EXERCISE 2 - Postlab

1. Use your data from Part V of the Lab Procedures to plot a scatter diagram showing an absorption spectrum for potassium permanganate. Do not attempt to draw a best-fit straight line on your graph because the relationship between wavelength and absorbance is not linear. Instead, draw a smooth curve between your data points to reveal a peak in absorbance at the wavelength of light that the potassium permanganate absorbs best. **Use the "Graphing Checklist" in Prelab 2.8 to make sure you have included all necessary information on your graph**. Also, write the wavelength maximum for $KMnO_4$ on your graph.

2. Explain how you could have obtained a more accurate estimate of the wavelength maximum for $KMnO_4$.

3. Plot a scatter diagram of concentration vs. absorbance using the data from Part VI of the Lab Procedures. Plot the data from your parallel and serial dilutions on the same graph, but use different symbols (e.g. dots, small circles, or x's) to represent each series. **Use the "Graphing Checklist" in Prelab 2.8 to make sure you have included all necessary information on your graph.**

4. Concentration and absorbance are linearly related, so all of your data points should appear to fall on a straight line, at least for low and moderate concentrations of $KMnO_4$.

   a) Do the data points from both dilution series that you prepared (parallel and serial) seem to fit a straight line?

   b) Do they seem to fit the same straight line?

   c) Do the data points from one series (either parallel or serial) seem to fit a straight line better than the other? If so, what does that tell you about the relative precision of the two dilution techniques?

   d) If a group of students obtained data points that did not fall close to a straight line, what can you conclude about the solutions they prepared?

5. Plot a second scatter diagram of concentration vs. absorbance using the data from both parallel and serial dilutions, but this time do not include points from the high end of the concentration range if the linear relationship does not seem to hold in this region (i.e. the slope of the line seems to significantly increase or decrease at relatively high concentrations of $KMnO_4$.) Use the "Graphing Check List" on p.18 of the Prelab to make sure you have included all necessary information on your graph. Calculate the correlation coefficient and linear regression equation for your data, and write these on your graph. Also, plot the best fit straight line for your data points.

6. Use the linear regression equation for your data to determine the $KMnO_4$ concentration of your unknown solution

7. The F.W. of NaCl is 58.4g. Write a short paragraph describing ***exactly*** how you would prepare 900 mL of a 0.5 M solution of this salt. Describe your actions–exactly what you would ***do*** –step-by-step–when preparing this solution. Also show all calculations. Be sure all amounts include units of measurement.

8. Describe how you would prepare 30 mL of a 0.5M NaCl solution from a 2M NaCl stock solution. Describe your actions–exactly what you would ***do*** –step-by-step–when preparing this solution. Also show all calculations. Be sure all amounts include units of measurement.

9. Describe how you would prepare 90 mL of a 5 mM NaCl solution from a 2 M NaCl stock solution. Describe your actions–exactly what you would ***do*** –step-by-step–when preparing this solution. Also show all calculations. Be sure all amounts include units of measurement.

10. Describe how you would prepare 10 mL each of 2 M, 1.5 M, and 1 M NaCl solutions from a 2 M stock NaCl solution. Describe your actions–exactly what you would ***do*** –step-by-step–when preparing this solution. Also show all calculations. Be sure all amounts include units of measurement.

11. Scientists sometimes measure concentration using percent rather than molarity. A 1% solution of NaCl means that 1% of the solution is NaCl. Therefore, if we want 500 mL of a 1% NaCl solution, 1% of the total weight or 5 g should be NaCl. (Remember that 1 mL of water weighs 1 g. Therefore, 500 mL of an NaCl solution–which is mostly water–weighs about 500 g.) To prepare the solution, we would weigh out 5 g of NaCl and add enough water to produce a final volume of 500 mL.

    a) Explain how you would prepare 900 mL of a solution containing 0.02% thimerasol. Show your calculations.

12. A student wishes to prepare 300 mL of 0.25 M sucrose. He puts 25.7 g of sucrose in a beaker and then adds 300 mL of dH2O. The total volume of the solution after the sucrose has been dissolved is 330 mL.

    a) What did he do wrong when preparing his solution?

    b) What is the actual concentration of the sucrose solution he prepared?

    c) What is the percentage error in the concentration of sucrose from the desired 0.25 M?

References:

ASM Style Manual for Journals and Books, American Society for Microbiology, Washington DC, 1991

Seidman, L.A. & C. Moore, *Basic Laboratory Methods for Biotechnology*, Prentice Hall, 2000