Significant Digits and Isotopic Abundance

How big?

How small?

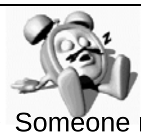
How accurate?

Scientific notation

- Read “Scientific Notation” on page 621
- Complete the chart below

Decimal notation	Scientific notation
127	
0.0907	
	5.06×10^{-4}
	2.3×10^{12}

What time is it?



- Someone might say “1:30” or “1:28” or “1:27:55”
- Each is appropriate for a different situation
- In science we describe a value as having a certain number of “significant digits”
- The # of significant digits in a value includes all digits that are certain and one that is uncertain
- “1:30” likely has 2, 1:28 has 3, 1:27:55 has 5
- There are rules that dictate the # of significant digits in a value (read handout up to A. Try A.)

Significant Digits

- It is better to represent 100 as 1.00×10^2
- Alternatively you can underline the position of the last significant digit. E.g. $10\underline{0}$.
- This is especially useful when doing a long calculation or for recording experimental results
- Don’t round your answer until the last step in a calculation.
- Note that a line overtop of a number indicates that it repeats indefinitely. E.g. $9.\overline{6} = 9.6666\ldots$
- Similarly, $6.\overline{54} = 6.545454\ldots$

Adding with Significant Digits

- How far is it from Toronto to room 229? To 225?
- Adding a value that is much smaller than the last sig. digit of another value is irrelevant
- When adding or subtracting, the # of sig. digits is determined by the sig. digit furthest to the left when #s are aligned according to their decimal.
- E.g. a) 13.64 + 0.075 + 67 b) 267.8 – 9.36

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   13.6④          267.⑧
+   0.07⑤        – 9.3⑥
+  6⑦.
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   81            258.④
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- Try question B on the handout

Multiplication and Division

- Determining sig. digits for questions involving multiplication and division is slightly different
- For these problems, your answer will have the same number of significant digits as the value with the fewest number of significant digits.
- E.g. a) 608.3 x 3.45 b) 4.8 ÷ 392

a) 3.45 has 3 sig. digits, so the answer will as well
$608.3 \times 3.45 = 20\underline{9}8.635 = 2.10 \times 10^3$

b) 4.8 has 2 sig. digits, so the answer will as well
$4.8 \div 392 = 0.01\underline{2}245 = 0.012$ or 1.2×10^{-2}

- Try question C and D on the handout (recall: for long questions, don’t round until the end)

Unit conversions

- Sometimes it is more convenient to express a value in different units.
- When units change, basically the number of significant digits does not.

E.g. 1.23 m = 123 cm = $12\underline{3}0$ mm = 0.00123 km

- Notice that these all have 3 significant digits
- This should make sense mathematically since you are multiplying or dividing by a term that has an infinite number of significant digits

E.g. $12\underline{3}$ cm x 10 mm / cm = $12\underline{3}0$ mm

- Try question E on the handout

Isotopic abundance

- Read 163 – 165
- Let’s consider the following question: if ^{12}C makes up 98.89% of C, and ^{13}C is 1.11%, calculate the average atomic mass of C:

Mass from ^{12}C atoms + Mass from ^{13}C atoms

$12 \times 0.9889 + 13 \times 0.0111$

$11.8\underline{6}68 + 0.14\underline{4}3 = 12.01$

- To quickly check your work, ensure that the final mass fits between the masses of the 2 isotopes
- Do the sample problem (page 165) as above and try questions 10 and 11 (page 166)