Chemistry 11
Mole I

Name: Key.
Date:
Block:

1. **Significant Figures**
2. **Scientific Notation**

Significant Figures

A significant figure is a **measured** or **meaningful digit.** They are important in the way we report different kinds of data.

- If a balance gives a reading of 97.53 g when a beaker is placed on it, the reading is considered to have 4 significant figures.
- If the beaker is then put on a different balance and gives a reading of 97.5295 g, there are more significant figures to the measurement (6 significant figures). This balance is more precise than the first balance.

Rules:

1. All non-zero digits are significant
   - 3.14 has 3 SF
   - 18.22 has 4 SF

2. Zeros that are placeholders are not significant
   - 0.046 has 2 SF
   - 0.581 has 3 SF
   - 8200 has 2 SF
   - 10 has 1 SF

   * 0's just tell you how big or small the # is.

3. Zeros placed between digits are significant
   - 4002 has 4 SF
   - 808 has 3 SF

4. Zeros after a decimal AND other digits are significant
   - 1.80 has 3 SF
   - 1.800 has 4 SF
   - 1.8000 has 5 SF

   * otherwise why would we write them.

5. All digits of numbers expressed in scientific notation are significant
   - 2.56×10^{17} has 3 SF
   - 5.6×10^{-7} has 2 SF

* **IMPORTANT: Don't apply the significant figure rules to "counting numbers" (ex. 12 eggs, 4 children, 1 basketball) or conversion factors (ex. 1km = 1000m). These numbers are assumed to be perfect and have infinite significant figures.**

How many significant figures does each of the following measurements have?

1. 1.25 kg 3
2. 1255 kg 4
3. 11 s 2
9. 1.05 3
10. 90 1
11. 100.00 5

4. 150 m 2
5. 1.283 cm 4
6. 365.249 days 6
7. 2 000 000 years 1
8. 17.25 L 4
12. 24501 5
13. 12.12 4
14. 123450 5
15. 0.1 1
16. 0.100 3

A. Adding or Subtracting Significant Figures

When adding or subtracting significant figures, round off the answer to the least number of decimal places contained in the calculation.

Example:

12.56 cm *(2 SF after decimal)* + 125.8 cm *(1 SF after decimal)* = 138.36 cm → 138.4 cm *(1 SF after decimal)*

12.56
+ 125.8
138.36 → 138.4

Exercise:

1. 15.1 + 75.32 = 90.42 = 90.4
2. 178.904 56 – 125.8055 = 53.09906 = 53.0991
3. $4.55 \times 10^{-5} + 3.1 \times 10^{-5}$ $= (4.55 + 3.1) \times 10^{-5} = 7.65 \times 10^{-5}$
4. $1.805 \times 10^{4} + 5.89 \times 10^{2}$ $= 7.7 \times 10^{-5}$

$1.805 \times 10^4 + 0.0589 \times 10^4 = 1.8639 \times 10^4$

$= 1.864 \times 10^4$

* make sure the exponents are the same before you add or subtract!

B. Multiplying or Dividing Significant Figures

When multiplying or dividing significant figures, round off the answer to the least number of significant figures contained in the calculation.

Example:

2.00 *(3 SF)* x 3.000 00 *(6 SF)* = 6.00 *(3 SF)*

Exercise:

1. 12.5 x 0.50 = 6.25 = 6.3
   3SF 2SF
2. 0.15 x 0.0016 = 0.00024
   2SF 2SF
3. 40.0 / 30.000 = 1.33
   3SF 5SF
4. 2.5 x 7.500 / 0.150 = 125 = 130
   2SF 4SF 3SF

5. $(6.40 \times 10^8) \times (5 \times 10^5)$ = $6.40 \times 5 \times 10^8 \times 10^5 = 32 \times 10^{8+5} = 30 \times 10^{13}$
   3SF 1SF

6. $4.37 \times 103 / 0.008\,560\,0$ = $52\,582.9 = 52600 = 3 \times 10^{14}$
   3SF 3SF 5SF

7. $0.51 \times 10^{-4} / 6 \times 10^{-7}$ = $0.51 \div 6 \times 10^{-4} \div 10^{-7}$
   2SF 1SF
   $= 0.085 \times 10^{-4--7} = 0.085 \times 10^3 = 85 = 90$

8. $0.000\,01 / 0.1000$
   1SF 4SF = 0.0001

Summary Practice Exercises:

In the following mixed calculations, perform multiplications and divisions before doing the additions and subtractions. Keep track of the number of significant figures at each stage of a calculation.

BEDMAS!

1. $25.00 \times 0.100 - 15.87 \times 0.1036$

   $2.50 - 1.644 = 0.86$

2. $35.0 \times 1.525 + 50.0 \times 0.975$

   $53.4 + 48.8 = 102.2$

3. $(0.865 - 0.800) \times (1.593 + 9.04)$

   $0.065 \times 10.63 = 0.69$

4. $(0.3812 - 0.4176) / (0.0159 - 0.0146)$

   $-0.0364 / 0.0013 = -2.8$

5. $9.34 \times 0.071\,46 - 6.88 \times 0.081\,15$

   $0.667 - 0.558 = 0.109$

Scientific Notation

C. Scientific Notation

Scientific Notation is a way of writing numbers for values too large or small to be conveniently written in standard decimal notation.

$10 = 1SF$

$10. = 2SF$

Example:

- $10 = 1.0 \times 10^1$
- $25 = 2.5 \times 10^1$
- $250 = 2.5 \times 10^2$
- $0.000\,0350\,000 = 3.5000 \times 10^{-5}$

Write the following numbers in scientific notation:

1. 3570 = 3.57×10^3
2. 41.400 = 4.1400×10^1
3. 0.000 572 = 5.72×10^{-4}
4. 41.50×10^{-4} = 4.150×10^{-3}
5. $0.000\,410 \times 10^7$ = 4.10×10^3

* When you move to the right, subtract
* When you move to the left, add