

**Name:** \_\_\_\_\_  
200 points  
Dr. Jay H. Baltisberger

Final Test  
Chemistry 121A  
December 11, 1995

**SHOW ALL CALCULATIONS & USE PROPER SIGNIFICANT FIGURES AND UNITS**

**Multiple Choice Questions: Circle the single best answer. No penalty for guessing.**

- How many significant figures do the following numbers have: 0.0003830 and 9320? (4 points)  
A) 4 for the first 3 for the second      B) 3 for the first 3 for the second  
C) 4 for the first 4 for the second      D) 7 for the first 4 for the second  
E) 8 for the first 3 for the second
- $\text{IF}_3$  is which of the following molecular geometries. (4 points)  
A) tetrahedral      B) T-shaped      C) trigonal planar      D) octahedral      E) seesaw
- What is the formal charge on carbon in CO? (4 points)  
A) -1      B) +1      C) 0      D) +2      E) +5
- Calculate the formula weight of  $\text{Na}_2\text{CO}_3$ . (4 points)  
A) 51.00 g/mol      B) 105.989 g/mol      C) 73.989 g/mol  
D) 221.970 g/mol      E) 82.998 g/mol
- How many nodes does a  $4d_{xy}$  orbit have? (4 points)  
A) 2 radial and 1 angular      B) 0 radial and 1 angular  
C) 1 radial and 1 angular      D) 3 radial and 2 angular  
E) 1 radial and 2 angular
- What volume of 0.3321 M NaOH is required to titrate 37.2 ml of 2.11 M HCl to a neutral endpoint? (4 points)  
A) 37.2 ml      B) 236.4 ml      C) 26.07 ml      D) 5.86 ml      E) 33.21 ml
- What is the  $q$  of the surroundings if 1.00 mole of  $\text{CH}_4$  is burned assuming no work is done on either the system or surrounding given the  $H_{\text{combustion}} = -802 \text{ kJ mol}^{-1}$  for  $\text{CH}_4$ . (4 points)  
A) 802 kJ      B) -802 kJ      C) 0 kJ      D) 1602 kJ      E) cannot be determined

Name: \_\_\_\_\_

Final Test

8. A given  $\gamma$ -ray photon has  $2.21 \mu\text{J}$  of energy. What is the energy if the frequency of this  $\gamma$ -ray were doubled? (4 points)

- A)  $2.21 \mu\text{J}$       B)  $4.42 \mu\text{J}$       C)  $8.84 \mu\text{J}$       D)  $1.11 \mu\text{J}$       E) cannot be determined

9. Which of the following atoms or ions has the  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$  electron configuration? (4 points)

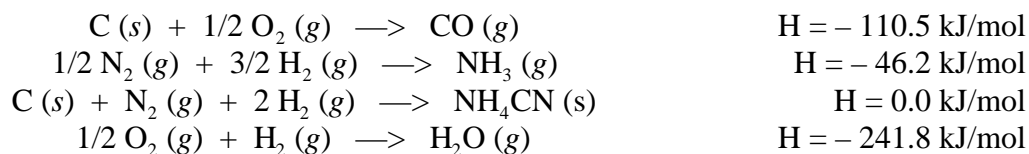
- A) He      B) Ca      C) Ru      D) Mn      E)  $\text{Fe}^{2+}$

10. Draw the Lewis dot structure for  $\text{SF}_4$  and indicate oxidation numbers for each atom. (15 points)

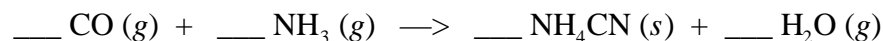
11. Write the formula or name of the following ionic compounds and indicate the solubility. (16 points)

$\text{ZnSO}_4$	_____	_____
$\text{Hg}_2(\text{ClO}_4)_2$	_____	_____
_____	potassium fluoride	_____
_____	manganese (II) sulfide	_____

