**Answers:**

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1. Linear – If simple molecule (only consists of 2 atoms) then always linear. If central atom has 2 bonding areas and no unshared electrons it is linear.
   - Tetrahedral – Central atom has 4 bonding areas and no unshared electron pairs.
   - Trigonal planar – Central atom has 3 bonding areas and no unshared electron pairs.
   - Bent – Central atom has 2 bonding areas and 1 or 2 pairs of unshared electrons.

2. **CH₄ has tetrahedral shape (Carbon is central atom, single bonded to 4 Hydrogens)**
   - SF₆ has a bent shape (S is central atom, single bonded to each Cl) 2 pairs electrons on S, 3 on each Cl.
   - H₂CO has trigonal planar shape (C central atom, double bonded to O, single bonded to both H, 2 pairs electrons on O)
   - HCN has linear shape (C is central atom, single bonded to H, triple bonded to N, 1 pair electrons on N)
   - NH₃ has trigonal pyramidal shape (N is central atom, single bonded to 3 H, pair of electrons on N)

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1. Forces between molecules

2. If there are negatively and positively charged ends to the molecule. Determine shape and look at lewis dot structure to determine if molecule is polar or nonpolar.

3. Dipole-Dipole and London Dispersion. If Polar and contains Hydrogen it will also form a special type of dipole bond called Hydrogen Bond.

4. London Dispersion only

5. Bent and Trigonal Pyramidal are always polar

6. Determine Electronegativity difference between the 2 atoms (EN #1-EN #2) If the difference is greater than .5 then it is polar.

7.   - H₂O – polar bonds
   - CO₂ – polar bonds
   - CH₄ – non polar bonds
   - CCl₄ – polar bonds
   - N₂ - non polar bonds
   - S₂ – non polar bonds

8.   - H₂O – polar molecule
   - CO₂ – non polar molecule
   - CH₄ – non polar molecule
   - N₂ – non polar molecule
   - NH₃ – polar molecule
   - HCl – polar molecule
   - C₂H₂ – non polar molecule
   - PCl₃ – polar molecule
   - NO₂ – non polar molecule

9. Bond polarity depends on a difference in electronegativity between the atoms in the bond. Molecular polarity depends on the shape of the molecules.

10. Bonding clouds and electron pairs on the central atom spread themselves out to be as far from the others as possible. They organize into 5 different shapes depending on the combination of bonding clouds and lone pair clouds.

11. The answer is yes to both scenarios. Take CF₄ as an example of a non-polar molecule with polar bonds. The difference in EN between F and C in one of the bonds is about 1.8 making the bonds very polar, but the shape is tetrahedral and the dipoles effectively cancel each other out resulting in a non-polar molecule.

12. The stronger the polarity of the molecule, the stronger intermolecular forces.

13. The more intermolecular forces (higher polarity), the higher the melting and boiling point.
   a. Ex: Water is polar and melts at 0°C
   b. CH₄ is nonpolar and melts at -183°C