Chem 1C Midterm 2

Practice Test

Credit will only be given for answers on this sheet. Units must be included in your answers and points will be taken off for incorrect or missing units. No partial credit will be awarded. Calculators are allowed. Cell phones may not be used as calculators.

Name:	Perm Number

Make sure your writing is dark and large enough to be picked up by a scanner. Failure to do this results in the loss of 5 points on the exam.

If you are sitting next to someone with the same version of the test you both will lose 5 points.

Fundamentals	
Question (Points)	**Answer**
1 (6 pts) 3,3	pentaaquahydroxoiron(III) chloride
	$(NH_4)_2[Ni(C_2O_4)_2(H_2O)_2]$
2 (8 pts) 4,4	1.3 M and $1.4 \frac{mol}{kg}$
3 (6 pts)	$162 \frac{kJ}{mol}$
4 (6 pts)	$1.8 \times 10^{-4} M$
5 (6 pts) 2,2,2	3+
	$[Ar]3d^6$
	6
6 (6 pts)	A = methanol and B = Water

Multiple Choice	
Question (Points)	**Answer**
7 (4 pts)	○ A ● B ○ C ○ D ○ E
8 (6 pts)	○ A ○ B ○ C ○ D ● E
9 (7 pts)	○ A ○ B ● C ○ D ○ E
10 (5 pts)	○ A ○ B ○ C ● D ○ E
11 (7 pts)	○ A ○ B ● C ○ D ○ E
12 (6 pts)	● A ○ B ○ C ○ D ○ E

Challenge Problems	
Question (Points)	**Answer**
13 (10 pts)	43.4% $C_{10}H_8$ and 56.6% $C_{14}H_{10}$
14 (11 pts) 6,5,7	Formula $[CrCl(NH_3)(H_2O)_2]Cl_2$
	Isomers
	$[CoCl_4]^2$ is Blue, $[Co(H_2O)_6]^{2+}$ is Red, and $[Co(NH_3)_6]^{2+}$ is Yellow

Fundamental Questions

1a) *3 pts* What is the name of $[Fe(OH)(H_2O)_5]Cl_2$?

1a) *3 pts* What is the formula of ammonium diaquabis(oxalato)nickelate(II)?

2) *8 pts* A student dissolves 6.3 g of methanol (CH_3OH) in 150.0 mL of a solvent with a density of 0.92 $\frac{g}{mL}$. The student notices that the volume of the solvent does not change when the methanol dissolves in it.
Calculate the molarity and molality of the student's solution.

3) *6 pts* The $[CrCl_6]^{3-}$ ion has a maximum absorbance spectrum at 735 nm. Calculate the crystal field splitting energy in $\frac{kJ}{mol}$ for this ion.

4)   *6 pts*   If the partial pressure of oxygen is 0.14 atm at 298K and Henry's constant for O_2 in H_2O is 4.34×10^4 atm. What is the molar solubility (in M) of the O_2 in the water? $(d_{H_2O} = 1.00 \frac{g}{cm^3})$

5a) *2 pts*   What is the oxidation number (on the metal) of $[Co(ox)_3]^{3-}$?

5b) *2 pts*   What is the electron configuration for Co^x (x is the oxidation number found in 5a?

5c) *2 pts*   What is the coordination number for $[Co(ox)_3]^{3-}$

6)   *6 pts*   When pure methanol (CH_3OH) is mixed with water, the solution gets cold to the touch. Draw a graph showing the vapor pressure as a function of the mole fraction of water, χ_{H_2O}.

Multiple Choice

7) *4 pts*   What color light is needed for photosynthesis?

     a. Green
     b. Red
     c. Violet
     d. Yellow
     e. Blue

8) *6 pts*   Which of the following is(are) diamagnetic?

     a. $[Co(OH_2)_6]^{2+}$
     b. $[Cr(NH_3)_6]^{3+}$
     c. $[Fe(CN)_6]^{3-}$
     d. $[Fe(OH_2)_6]^{2+}$
     e. $[Co(NH_3)_6]^{3+}$

9) *7 pts*   Using the data below, calculate the vapor pressure of chloroform over a chloroform-benzene solution at 25°C, which contains 50.0 g of $CHCl_3$ and 50.0 g of C_6H_6. Assume that the solution behaves ideally.

	Vapor pressure at 25°C
Benzene(C_6H_6)	94.4 torr
Chloroform ($CHCl_3$)	172.0 torr

     a. 125 torr
     b. 172 torr
     c. 68.0 torr
     d. 148 torr
     e. None of the above

10) *5 pts*   A salt solution sits in an open beaker. Assuming constant temperature and pressure, the vapor pressure of the solution

a. stays the same over time
b. increases over time
c. We need to know the temperature and pressure to answer this.
d. Decreases over time
e. We need to know which salt is in the solution to answer this.

11) *7 pts*   Which of the following complexes is(are) chiral?
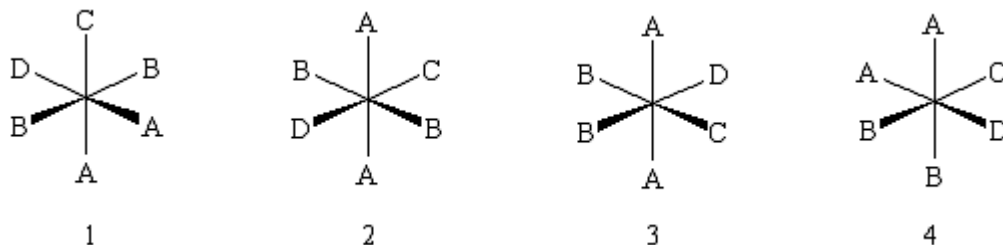
a. 1 and 3
b. 3
c. 4
d. 2
e. None of these are chiral

12) *6 pts*   A solution contains 1 mol of liquid A and 3 mol of liquid B. The vapor pressure of this solution is 314 torr at 25°C. At 25°C, the vapor pressure of liquid A is 265 torr and the vapor pressure of liquid B is 355 torr. Which of the following is true?

a. This solution exhibits a negative deviation from Raoult's law.
b. This solution is ideal
c. This solution exhibits a positive deviation from Raoult's law

Challenge Problems

13) *10 pts* A 1.60 g sample of a mixture of naphthalene ($C_{10}H_8$) and anthracene ($C_{14}H_{10}$) is dissolved in 20.0 g of benzene (C_6H_6). The freezing point of the solution is 2.81°C. What is the composition of the sample mixture in terms of mass percent? The freezing point of benzene is 5.51°C and K_f is $5.12 \frac{kg}{mol}$.

14a) *11 pts*   Two chemists prepared a complex and determined its formula, which they wrote as $[CrCl_3(NH_3)]\cdot 2H_2O$. However, when they dissolved 2.11 g of the compound in water and added an excess of silver nitrate, 2.87 g of AgCl precipitated and they realized that the formula was incorrect. Write the correct formula of the compound and draw the structure of the complex ion, including all possible isomers. Assume the complex ion has square planer geometry.

14b)   *6 pts*   The complexes $[Co(NH_3)_6]^{2+}$, $[Co(H_2O)_6]^{2+}$, and $[CoCl_4]^{2-}$ (tetrahedral) form colored solutions. One is red, one yellow, and the third blue. Use the spectrochemical series and the relative magnitudes of Δ_o and Δ_t to match each color to a complex. You must explain your reasoning to get full credit.