Name: Key Date:__________ Per.__________

# Significant Figures

Every measurement has a certain degree of uncertainty and reflects the precision of your measuring device. It's easy to show the degree of precision in an original measurement simply by recording it correctly, but it's a bit more complicated if measurements are combined by adding, subtracting, multiplying or dividing them. When measurements are combined mathematically, a set of rules for keeping track of the uncertainty is used. These rules depend on the concept of significant figures, or digits, in each of the original measurements.

significant figures – the certain digits and the last, estimated, digit of a measurement

An easy way to determine the number of significant figures is to use the **Atlantic-Pacific rule**. Imagine or sketch the U.S. and the ocean along each coast and then consider that there are two types of numbers: those with a decimal and those without. Write the measurement on the map. If a decimal point is Present, count the digits from the Pacific side, beginning with the first nonzero digit. If a decimal point is Absent, count the digits from the Atlantic side, beginning with the first nonzero digit.


Determine the number of significant figures in each of the following measurements:

1. 9 ___1___
2. 90 ___1___
3. 900.0 ___4___
4. 0.009 ___1___
5. 0.04900 ___4___
6. 0.090 ___2___
7. 909 ___3___
8. 3.00 ___3___
9. 200.41 ___5___
10. 600 ___1___
11. 5.300 ___4___
12. 4.271 ___4___
13. .013 ___2___
14. 3000 ___1___
15. 30220 ___4___

When it's necessary to show a zero as significant when it's before or after the first nonzero digit, you can put a line over the last significant zero. For example, the number 30$\bar{0}$0 has three significant figures. Determine the number of significant figures in each of the following measurements:

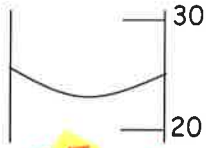
1. 62$\bar{0}$00 ___3___
2. 80$\bar{0}$ ___3___
3. 557$\bar{0}$ ___4___
4. 909$\bar{0}$ ___4___
5. 53$\bar{0}$0 ___3___
6. 428$\bar{0}$0 ___4___

Note: If a whole number ends in a zero that is significant, all zeros can be shown as significant by placing a decimal at the end of the number. For example, the number 3000. has four significant figures.

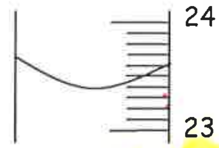
Fill in the tables below as indicated; the first examples are done for you.

| Original number | Number of SFs in original number | Round original to 3 SFs, standard notation | Round original to 2 SFs, standard notation | Round original to 2 SFs, scientific notation |
|---|---|---|---|---|
| 1. 123.45 | 5 | 123 | 120 | $1.2 \times 10^2$ |
| 2. 1 446 000 | 4 | 1450 000 | 1500 000 | $1.5 \times 10^6$ |
| 3. 0.002 300 | 4 | 0.00230 | 0.0023 | $2.3 \times 10^{-3}$ |

Graduated cylinder:








| | | | |
|---|---|---|---|
| Volume and Uncertainty: | 25 mL | 23.5 mL | 23.40 mL |
| Number of SFs: | 2 | 3 | 4 |

## 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 cm x 432 cm x 19 cm = 188,784 $cm^3$
> The answer is expressed as 190,000 $cm^3$ 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. DPAS MDSF

> **Example 1:** 123.25 mL + 46.0 mL + 86.257 mL = 255.507 mL
> The answer is expressed as 255.5 mL since 46.0 mL only has one decimal place.

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

1. 1.35 m x 2.467 m = 3.33 $m^2$ (3.33045 $m^2$)
2. 1,035 $m^2$ / 42 m = 25 m (24.64285714 mL)
3. 12.01 mL + 35.2 mL + 6 mL = 53 mL (53.21 mL)
4. 55.46 g - 28.9 g = 26.6 g (26.56 g)
5. .021 cm x 3.2 cm x 100.1 cm = 6.7 $cm^3$ (6.72672 g)
6. 0.15 cm + 1.15 cm + 2.051 cm = 3.35 cm (3.351 cm)
7. 150 $m^3$ / 4 m = 40 $m^2$ (37.5 $m^2$)
8. 505 kg - 450.25 kg = 55 kg (54.75 kg)
9. 1.252 mm x 0.115 mm x 0.012 mm = 0.0017 $mm^3$ (0.00172776 $mm^3$)
10. 1.278 x $10^3$ $m^2$ / 1.4267 x $10^2$ m = 8.958 m (8.957734632 m)

**Write the following in scientific notation**

11. 0.07882 $7.882 \times 10^{-2}$
12. 0.00002786 $2.786 \times 10^{-5}$
13. 87200 $8.72 \times 10^{4}$
14. 74171.7 $7.41717 \times 10^{4}$

**Write the following in standard notation**

15. 5.8 x $10^{-7}$ 0.00000058
16. 1.525 x $10^{6}$ 1525000
17. 6.58157 x $10^{7}$ 65815700
18. 5.1821 x $10^{-4}$ 0.00051821