


**Chapter 10 Practice Problems (Answers in the end)**

- 10.1 In the  $\text{ICl}_4^-$  ion, the electron pairs are arranged around the central iodine atom in the shape of
- a tetrahedron.
  - a trigonal bipyramid.
  - a square plane.
  - an octahedron.
  - a trigonal pyramid.
- 10.4 In the  $\text{I}_3^-$  ion (all in one chain), how many valence electrons are there about the central iodine atom?
- 4
  - 6
  - 8
  - 10
  - 12
- 10.5 In phosgene,  $\text{Cl}_2\text{CO}$ , the electron pairs are located about the central carbon atom in a \_\_\_\_\_ arrangement.
- pyramidal
  - tetrahedral
  - trigonal planar
  - trigonal bipyramidal
  - square planar
- 10.8 The electron pairs on the central nitrogen atom can be considered approximately tetrahedrally directed in
- FNO.
  - $\text{NF}_2^-$ .
  - $\text{NO}_2^-$ .
  - $\text{N}_2\text{F}_2$ .
  - $\text{NO}^-$ .
- 10.11 All the atoms in each of the following species are in one plane **EXCEPT**
- $\text{C}_2\text{F}_4$ .
  - HCCH.
  - $\text{SO}_3$ .
  - $\text{N}_2\text{H}_4$ .
  - HNNH.
- 10.14 The shape of the ammonium ion,  $\text{NH}_4^+$ , is most similar to the shape of
- $\text{NH}_2^-$ .
  - $\text{NH}_3$ .
  - $\text{N}_2\text{H}_4$ .
  - $\text{CH}_3^+$ .
  - $\text{CH}_4$ .
- 10.19 The molecular shape of the  $\text{BrO}_3^-$  ion is
- square pyramidal.
  - tetrahedral.
  - trigonal planar.
  - pyramidal.

- e. square planar.
- 10.27 Which of the following species has a pyramidal shape?
- $\text{CO}_3^{2-}$ .
  - $\text{SO}_3$ .
  - $\text{BF}_3$ .
  - $\text{C}_2\text{H}_4$ .
  - $\text{SO}_3^{2-}$ .
- 10.30 All the following species are linear **EXCEPT**
- $\text{N}_2\text{O}$ .
  - $\text{NO}_2^+$ .
  - $\text{CS}_2$ .
  - $\text{OCN}^-$ .
  - $\text{O}_3$ .
- 10.34 The approximate H—C—C bond angle in ethane,  $\text{C}_2\text{H}_6$ , is
- $60^\circ$ .
  - $90^\circ$ .
  - $109^\circ$ .
  - $120^\circ$ .
  - $180^\circ$ .
- 10.35 The diagram  could represent a molecule of
- $\text{SO}_2$ .
  - $\text{N}_2\text{O}$ .
  - $\text{HCN}$ .
  - $\text{H}_2\text{CO}$ .
  - $\text{BeH}_2$ .
- 10.40 All the following molecules have polar bonds and are polar molecules **EXCEPT**
- $\text{ClF}_3$ .
  - $\text{PF}_3$ .
  - $\text{PF}_5$ .
  - $\text{SF}_4$ .
  - $\text{H}_2\text{CF}_2$ .
- 10.45 Of the following molecules, the only one with no permanent dipole moment is
- water,  $\text{H}_2\text{O}$ .
  - acetone,  $\text{CH}_3\text{COCH}_3$ .
  - carbon dioxide,  $\text{CO}_2$ .
  - sulfur dioxide,  $\text{SO}_2$ .
  - chloromethane,  $\text{CH}_3\text{Cl}$ .
- 10.50 The molecule  $\text{AX}_3$ , in which A is the central atom, is polar and obeys the octet rule; therefore,
- A has no lone pairs.
  - A has one lone pair.
  - A has two lone pairs.
  - A has three lone pairs.
  - A has four bonding pairs.

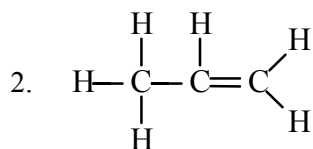
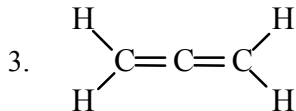
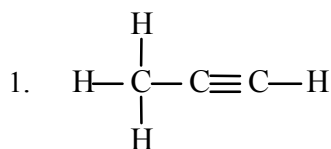
- 10.52 When a carbon atom has  $sp^3$  hybridization, it has
- four  $\pi$  bonds.
  - three  $\pi$  bonds and one  $\sigma$  bond.
  - two  $\pi$  bonds and two  $\sigma$  bonds.
  - one  $\pi$  bond and three  $\sigma$  bonds.
  - four  $\sigma$  bonds.

Questions 10.56 through 10.58 pertain to the information below (each response may be used once or more than once):

- $180^\circ$
  - $120^\circ$
  - $90^\circ$
  - $109^\circ$
  - slightly less than  $109^\circ$
- 10.56 The H—C—C bond angle in ethylene,  $H_2CCH_2$
- 10.57 The H—N—H bond angle in the ammonium ion
- 10.58 The O—S—O bond angle in sulfur dioxide

- 10.67 A  $\pi$  (pi) bond is the result of the
- overlap of two s orbitals.
  - overlap of an s orbital and a p orbital.
  - overlap of two p orbitals along their axes.
  - sidewise overlap of two parallel p orbitals.
  - sidewise overlap of two s orbitals.

- 10.69 Consider the following three molecules, and identify the compound (or compounds) that contain(s) both  $sp$ -hybridized and  $sp^3$ -hybridized carbon atoms.



- 1 only
  - 2 only
  - 3 only
  - 1 and 2 only
  - 1 and 3 only
- 10.75 Which of the following diatomic species would you expect to have the shortest bond length?
- $F_2^-$
  - $N_2$
  - $O_2$

- d.  $O_2^{2-}$   
 e.  $F_2$
- 10.78 The nitrosyl ion,  $NO^+$ , has ten bonding electrons and four antibonding electrons. Therefore, it has a bond order of
- a. 3.  
 b. 7.  
 c. 1.  
 d. 5/2.  
 e. 2.
- 10.82 Which of the following species has a bond order of 2.5?
- a.  $NO^-$   
 b.  $NO^+$   
 c.  $O_2^+$   
 d.  $N_2$

ANSWERS:

- 10.1 \*d. an octahedron.  
 10.4\*d.10  
 10.5 \*c. trigonal planar  
 10.8 \*b.  $NF_2^-$ .  
 10.11 \*d.  $N_2H_4$ .  
 10.14 \*e.  $CH_4$ .  
 10.19 \*d. pyramidal.  
 10.27 \*e.  $SO_3^{2-}$ .  
 10.30 \*e. $O_3$ .  
 10.34 \*c.  $109^\circ$ .  
 10.35 \*a.  $SO_2$ .  
 10.40 \*c.  $PF_5$ .  
 10.45 \*c. carbon dioxide,  $CO_2$ .  
 10.50 \*b. A has one lone pair.  
 10.52\*e.four  $\sigma$  bonds.  
 10.56 \*b.  
 10.57 \*d.  
 10.58 \*b.  
 10.67 \*d. sidewise overlap of two parallel p orbitals. .  
 10.70  
 \*a. 1 only  
 10.75 \*b.  $N_2$   
 10.78 \*a. 3.  
 10.82 \*c.  $O_2^+$