

Welcome to our CHEM 4 lecture

Review clicker question: Covers material from last class

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1) What total volume (in L) would you get if you added the following volumes:

$$(4700 \mu\text{L}) + (6.0 \times 10^{-3} \text{ L}) = ???$$

A) 0.001 L

C) 0.009 L

E) 0.011 L

B) 0.0010 L

D) 0.01 L

F) 0.0107 L

Answer:

• Convert μL to L: $(4700 \mu\text{L}) \left(\frac{10^{-6} \text{ L}}{1 \mu\text{L}} \right) = 0.0047 \text{ L}$ (keep 2 sf)

• Undo the scientific notation: $6.0 \times 10^{-3} \text{ L} = 0.0060 \text{ L}$ (keep 2 sf)

• Add the volumes: $0.004\text{7} + 0.006\text{0} = 0.0107 \text{ L}$ (keep 10,000^{ths})

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2) Which of the following conversion factors is incorrect?

A) $\frac{1000 \text{ cm}^3}{1 \text{ L}}$

C) $\frac{128 \text{ fl oz}}{4 \text{ qt}}$

E) $\frac{16 \text{ oz}}{453.6 \text{ g}}$

B) $\frac{1 \text{ fs}}{10^{-15} \text{ s}}$

D) $\frac{1 \text{ in}}{2.54 \text{ cm}}$

F) $\frac{1 \text{ L}}{10^9 \text{ GL}}$

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3) Which of the following conversion factors does not have infinite significant figures?

A) $\frac{1000 \text{ cm}^3}{1 \text{ L}}$

C) $\frac{128 \text{ fl oz}}{4 \text{ qt}}$

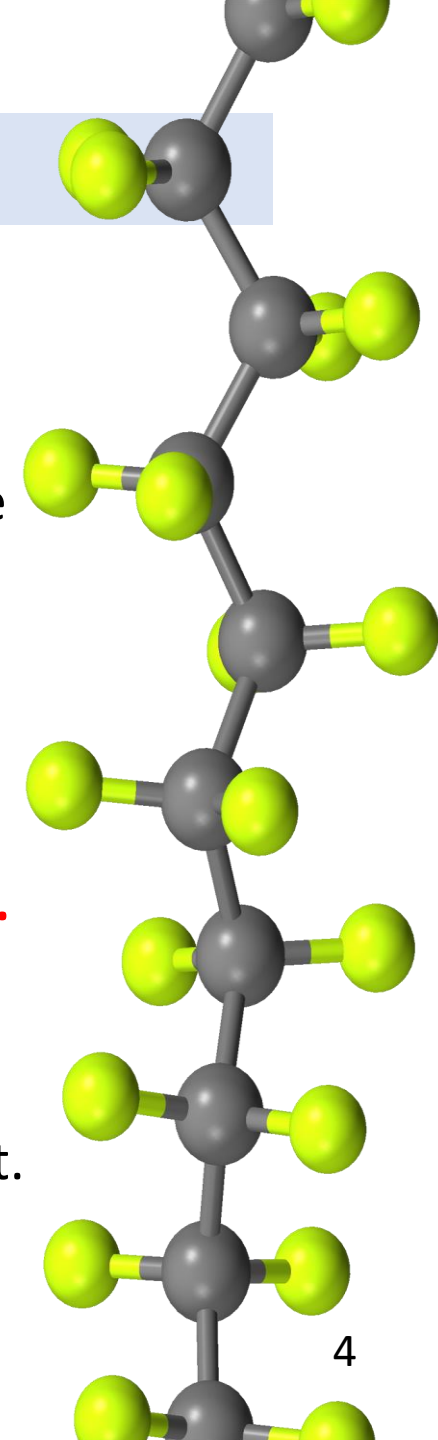
E) $\frac{16 \text{ oz}}{453.6 \text{ g}}$

B) $\frac{1 \text{ fs}}{10^{-15} \text{ s}}$

D) $\frac{1 \text{ in}}{2.54 \text{ cm}}$

Key to Success in CHEM 4

- ✓ Visit our CHEM 4 website regularly: tinyurl.com/SacStateChem4
- ✓ Attend every lecture having completed the assigned reading.
- ✓ Review our PowerPoint slides and/or lecture recordings after each class (they are posted on the above website in the calendar section)
- ✓ Keep up with daily homework. **However, all students will automatically receive full credit for all late homework this semester.**
- ✓ Complete all of the practice exams.
- ✓ **Talk to your Commit to Study peer mentor about how you are doing in CHEM 4.**
- ✓ Get help when needed:
 - ✓ Put together a weekly study group.
 - ✓ Jeff's office hours: MWF 9 – 9:30 am and 11 – 11:30 am; and by appointment.
 - ✓ PAL office hours: link is on our CHEM 4 website.



