

# SIGNIFICANT FIGURES

Name \_\_\_\_\_

Measurement can only be as accurate and precise as the instrument that produced it. A scientist must be able to express the accuracy of a number, not just its numerical value. We can determine the accuracy of a number by the number of significant figures it contains.

- 1) All digits 1-9 inclusive are significant.  
Example: 129 has 3 significant figures.
- 2) Zeros between significant digits are always significant.  
Example: 5,007 has 4 significant figures.
- 3) Trailing zeros in a number are significant only if the number contains a decimal point.  
Example: 100.0 has 4 significant figures.  
100 has 1 significant figure.
- 4) Zeros in the beginning of a number whose only function is to place the decimal point are not significant.  
Example: 0.0025 has 2 significant figures.
- 5) Zeros following a decimal significant figure are significant.  
Example: 0.000470 has 3 significant figures.  
0.47000 has 5 significant figures.

Determine the number of significant figures in the following numbers.

- |                |                   |
|----------------|-------------------|
| 1. 0.02 _____  | 6. 5,000. _____   |
| 2. 0.020 _____ | 7. 6,051.00 _____ |
| 3. 501 _____   | 8. 0.0005 _____   |
| 4. 501.0 _____ | 9. 0.1020 _____   |
| 5. 5,000 _____ | 10. 10,001 _____  |

Determine the location of the last significant place value by placing a bar over the digit.  
(Example: 1.700̄)

- |                              |                                |
|------------------------------|--------------------------------|
| 1. 8040 _____                | 6. 90,100 _____                |
| 2. 0.0300 _____              | 7. $4.7 \times 10^{-8}$ _____  |
| 3. 699.5 _____               | 8. 10,800,000. _____           |
| 4. $2.000 \times 10^2$ _____ | 9. $3.01 \times 10^{21}$ _____ |
| 5. 0.90100 _____             | 10. 0.000410 _____             |

# CALCULATIONS USING SIGNIFICANT FIGURES

When multiplying and dividing, limit and round to the least number of significant figures in any of the factors.

**Example 1:**  $23.0 \text{ cm} \times 432 \text{ cm} \times 19 \text{ cm} = 188,784 \text{ cm}^3$

The answer is expressed as  $190,000 \text{ cm}^3$  since 19 cm has only two significant figures.

When adding and subtracting, limit and round your answer to the least number of decimal places in any of the numbers that make up your answer.

**Example 2:**  $123.25 \text{ mL} + 46.0 \text{ mL} + 86.257 \text{ mL} = 255.507 \text{ mL}$

The answer is expressed as  $255.5 \text{ mL}$  since 46.0 mL has only one decimal place.

Perform the following operations expressing the answer in the correct number of significant figures.

- $1.35 \text{ m} \times 2.467 \text{ m} = \underline{\hspace{2cm}}$
- $1,035 \text{ m}^2 + 42 \text{ m} = \underline{\hspace{2cm}}$
- $12.01 \text{ mL} + 35.2 \text{ mL} + 6 \text{ mL} = \underline{\hspace{2cm}}$
- $55.46 \text{ g} - 28.9 \text{ g} = \underline{\hspace{2cm}}$
- $.021 \text{ cm} \times 3.2 \text{ cm} \times 100.1 \text{ cm} = \underline{\hspace{2cm}}$
- $0.15 \text{ cm} + 1.15 \text{ cm} + 2.051 \text{ cm} = \underline{\hspace{2cm}}$
- $150 \text{ L}^3 + 4 \text{ L} = \underline{\hspace{2cm}}$
- $505 \text{ kg} - 450.25 \text{ kg} = \underline{\hspace{2cm}}$
- $1.252 \text{ mm} \times 0.115 \text{ mm} \times 0.012 \text{ mm} = \underline{\hspace{2cm}}$
- $1.278 \times 10^3 \text{ m}^2 + 1.4267 \times 10^2 \text{ m} = \underline{\hspace{2cm}}$

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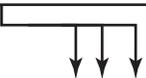
**3**

**Significant Figures**

Use with Appendix B,  
Significant Figures

**Rules for Significant Figures**

- 1** All nonzero figures are significant.


  
**721 mm**

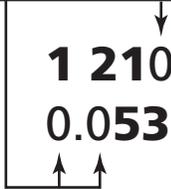
*3 significant figures*
  
- 2** When a zero falls between nonzero digits, that zero is significant.


