**CHE2060 Assignment: Orbital hybridization & VSEPR**

**Bleomycin** is a drug that binds to DNA and then uses metal atoms to cut the DNA helix. In nature, bleomycin is made by the bacterium *Streptomyces verticillus*. And it’s now synthesized in the lab. It’s used to treat a variety of cancers.

For each circled atom:

1. Add any missing electron pairs.
2. Determine orbital hybridization.
3. Draw a slot-arrow orbital hybridization diagram.
4. Identify the atom’s electron pair geometry.
5. Identify the atom’s molecular geometry.



1. S+
(a) One pair of electrons & three sigma bonds

(b) sp3

(c) One sp3 orbitals holds a pair & three have single electrons for sigma bonds. NB: S has six valence electrons but has lost one, thus the +1 charge, and thus has five valence electrons.

(d) tetrahedral

(e) trigonal pyramidal

2. N

(a) one pair of electrons & three sigma bonds

(b) sp3

(c) One sp3 orbitals holds a pair & three have single electrons for sigma bonds.

(d) tetrahedral

(e) trigonal pyramidal

3. S

(a) two pairs of electrons & two sigma bonds

(b) sp3

(c) two sp3 orbitals hold free electron pairs & two hold single electrons for sigma bonds.

(d) tetrahedral

(e) bent

4. N

(a) one pair of electrons, two sigma bonds, one pi bond

(b) sp2

(c) One sp2 holds a free pair of electrons; the other two hold single electrons for sigma bonds. An unhybridized p orbital holds an electron that will form the pi bond.

(d) trigonal planar

(e) bent

5. O

(a) two free electron pairs in addition to one sigma and one pi bond.

(b) sp2

(c) two sp2 orbitals hold free electron pairs; one holds one electron for a the sigma bond. An unhybridized p orbital holds and electron that will form the pi bond.

(d) trigonal planar

(e) linear

6. O

(a) two free electron pairs in addition to two sigma bonds

(b) sp3

(c) two sp3 orbitals hold free electron pairs; two hold single electrons for sigma bonds.

(d) tetrahedral

(e) bent

7. C

(a) no free electron pairs; just four sigma bonds

(b) sp3

(c) each sp3 orbital holds a single electron to form sigma bonds.

(d) tetrahedral

(e) tetrahedral

8. C

(a) no free electron pairs; three sigma & one pi bond

(b) sp2

(c) Each of the three sp2 orbitals holds a single electron for sigma bonds. One unhybridized p orbital holds a single electron & will form a pi bond.

(d) trigonal planar

(e) trigonal planar