Prerequisites for CHEM 1A/1E

Students can meet the *chemistry prerequisite* in any of the following ways:

- ~~Having a Chemistry Diagnostic Score of 35 or higher. (not available during COVID)~~
- Completed CHEM ALEKS (CARA) with 85% of the topics completed.
- Passing CHEM 4 or CHEM 6A with a grade of C or better.
- Having obtained D to a C- in CHEM 4 AND completing 85% or the topics successfully in CARA.

Students can meet the *math prerequisite* in any of the following ways:

Math Prerequisite for CHEM 1A: • A Math ALEKS PPL Score of 61 or higher • Successful completion of Math 12 or the equivalent • Current enrollment in Math 26A, Math 29 or a higher • Score of a 3 or higher on AB or BC Calculus AP Test • Ability to enroll in Math 26A or Math 29	Math Prerequisite for CHEM 1E: • A Math ALEKS PPL score of 76 or higher • Successful completion of Math 29 or equivalent • Enrollment in a math course of Math 30 or higher • Score of a 3 or higher on AB or BC Calculus AP Test
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- Questions can be directed to **Dr. Susan Crawford** (crawford@csus.edu) or **Dr. Roy Dixon** (rdixon@csus.edu)
- Chem department: <https://www.csus.edu/college/natural-sciences-mathematics/chemistry/>
- Math dept ALEKS PPL: <https://www.csus.edu/college/natural-sciences-mathematics/math-placement-exam/>

CHEM 4 lecture

Wednesday – October 14, 2020

Sec 2.7 – 2.8

Multi-step conversions

Background: Multi-step conversions

- When converting between 2 metric prefixes, I recommend you go to the base unit first.

Example: The 1999 noble prize in chemistry was awarded to Ahmed Zewail (Egyptian-American, prof at CalTech) for his study of chemical reactions on the femtosecond (fs) timescale. How many milliseconds (ms) are in 5.40×10^4 fs?

Answer:

1) Flowchart: fs $\rightarrow$ s $\rightarrow$ ms 2) Conversion factors: $\left(\frac{1 \text{ fs}}{10^{-15} \text{ s}}\right) \left(\frac{1 \text{ ms}}{10^{-3} \text{ s}}\right)$

3) Perform calculation:

$$5.40 \times 10^4 \cancel{\text{fs}} \left(\frac{10^{-15} \cancel{\text{s}}}{1 \cancel{\text{fs}}} \right) \left(\frac{1 \text{ ms}}{10^{-3} \cancel{\text{s}}} \right) = 5.4 \times 10^{-8} \text{ ms} = \mathbf{5.40 \times 10^{-8} \text{ ms}}$$

4) Sig figs: 3 sf $\infty \text{ sf}$ $\infty \text{ sf}$ *Keep 3sf*

5) Check answer: Correct units. “ms” are bigger than “fs”, so there should be fewer “ms” than our starting number of “fs”. The exponent makes sense: $(10^4)(10^{-15})(10^3) = 10^{-8}$

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4) How many ng are in 6.0 kg?

A) $6.0 \times 10^9 \text{ ng}$

E) $6 \times 10^{12} \text{ ng}$

B) 6.0×10^{12}

F) $6.0 \times 10^3 \text{ ng}$

C) 6×10^3

G) 6.0×10^9

D) $6.0 \times 10^{12} \text{ ng}$

H) $6 \times 10^9 \text{ ng}$

Answer:

1) Flowchart: $\text{kg} \rightarrow \text{g} \rightarrow \text{ng}$

2) Conversion factors: $\left(\frac{10^3 \text{ g}}{1 \text{ kg}}\right) \left(\frac{10^{-9} \text{ g}}{1 \text{ ng}}\right)$

3) Calculation: $(6.0 \cancel{\text{kg}}) \left(\frac{10^3 \cancel{\text{g}}}{1 \cancel{\text{kg}}}\right) \left(\frac{1 \text{ ng}}{10^{-9} \cancel{\text{g}}}\right) = 6 \times 10^{12} = \mathbf{6.0 \times 10^{12} \text{ ng}}$

4) Sig figs: 2 sf $\infty \text{ sf}$ $\infty \text{ sf}$ *Keep 2sf*

5) Check answer: Correct units. “kg” are bigger than “ng”, so there should be a large number of “ng” in 6.0 kg. The exponent makes sense: $(10^3)(10^9) = 10^{12}$

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5) How many inches are equivalent to 63.00 μm ?

