

CHEMISTRY :

MEASUREMENT PRACTICE I

SIGNIFICANT DIGITS

Significant figures are the digits in any measurement that are known with certainty plus one digit that is uncertain.

Rule 1: In numbers that do not contain zeros, all the digits are significant.

| | |
|--------|-----|
| 3.1428 | [5] |
| 3.14 | [3] |
| 469 | [3] |

Rule 2: All zeros between significant digits are significant.

| | |
|-------|-----|
| 7.053 | [4] |
| 7053 | [4] |
| 302 | [3] |

Rule 3: Zeros to the left of the first nonzero digit serve only to fix the position of the decimal point and are not significant.

| | |
|----------|-----|
| 0.0056 | [2] |
| 0.0789 | [3] |
| 0.000001 | [1] |

Rule 4: In a number with digits to the right of a decimal point, zeros to the right of the last nonzero digit are significant.

| | |
|---------|-----|
| 43 | [2] |
| 43.0 | [3] |
| 43.00 | [4] |
| 0.00200 | [3] |
| 0.40050 | [5] |

Rule 5: In a number that has no decimal point, and that ends in zeros (such as 3600), the zeros at the end may or may not be significant (it is ambiguous). To avoid ambiguity express the number in scientific notation showing in the coefficient the number of significant digits.

3.6×10^3 contains two significant digits

A. How many significant digits are in each of the following numbers?

| | | | |
|-----------------------|--|-----------|--|
| 1837 | | 205.8 | |
| 3.14145×10^4 | | 1900 | |
| 6005 | | 1200.43 | |
| 0.08206 | | 6000 | |
| 0.000014 | | 632 | |
| 149356 | | 14.163000 | |
| 8.7300 | | 14.000 | |
| 0.00743 | | 302400.00 | |
| 302400 | | 0.0019872 | |
| 8.732 | | 20000 | |
| 14.000 | | 426.1 | |
| 19.7342 | | 60.0 | |

SCIENTIFIC NOTATION

B. Convert the following numbers into or out of scientific notation:

| | |
|-----------------------|--|
| 142.63 | |
| 1,500,000 | |
| 0.00336 | |
| 1.63×10^7 | |
| 3.11×10^{-4} | |
| 0.00125 | |
| 86,400 | |
| 1.01×10^6 | |
| 9.81×10^1 | |
| 0.000000000000144 | |
| 4,663,310.56 | |

ROUNDING

GENERAL RULES FOR ROUNDING:

XY-----> X
When $Y > 5$, increase X by 1
When $Y < 5$, don't change X

When $Y = 5$,

If X is odd, increase X by 1
If X is even, don't change X

C. Round each of the following numbers to four significant digits.

| | |
|-----------------------|--|
| 6.16782 | |
| 6.19648 | |
| 0.0019872 | |
| 3.14145×10^4 | |
| 213.25 | |
| 14.163000 | |
| 90210 | |
| 234.4 | |
| 1200.43 | |
| 0.0022475 | |
| 14.16300 | |
| 0.02315 | |
| 13.462 | |
| 135.69 | |
| 152.00 | |
| 395.55 | |

SIGNIFICANT DIGITS IN OPERATIONS

D. Add or subtract as indicated and state the answer with the correct number of significant digits.

| | |
|----------------------------|--|
| 85.26 cm + 4.6 cm | |
| 1.07 m + 0.607 m | |
| 186.4 g - 57.83 g | |
| 60.08 s - 12.2 s | |
| 4,285.75 - 520.1 - 386.255 | |
| 72.60 m + 0.0950 m | |

E. Multiply or divide as indicated and state the answer with the correct number of significant digits.

| | |
|----------------------------------|--|
| (5.5 m) (4.22 m) | |
| (0.0167 km) (8.525 km) | |
| 2.6 kg ÷ 9.42 m ³ | |
| 0.632 m ÷ 3.8 s | |
| (8.95) (9.162)/(4.25) (6.3) | |
| 0.0045 mm ² ÷ 0.90 mm | |

F. Evaluate the following with answers expressed to proper number of significant digits.

| | |
|--|--|
| $4.22 \times 10^5 + 3.11 \times 10^7 + 6.003 \times 10^6$ | |
| $(9.11 \times 10^{-28})(6.02 \times 10^{23})$ | |
| $2.160 \times 10^3 + 6.2000 \times 10^4 + 5.2 \times 10^1$ | |
| $\frac{8.4 \times 10^7}{2.1 \times 10^4}$ | |
| $\frac{8.4 \times 10^{17}}{2.1 \times 10^4}$ | |
| $\frac{8.4 \times 10^7}{2.1 \times 10^{14}}$ | |
| $\frac{8.4 \times 10^{17}}{2.1 \times 10^{14}}$ | |
| $\frac{6.02 \times 10^{23}}{9.11 \times 10^{28}}$ | |

| | |
|--|--|
| $(\sqrt[3]{0.0000080})(4.0)^2$ | |
| $\frac{(240)(0.049)(0.14)}{(0.0028)(350)(42,000)}$ | |
| $(\sqrt{8.1 \times 10^{15}})(\sqrt[3]{2.7 \times 10^{16}})$ | |
| $\frac{(63,000,000)(\sqrt{4.9 \times 10^{17}})}{(0.0021)(\sqrt[3]{6.4 \times 10^{10}})}$ | |
| $(3.652 \times 10^8)(42.8 \times 10^{16})$ | |
| $\frac{(30 \times 10^{14})(40 \times 10^4)^2}{\sqrt{3.6 \times 10^7}}$ | |

G. Given the following numbers (a-e), solve the following problems, expressing the answer to the proper number of significant digits.

- (a) 1.72 cm
- (b) 0.15 cm
- (c) 627.1 cm
- (d) 0.007 cm
- (e) 704.050 cm

| | |
|-------------------|--|
| a + b + c + d + e | |
| a + c + e | |
| c - a | |
| e - b | |
| (a + c) - (b + d) | |
| (a) (e) | |
| (c) (d) | |
| (a + b) (b + e) | |
| c ÷ b | |
| e ÷ d | |
| (b + c) ÷ (e - c) | |
| (b) ³ | |