Name: _____ Final Test

200 points Chemistry 121A

Dr. Jay H. Baltsberger December 15, 1993

SHOW ALL CALCULATIONS, CIRCLE YOUR FINAL ANSWERS AND USE PROPER SIGNIFICANT FIGURES AND UNITS

Constants and Useful Formulas

Avogadro's number, $N_A = 6.02 \times 10^{23}$

Planck's constant, $h = 6.626 \times 10^{-34}$ Js

DeBroglie wavelength, $\lambda = h / mv$

Speed of light, $c = \lambda \nu = 3.00 \times 10^{8}$ m/s

Photon energy, $E_n = n h \nu$

Hydrogen energy, $E_n = - hcR_H / n^2$

Rydberg constant, $R_H = 1.0974 \times 10^{7}\ m^{-1}$

Heat transfer, $q = m S \Delta T$

0. Having survived (I hope) one or more semesters, what is your current major? _____

1. Write the molecular formula of a compound whose empirical formula is C_4H_3N and whose molecular weight is 195.223 g/mol. (6 points)

2. Complete the following table of ionic compounds and emprical formulas and determine whether each compound is soluble in H_2O (16 points):

Empirical Formula	Name	Solubility
NH_4CN	_____	_____
$NaClO_2$	_____	_____
_____	lithium nitrate	_____
_____	lead (II) iodide	_____

3. Determine the number of moles of berylium in 53.123 kg of berylium fluoride. (6 points)

4. Write the complete atomic symbols for two different isotopes of ${}^{34}_{16}S$. (6 points)

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5. Balance the following equation without adding any additional elements or compounds and determine how many grams of Cr may be produced from 11.3 g of Zn and excess $Cr(NO_3)_2$. (10 points)

___ Zn (s) + ___ $Cr(NO_3)_2$ (s) ---> ___ Cr (s) + ___ $ZnNO_3$ (s)

6. Balance the following reduction/oxidation reactions in acidic conditions using the half-reaction method, remember to add H_2O and H^+ to these equations as needed. (20 points)

___ Al (s) + ___ Sn^{+4} (aq) ---> ___ Al^{+3} (aq) + ___ Sn^{+2} (aq)

___ Na (s) + ___ IO_3^- (aq) ---> ___ Na^+ (aq) + ___ I^- (aq)

7. Calculate the total heat (in kJ) needed to heat 0.245 L of ethylene glycol from 25.3 ˚C to 213.0 ˚C which freezes at -77.0 ˚C and boils at 285.0 ˚C. The heat of fusion is −452.5 J/g, the heat of vaporization is 893.2 J/g, the specific heat is 2.420 J/g K and the density is 2.4511 g/ml. (16 points)

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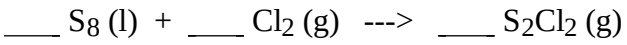
8. Calculate the DeBroglie wavelength of a neon atom moving at 1340 m/s. (10 points)

9. Determine the energy (in J) of a single photon of red light with a wavelength of 925 nm. (10 points)

10. Balance the following chemical equation and calculate the number of grams of disulfur dichloride that can be produced from 32.0 g of S_8 and 71.0 g of Cl_2 in this process. (8 points)



11. Draw the ground state electron box notation and rare gas electron configuration for titanium, Ti. (8 points)

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12. A compound containing only chromium, Cr, and oxygen was created by burning 51.31 g of Cr in exactly 63.14 g of oxygen. Write the empirical formula for this compound. (8 points)

13. Draw the Lewis dot structure for ICl_3 and describe both the structural pair and molecular geometries for this molecule. (12 points)

14. Give a complete valence bond description of the bonding in CO_2. Include hybridization of each atom and total number and location of sigma and pi bonds formed. (16 points)

15. Show the molecular orbital electron configuration for NO and NO^+. State whether these are paramagnetic or diamagnetic (12 points)

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16. Arrange N, O, F, Ne, Na, Cs in order of electronegativity from highest (on the left) to lowest (on the right). (6 points)

_____ _____ _____ _____ _____ _____

Highest Electronegativity Lowest

17. Determine the final hydrogen ion concentration (in mol/L) in a solution prepared by diluting 33.23 ml of 15.332 M HNO_3 to 250.0 ml. (10 points)

18. Draw the Lewis dot structure for IO_4^- and determine the oxidation number for each atom. (10 points)

19. Calculate the concentration of a NaOH solution when 35.32 ml are needed to titrate 25.00 ml of 0.1033 M HCl to the equivalence point. (10 points)

20. Bonus Question: Write the net ionic equation for a reaction when an aqueous solution of $BaCl_2$ is added to an aqueous solution of Na_2CO_3. (10 points)