1. Make clear drawings of the three-dimensional structures of the following, basing your predictions on the VSEPR rules. Name the geometry created by the atomic nuclei.

   a) O₃  b) H₂CNH  c) AsH₃  d) BH₄⁻  e) NO₃⁻

2. Draw two atomic orbital models, of the type demonstrated in lecture, for H₂S. Use a) non-hybridized sulfur for one model, and b) sp³ hybridized sulfur. Based on the known bond angle of 92.1° in this molecule, which is the better model?

3. Draw atomic orbital models, of the type demonstrated in lecture, for the following. Label the orbitals used, and show all valence electrons, including unshared pairs.

   a) BH₃  b) NH₂Cl  c) CH₃OH  d) BeI₂ (assume covalent bonds)

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Common hybridization states involving s and p orbitals
(the minor lobes of hybridized orbitals are not shown)

- **unhybridized atom**
  (makes 90° bond angles)

- **atom with sp hybridization**
  (makes 180° bond angles)

- **atom with sp² hybridization**
  (makes 120° bond angles)

- **atom with sp³ hybridization**
  (makes 109° bond angles)
1. a) bent
   b) trigonal at C
   c) pyramidal
   d) tetrahedral
   e) trigonal

2. a) non-hybrid (90°)
   b) sp³ (109.5°)
   The 92.1° bond angle is better represented using non-hybridized sulfur.

3. a) BH₃
   b) sp² hybrids
   Use sp² hybridization.

3. a) all sp³ hybrid orbitals
   b) sp³ hybrids
   c) sp³ hybridized
   d) Be is sp hybridized. I is not hybridized.