4.201×10^4 km	4.20×10^4 km
5.09819×10^{-3} mm	5.10×10^{-3} mm
0.00318787 m	0.00319 m
0.09025091 cm^3	0.0903 cm^3

Mercury has a density of 13.6 g / mL. What volume will 300.0 g occupy?

$$300.0 \text{ g } \times \frac{1 \quad \text{mL}}{13.6 \text{ g}} = 22.1 \text{ mL}$$

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Calculate the following:

$$\frac{345.67\ \text{g}}{2.23\ \text{mL}} = 155.009 \rightarrow 155\ \text{g/mL}$$

$$4.4546\ \text{m} \times 2.432\ \text{m} = 10.83336 \rightarrow 10.83\ \text{m}^2$$

```
    12.945   g              234.567  mL
     1.01    g          -    1.0      mL
 +  123.209  g             233.567  ➜  233.6 mL
    137.164  ➜ 137.16 g
```

$$107.40\ \text{g} - 98.107.40\ \text{g} = 9.292\ \text{g} \rightarrow 9.29\ \text{g}$$

$$6.248 \times 10^{-3}\ \text{m} + 9.342 \times 10^{-2}\ \text{m} = 9.967 \times 10^{-2}\ \text{m}$$

$$85\ \text{mL} + 55.3\ \text{mL} = 140.3\ \text{mL} \rightarrow 140\ \text{mL}$$

$$8.0\ \text{g} \times 5.2\ \text{cm} = 41.6\ \text{g cm} \rightarrow 42\ \text{g cm}$$

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