Unit 1, Lesson 12: Intra and Inter-Molecular Forces, Answers to Homework

1. Read pages 190 – 195.
2. On page 208: Q 1, 2, 6, 7, 8

Page 208, question 1:
The intra-molecular forces (chemical bonds) in HBr (l) are polar covalent bonds. The ΔEN between Br and H is 0.76, so it is polar, but not excessively.

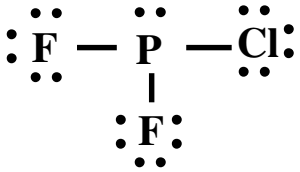
The inter-molecular forces between HBr molecules are dipole-dipole attractions because it is a polar molecule, as well as London Dispersion forces. Hydrogen bonding will not occur. The inter-molecular forces are much less strong than the intra-molecular forces (the bonds).

Page 208, question 2:
The boiling point of H_2O_2 is 150ºC, compared to 100ºC for water. Account for this difference.

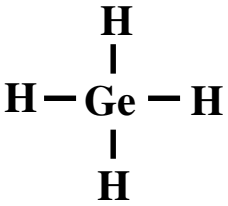
H_2O_2 and H_2O are both polar covalent molecules, so both will have dipole-dipole attractions between their molecules. Because both molecules also contain O – H bonds, both molecules have significant hydrogen bonding. This significantly increases the boiling point of both molecules.

The boiling point of H_2O_2 is higher than H_2O for three reasons. One is that it is a heavier molecule. The MM of H_2O_2 is 34.02 amu compared to 18.02 amu for H_2O . This will increase the boiling point. Also, the molecular shape of H_2O_2 allows more opportunity for H-bonding between molecules, so this will also increase the boiling point. Thirdly, because the H_2O_2 molecule is "longer", it will have more places where London dispersion forces can act between molecules.

Page 208, question 6:
$PF_2C\ell$ has a trigonal pyramid shape, so it is a polar molecule. It is polar because it is asymmetrical, both because of the arrangement of atoms and because of the lone pair on the phosphorus atom.



Page 208, question 7:
The VSEPR notation for GeH_4 is AX_4E_0. It is tetrahedral in shape and a non-polar molecule because it is completely symmetrical.



Page 208, question 8:
The melting points of the cesium halides, in order from highest to lowest would be:
CsF > CsCℓ > CsBr > CsI.
This order is predicted based on the ΔEN values for the bonds. The greater the ΔEN, the more polar the molecule and the stronger the inter-molecular attractions. This causes the melting points to increase.