

# Chem 30A - Fossum

## Answers

### Practice Problems on Intermolecular Forces

P. 1

- $C_2H_6$  or  $C_4H_{10}$  - both are nonpolar (contain only C, H) they only have London forces. London forces increase with increasing molar mass. Since  $C_4H_{10}$  has a higher molar mass, it will have stronger London forces and a higher boiling point. ( $C_4H_{10}$  molecules will be harder to separate than  $C_2H_6$  molecules).
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|--|--|
| a. $C_8H_{18}$ MM = 114 g/mol<br>nonpolar - only London forces   | b. $CH_3CH_2CH_3$ MM = 44 g/mol<br>nonpolar - only London forces                                       |
| c. $CH_3CH_2F$ MM = 48 g/mol<br>polar - F is very electronegative<br>has dipole-dipole and London forces | d. $CH_3CH_2OH$ MM = 46 g/mol<br>polar, can H-bond -<br>has London, dipole-dipole and H-bonding forces |

Molecules b, c, and d have very similar molar masses, so the strength of their London forces will be similar. a has a much higher molar mass than any of the others - more than twice as high. Even though it only has London forces, the London forces in a are very strong. It will have strongest IMF's overall.

Comparing b, c, and d. (similar London forces)

d can H-bond - stronger forces overall than the others

c. has dipole-dipole forces so higher bp than b.

b. only London forces - weak ones.

Ranking: a, d, c, b

highest  
bp

lowest  
bp

- $H_2O$  MM = 18 g/mol      Octane MM = 114 g/mol  
Octane has a much higher molar mass than water and is a much larger molecule overall. The London forces in  $C_8H_{18}$  are very strong - strong enough to outweigh all of the IMF's present in water (even all that H-bonding).

## Answers - IMF's practice

P.2

- 4
- KBr is ionic - more soluble in water, since water is polar.
  - $\text{CH}_3\text{CH}_2\text{OH}$  - polar and can hydrogen bond - more soluble in water - can form H-bonds with water.
  - $\text{C}_6\text{H}_{12}$  - nonpolar - more soluble in oil (also nonpolar)
  - $\text{NH}_3$  - polar - more soluble in water - also polar.
  - has 6-C hydrocarbon chain and one OH group at the end - more soluble in oil. This molecule is mostly nonpolar!
  - This molecule is long but it has lots of OH groups, so it can form lots of hydrogen bonds to water. This will be more soluble in water.

5. Most Soluble in water:

- has 3 carbons and 3 OH groups - will be very soluble in water. 1C:1OH
- has 2 C's, one OH group - will be soluble in water. 2C:1OH
- has 4 C's, one OH group 4C:1OH  
longer nonpolar section, so not as soluble as C (even though this one can also H-bond with water)
- not soluble in water - completely nonpolar.