Name _____
(Please Print)

Chem 103 - Section 1
Sample Test III

This test consists of six (6) pages, including this cover page. Be sure your copy is complete before beginning your work. If this test packet is defective, ask for another one.

A separate copy of the periodic table will be distributed with this test packet. Feel free to use it in conjunction with any test question.

DO NOT WRITE BELOW THIS LINE

DISCLAIMER

This is a copy of a typical third test given in Chem 103 during the regular academic year. Your test will be different. This test is being posted to give you a sense of the format, style, scope, and level of a typical test on this material. This test may have questions on topics that will not be covered on the test you take. Moreover, your test may have questions on topics that are not covered on this test. Posting this test in no way limits the format, style, scope, or level of the test that you will take. **Do not limit your preparation to the material on this sample test.**

Name _____

1. (36 points; 3 points each) Circle the correct answer to each of the following.

a. The number of nodes in a 3*s* orbital is

0 1 2 3 4

b. Which one of the following atoms is smallest?

P S Se Cl Br

c. Which one of the following has the highest first ionization energy?

Sb P O C Cl

d. Which one of the following isoelectronic species is largest?

N^{3-} O^{2-} F^{-} Ne Na^{+}

e. Which one of the following combinations of n, l, and m_l is not allowed?

$n = 5, l = 3, m_l = 0$ $n = 2, l = 1, m_l = -1$ $n = 3, l = 3, m_l = -2$

$n = 4, l = 3, m_l = +3$ $n = 6, l = 0, m_l = 0$

f. Which one of the following valence configurations corresponds to a paramagnetic atom or ion?

$2s^2 2p^2$ $3d^{10} 4s^2$ $4f^{14} 5d^{10} 6s^2$ $3s^2 3p^6$ $1s^2 2s^2$

g. Judging from trends in electronegativity, which one of the following bonds would be most polar?

C–Si Sr–O N–O Se–Br N–N

h. Which one of the following compounds would have the smallest (least stable) lattice energy?

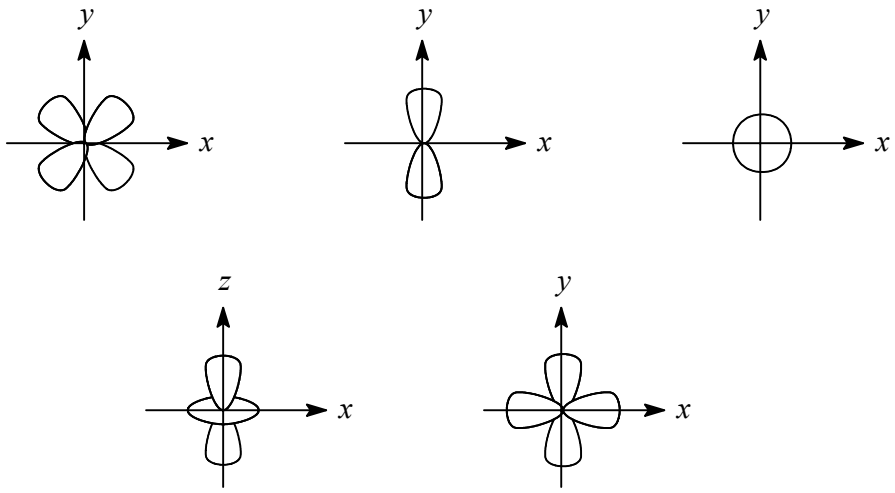
$CaBr_2$ Al_2O_3 KCl RbI SrO

i. In which of the following compounds is the central atom hypervalent?

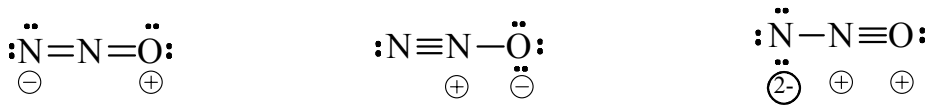
BF_3 H_2O CCl_4 PCl_3 PF_5

Name_____

j. Which of the following represents a $3d_{xy}$ orbital?



k. The following three Lewis structures are the principal resonance forms of nitrous oxide ("laughing gas"). Which one of these probably contributes the *least* to the actual bonding state of N_2O?



l. The first ionization energy of Be is 899 kJ/mol, and that of B is 801 kJ/mol. Which one of the following statements explains these data?

B is a metal and Be is a metalloid, so B should have a lower ionization energy.

Ionization energy decreases from left to right in a period.

Be is smaller than B, so the removed electron is closer to the nucleus.

Ionization in Be disrupts a stable $2s^2$ configuration, but ionization of B achieves this.

Shielding by the core $1s^2$ configuration is better in Be.

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2. (15 points; 3 points each) Fill in the blanks with the correct answers. **Do not use noble gas core notation; e.g. [Ne].**

a. The symbol for the element whose valence electronic configuration is $3d^3 4s^2$ is _____.

b. The valence configuration of $_{17}$Cl is _____.

c. In the space below draw the orbital diagram ("line-and-arrow" notation) for the valence configuration of $_{17}$Cl.

d. The valence configuration of the Fe^{2+} cation is _____.

e. The valence configuration of the S^{2-} anion is _____.

3. (10 points; 5 points each) Write the *complete* electronic configuration ($1s^2 2s^2 ...$) for each of the following. **Do not use noble gas core notation; e.g. [Ne].**

$_{35}$Br_____

$_{83}$Bi_____

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4. (24 points, 8 points each) Draw Lewis dot structures, showing all valence electrons, for each of the following. **Your work should show a count of the total number of valence electrons.** Note: when there is a subscript to a symbol in a formula, the atoms denoted are separately bonded to the atom immediately following or preceding in the formula.

a. OF_2

b. ClO_4^-

c. FNNF

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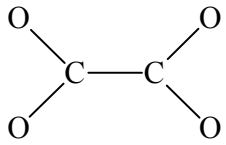
5. (15 points) The oxalate ion, $C_2O_4^{2-}$, is a hybrid of four (4) resonance forms. Its shape and atom linkages are shown below:



There are 34 valence electrons. Draw the Lewis structures for the four resonance forms (8 points); indicate any non-zero formal charges (4 points) for each form; and indicate the bond order of the four equivalent C–O bonds, writing your answer on the line below (3 points).

C–O bond order = _____