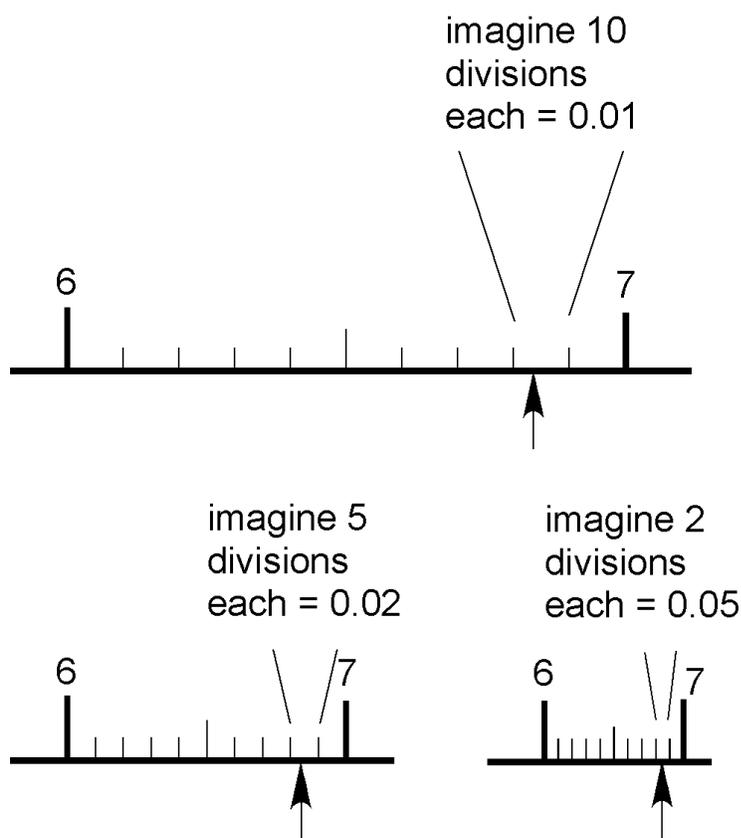


Chemistry - Unit 1

Scale Reading, Uncertainty and Significant Figures

Significant figures – These are all the digits you know for sure + one place that is an estimate.

Uncertainty – Limit of precision of the reading (based on your ability to estimate the final digit). See examples below.



Rules for zeros: All zeros count except placeholder zeros – these are the ones that disappear when you write the number in scientific notation. Examples:

$$93,000,000 = 9.3 \times 10^7 \quad 2 \text{ sf's}$$

$$0.000372 = 3.72 \times 10^{-4} \quad 3 \text{ sf's}$$

$$0.0200 = 2.00 \times 10^{-2} \quad 3 \text{ sf's}$$

Rounding Off Numbers: You must first choose the number of significant figures you want to round off to. Then count the number of significant figures and look at the number to the immediate right of the last significant figure. If this number is 5 or greater, round up. If the number is 4 or less, round down.

Examples: Round the number 2.3456 to three significant figures: 2.35

Round the number 8.1214 to four significant figures: 8.121

Operations with Significant Figures

Multiplication and division: When you multiply or divide measurements, your answer must have the same number of significant figures as the measurements with the fewest significant figures.

Example: $2.453 \times 1.5 = ?$ 1.5 is the number with the fewest significant figures (2) so the answer must be rounded to 2 significant figures. According to the calculator: $2.453 \times 1.5 = 3.6795$; therefore, the answer should be rounded to 3.7. The same applies for division.

Addition and subtraction: When you add or subtract measurements, your answer must have the same number of digits to the **right** of the decimal point as the value with the fewest digits to the **right** of the decimal point.

Example: $3.54 + 2.1 = ?$ The number with fewest digits left of the decimal point is 2.1 (only 1). So we should add normally and then round to only one decimal. $3.54 + 2.1 = 5.64$; rounding to 1 decimal only = 5.6 The same applies to subtraction.

Notice that a measurement may have zero numbers to the right of the decimal point such as 4. If we add $4 + 3.523$ the answer should have no numbers to the right of the decimal point. When we add the two numbers we get 7.523 but since we need to round to zero numbers right of the decimal point, the answer becomes 8!

Extra Problems: Do these problems as homework!

1. What is the number of significant figures in each of the following measurements:

a) 1.689×10^{-3} km b) 0.02340 m^2 c) 435.983 K; d) 204.080 g. e) 0.00296 s.

2. Round each of the following numbers to three significant figures and express the result in scientific notation.

a) 300.235800; b) 143700; c) 33,987.22 d) -6.5559 e) 0.000957830

3. Perform the following calculations and report the answer with the right amount of significant figures. (Include correct units):

a) $6.5 \text{ cm} \times 2.1 \text{ cm}$ b) $24.62 \text{ m} / 8 \text{ s}$ c) $2.33 \text{ m} \times 5.15 \text{ m}$ d) $78,132 \text{ (m/s)} / 2.50 \text{ s}$

4. Perform the following operations and report the answer with the right amount of significant figures

a) $162.1 + 38.73 + 1.554$ b) $44.7 - 2.7$ c) $21.9 + 157$ d) $9.88 - 7.2$