Chemistry 11

Mole I

Name: Notes
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1. **Scientific Notation**
2. **Significant Figures**

Scientific Notation

A. Scientific Notation

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

Examples:

$$25 = 2.5 \times 10^{1}$$

$$250 = 2.5 \times 10^{2}$$

$$250{,}000{,}000 = 2.5 \times 10^{8}$$

$$0.000025 = 2.5 \times 10^{-5}$$

Positive exponent = Large number

Negative exponent = Small number

Write the following numbers in scientific notation:

1. 357,000 = $3.57 \times 10^{5} = 35.7 \times 10^{4}$
2. 41,000,000 = 4.1×10^{7}
3. 0.000572 = 5.72×10^{-4}
4. 0.0000067 = 6.7×10^{-6}
5. 810,000 = 8.1×10^{5}

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 <u>are</u> significant
   - 3.14 has 3 SF
   - 18.22 has 4 SF

2. Zeros that are placeholders <u>are not</u> significant
   - 0.046 has 2 SF
   - 0.581 has 3 SF
   - 8200 has 2 SF → 8200.
     ↑ 4 sig figs
   - 10 has 1 SF

3. Zeros placed between digits <u>are</u> significant
   - 4002 has 4 SF
   - 808 has 3 SF

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

5. All digits of numbers expressed in scientific notation <u>are</u> significant
   - 2.56 x 10^{17} has 3 SF
   - 5.6 x 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

Practice: how many significant figures does each of the following measurements have?

1. 1.25 kg 3
2. 1255 kg 4
3. 11 s 2
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
9. 1.05 3
10. 90 1
11. 100.00 5
12. 24501 5
13. 12.12 4
14. 123450 5
15. 0.1 1
16. 0.100 3

B. 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)*

Practice:

1. 15.1 + 75.32 = 90.42 = 90.4
   1sf 2sf
2. 178.904 56 – 125.8055 = 53.09906 = 53.0991
   5sf 4sf
3. 14.0 + 2.888 = 16.888 = 16.9
   1sf 3sf
4. 1.805 x 10^4 + 5.89 x 10^2 = 18639 = 1.86×10^4
   3sf 2sf

C. 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)*

Practice:

1. 12.5 x 0.50 = 6.25 = 6.3
   3sf 2sf
2. 0.15 x 0.0016 = 2.4×10^{-4}
   2sf 2sf
3. 40.0 / 30.000 = 1.3333 = 1.33
   3sf 5sf
4. 2.5 x 7.500 / 0.150 = 125 = 130
   2sf 4sf 3sf
5. (6.40 x 10^8) x (5 x 10^5) = 3.2×10^{14} = 3×10^{14}
   3sf 1sf