

CHEMISTRY 111, EXAM 3 Practice

NAME: _____

SECTION #: _____

1. A π (pi) bond is the result of the
 - a) overlap of two s orbitals.
 - b) overlap of an s orbital and a p orbital.
 - c) overlap of two p orbitals along their axes.
 - d) sidewise overlap of two parallel p orbitals.
 - e) sidewise overlap of two s orbitals.

2. In the XeF_4 molecule, how many valence electrons are around the Xe atom?
 - a) 4
 - b) 6
 - c) 8
 - d) 10
 - e) 12

3. All the following species would be expected to have a tetrahedral geometry EXCEPT
 - a) BF_4^-
 - b) CF_4
 - c) NF_4^+
 - d) SiF_4
 - e) ClF_4^-

4. In the ICl_4^- ion, the electron pairs are arranged around the central iodine atom in the shape of
 - a) a tetrahedron.
 - b) a trigonal bipyramid.
 - c) a square plane.
 - d) an octahedron.
 - e) a trigonal pyramid.

5. Which of the following have 10 electrons in the d orbitals?
- Mn
 - Fe
 - Cu
 - Zn
 - two of the above
6. The total number of electrons in p orbitals in a ground-state nickel atom is
- 6
 - 12
 - 18
 - 24
 - 30
7. An element that has the same valence-shell configuration as tin is
- antimony
 - tellurium
 - indium
 - selenium
 - germanium
8. Fe has _____ that is(are) unpaired in its d orbitals.
- 1 electron
 - 2 electrons
 - 3 electrons
 - 4 electrons
 - none of these
9. Which of the following properties, in general, increases from left to right across a period in the periodic table?
- atomic radius
 - ionization energy
 - metallic character
 - ionic charge
 - density
10. Atoms of an element X have the ground-state electron configuration $1s^2 2s^2 2p^6 3s^2 3p^4$. What type of ion is X most likely to form?
- X^{6+}
 - X^{4+}
 - X^-
 - X^{2-}
 - X^{3-}
11. All of the following have ground-state noble-gas electron configurations except
- Cl^-
 - N^{3-}
 - Mg^{2+}
 - P^{3+}
 - Ar

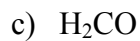
12. What is the ground-state electron configuration of Cr?
- $[\text{Ar}]3d^44s^2$
 - $[\text{Ar}]3d^54s^1$
 - $[\text{Ar}]3d^8$
 - $[\text{Ar}]3d^24s^2$
 - $[\text{Ar}]3d^44s^1$
13. All of the following species are isoelectronic except
- N^{3-}
 - F^-
 - Ne
 - O^-
 - Mg^{2+}
14. Rank the following ions in order of decreasing ionic radius: S^{2-} , O^{2-} , F^- , Na^+ , Mg^{2+} .
- S^{2-} , O^{2-} , F^- , Na^+ , Mg^{2+}
 - O^{2-} , F^- , Na^+ , Mg^{2+} , S^{2-}
 - Mg^{2+} , Na^+ , F^- , O^{2-} , S^{2-}
 - Mg^{2+} , S^{2-} , Na^+ , F^- , O^{2-}
 - O^{2-} , S^{2-} , F^- , Na^+ , Mg^{2+}
15. The number of valence electrons in the perfluoropropionate ion, $\text{CF}_3\text{CF}_2\text{COO}^-$, is
- 58
 - 60
 - 62
 - 66
 - 80
16. In which of the following molecules is the octet rule violated?
- PF_3
 - SiF_4
 - OF_2
 - ClF_3
 - ClF
17. Using bond-energy data, what is ΔH° for the following reaction?
- $$\text{CH}_4(g) + 2\text{F}_2(g) \rightarrow \text{CF}_4(g) + 2\text{H}_2(g)$$

Bond	Bond Energy (kJ/mol)
C-H	411
H-H	432
F-F	155
C-F	485

- a) -850 kJ
 - b) 850 kJ
 - c) 573 kJ
 - d) -573 kJ
 - e) 1483 kJ
18. Which molecule or ion does not have a trigonal pyramidal molecular geometry?
- a) NI_3
 - b) PO_3^{3-}
 - c) SO_3^{2-}
 - d) BF_3
 - e) XeO_3
19. Which molecule or ion is not planar?
- a) BCl_3
 - b) NO_3^-
 - c) CF_4
 - d) XeF_4
 - e) F_2CCF_2
20. The approximate $\text{H}-\text{C}-\text{H}$ bond angle in CH_3^+ is (hint, the C has an empty p-orbital)
- a) 60°
 - b) 90°
 - c) 109°
 - d) 120°
 - e) 180°
21. In phosgene, COCl_2 , the electron groups are located about the central carbon atom in a _____ arrangement.
- a) pyramidal
 - b) tetrahedral
 - c) trigonal planar
 - d) trigonal bipyramidal
 - e) square planar
22. According to valence-bond theory, the bonding in ketene, H_2CCO , is best described as
- a) five σ bonds
 - b) four σ bonds and two π bonds
 - c) five π bonds
 - d) four σ bonds and one π bond
 - e) three σ bonds and two π bonds
23. What is the hybridization of B in BF_3 ?
- a) sp
 - b) sp^2
 - c) sp^3
 - d) sp^3d
 - e) sp^3d^2

Part 2

a) Write the Lewis formulas for the following molecules/ ions? (20pts)



Using the valence bond theory, describe the multiple bonding in acetylene $\text{HC}\equiv\text{CH}$ showing the type of hybridization and type of bonds (σ -sigma and π -pi) in the structure. (8pts)

2. A molecular compound is composed of 60.4% Xe, 22.1% O, and 17.5% F, by mass. If the molecular weight is 217.3 g/mol, what is the molecular formula? What is the Lewis formula? Predict the molecular geometry using the VSEPR model. Describe the bonding, using valence bond theory? (10pts)