General Chemistry I, CHE 120-N03 Instructor: J. H. Niewahner
Test 3. Part Chapter 7, Chapter 8, Chapter 9 (Moore)
December 1, 2005

Name _____

All multiple choice questions MUST be answered on the Scantron™ score sheet.

1(02) Which element has the largest atomic radius?
a) P b) As c) Se d) Br e) F

2(02) Arrange the elements given in order from largest to smallest radii.
Al Ca Sr Mg S

a) Sr > Ca > Mg > Al > S
b) Sr > Ca > S > Al > Mg
c) Al > Sr > S > Ca > Mg
d) Ca > Mg > Sr > Al > S
e) Mg > Al > S > Ca > Sr

3(02) Arrange the following in order of increasing ionization energy.
Ar Cl K Na P

a) P < Cl < Ar < K < Na
b) Na < K < P < Cl < Ar
c) Ar < Cl < Na < K < P
d) K < Na < P < Cl < Ar
e) P < Cl < Ar < Na < Li

4(02) Arrange the following in order of increasing electron affinity.
As F O S Se

a) As < F < O < Se < S
b) F < O < S < Se < As
c) Se < S < O < As < F
d) O < Se < S < As < F
e) As < Se < S < O < F

5(02) Which molecule contains a double bond?
a) HCN b) H_2S c) C_2H_2 d) C_2H_6 e) S_2

6(02) Which molecule contains a triple bond?
a) C_2H_4 b) CCl_4 c) H_2O d) N_2 e) O_2

7(02) Which of the following compounds can exhibit cis-trans isomerism?
a) ClHC=CHCl b) CH_3CH_3 c) $H_2C=O$ d) $CH_2=CH_2$ e) $Cl_2C=CCl_2$

8(02) Predict qualitatively the relative bond lengths of the four single bonds given below and arrange them from shortest to longest.

C-C N-N O-O F-F

a) C-C < N-N < O-O < F-F
b) N-N < O-O < F-F < C-C
c) F-F < O-O < N-N < C-C
d) O-O < N-N < F-F < C-C
e) C-C < F-F < N-N < O-O

9(02) Which bond is least polar?

a) C-C b) C-N c) N-H d) C-F e) C-O

10(02) Arrange the following elements in order of increasing electronegativity.

Ge N O P Si

a) Ge < N < O < P < Si
b) Si < P < O < N < Ge
c) P < N < Ge < O < Si
d) Ge < Si < P < N < O
e) O < N < P < Si < Ge

11(02) What is the formal charge on carbon in CO_2? (Write the Lewis formula)

a) -4 b) -2 c) 0 d) +2 e) +4

12(02) What is the formal charge on sulfur in SO_2? (Write the Lewis formula)

a) +2 b) +1 c) 0 d) -1 e) -2

13(02) Of the elements listed below, which cannot exceed the octet rule?

B Si N P O S F Cl

a) Si, P, S, Cl b) B, Si, N, P c) O, S, F, Cl d) B, N, O, F
e) all eight can exceed the octet rule

14(02) Which one of the following has hydrogen bonding as one of its intermolecular forces?

a) O_2 b) CH_3OH c) AsH_3 d) HI e) SiH_4

15(02) Which of the following interactions are present between ClF_3 molecules?
I. London forces II. Dipole-dipole III . Hydrogen bonding

a) I only b) I and II c) II and III d) I and III e) I, II, and III

16(02) Which one of the following has the lowest boiling point?

a) NH_3 b) HCl c) H_2O d) CH_4 e) H_2Se

17(02) Which one of the following is a free radical?

a) SO_2 b) CO_2 c) NO_2 d) CO_3^{2-} e) NO_2^{1-}

18(04) From the data given below, calculate the approximate enthalpy change of reaction for the reaction below.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

bond	enthalpy kJ/mol
C-H	414
C-C	347
C=C	611
C-O	351
C=O	803
O-H	463
O=O	498
H-H	436

a) - 482 kJ b) - 471 kJ c) 444 kJ d) 471 kJ e) 486 kJ

19(24) For each of the following, draw the Lewis structure, sketch the three-dimensional perspective using dashed lines, wedges, and straight lines, indicate the electron-pair geometry, indicate the molecular geometry, indicate the hybridization of the central atom, indicate the orbitals which overlap to form the bonds indicated, and indicate whether the molecule is polar or non-polar.

NH_3 Lewis structure: 3-D Perspective:

Electron-pair geometry: _____
Molecular geometry: _____
Hybridization of central atom: _____
Overlapping orbitals in N-H bond: _____
Polar or Non-polar? _____
Number of single bonds _____
Number of double bonds _____
Total number of lone pairs in the molecule _____

SF_4 Lewis structure: 3-D Perspective:

Electron-pair geometry: _____
Molecular geometry: _____
Hybridization of central atom: _____
Overlapping orbitals in S-F bond: _____
Polar or Non-polar? _____
Number of single bonds _____
Number of double bonds _____
Total number of lone pairs in the molecule _____

20(22) Draw the Lewis formula and all resonance forms, if any, for each of the following and give the ideal and predicted bond angles specified and indicate the number of sigma and pi bonds in each molecule and which orbitals overlap to form the specified bonds

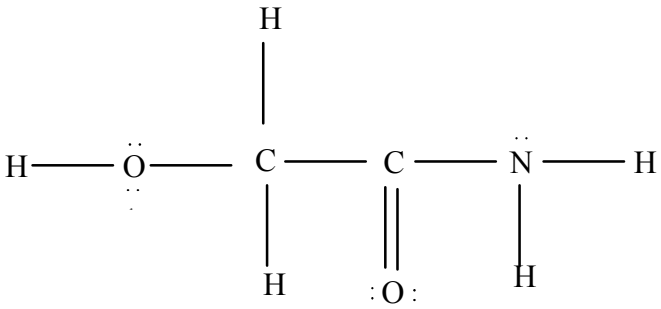
a) SO_2

Ideal OSO bond angle in SO_2 _____
Predicted OSO bond angle in SO_2 _____
Number of sigma bonds _____ Number of pi bonds _____
Orbitals that overlap to form the sigma bonds _____
Orbitals that overlap to form the pi bonds _____

b) XeF_4

Ideal FXeF bond angle in XeF_4 _____
Predicted FXeF bond angle in XeF_4 _____
Number of sigma bonds _____ Number of pi bonds _____
Orbitals that overlap to form the sigma bonds _____
Orbitals that overlap to form the pi bonds _____

21(10)



a) What is the hybridization of the singly bonded oxygen? _____
b) What is the hybridization of the doubly bonded carbon? _____
c) What orbitals overlap to form the sigma bond between the double bonded C and O? _____
d) What orbitals overlap to form the pi bond between the double bonded C and O? _____
e) What orbitals overlap to form the bond between N and H? _____

22(06) Label the molecular orbitals as either σ, σ*, π, or π^*. Fill in the molecular orbitals with the valence electrons of N_2. Calculate the bond order for N_2 _____.