12. Given the following data enthalpies of reaction:



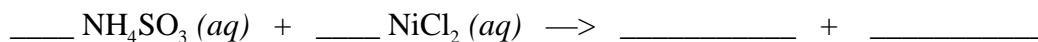
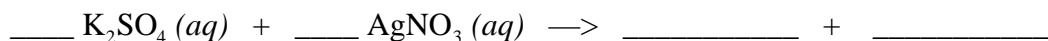
Calculate the  $H$  for the reaction of  $\text{CO}$  with  $\text{NH}_3$ . How much heat is released when 9.5 g of  $\text{NH}_3$  reacts with excess  $\text{CO}$ ? (15 points)



Name: \_\_\_\_\_

Final Test

13. Explain the trend for the first ionization energy of the following atoms (Rb, Ca, Kr, Ar, F). Use electron configuration and effective charge arguments. (10 points)
14. Write the electron configuration for Be, Y,  $P^{3+}$  and  $I^-$  using noble gas configuration abbreviations if you want. Indicate if any of these have unpaired electrons. (12 points)
15. Which has a higher bond enthalpy, N=N (double bond) or N-N (single bond). Explain why. (6 points)
16. Balance the following two equations and write out a final net ionic equations. (12 points)



Name: \_\_\_\_\_

Final Test

17. The density of air at ordinary atmospheric pressure and 25°C is 1.19 g/L. What is the mass, in kilograms, of the air in a room that measures 8.2 x 13.5 x 2.75 m. (6 points)
18. How much heat is needed to raise the temperature of 250.0 mL of deionized water from 12.3 °C to 110.0 °C. Assume that the  $H_{\text{vap}}$  for water is 2.253 kJ g<sup>-1</sup>, the heat capacity of steam is 1.866 J g<sup>-1</sup> K<sup>-1</sup>, and the heat capacity of liquid water is 4.184 J g<sup>-1</sup> K<sup>-1</sup>. (12 points)
19. How many protons, electrons and neutrons does <sup>197</sup>Au<sup>+2</sup> have? (5 points)
20. A mixture of N<sub>2</sub> (g) and H<sub>2</sub> (g) is caused to react in a closed container to form ammonia, NH<sub>3</sub> (g). The reaction ceases before either reactant has been totally consumed. At this stage, 2.0 mol of N<sub>2</sub>, H<sub>2</sub> and NH<sub>3</sub> are present. How many moles of N<sub>2</sub> and H<sub>2</sub> were present originally? (10 points)
21. If the human eye receives a 1.45x10<sup>-17</sup> J signal from photons whose wavelength is 550 nm, how many photons have hit the eye (h = 6.626x10<sup>-34</sup> J s, c = 3.00x10<sup>8</sup> m s<sup>-1</sup>)? (10 points)

Name: \_\_\_\_\_

Final Test

22. Give the Lewis dot structure (including any resonance forms), formal charges, electron pair and molecular geometry for the molecule  $\text{N}_2\text{O}$ . (15 points)
23. Which of the following oxides are ionic and which are molecular:  $\text{N}_2\text{O}$ ,  $\text{Na}_2\text{O}$ ,  $\text{CaO}$ ,  $\text{CO}$ ,  $\text{Cl}_2\text{O}_7$ ? Explain the reasons for your choices. (10 points)
24. Show the locations of electrons on a molecular orbital energy diagram and give the bond order for  $\text{NO}$ . (10 points)
25. BONUS: A mixture of pure  $\text{AgCl}$  and pure  $\text{AgBr}$  is found to contain 60.94%  $\text{Ag}$  by mass. What are the mass percentages of  $\text{Cl}$  and  $\text{Br}$  in the mixture? *Hint*: Solve a system of two equations (one relating *moles* of  $\text{Ag}$ ,  $\text{Cl}$  and  $\text{Br}$  and the other relating *masses*) to give the final percentages. (10 points)