A) 0.0025 in.

E) 0.002 in.

B) 2.48×10^{-3} in.

F) 2.5×10^{10} in.

C) 0.0024803 in.

G) 0.002480 in.

D) 1.6×10^{-6} in.

H) 6.2×10^{-7} in.

Answer:

1) Flowchart: $\mu\text{m} \rightarrow \text{m} \rightarrow \text{in.}$

2) Conversion factors: $\left(\frac{10^{-6} \text{ m}}{1 \mu\text{m}}\right) \left(\frac{39.37 \text{ in.}}{1 \text{ m}}\right)$

3) Calculation: $(63.00 \cancel{\mu\text{m}}) \left(\frac{10^{-6} \cancel{\text{m}}}{1 \cancel{\mu\text{m}}}\right) \left(\frac{39.37 \text{ in.}}{1 \cancel{\text{m}}}\right) = 0.00248031 = \mathbf{0.002480 \text{ in.}}$

4) Sig figs:

4 sf

∞ sf

4sf

Keep 4sf

5) Check answer: Correct units. Seems reasonable since μm are so small.

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6) A car is driving at 55 mph. What is the car's speed in km/s?

A) 0.025 km/s

E) 1.5 km/s

B) 0.0095 km/s

F) 34 km/s

C) 88 km/s

G) 2.1×10^3 km/s

D) 0.57 km/s

Hints:

- Write 55 mph as $\frac{55 \text{ miles}}{1 \text{ hr}}$
- Handle numerator and denominator separately.

Answer:

1) Flowchart: *numerator:* miles $\rightarrow$ km *denominator:* hr $\rightarrow$ min $\rightarrow$ s

2) Conversion factors: $\left(\frac{1 \text{ mile}}{1.609 \text{ km}}\right)$ $\left(\frac{1 \text{ hr}}{60 \text{ min}}\right) \left(\frac{1 \text{ min}}{60 \text{ sec}}\right)$

3) Calculation: $\left(\frac{55 \cancel{\text{ miles}}}{1 \cancel{\text{ hr}}}\right) \left(\frac{1.609 \cancel{\text{ km}}}{1 \cancel{\text{ mile}}}\right) \left(\frac{1 \cancel{\text{ hr}}}{60 \cancel{\text{ min}}}\right) \left(\frac{1 \cancel{\text{ min}}}{60 \cancel{\text{ s}}}\right) = 0.024581944 = \mathbf{0.025 \text{ km/s}}$

4) Sig figs: 2 sf 4 sf $\infty \text{ sf}$ $\infty \text{ sf}$ *Keep 2sf*

5) Check answer: Correct units. Seems reasonable since "s" are small.

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7) Usain Bolt, holds the world record for running 200.0 m in 19.19 s. Assuming he ran at that same speed, how long would it take him to run 100.0 yards?

A) 9 s

D) 31 s

B) 953.0 s

E) 8.771 s

C) 8.77 s

F) 8.8 s

*Hint: Make a conversion factor
out of the first sentence:* $\frac{200.0 \text{ m}}{19.19 \text{ s}}$

Answer:

1) Flowchart: yd $\rightarrow$ m $\rightarrow$ s

2) Conversion factors: $\left(\frac{1 \text{ m}}{1.094 \text{ yd}}\right) \left(\frac{200.0 \text{ m}}{19.19 \text{ s}}\right)$

3) Calculation: $(100.0 \text{ yd}) \left(\frac{1 \text{ m}}{1.094 \text{ yd}}\right) \left(\frac{19.19 \text{ s}}{200.0 \text{ m}}\right) = 8.7705566728 = \mathbf{8.771 \text{ s}}$

4) Sig figs: 4 sf 4 sf 4 sf $\text{Keep } 4 \text{ sf}$

5) Check answer: Correct units.