  
**106 K**

*3 significant figures*
  
- 3** When a zero falls after the decimal point and after a significant figure, that zero is significant.


  
**1.50 L**

*3 significant figures*
  
- 4** When a zero is used merely to indicate the position of the decimal, that zero is *not* significant.


  
**1 210 m**

*3 significant figures*

**0.053 m**

*2 significant figures*
  
- 5** All counting numbers and exact numbers are treated as if they have an infinite number of significant figures.

**10 pairs**

*infinite number of significant figures*

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# Significant Figures

**Use with Appendix B,  
Significant Figures**

1. For each of the measurements in the table below, determine if the underlined number is significant or not significant. Place a check mark in the appropriate box and in the box under the rule that you used to make your determination.

Measurement	Significant	Not Significant	Rule				
			1	2	3	4	5
a. 30 <u>3</u> 8 m							
b. 1.5 <u>6</u> 1 L							
c. 0. <u>0</u> 74 mm							
d. 50 <u>5</u> 0 s							
e. 3. <u>0</u> 07 km							
f. 6. <u>1</u> 0°C							
g. 82 <u>1</u> .0 g							
h. <u>0</u> .560 g							

2. Determine the number of significant figures in each of the following measurements.

- |                               |                                      |
|-------------------------------|--------------------------------------|
| a. 56 m _____                 | n. 0.0021 m _____                    |
| b. 1104 mL _____              | o. 30 015 g _____                    |
| c. 15 pairs _____             | p. 90 km _____                       |
| d. 0.20 mol _____             | q. 12.0 cm _____                     |
| e. 105 000 mm _____           | r. 0.0305 kPa _____                  |
| f. 6.02 L _____               | s. 50 gross _____                    |
| g. 0.176 kPa _____            | t. 83.90 m/s <sup>2</sup> _____      |
| h. 819 000.0 g _____          | u. 0.100 50 cg _____                 |
| i. 4.030 m <sup>3</sup> _____ | v. 0.0510 kg _____                   |
| j. 0.005 42 s _____           | w. 6.12 × 10 <sup>5</sup> mm _____   |
| k. 49 000 km _____            | x. 4.01 × 10 <sup>2</sup> s _____    |
| l. 7.81 kg _____              | y. 60 000 × 10 <sup>3</sup> g _____  |
| m. 7.01 m/s _____             | z. 1.000 × 10 <sup>2</sup> kPa _____ |

### SIGNIFICANT FIGURES

Name \_\_\_\_\_

Measurement can only be as accurate and precise as the instrument that produced it. The student must be able to express the accuracy of a number, not just its numerical value. We can determine the accuracy of a number by the number of significant figures it contains.

- 1) All digits 1-9 inclusive are significant.  
Example: 120 has 3 significant figures.
- 2) Zeros between significant digits are always significant.  
Example: 5,007 has 4 significant figures.
- 3) Trailing zeros in a number are significant only if the number contains a decimal point.  
Example: 100.0 has 4 significant figures.  
100 has 1 significant figure.
- 4) Zeros in the beginning of a number whose only function is to place the decimal point are not significant.  
Example: 0.0025 has 2 significant figures.
- 5) Zeros following a decimal significant figure are significant.  
Example: 0.000420 has 3 significant figures.  
0.42000 has 5 significant figures.

Determine the number of significant figures in the following numbers.

1. 0.02 2
  2. 0.020 3
  3. 601 3
  4. 601.0 4
  5. 5,000 1
  6. 5,000 4
  7. 6,061.00 6
  8. 0.0005 1
  9. 0.1020 4
  10. 10.001 5
- Determine the location of the last significant place value by placing a bar over the digit.  
(Example: 1.700)
1. 8040 \_\_\_\_\_
  2. 0.0000 \_\_\_\_\_
  3. 699.5 \_\_\_\_\_
  4.  $2.000 \times 10^3$  \_\_\_\_\_
  5. 0.90100 \_\_\_\_\_
  6. 90,100 \_\_\_\_\_
  7.  $4.7 \times 10^4$  \_\_\_\_\_
  8. 10,800,000. \_\_\_\_\_
  9.  $3.01 \times 10^2$  \_\_\_\_\_
  10.  $0.000410$  \_\_\_\_\_

### CALCULATIONS USING SIGNIFICANT FIGURES

Name \_\_\_\_\_

When multiplying and dividing, limit and round to the least number of significant figures in any of the factors.

