

AP Chemistry Chapter 9 Answers – Zumdahl

9.15

H_2O has $2(1) + 6 = 8$ valance electrons

H_2O has a tetrahedral arrangement of the electron pairs about the O atom that requires sp^3 hybridization. Two of the four sp^3 hybrid orbitals are used to form bonds to the two hydrogen atoms and the other two sp^3 hybrid orbitals hold the two lone pairs of oxygen. The two O-H bonds are formed from overlap of the sp^3 hybrid orbitals on oxygen with the 1s atomic orbitals on the hydrogen atoms.

9.17

H_2CO has $2(1) + 4 + 6 = 12$ valence electrons

The central carbon atom has a trigonal planar arrangement of the electron pairs which requires sp^2 hybridization. The two C-H sigma bonds are formed from overlap of the sp^2 hybrid orbitals on carbon with the hydrogen 1s atomic orbitals. The double bond between carbon and oxygen consists of one σ and one π bond. The oxygen atom, like the carbon atom, also has a trigonal planar arrangement of the electrons which requires sp^2 hybridization. The σ bond in the double bond is formed from overlap of a carbon sp^2 hybrid orbital with an oxygen sp^2 hybrid orbital. The π bond in the double bond is formed from overlap of the unhybridized p atomic orbitals. Carbon and oxygen each have one unhybridized p atomic orbital which are parallel to each other. When two parallel p atomic orbitals overlap, a π bond results.

9.19

Ethane, C_2H_6 , has $2(4) + 6(1) = 14$ valence electrons.

The carbon atoms are sp^3 hybridized. The six C-H sigma bonds are formed from overlap of the sp^3 hybrid orbitals on C with the 1s atomic orbitals from the hydrogen atoms. The carbon-carbon sigma bond is formed from overlap of an sp^3 hybrid orbital on each C atom.

Ethanol, $\text{C}_2\text{H}_5\text{O}$ has $2(4) + 6(1) + 6 = 20$ e⁻

The two C atoms and the O atom are sp^3 hybridized. All bonds are formed from overlap with these sp^3 hybrid orbitals. The C-H and O-H sigma bonds are formed from overlap of sp^3 hybrid orbitals with hydrogen 1s atomic orbitals. The C-C and C-O sigma bonds are formed from overlap of the sp^3 hybrid orbitals on each atom.

9.21

See Exercises 8.67 and 8.73 for the Lewis structures. To predict the hybridization, first determine the arrangement of electron pairs about each central atom using the VSEPR model; then utilize the information in Figure 9.24 of the text to deduce the hybridization required for that arrangement of electron pairs.

Answers For Zumdahl Chemistry Exercises

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Answers For Zumdahl Chemistry Exercises:

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