Chemistry 100: Exam #3 Name (printed)_____
October 27, 2003

*100 points. Read Carefully! Draw a **BOX** around the final answer of any calculation.*

Useful constants: R = (0.0821 L·atm)/(K·mol) 1 mole of any gas at STP = 22.41 L

Part I: Multiple Choice. (3 pts. each)

1. What is the conjugate base of HSO_4^-?
   a) SO_4^{2-} b) H_2SO_4 c) OH^- d) HSO_3^- e) H_2SO_3
2. How many moles of HCl are present in 50.0 mL of a 12 M solution?
   a) 0.0042 mol
   b) 0.24 mol
   c) 0.60 mol
   d) 4.2 mol
   e) 600 mol
3. In a gas mixture of 35% He and 65% O_2 the total pressure is 900 mm Hg. What is the partial pressure of oxygen?
   a) 14 mm Hg b) 65 mm Hg c) 189 mm Hg d) 315 mm Hg e) 585 mm Hg f) 900 mm Hg
4. A solution contains 15 g sucrose (table sugar) in 60. mL of solution. What is the %(m:v) of the sucrose solution?
   a) 0.25%
   b) 4.0%
   c) 15%
   d) 25%
   e) 30%
5. How many grams of NaCl are needed to prepare 0.500 L of a 4.00 M NaCl solution?
   a) 2.00 g NaCl
   b) 4.00 g NaCl
   c) 58.5 g NaCl
   d) 117 g NaCl
   e) 125 g NaCl
6. What is the pH of a 1.0×10^{-3} M solution of potassium hydroxide (KOH)?
   a) 1 b) 3 c) 7 d) 11 e) 13
7. Considering 1.0 M solutions of each substance, which contains the largest concentration of ions?
   a) $CaCO_3$ b) $AlCl_3$ c) H_2SO_4 d) NH_3 e) KCl
8. A gas pressure of 0.947 atm is the same as:
   a) 947 mm Hg b) 803 mm Hg c) 760 mm Hg d) 720 mm Hg e) 700 mm Hg
9. If coffee has a pH of 5.3, what is the molarity of hydronium, $[H_3O^+]$?
   a) 5.0×10^{-5} M
   b) 5.3×10^{-5} M
   c) 5.0×10^{-6} M
   d) 2.0×10^{-8} M
   e) 2.0×10^{-9} M

10. When water evaporates from a saturated salt solution,

    a) salt also evaporates b) more salt will dissolve c) salt will precipitate out d) the salt changes to sugar

11. The liquid that would exhibit hydrogen bonding is:

    a) CH_4 (**l**) b) HCl (**l**) c) H_2 (**l**) d) NH_3(**l**) e) H_2S (**l**)

12. Consider the reaction: $HCOOH + OH^-$ **qwe** $HCOO^- + H_2O$

    A conjugate acid-base pair in the reaction shown is:

    a) HCOOH and OH^-
    b) HCOOH and $HCOO^-$
    c) HCOOH and H_2O
    d) OH^- and $HCOO^-$
    e) $HCOO^-$ and H_2O

Part II: True/False. (2 pts. each) Circle T or F.

13. T F one mole of calcium ion contains two equivalents of ions
14. T F in a container of gas particles, most of the volume is empty space
15. T F NH_2Cl would be expected to dissolve in water
16. T F water and cyclohexane (C_6H_{12}) would be immiscible liquids
17. T F a solution of pH 7 has equal amounts of hydronium and hydroxide ions
18. T F PO_4^{-3} is the phosphide ion
19. T F a solution with pOH = 11 would be basic
20. T F a base is any substance that can accept a proton
21. T F the solubility of gases in liquids normally increases with increasing pressure
22. T F the pH of a 0.5 M solution of HCl is less than 1

Part III: Short Answers

23. (8) What volume of hydrogen gas is produced at STP when 1.250 g of iron reacts with excess hydrochloric acid according to the equation: $2\ Fe(s) + 6\ HCl(aq)$ **d** $3\ H_2(g) + 2\ FeCl_3(aq)$?

24. (8) If a 10' x 12' bedroom contains 2.70×10^3 L of nitrogen gas at 740 torr and 25°C, what is the mass of the nitrogen in grams? The molar mass of nitrogen is 28.02.

25. (10) The typical dextrose (D-glucose) solution used in IV's is 5.0% $C_6H_{12}O_6$. What is this concentration in molarity (M)? The molar mass of dextrose is 180.16.

26. (10) It required 42.65 mL of 0.446 M NaOH to titrate a 20.00-mL portion of phosphoric acid (H_3PO_4) to an endpoint. What was the molarity of the acid? (Don't forget to write the balanced reaction first.)

27. (8) Circle the solutions that would be useful as buffers. Then explain the reason for your choices.

    0.15 M CH_3CO_2H / 0.12 M CH_3CO_2Na _____

    0.05 M H_2SO_4 / 0.05 M $KHSO_4$ _____

    0.20 M NH_3 / 0.22 M NH_4Cl _____

    0.05 M H_3PO_4 / 0.10 M NaH_2PO_4 _____

Bonus: Invent a question that you wish I had asked, because you studied it. Answer your question for up to 5 bonus points, depending upon difficulty.