Example 1:  $23.0 \text{ cm} \times 432 \text{ cm} \times 19 \text{ cm} = 188,784 \text{ cm}^3$   
The answer is expressed as  $190,000 \text{ cm}^3$  since 19 cm has only two significant figures.

When adding and subtracting, limit and round your answer to the least number of decimal places in any of the numbers that make up your answer.

Example 2:  $123.25 \text{ mL} + 46.0 \text{ mL} + 86.257 \text{ mL} = 255.507 \text{ mL}$   
The answer is expressed as  $255.5 \text{ mL}$  since 46.0 mL has only one decimal place.

Perform the following operations expressing the answer in the correct number of significant figures.

1.  $1.35 \text{ m} \times 2.467 \text{ m} =$  3.33 m<sup>2</sup>
2.  $1.035 \text{ m}^3 + 42 \text{ m} =$  25 m
3.  $12.01 \text{ mL} + 35.2 \text{ mL} + 6 \text{ mL} =$  53 mL
4.  $55.46 \text{ g} - 28.9 \text{ g} =$  26.6 g
5.  $.021 \text{ cm} \times 3.2 \text{ cm} \times 100.1 \text{ cm} =$  6.7 cm<sup>3</sup>
6.  $0.15 \text{ cm} + 1.15 \text{ cm} + 2.051 \text{ cm} =$  3.35 cm
7.  $150 \text{ L}^3 + 4 \text{ L} =$  40 L<sup>3</sup>
8.  $505 \text{ kg} - 450.25 \text{ kg} =$  55 kg
9.  $1.252 \text{ mm} \times 0.115 \text{ mm} \times 0.012 \text{ mm} =$  0.0017 mm<sup>3</sup>
10.  $1.278 \times 10^3 \text{ m}^2 + 1.4267 \times 10^2 \text{ m} =$  8.958 m

## Significant Figures

Use with Appendix B  
Significant Figures

1. For each of the measurements in the table below, determine if the underlined number is significant or not significant. Please check, mark in the appropriate box and in the box under the title, but you need to make your determination.

Measurement	Significant	Not Significant	Dish					
			1	2	3	4	5	
a. <u>3</u> gallons	✓			✓				
b. 1. <u>5</u> 1 L	✓			✓				
c. 0. <u>0</u> 74 mm		✓						✓
d. <u>50</u> 00 s		✓						✓
e. <u>2</u> 007 km	✓						✓	
f. 5.0 <u>0</u> C	✓						✓	
g. <u>82</u> 0.0 g	✓				✓			
h. <u>0</u> .000g		✓						✓

2. Determine the number of significant figures in each of the following measurements.
- a. 56m \_\_\_\_\_ 2  
 b. 100 mL \_\_\_\_\_ 4  
 c. 15 years \_\_\_\_\_ Infinite number  
 d. 0.20 mol \_\_\_\_\_ 2  
 e. 105,000 mm \_\_\_\_\_ 3  
 f. 6.02 L \_\_\_\_\_ 3  
 g. 0.176 kPa \_\_\_\_\_ 3  
 h. 99,000,000 g \_\_\_\_\_ 7  
 i. 4,000 m<sup>2</sup> \_\_\_\_\_ 4  
 j. 0.005 42 s \_\_\_\_\_ 3  
 k. 49,000 km \_\_\_\_\_ 2  
 l. 7.81 kg \_\_\_\_\_ 3  
 m. 7.01 m/s \_\_\_\_\_ 3
- n. 0.0021 m \_\_\_\_\_ 2  
 o. 20.015 g \_\_\_\_\_ 5  
 p. 90 km \_\_\_\_\_ 1  
 q. 120 mm \_\_\_\_\_ 3  
 r. 0.0005 kPa \_\_\_\_\_ 3  
 s. 50 grams \_\_\_\_\_ Infinite number  
 t. 85.90 m/s<sup>2</sup> \_\_\_\_\_ 4  
 u. 0.000 85 kg \_\_\_\_\_ 5  
 v. 0.05 10 kg \_\_\_\_\_ 3  
 w. 5.12 × 10<sup>3</sup> mm \_\_\_\_\_ 3  
 x. 4.01 × 10<sup>5</sup> s \_\_\_\_\_ 3  
 y. 60,000 × 10<sup>3</sup> g \_\_\_\_\_ 1  
 z. 1,000 × 10<sup>3</sup> kPa \_\_\_\_\_ 4