

Name: \_\_\_\_\_  
100 points  
Dr. Jay H. Baltsberger

Test 3  
Chemistry 121A  
December 1, 1995

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

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

- Which is the atomic symbol for the atom which has 13 more protons, 12 more electrons and 16 more neutrons than  $^{23}\text{Na}^{+}$ ? (3 points)  
A)  $^{52}\text{Cr}^{2+}$       B)  $^{53}\text{Mn}^{2+}$       C)  $^{51}\text{V}^{2+}$       D)  $^{51}\text{Cr}^{+}$       E)  $^{52}\text{Co}^{2-}$
- What is the molecular geometry of a molecule with 4 pairs valence electrons about the central atom, of which 2 pairs are lone pairs of electrons (*i.e.*  $\text{H}_2\text{S}$ )? (3 points)  
A) trigonal      B) tetrahedral      C) linear      D) bent      E) square planar
- Which of the following types of molecular orbitals for a diatomic system would have the greatest electron density along the bond axis and between the atoms? (3 points)  
A)      B) \*      C) \*      D)      E)
- How many different types of 4d orbitals are there? (3 points)  
A) 3      B) 4      C) 5      D) 6      E) 7
- What is the electron configuration for elemental oxygen, O? (3 points)  
A)  $1s^2 2p^6$       B)  $1s^2 2s^2 3s^2$       C)  $2s^2 2p^4$       D)  $2s^2 2p^6$       E)  $1s^2 2s^2 2p^4$
- Which of the following atoms or ions has the greatest first ionization energy? (3 points)  
A) Fe      B) Al      C) F      D) Na      E) Rh
- Draw the Lewis dot structures for  $\text{Si}(\text{OH})_4$  and  $\text{XeF}_2$ . (12 points)

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

LiOH	_____	_____
AgNO <sub>2</sub>	_____	_____
_____	nickel (II) acetate	_____
_____	hydrobromic acid	_____

9. Explain why a NaF solid lattice melts at a temperature so much higher (993 °C) than a lattice of Ne atoms (-248 °C)? (8 points)
10. Draw the Lewis dot structure for PO<sub>4</sub><sup>3-</sup> (including resonance structures if any exist). Indicate the molecular and electron pair geometries for each as well as formal charges. (10 points)
11. List the members of the following series in order of increasing bond length and explain why the trend is predicted: N<sub>2</sub><sup>+</sup>, N<sub>2</sub>, N<sub>2</sub><sup>-</sup>. (8 points)

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12. Explain why He (helium) atoms are smaller than both H (hydrogen) and Ne (neon) atoms using electron configuration and charge arguments. (8 points)
13. Calculate the enthalpy of combustion (reaction with  $O_2$  to make  $CO_2$  and  $H_2O$ ) for  $C_2H_6$ , given the following bond dissociation energies: C–H 413; C=O 799; O–H 463 kJ/mol. (10 points, remember to right a balanced equation first.)
14. Balance the following equation and write out a final net ionic equation. Calculate the mass of solid precipitate formed when 0.2 moles of  $K_2S$  in solution reacts with 0.1 moles of  $CaSO_4$  in solution. (10 points)
- $$\underline{\hspace{1cm}} K_2S (aq) + \underline{\hspace{1cm}} CaSO_4 (aq) \longrightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$
15. BONUS QUESTION: Explain why a  $d$  orbit constructed with two 2p atomic orbits is higher in energy than a  $d$  orbit constructed from two 2s atomic orbits.. (5 bonus points)