

Chapter 4 Problems - Water and Hydrogen Bonding

For each of the following molecules, answer true if the compound can form intermolecular hydrogen bonds to itself and false if it is not capable of hydrogen bonding.

1. Methanol (CH_3OH)
 2. Methane (CH_4)
 3. Methylamine (CH_3NH_2)
 4. Chloromethane (CH_3Cl)
 5. Hydrogen sulfide (H_2S)
 6. Dimethylether (CH_3OCH_3)
 7. Acetone (CH_3COCH_3)
 8. Acetic acid (CH_3COOH)
 9. Trimethylamine [$(\text{CH}_3)_3\text{N}$]
10. Three of the molecules above cannot hydrogen bond to themselves but are capable of hydrogen bonding to other compounds such as water. Which two have this capability? (Mark all correct answers).
- a. Methane (CH_4)
 - b. Chloromethane (CH_3Cl)
 - c. Dimethylether (CH_3OCH_3)
 - d. Acetone (CH_3COCH_3)
 - e. Trimethylamine [$(\text{CH}_3)_3\text{N}$]

The table to the right gives boiling points for groups 4A to 7A of periods 2 through 5 for compounds with hydrogen. Comparison of the values provides several pieces of evidence in support of hydrogen bonding.

11. Which of the statements below provides is supported by the data? (Mark all correct answers).

- a. The boiling points of ammonia, water and hydrogen fluoride are much much higher than for methane.
- b. The boiling points of SnH_4 , SbH_3 , H_2Te and HI are higher than expected.
- c. The boiling point of ammonia is higher than the value for PH_3 .
- d. The boiling point of SiH_4 is higher than the boiling point of GeH_4 .

Problem 11			
CH_4	NH_3	H_2O	HF
-161.7	-33.4	100	19.5
SiH_4	PH_3	H_2S	HCl
-111.8	-87.4	-60.7	-85.0
GeH_4	AsH_3	H_2Se	HBr
-88.5	-55	-41.5	-67.0
SnH_4	SbH_3	H_2Te	HI
-52	-17.1	-2.2	-35.4