Chapter 9

Molecular Geometry and Bonding Theories

1. The basis of the VSEPR model of molecular bonding is _____.

A) regions of electron density on an atom will organize themselves so as to maximize s-character
B) regions of electron density in the valence shell of an atom will arrange themselves so as to maximize overlap
C) atomic orbitals of the bonding atoms must overlap for a bond to form
D) electron domains in the valence shell of an atom will arrange themselves so as to minimize repulsions
E) hybrid orbitals will form as necessary to, as closely as possible, achieve spherical symmetry

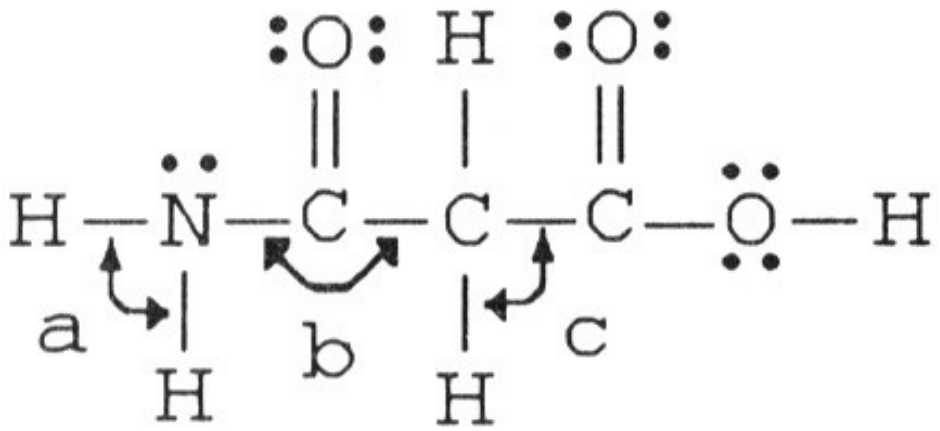
2. The electron domain and molecular geometry of BrO_2^- is _____.

A) tetrahedral, trigonal planar
B) trigonal planar, trigonal planar
C) trigonal pyramidal, linear
D) tetrahedral, bent
E) trigonal pyramidal, seesaw

3. Of the following species, _____ will have bond angles of 120^{o}.

A) PH_3
B) ClF_3
C) NCl_3
D) BCl_3
E) All of these will have bond angles of 120°

4. The bond angles marked a, b, and c in the molecule below are about _____, _____, and _____, respectively.



A) 90° , 90° , 90°
B) 120° , 120° , 90°
C) 120° , 120° , 109.5°
D) 107° , 120° , 104.5°
E) 109.5° , 90° , 120°

5. The central iodine atom in the ICl_4^- ion has _____ nonbonded electron pairs and _____ bonded electron pairs in its valence shell.

A) 2, 2
B) 3, 4
C) 1, 3
D) 3, 2
E) 2, 4

6. An electron domain consists of _____.

a) a nonbonding pair of electrons
b) a single bond
c) a multiple bond

A) a only
B) b only
C) c only
D) a, b, and c
E) b and c

7. The electron-domain geometry and the molecular geometry of a molecule of the general formula AB_n will always be the same if _____.

A) there are no lone pairs on the central atom
B) there is more than one central atom
C) n is greater than four
D) n is less than four
E) the octet rule is obeyed

8. For which of the molecules is the molecular geometry (shape) the same as the VSEPR electron domain arrangement (electron domain geometry) _____?

(i) PCl_3 (ii) CCl_4 (iii) $TeCl_4$ (iv) XeF_4 (v) SF_6

A) (i) and (ii)
B) (i) and (iii)
C) (ii) and (v)
D) (iv) and (v)
E) (v) only

9. Of the following molecules, only _____ is polar.

A) $BeCl_2$
B) BF_3
C) CBr_4
D) SiH_2Cl_2
E) Cl_2

10. An antibonding MO _____ the corresponding bonding MO.

A) is always lower in energy than
B) can accommodate more electrons than
C) can accommodate fewer electrons than
D) is always higher in energy than
E) is always degenerate with

11. Of the following, only _____ has sp^2 hybridization of the central atom.

A) PH_3
B) CO_3^{2-}
C) ICl_3
D) I_3^-
E) PF_5

12. The hybridizations of nitrogen in NF_3 and NH_3 are _____ and ___, respectively.

A) sp^2, sp^2
B) sp, sp^3
C) sp^3, sp
D) sp^3, sp^3
E) sp^2, sp^3

13. When four atomic orbitals are mixed to form hybrid orbitals, how many hybrid orbitals are formed _____?

A) one
B) six
C) three
D) four
E) five

14. Valence bond theory does not address the issue of _____.

A) excited states of molecules
B) molecular shape
C) covalent bonding
D) hybridization
E) multiple bonds

15. In molecular orbital theory, the σ_{1s} orbital is _____ and the σ_{1s}* orbital is _____ in the H_2 molecule.

A) filled, filled
B) filled, empty
C) filled, half-filled
D) half-filled, filled
E) empty, filled

16. Molecular Orbital theory correctly predicts diamagnetism of fluorine gas, F_2. This is because _____.

A) the bond order in F_2 can be shown to be equal to 1.
B) there are more electrons in the bonding orbitals than in the antibonding orbitals.
C) all electrons in the MO electron configuration of F_2 are paired.
D) the energy of the π_{2p} MOs is higher than that of the σ_{2p} MO
E) the F-F bond enthalpy is very low