Chem 1A - Review Problems for the Final Exam - Part 2

- 1. A mixture of gases contains 0.350 mole nitrogen, 0.120 mole oxygen, and 0.225 mole carbon dioxide. If the total pressure is 875 torr and the total volume of the container is 15.0 L, what is the temperature of the mixture of gases?
- 2. In a titration, the following molarities are obtained: 0.1082 M, 0.1087 M, and 0.1075 M. Calculate the percent difference between these molarities and round to the correct number of significant figures.
- 3. 0.944 g of an unknown diprotic acid requires 24.88 mL of 0.4517 M KOH to reach the endpoint. What is the molar mass of the acid?
- 4. What was Rutherford's experiment, and what did it imply about the structure of the atom?
- 5. Draw diagrams indicating the arrangement of particles in a solid, a liquid, and a gas.
- 6. Name:

 $\begin{array}{cccc} SCl_2 & Fe(OH)_3 \\ SnCl_2 & KSCN \\ NaMnO_4 & NaH_2PO_4 \\ K_2Cr_2O_7 & Cr(BrO_3)_3 \\ HNO_2 & HIO_3 \\ CuSO_4 & HI \\ Pb(NO_3)_4 & CI_4 \end{array}$

7. Write formulas for: copper (I) sulfite

oxygen difluoride zinc sulfide silver nitrate hydrosulfuric acid perchloric acid barium fluoride magnesium nitride hypobromous acid cobalt (II) chloride

- 8. A piece of aluminum 3.20 in \times 1.70 in reacts completely with 100.0 mL of 12.0 M HCl. The products of the reaction are aluminum chloride and hydrogen gas. The density of aluminum is 2.70 g/cm³.
 - a. What is the thickness of the aluminum, in mm? b. What volume of hydrogen will it form at STP?
- 9. For the reaction:

$$Ag + S_8 \rightarrow Ag_2S$$

If 3.0 g Ag and 2.0 g of S_8 are mixed, what mass of silver sulfide will be produced? What mass of the excess reactant is left over after the reaction?

ammonium bicarbonate

- 10. Round to the correct number of significant figures: 120 + 180 =
- 11. Draw three non-equivalent resonance structures for NNO. Decide which would be the best structure, based on formal charge.
- 12. a. Write the reaction for the combustion of ethane $(C_2H_{6 (g)})$. Make sure to use the lowest whole number coefficients.
 - b. Calculate ΔH_{rxn} . Look up any necessary values from your textbook.
 - c. Estimate ΔH_{rxn} using bond energies. (Look up values from textbook.)
 - d. If you mix 13.0 L oxygen gas and 1.50 L ethane at 25°C and 1.00 atm and allow them to react, how much heat will be evolved?

- 13. If you have 100. g of water at 25°C and you wish to heat it to 75°C using steam, what mass of steam should you add if the steam is initially at 140.°C? (The steam must end up at 75°C.)
- 14. The balanced equation for the combustion of isobutane is: ${}_{2}$ $C_{4}H_{10~(g)}+13$ $O_{2~(g)}\rightarrow 8$ $CO_{2~(g)}+10$ $H_{2}O_{(l)}$ 1.036 g of isobutane is burned with 5.00 g O_{2} in a bomb calorimeter. The heat capacity of the calorimeter and its contents (including the water) is 4.947 kJ/K. The initial temperature is 24.88°C and the final temperature is 35.17°C. Calculate ΔH for the reaction as written.
- 15. 100. mL of 0.200 M CsOH is mixed with 50.0 mL of 0.400 M HCl. The temperature of the original solutions is 22.50 °C and it rises to 24.28°C after the reaction occurs. Calculate ΔH for the neutralization reaction. State any assumptions made.
- 16. The mass of ⁶Li is 6.015121 amu, and its percent natural abundance is 7.50%. The mass of ⁷Li is 7.016003 amu and its abundance is 92.50%. From this information, calculate the weighted-average atomic mass of lithium.
- 17. How many protons, electrons, and neutrons are present in 7Li? In 7Li+?
- 18. Write the equations (molecular and net ionic) for each of the following reactions.
 - a. Al (s) (an active metal) + HNO_{3 (aq)} \rightarrow
 - b. $K_{(s)}$ (a very active metal) + $H_2O_{(l)} \rightarrow$
 - c. Ca_(s) (a very active metal) + $H_2O_{(1)} \rightarrow$

Mg is more active than Al.

