



## MEASUREMENT

### 1.7 - Calculations Involving Significant Figures

#### 1.7.1 - Rules for Rounding off Numbers

#### Correct Answers

**Rule 1.** If the digit to be dropped is less than 5, drop that digit and all other to the right of that digit.

eg - Round off 86.0234 g to 3 significant figures.

86.0 g

**Rule 2.** If the digit to be dropped is greater than or equal to 5, increase the value of the last digit retained by one.

eg - Round off 0.06587 L to 3 significant figures.

0.0659 L

**Rule 3.** If the digits to be dropped are to the left of the decimal point, zeros are used as their replacements.

eg 1- Round off 1780.1 m to 4 significant figures.

1.780 x 10<sup>3</sup> m OR  
1780 m

Do not leave it as '1780 m' as it is confusing.

eg 2 - Round off 25,369 g to 3 significant figures.

2.54 x 10<sup>3</sup> g OR  
25,400 g

**Additional Rule\*** If the digit to be dropped is 5 and is followed by zeros, drop the 5 and  
(i) keep the last digit as is if the digit before the '5' is even, or  
(ii) increase the last digit by 1 if the digit before the '5' is odd

eg 1 - Round off 47.250 g to 3 significant figures.

47.2 g

eg 2 - Round off 47.350 g to 3 significant figures.

47.4 g

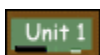
\* This rule is strictly applied if you are doing round off of statistical data as it prevents consistent rounding up of the data. For this course, this rule is not strictly enforced.

#### 1.7.2 - Rules for Addition and Subtraction

The answer must retain the same number of digits to the right of the decimal point as were present in the value with the fewest number of digits to the right of the decimal point.

#### 1.7.3 - Rules for Multiplication and Division

The answer must contain the same number of significant figures as were present in the measurement with the fewest number of significant figures.



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### 1.7 - Calculations Involving Significant Figures

#### 1.7.2 - Rules for Addition and Subtraction

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**Question:** If you have 3.18 L of water and you add 0.01315 L more. How much water do you end up with?

**Answer:** It is easiest if you look write out the addition problem by aligning the decimal point.

$$\begin{array}{r} 3.18 \quad \text{L} \\ + 0.01315 \quad \text{L} \\ \hline 3.19 \quad \text{L} \end{array}$$

Number with fewest number of digits to the right of the decimal point. (i.e. - 2 digits to the right of the decimal point.)

The answer is LIMITED to 2 digits to the right of the decimal point.

The answer is 3.19 L; 3 significant figures.





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#### 1.7.3 - Rules for Multiplication and Division

The answer must contain the same number of significant figures as were present in the measurement with the fewest number of significant figures.

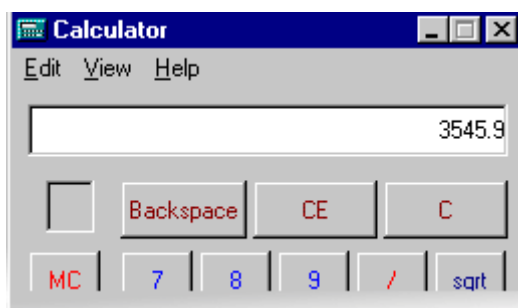
**Question:** A student measures the length of a table to be 120.2 cm and the width to be 29.5 cm. What is the area of the table. Express the answer with the proper number of significant figures.

#### Answer:

**Step 1:** To obtain the area of the table, we perform the following multiplication using the calculator.

$$29.5 \text{ cm} \times 120.2 \text{ cm} = ?$$

The calculator displays the answer to be 3545.9. The unit is in  $\text{cm}^2$ .



**Step 2:** Inspect each number and determine the number of significant figures in each number.

29.5 3 significant figures  
(This measurement has the fewest number of significant figures.)

120.2 4 significant figures

The measurement 29.5 limits **the number of significant figures in the answer to 3 significant figures.**

The answer is  $3.55 \times 10^3 \text{ cm}^2$ ; **3 significant figures.**

Going back to the example in [section 1.7](#), the answer is

**$3.85 \times 10^3 \text{ cm}^2$ .**

The answer has 3 significant figures because the length measurement is the measurement with the fewest significant figures (i.e. 3 significant figures). It limits the final answer to 3 significant figures.



**Section 2.6**  
**Mathematical Operations Involving Significant Digits ..p23**