SL & HL Questions on Shapes & Molecular polarity

1. Predict the shape and bond angles of:

i. boron trichloride, BCl_3

ii. phosphoryl chloride, $POCl_3$

iii. phosphine, PH_3

iv. hydrogen cyanide, HCN

2. Explain why sulfur dioxide molecules, SO_2, have a bent shape whereas carbon dioxide molecules, CO_2, are linear.

3. Explain why C=O bonds are polar and yet the carbon dioxide molecule is non-polar.

4. Explain why the H-N-H angle in ammonia is smaller than the H-N-H angle in the ammonium ion.

5. i. A simplified model of benzene, C_6H_6, shows the six carbon atoms in a ring with alternate single and double bonds between the carbon atoms. Each carbon atom is also bonded to one hydrogen atom. Based on this model predict the C-C-C bond angle in benzene.

ii. In cyclohexane, C_6H_{12} the six carbon atoms are also in a ring but are joined to each other only by single bonds. Each carbon atom is also bonded to two hydrogen atoms. Predict the C-C-C bond angle in cyclohexane.

6. Fluorine and oxygen are very electronegative elements. Explain why hydrogen fluoride, HF, and water, H_2O, are very polar molecules but tetrafluoromethane, CF_4, and carbon dioxide, CO_2 are non- polar.

HL only questions

7. Predict the shape of:

i. xenon tetrafluoride, XeF_4

ii. the iodine tetrachloride ion, ICl_4^-

iii. chlorine trifluoride, ClF_3

8. Predict all the F-P-F bond angles in:

i. phosphorus pentafluoride, PF_5

ii. the phosphorus hexafluoride ion, PF_6^-