1.3 – Scientific Notation, Dimensional Analysis

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Scientific Notation

Way of writing really BIG or small numbers manageably.

1. Put a decimal behind the first non-zero digit to determine the coefficient.

2. Count how many places the decimal moves to determine exponent.

If it moves left, exponent is positive.
If it moves right, it's negative.

Note: the 'E' stands for 'exponent'.

Ex: 428.1 = 4.281 E 2

Coefficient   Exponent

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Calculator Tutorial (Don't write this down)

To program scientific notation on your desk calculators:
1. Type in the coefficient.

TI-30XA
2A. Press the EE key - 00 appears to the right of your coefficient.
3A. Enter the exponent: press the [↕] key to make it negative.

TI-30XIIS
2B. Press 2nd, then EE key - E appears to the right of your coefficient.
3B. Enter the exponent. Use the (-) key to make it negative before the number, if necessary.

Try these: 4.5 E -15 / 1.92 E 40 = 2.34375 E -55
4.5 E 86 X 1.92 E -40 X 13.78 E -15 = 1.190592 E 33

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Ex. 1.

Put the following in scientific notation:

A. 460,000,000 → 4.6 E 8

B. 0.0000128 → 1.28 E -5

C. 456.23 → 4.5623 E 2

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Dimensional Analysis

Using conversion factors to change units.

Conversion Factor: ratio of equivalent values with different units

Examples: $\dfrac{1\ mL}{1\ cm^3}$ $\dfrac{3.0\ feet}{1\ yard}$ $\dfrac{100\ cm}{1\ m}$

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Note 1:

Conversion factors can be written TWO ways.

Relation: 1000 m = 1 km

Two conversions for this are: $\dfrac{1000\,m}{1\,km}$ and $\dfrac{1\,km}{1000\,m}$

Note 2:

Derived units can be conversion factors:

Ex: → Density.
A 2.5 g sample with 1.8 mL volume:

$$\dfrac{2.5\,g}{1.8\,mL}\ or: \dfrac{1.8\,mL}{2.5\,g}$$

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Metric Conversions Guide (Resource P. 10)

1. Write down the value you want to convert.

  Ex: 0.0067 m to nm

2. Multiply it by a conversion factor with the unit you want in the numerator, and the one you are converting from is in the denominator. (Use the Table)

$$0.0067\,m \times \frac{1\,E\,9\,nm}{1\,m}$$

3. Cancel units and perform math operations.

$$0.0067\,\cancel{m} \times \frac{1\,E\,9\,nm}{1\,\cancel{m}} = 6.7\,E\,6\,nm$$

4. For multiple step conversions, add in more conversion factors, making sure that the undesired units cancel out.

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Using Conversions

Example: How many centimeters are there in 482.9 meters?

1. Choose a conversion: 100 cm = 1 m.

Can be written two ways: $\dfrac{1\,m}{100\,cm}$ and $\dfrac{100\,cm}{1\,m}$

Set conversion so meters cancel, leaving cm.

$$482.9\,\cancel{m} \cdot \frac{100\,cm}{1\,\cancel{m}} = 48,290\,cm$$

Starting Value   Conversion Factor   Output

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Ex. 2

With a table partner, convert:

A. 360 s → ms $360\,\cancel{s} \cdot \dfrac{1000\,ms}{1\,\cancel{s}} = 360,000\,ms$

B. 4800 g → kg $4800\,\cancel{g} \cdot \dfrac{1\,kg}{1000\,\cancel{g}} = 4.8\,kg$

C. 589.0 mm → km   (2 steps, m 1st then km)

$$589\,\cancel{mm} \cdot \frac{1\,\cancel{m}}{1000\,\cancel{mm}} \cdot \frac{1\,km}{1000\,\cancel{m}} = 5.89\,E-4\,km$$

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Multi Steps

How many seconds in one year?

$$1\,\cancel{year} \cdot \frac{365\,\cancel{days}}{1.0\,\cancel{year}} \cdot \frac{24\,\cancel{hours}}{1\,\cancel{day}} \cdot \frac{60\,\cancel{min\,utes}}{1\,\cancel{hour}} \cdot \frac{60\,\sec onds}{1\,\cancel{min\,ute}}$$

31,536,000 seconds!

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More Conversion Examples

Convert:

5.70 g to mg $5.70\,\cancel{g} \times \dfrac{1000\,mg}{1\,\cancel{g}} = 5,700\,mg$

4.37 cm to m $4.37\,\cancel{cm} \times \dfrac{1\,m}{100\,\cancel{cm}} = 0.0437\,m$

45.3 mm to m $45.3\,\cancel{mm} \times \dfrac{1\,m}{1000\,\cancel{mm}} = 0.0453\,m$

783 kg to g $783\,\cancel{kg} \times \dfrac{1000\,g}{1\,\cancel{kg}} = 783,000\,g$

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Homework

Read Section 2.3.
1.3 Problems in Booklet

Conversions Skill Wks. P. 23

Due: Next Class

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Attachments

7. Fall Final Review & Resources.docx