Section 18A

1) Answer the following questions about concentration, for all questions assume that there is no change in volume when solid added to solution:
a) What is the concentration of a solution if 3.65g of NaCl is added to 65.0 mL of water?
b) What mass of calcium nitrate is needed to make a 225 mL 0.45M solution?
c) What volume of a 0.55M $AlCl_3$ solution is needed to collect 1.25×10^{-3} moles of $AlCl_3$?
d) What is the concentration of a solution in which 5.90×10^{2} g of $BaBr_2$ is added to 250 mL of water?
e) What mass of sodium phosphate is needed to make 200 mL of a 0.125M solution?

2) Answer the following questions about dilution:
a) What volume of 18M H_2SO_4 is needed to make 150mL of 4.0M solution?
b) What volume of 0.58M HCl can be created from 17.5mL of 16M solution?

3) What is the final concentration of a solution in which 134mL of 0.455M potassium nitrate is added to 252mL of 0.233M potassium nitrate?

4) Determine the percent by volume of a solution made of 25.4g of ethanol and 189g of water. The densities for the two compounds are 1.00g/mL for water and 0.789 g/mL for ethanol.

5) Determine the mass percent of the following solutions:
a) What is the mass percent of sodium hydroxide if 52.3 g is added to 153 mL of H_2O?
b) What is the mass of percent of 4.277 M solution of sodium chloride that has a density of 1.25 g/mL?

6) Calculate the *molality* of each solute in the following solutions:
a) 17.8 g glucose ($C_6H_{12}O_6$) dissolved in 780.5 g water
b) 10% by weight ethanol solution in water has a density of 0.983 g/mL.
c) 45.5 g $MgCl_2$ dissolved in 856 mL water.

7) The following questions relate to the graphs on the board:
a) What trend can be established from each graph?
b) Why might the derivative for the solid graph be positive and the gas graph be negative?
c) What dilemmas do you see arising in the world after looking at the gas graph?

Experiment

1) Prepare a hot water bath by filling a 100 mL beaker 2/3 full with water and place on a hot plate.

2) Label four test tubes A B C D and setup a massing station for the test tubes. Using a beaker, zero the balance and mass each test tube.

3) Mass the following amounts of KNO_3 in each of the test tubes:

A	**0.35-0.45g KNO_3**	**C**	**1.10-1.20 g KNO_3**
B	**0.75-0.85g KNO_3**	**D**	**1.50-1.60 g KNO_3**

4) Add 20 drops of water to each test tube. Mass the tubes again and determine the mass of water in each. If the mass increase due to the water does NOT fall in the range of 0.80 g and 1.10 g then add a few more drops of water until the mass of water falls within this range.

5) Place all for test tubes in your hot water bath and put a thermometer in test tube D. Stir D using the thermometer in a slow up/down motion until the solid completely dissolves. At this point the solids in the other test tubes should be completely dissolved.

6) Remove the hot water bath from the hot plate. Remove test tube D from the beaker and allow the tube to cool. Watch the test tube closely for the formation of crystals, the instant you see crystals forming, record the temperature.

You are looking for clear crystals in a clear solution, they will not be the easiest thing to see.

7) Rinse the thermometer with water and dry with a paper towel. Place the thermometer in the hot water bath for a moment, then place in test tube C. Repeat the process from **(6)**.

8) Repeat the process with test tubes B and A, be sure to record your temperatures.

Test Tube	**Mass of KNO_3**	**Mass of H_2O**	$\frac{g\ KNO_3}{g\ H_2O}$	**Crystallization Temp**	**[KNO_3] in g/100gH_2O**

Questions

1) Fill in the data table above, performing all necessary calculations.

2) Using Excel, plot a graph of the solubility of KNO_3 in g/100g H_2O vs. temperature. Use temperature at the x-axis. Draw a line of best fit from 0°C to 100°C.

3) Using your graph, determine the solubility of KNO_3 at 30°C, 70°C, 0°C, and 90°C

4) Define the terms *saturated, unsaturated, supersaturated*

5) From your graph determine the temperature at which each of the following mixtures of KNO_3 and water would be saturated:

a. 45 g KNO_3 in 100 g H_2O **b.** 20 g KNO_3 in 100 g H_2O

c. 25 g KNO_3 in 25 g H_2O **d.** 100 g KNO_3 in 250 g H_2O

6) Based on your graph determine if the following solutions are saturated, unsaturated, or supersaturated:

a. 75 g KNO_3/100 g H_2O at 40°C **b.** 60 g KNO_3/100 g H_2O at 50°C

c. 100 g KNO_3/75 g H_2O at 80°C **d.** 175 g KNO_3/250 g H_2O at 40°C