

Significant Figure Rules

Determining Number of Significant Figures (Sig Figs)

- 1) All non-zero integers are significant.

Example 1: 412945 has 6 sig figs.

- 2) All **exact** numbers have an unlimited number of sig figs.

Example 2: If you counted the number of people in your class to be **exactly** 35, then 35 would have an *unlimited* number of sig figs.

Example 3: It has been determined that **exactly** 60 seconds are in a minute, so 60 has an *unlimited* number of sig figs.

- 3) Zeros are significant depending on what kind of zeros they are.
 - a. Zeros that are between non-zero integers are always significant.

Example 4: The zeros in 100045, 600.4545, and 23.04 are all significant because they are between non-zero integers.

- b. Zeros that come before non-zero integers are never significant.

Example 5: The zeros in 098, 0.3, and 0.000000000389 are **not** significant because they are all in front of non-zero integers.

- c. If the zeros come after non-zero integers and are followed by a decimal point, the zeros are significant.

Example 6: The zeros in 1000. are significant because they are followed by a decimal point.

- d. If the zeros come after non-zero integers but are not followed by a decimal point, the zeros are not significant.

Example 7: The zeros in 1000 are not significant because they are not followed by a decimal point.

- e. If the zeros come after non-zero integers and come after the decimal point, they are significant.

Example 8: The zeros in 9.89000 are significant because they come both after non-zero integers and after the decimal point.

Addition/Subtraction

When adding/subtracting, the answer should have the same number of decimal places as the limiting term. The limiting term is the number with the least decimal places.

Example 9:

$$\begin{array}{r}
 6.22 \\
 53.6 \\
 14.311 \\
 + \underline{45.09091} \\
 119.22191
 \end{array}
 \begin{array}{l}
 \leftarrow \text{limiting term has 1 decimal place} \\
 \\
 \rightarrow \text{round} \rightarrow \mathbf{119.2} \text{ (answer has 1 decimal place)}
 \end{array}$$

Example 10: 5365.999 \leftarrow limiting term has 3 decimal places

$$\begin{array}{r}
 5365.999 \\
 - \underline{234.66706} \\
 5131.33194
 \end{array}
 \rightarrow \text{round} \rightarrow \mathbf{5131.332} \text{ (answer has 3 decimal places)}$$

Multiplication/Division

When multiplying/dividing, the answer should have the same number of significant figures as the limiting term. The limiting term is the number with the least number of significant figures.

Example 11: $503.29 \times 6.177 = 3108.82233 \rightarrow \text{round} \rightarrow \mathbf{3109}$

\uparrow
 limiting term has 4 sig figs

Example 12: $\frac{1000.1}{243} = 4.11563786 \rightarrow \text{round} \rightarrow \mathbf{4.12}$

\uparrow
 limiting term has 3 sig figs

Conversions

When converting a number, the answer should have the same number of significant figures as the number started with.

Example 13: $52.4 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 4.36666667 \text{ ft} \rightarrow \text{round} \rightarrow \mathbf{4.37 \text{ ft}}$

\uparrow
 3 sig figs

Sample Problems

How many significant figures does each of the following contain?

1. 54
2. 45678
3. 4.03
4. 4.00
5. 400
6. 400.
7. 0.041
8. 65000
9. 190909090
10. 0.00010

Which number in each of the additions/subtractions is the limiting term, and how many decimal places should the answer of each addition/subtraction have?

11. $55.43 + 44.333 + 5.31 + 9.2$
12. $890.019 + 890.1234 + 890.88788$
13. $69.99999 - 45.44444444$

Which number in each of the multiplication/division problems is the limiting term, and how many sig figs should the answer of each multiplication/division have?

14. $343.4 / 34.337$
15. $0.000000003 \times 30.03030$

Perform the following operations and round using the correct sig fig rule.

16. $17.12 + 30.123$
17. $35.010 / 1.23$
18. $1000.00 - 62.5$
19. $0.1700 \times 1700. \times 1700$
20. $15.05 + 0.0044 + 12.34$

Answers

1. 2
2. 5
3. 3
4. 3
5. 1
6. 3
7. 2
8. 2
9. 8
10. 2
11. 9.2 is the limiting term 1 decimal place
12. 890.019 is the limiting term 3 decimal places
13. 69.99999 is the limiting term 5 decimal places
14. 343.4 is the limiting term 4 sig figs
15. 0.000000003 is the limiting term 1 sig fig
16. 47.24
17. 28.5
18. 937.5
19. 490000
20. 27.39

* Information for this handout was obtained from the following sources:

- Zumdahl. *Introductory Chemistry: A Foundation*. 5th Ed. Houghton Mifflin Company. 2004.