Table 8.2

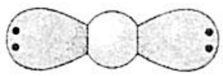
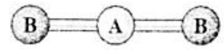
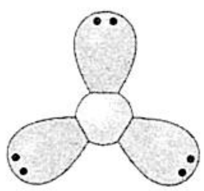
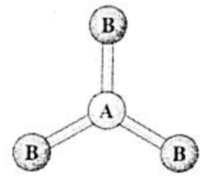
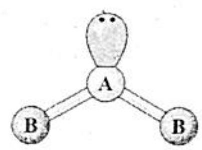
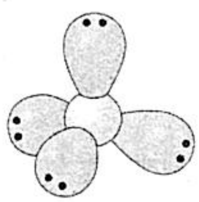
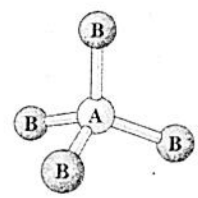
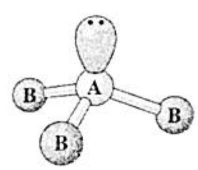
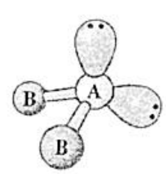
Electron Pairs	Electron pair arrangement	Bonding pairs	Nonbonding pair	Molecular geometry	Example
2	 Linear	2	0	 Linear	CO_2 BeH_2
3	 Trigonal planar	3	0	 Trigonal planar	BCl_3 SO_3
		2	1	 Bent	$SnCl_2$
	 Tetrahedral	4	0	 Tetrahedral	CH_4
4		3	1	 Trigonal pyramidal	NH_3
		2	2	 Bent	H_2O

Table 8.2 (Continued)

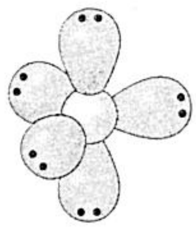
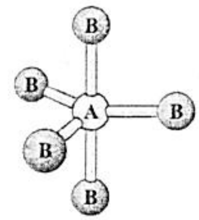
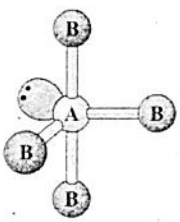
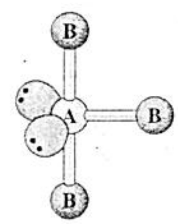
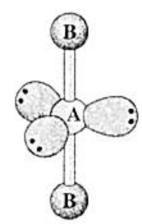
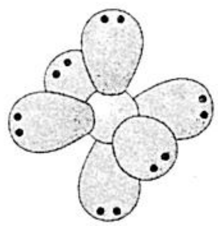
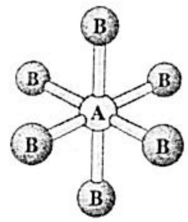
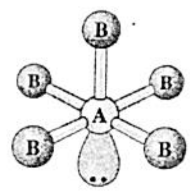
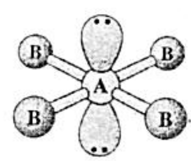
Electron Pairs	Electron pair arrangement	Bonding pairs	Nonbonding pair	Molecular geometry	Example
	 Trigonal bipyramidal	5	0	 Trigonal bipyramidal	PCl_5
5		4	1	 Seesaw	SF_4
		3	2	 T-shaped	ClF_3
		2	3	 Linear	XeF_2

Table 8.2 **(Continued)**

Electron Pairs	Electron pair arrangement	Bonding pairs	Nonbonding pair	Molecular geometry	Example
6	 Octahedral	6	0	 Octahedral	SF_6
		5	1	 Square pyramidal	BrF_5
		4	2	 Square planar	XeF_4

nonbonding electrons have a larger repulsive force than the bonding electrons. As a result, the bonding electrons between the hydrogen atoms and the central atoms are "squeezed" more tightly together. The more nonbonding pairs, the greater the decrease in bond angle. This same effect can be seen with multiple bonds. Multiple bonds also have the effect of compressing bond angles by exerting a greater repulsive force on neighboring electrons.

MOLECULAR GEOMETRY

The shapes of most molecules can be predicted using the six models for electron pair arrangements. What you need to do for each one is

1. Determine the number of electron pairs on the central atom—this determines the electron pair arrangements.
2. Determine the number of bonding pairs and nonbonding pairs. You should "ignore" the nonbonding pairs when determining the shape of the molecule (since they are not part of the molecule). The nonbonding pairs will only become significant if you need to determine information about bond angles.

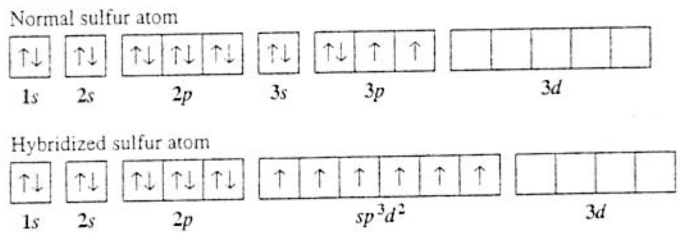


Figure 8.21

Conveniently, the shapes of the hybridized orbitals are identical to the shapes shown in table 8.1. A quick summary is shown in table 8.3:

Table 8.3

Hybridization	Number of hybridized orbitals	Geometry
sp	Two	Linear
sp^2	Three	Trigonal planar
sp^3	Four	Tetrahedral
sp^3d	Five	Trigonal bipyramidal
sp^3d^2	Six	Octahedral

Samples: Determine the hybridization of the central atom in the following molecules:

a) CF_4 b) TeF_4 c) KrF_2

Answers:

a) sp^3 The central carbon atom has two electrons in the 2*s* orbital and two unpaired electrons in the 2*p* orbitals. By promoting an electron from the *s* orbital to the unoccupied *p* orbital, carbon can form four sp^3 orbitals.

b) sp^3d The molecule requires four bonding pairs of electrons and one nonbonding pair. By promoting an electron to the *d* orbitals, Te will have five hybridized orbitals. In those sp^3d orbitals, one will contain a pair of electrons (the lone pair), while the other four will contain unpaired electrons (which will become bonding pairs with the fluorine atoms).

c) sp^3d By promoting one electron to a *d* orbital, krypton will have two unpaired electrons (that can bond to fluorine). The three remaining sp^3d orbitals will be filled by nonbonding pairs of electrons.