

- For each of the following substances describe the importance of London dispersion forces, dipole-dipole interactions and hydrogen bonding:  
a. HCl                      b. Br<sub>2</sub>                      c. ICl                      d. HF                      e. CH<sub>4</sub>
- When one of the H atoms in benzene, C<sub>6</sub>H<sub>6</sub> is replaced by another atom or group of atoms, the boiling point changes. Explain the observed boiling points:  
a. C<sub>6</sub>H<sub>6</sub>, 80°C    b. C<sub>6</sub>H<sub>5</sub>Cl, 132°C    c. C<sub>6</sub>H<sub>5</sub>Br, 156°C    d. C<sub>6</sub>H<sub>5</sub>OH, 182°C
- What is the strongest "inter-particle" force (includes ion-ion interaction) that occurs in each of the following substances:  
a. CH<sub>3</sub>OH                      b. CCl<sub>4</sub>                      c. NaI                      d. H<sub>3</sub>PO<sub>4</sub>                      e. SO<sub>2</sub>
- Which member of the following pairs form intermolecular H bonds? Draw H-bonded structures for these:  
a. (CH<sub>3</sub>)<sub>2</sub>NH                      or                      (CH<sub>3</sub>)<sub>3</sub>N  
b. HO-CH<sub>2</sub>-CH<sub>2</sub>-OH                      or                      F-CH<sub>2</sub>-CH<sub>2</sub>-F
- Which has greater polarizability?  
a. H<sub>2</sub>S                      or                      H<sub>2</sub>Se  
b. CCl<sub>4</sub>                      or                      CF<sub>4</sub>  
c. CH<sub>3</sub>-(CH<sub>2</sub>)<sub>4</sub>-CH<sub>3</sub>                      or                      CH<sub>3</sub>-CH(CH<sub>3</sub>)-(CH<sub>2</sub>)<sub>2</sub>-CH<sub>3</sub>
- Identify the major intermolecular forces in the following cases:  
a. liquid CH<sub>4</sub>  
b. H<sub>2</sub>O/CH<sub>3</sub>OH mixture  
c. LiCl/H<sub>2</sub>O solution
- Describe the major intermolecular force that exists in the following substances:  
a. O<sub>2</sub>                      b. CH<sub>3</sub>I                      c. CH<sub>3</sub>(CH<sub>2</sub>)<sub>7</sub>OH
- Which of the following substances will have hydrogen bonds? Show the hydrogen bonded structures:  
a. CH<sub>3</sub>-O-CH<sub>3</sub>  
b. CH<sub>4</sub>  
c. HF  
d. Br<sub>2</sub>  
e. CH<sub>3</sub>-OH  
f.  $\text{CH}_3 - \text{C} \begin{array}{l} \nearrow \text{O} \\ \searrow \text{OH} \end{array}$