- d. $Mg_{(s)} + Al(NO_3)_{3(aq)} \rightarrow$
- e. Al_(s) + Mg(NO₃)_{2 (aq)} \rightarrow

For each of the above reactions, decide which element is oxidized and which is reduced.

- 19. Draw the Lewis structure for the following molecules.
 - a. 2-chloropentane
 - b. 2,2-difluoropropane
 - c. 1-butanol
- 20. Given the following line structures, draw the corresponding Lewis structures.

- 21. What is "resonance"? Give an example of a molecule or ion that exhibits resonance, and explain the significance.
- 22. How many hydrogen atoms are in 5.00 μL of water?
- 23. Draw a graph showing the Boltzmann distribution of molecular speeds of a gas and explain what it means. Show how the shape of the graph changes (a) at different temperatures and (b) for gases of different molar mass.
- 24. If the (Kelvin) temperature of a gas in a rigid container doubles, what happens to the pressure of the gas? What happens to the volume?

Note: the following problems came from the review problems for Exam 3. You already have the answers to these problems.

- 25. How many grams of ethylene glycol ($C_2H_4(OH)_2$) must be added to 400. g of water to bring the freezing point of the solution down to -15°C? (#1 on Ex3 Rev)
- 26. A solution is made by dissolving 50.0 g urea, $CO(NH_2)_2$, in 275 g of water.
 - a. Calculate the vapor pressure of this solution at 45°C.
 - b. Calculate the boiling point of the solution.
 - c. Calculate the freezing point of the solution.
 - Look up any necessary information from your textbook. (#2 on Ex3 Rev)
- 27. A solution contains 3.75 g of a nonvolatile pure hydrocarbon in 95 g of acetone. The boiling points of pure acetone and the solution are 55.95°C and 56.50°C, respectively. The boiling-point constant of acetone is 1.71 °C/m. What is the molar mass of the hydrocarbon? (#5 on Ex3 Rev)
- 28. The osmolarity of a solution is the concentration (in molarity) of solute particles in the solution. The osmolarity of blood is 0.308 M. If a solution of 0.115 M CaCl_{2 (aq)} was injected into the bloodstream, what would happen, if anything, to the red blood cells in the vicinity of the injection? Explain in detail. Assume the cell membrane is only permeable to water. Draw a diagram if you want. (#18 on Ex3 Rev)
- 29. Solution A contains 0.10 M sucrose. Solution B contains 0.070 M sodium chloride. Will solution B have a <u>higher</u>, <u>lower</u>, or <u>equal</u> osmotic pressure compared to solution A? Explain in one sentence. (#19 on Ex3 Rev)

Some Answers:

- 1. 303 K or 30.°C
- 2. 1.1 % diff
- 3. 168 g/mol
- 8a. 1.14 mm
- 8b. 13.4 L
- 9. $3.4 \text{ g Ag}_2\text{S}$, $1.6 \text{ g S}_8 \text{ left}$
- 10. 3.0×10^2
- 12b. -3119.6 kJ or -2855.6 kJ
- 12c. 2831 kJ
- 12d. 95.7 kJ
- 13. 8.6 g
- 14. 5730. kJ
- 15. 55.2 kJ

- 16. 6.941 amu
- 17a. 3p, 3e, 4n
- 17b. 3p, 2e, 4n
- 22. 3.34×10^{20} H atoms
- 24. P doubles, V constant
- 25. 2.0×10^2 g
- 26a. 68.2 mmHg
- 26b. 101.5 °C
- 26c. 5.63 °C
- 27. 120 g/mol
- 28. cells shrink
- 29. B