Problem solving and Calculations

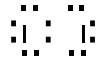
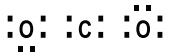
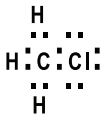
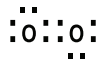
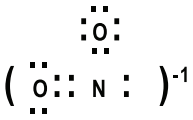
SET 10: Shape and Polarity-Answers

1. The electronegativity of iodine is much less than for fluorine as the outer electrons of iodine are much further from the nucleus and therefore held with less attractive force compared to

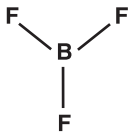
2. a) Cℓ x Cℓ
   Electrons exactly in the middle as each atom attracts them with exactly the same amount of force.
   Cℓ x H
   Electrons closer to chlorine as it attracts the electrons more than hydrogen does.
   Cℓ- Na+
   Electron has been transferred completely from sodium to chlorine as its attraction is much greater for the electron.
   b) Complete sharing forms a pure covalent bond, unequal sharing forms a polar covalent bond. Transferring forms an ionic bond.

3. b), c), d) & f). The covalent bonds within these molecules are between unlike elements.
   Different elements have differing electronegativities, attraction for electrons and so form covalent polar bonds

4.

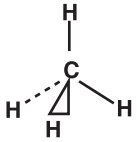
	Electron dot diagram	Shape	Polarity
a		linear	Non-polar
b		linear	Non-polar
c		Pyramidal	polar
d		tetrahedral	Polar
e		linear	Non-polar
f		bent	polar

Triangular Planar



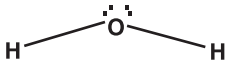
Bond angles for BF_3 are 120°

Tetrahedral



Bond angles for CH_4 are 109.5°

V-shaped

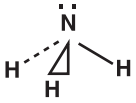


Bond angles for H_2O are 104.5°

Linear

Bond angles for $BeC\ell_2$ are 180°

Pyramidal



Bond angles for NH_3 are 107°

The bent and pyramidal shapes will always be polar due to the lone pair/s of electrons making them asymmetrical.

Website that may be useful for more information:
http://cost.georgiasouthern.edu/chemistry/general/molecule/vsepr.htm

6. It is possible to have a non-polar molecule with polar bonds.
   Eg. CO_2

   The bonds within carbon dioxide are polar as carbon and oxygen have different electro negativities. The overall molecule is non-polar as the sum of the two dipoles cancel leaving the molecule non-polar.

7. Polarity affects the type of intermolecular force present. Non-polar molecules only have dispersion forces. Polar molecules can have dipole forces (or hydrogen bonding) as well as dispersion forces.

8. a) To melt iodine, dispersion forces would need to be overcome as iodine is a non- polar covalent molecular element.
   b) To melt sodium iodide ionic forces would need to be overcome as this is an ionic compound.
   c) To melt sodium metallic forces would need to be overcome as this is a metallic element.
   Melting point, lowest to highest; iodine, sodium then sodium iodide.

9. Dispersion: CO_2, N_2, S_8, $CC\ell_4$
   Dipole: SO_2, $CFC\ell_3$, $CH_3C\ell$
   H-bonding: NH_3, H_2O

10. Molar mass.