ConcepTest Questions on Units:

Temperature Conversion

The normal human tolerance for pain in terms of temperature is 61° C (ask any McDonald's employee). What would this temperature be in the Fahrenheit scale?

1. 140° F
2. 66° F
3. 334 ° F
4. 170° F

Correct Answer: **1. 140° F = (61 x 1.8 + 32)**
Comment to instructor: Choice 2 was obtained by 61/1.8 + 32.
Choice 3 was obtained by 61 + 273.
Choice 4 was obtained by (61 + 32)1.8

Unit Conversion of g/L to mg/dL.

It is desirable to keep our cholesterol level down below 200 mg/dL of blood serum. If your cholesterol level is 1.55 g/L of blood serum, is it too high? What is it in mg/dL?

1. 1550 mg/dL
2. 155 mg/dL
3. 1.55 x 10^{-4} mg/dL
4. 1.55 x 10^{-2} mg/dL

Correct Answer: **2. 155 mg/dL (cholesterol level not bad)**

$$\chi \frac{\text{mg}}{\text{dL}} = \frac{1.55\,\text{g}}{\text{L}} \text{x} \frac{1\,\text{L}}{10\,\text{dL}} \text{x} \frac{10^3\,\text{mg}}{1\,\text{g}} = \frac{155\,\text{mg}}{\text{dL}}$$

Comment to Instructor: Choice #1 probably means students erroneously used 1 dL/10 L, or they erroneously used 10 dL/1L.
Choice #4 means students used 1 mg/10^3g but had the correct 10 dL/1 L.
Choice #3 means students erroneously used 1 dL/10 L <u>and</u> 1 mg/10^3 g, or had the right conversions but both were upside down: 10 dL/1L x 1 g/10^3 mg.

Unit Conversion of pint in hrs to mL/sec.

If a yeast fermentation is producing 0.551 pint of CO_2 in 5.43 hours, what is the rate of CO_2 production in mL per seconds? Show your dimensional analysis setup and then give the answer to the correct significant figures.

$$x\ \frac{mL}{s} = \frac{0.511 pt}{5.43 h}\ \left(\frac{1 qt}{2 pt}\right)\left(\frac{0.946 L}{1 qt}\right)\left(\frac{10^3 mL}{1 L}\right)\left(\frac{1 h}{60 \min}\right)\left(\frac{1 \min}{60 s}\right)$$

Correct Answer is **1.49×10^{-2} mL/s**

Comment to Instructor:
This is a complex unit conversion problem and may take more time than you wish to allow in a lecture.

The following are likely (wrong) answers that students come up with.
1. 6.91×10^5 mL/s
2. 1.5×10^{-2} mL/s
3. 1.49×10^{-1} mL/s

#1 indicates students are using their calculators improperly. Students are looking at the numbers as 0.511 x 0.946 x $10^3 \div$ 5.43h **x** *2pt* **x** *60min* **x** *60s. Instead of dividing by 2pt, dividing by 60min, and dividing by 60s, students have multiplied. This is common when students are learning to do chain operation on their calculator for the first time.*
#2 indicates students are considering 60 min and 60 s as having only 2 sig. fig. and therefore rounding their answers to 2 sig. fig.
#3 indicates students are entering 10^3 into their calculators improperly. Instead of pressing X 1 EE (or EXP) 3, they probably pressed X 10 EE (or EXP) 3 which gives them an answer that is a factor of 10 too big. They have erroneously entered 10 x 10^3 instead.