1.3 – Scientific Notation, Dimensional Analysis



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Scientific Notation

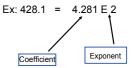
Way of writing really BIG or $_{\text{small}}$ numbers manageably.

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



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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 Ex. 1.

Put the following in scientific notation:

A. $460,000,000 \rightarrow 4.6 \to 8$

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: 1 ml

 $\frac{L}{1^3}$ $\frac{3.0 \text{ feet}}{1 \text{ yard}}$

100 cm 1 m Note 1:

Conversion factors can be written TWO ways.

Relation: 1000 m = 1 km

Two conversions for this are:

 $\frac{1000\,m}{1\,km}$ and $\frac{1\,km}{1000\,m}$

Note 2:

Derived units can be conversion factors:

Ex: \rightarrow Density.

A 2.5 g sample with 1.8 mL volume:

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

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) 1 E 9 nm

 $0.0067 \, m \times \frac{1E9 \, nm}{1 \, m}$

3. Cancel units and perform math operations.

$$0.0067 \, pr \times \frac{1E9 \, nm}{1 \, pr} = 6.7 \, E6 \, nm$$

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

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: $\frac{1m}{100 \, cm}$ and $\frac{100 \, cm}{1m}$

Set conversion so meters cancel, leaving cm.

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

Starting Value Co

Conversion

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Ex. 2

With a table partner, convert:

A. 360 s
$$\rightarrow$$
 ms 360 s. $\frac{1000 \, ms}{1 \text{ s}} = 360,000 \, ms$

B.
$$4800 \text{ g} \rightarrow \text{kg} \quad 4800 \text{ g} \cdot \frac{1 \text{ kg}}{1000 \text{ g}} = 4.8 \text{ kg}$$

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

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

Multi Steps

How many seconds in one year? $1 \text{ year} \cdot \frac{365 \text{ days}}{1.0 \text{ year}} \cdot \frac{24 \text{ hours}}{1 \text{ day}} \cdot \frac{60 \text{ min utes}}{1 \text{ hour}} \cdot \frac{60 \text{ sec onds}}{1 \text{ min ute}}$

31,536,000 seconds!



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More Conversion Examples

Convert:

5.70 g to mg 5.70 g X
$$\frac{1000 \text{ mg}}{1 \text{ gr}}$$
 = 5,700 mg

4.37 cm to m 4.37 cm X
$$\frac{1 \text{ m}}{100 \text{ cm}}$$
 = 0.0437 m

45.3 mm to m 45.3 mm
$$X \frac{1 \text{ m}}{1000 \text{ part}} = 0.0453 \text{ m}$$

783 kg to g 783 kg X
$$\frac{1000 \text{ g}}{1 \text{ kg}}$$
 = 783,000 g

Homework

Read Section 2.3.

1.3 Problems in Booklet

Conversions Skill Wks. P. 23

Due: Next Class

7. Fall Final Review & Resources.docx