Moles / Molarity Worksheet

Bio 210, 1996
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Moles are a measurement of quantity, analogous to a dozen. You can have a dozen eggs, a dozen people, etc. Like wise, you can have a mole of carbon, a mole of trypotosine, etc.

Molarity is a measurement of concentration. It is how man moles of something you have in a one liter volume of solution. Thus a 1 molar (M) solution has 1 mole per 1 liter of solution.

So far, so good. Now comes the important part. How to do conversions using the relationship between moles and molarity.

1) We put 1.75 moles into 1.5 liters, so:

$$\frac{1.75 \text{ moles}}{1.5 \text{ liter}} = 1.17\text{mol/L} = 1.17\text{M}$$

2) We now take 3 ml of this 1.17M solution and we want to determine how many moles are in it, so:

$$(3\text{ml}) \left(\frac{1.17\text{mol}}{\text{L}}\right)\left(\frac{\text{L}}{1{,}000\text{ml}}\right) = 3.51 \times 10^{-3} \text{ mol}$$

Notice that if we took one ml of this 1.17M solution we would have 1.17m moles. Thus, X moles per liter equals X millimoles per milliliter.

3) Biological concentrations are often given in millimoles per liter (mM). Note that this is easily converted to µmoles per ml as below:

$$(1\text{mL}) \left(\frac{12\text{mmol}}{\text{L}}\right) \left(\frac{\text{L}}{1000\text{ml}}\right) = \frac{12\mu\text{mol}}{1\text{ml}}$$

For more information you should refer to any general chemistry book. Healy Library has General Chemistry by D. Ebbing on reserve.

Calculating Linear Equations from a "Best Fit" Line

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There is an alternative method which involves determining the equation of the "best fit" line.
<u>The method is as follows:</u>

1)Pick two points (not data points) on the line, e.g., P_1 (32,14) and P_2 (45.5, 20).

2)Determine the slope of the line (m):

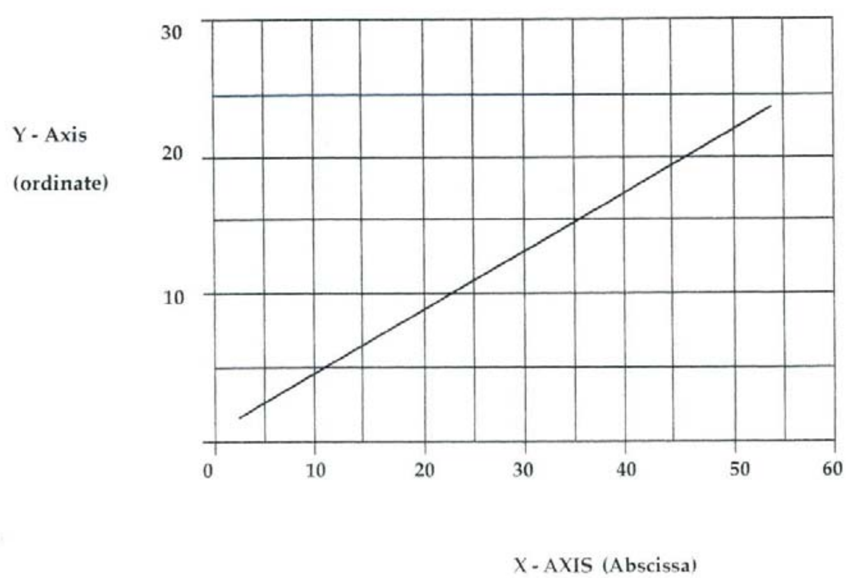
$$m = \left(\frac{\Delta Y}{\Delta X} \right) \left(\frac{Y_2 - Y_1}{X_2 - X_1} \right) \left(\frac{20-14}{45.5-32} \right) = 0.444$$

3) Use the point-slope formula to determine the slope intercept form of the linear equation.

$Y - Y_1 = m(X - X_1)$	$Y - 14 = 0.444\,(x-32)$
$Y = [m(X - X_1)] + Y_1$	$Y = [0.444\,(X - 32)\,] + 14$
$Y = mX + [m(-X_1) + Y_1]$ and $b = m(-X_1) + Y_1$	$Y = [0.444X + [0.444(-32) + 14]$
So, $Y = mX + b$	$Y = 0.444X + (-0.208)$
	Or, $Y = 0.444X - 0.208$

4) Now to determine the Y value for any given X you simply substitute for X in the equation.

5) Remember, if $Y = mX + b$, then it is also true that $X = (Y-b) / m$. This will come in handy for conversions from standard curves.



Consider the graph to the right. Data points have been plotted and a "best fit" line had been drawn. Once this has been done, you can determine the Y value for any given X by simply drawing a line up from the X-axis to the "best fit" line and then over to the Y-axis. In the case above the thick lines indicate two points on the "best fit" line that are not data points. These are P1 (32,14) and P2 (45.5, 20). However, it is not always convenient to use this method, particularly when you have a large number of cases or are dealing with decimals.