Answer Key Test 4 Chapters 9 & 10 (Silberberg)

1. B

2. C ( HCN and $CO_2$)

3. D

4. C

5. Polar Covalent HCl ( two nonmetals, different electronegativity)
   100% Covalent $Cl_2$, $H_2$ (diatomic molecules)
   Ionic Compounds NaCl ( usually metal and nonmetal- electronegativity difference greater than 1.7)
   The difference in electronegativity determines the bond type.

6. HF Greatest difference in electronegativity

7. C

8. E (none are metal/nonmetal combinations)

9. D
   Formal Charge = Valence Electrons – Electrons assigned by the drawing. Choose the drawing with formal charges nearest to zero. If two drawings have the same formal charges, the drawing assigning the negative charge to the most electronegative element is favored.

10. C ( Resonance – can draw more than one Lewis Dot Structure. Usually is based on a double bond shifting positions in the molecule.)

11. D ( Remember, boron is usually electron deficient and has 6 electrons around the atom. )

12. $\Delta H$ = Bonds Broken(reactants) – Bonds Formed(products)

    = [Br-Br + 3 F-F] –[6 Br-F]

    = [192 + 3(159)] – [6(197)]

    = -513 kJ Exothermic because of negative sign

13. Molecular Orbital filling order: $\sigma_{1s}\ \sigma_{1s}^{*}\ \sigma_{2s}\ \sigma_{2s}^{*}\ \pi_{2p}\ \sigma_{2p}\ \pi_{2p}^{*}$
    $\sigma$ all hold 2 electrons, $\pi$ all hold 4 electrons

$F_2$ has a total of 18 electrons

$\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4 \sigma_{2p}^2 \pi_{2p}^{*4}$

Since the last orbital is full with 4, there are no unpaired electrons. To be paramagnetic there must be unpaired electrons. In other words, the σ must contain only one, and the π must contain 1, 2, or 3 but not 4.

$B_2$ contains a total of 10 electrons:

$\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^2$ * means antibonding

Bond Order = Bonding electrons – Antibonding electrons $\left| \right.$ / 2

= $\left|\right.$ 6-4 $\left|\right.$ /2 = 1 Has a bond order of 1 which means single bond. As long as a molecule has a bond order greater than zero, it can exist. A bond order of 0 means it does not exist.

14. A

15. D

Additional Questions

16. D

17. C

18. C Longest is $NO_3^-$ because it has a bond order of one and a third. The one double bond is actually shared by the three oxygen atoms. In other works, you can draw three resonance structures showing the bond between the three different oxygen atoms. $NO^+$ is shortest because it contains a triple bond. The greater the bond order, the shorter the length.

19. E Water has a smaller bond angle than $CH_4$ because the lone pairs repel more than the bonded pairs of electrons causing the bond angle to be reduced.