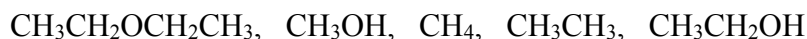


- Rank the following compounds in order of increasing boiling point? Justify your answer.



Marks
3



Only weak dispersion forces act in CH_4 and CH_3CH_3 . The bigger molecule has more interactions and hence the higher b.p. $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$ is a bigger molecule than CH_4 and CH_3CH_3 , so has more dispersion forces. It also has dipole-dipole forces due to the polarised C-O bonds.

CH_3OH and $\text{CH}_3\text{CH}_2\text{OH}$ have hydrogen bonds due to the very electronegative O atom bonded to the H atom. These H-bonds are much stronger than the dispersion and dipole-dipole forces in the other compounds and hence these two compounds have the highest boiling points. $\text{CH}_3\text{CH}_2\text{OH}$ has more dispersion forces than CH_3OH , so it has the highest boiling point.

- Melting points of the hydrogen halides increase in the order $\text{HCl} < \text{HBr} < \text{HF} < \text{HI}$. Explain this trend.

2

There are two competing intermolecular forces at play:

- Dipole-dipole forces increase as the halogen becomes more electronegative ($\text{I} < \text{Br} < \text{Cl} < \text{F}$).
- Dispersion forces are dependent on the polarisability of the atoms and increase with the size of the halogen.

Dispersion force dominate in HCl , HBr and HI and determines the order of their melting points.

The dipole-dipole force in HF is so strong (due to the very small and very electronegative F atom) that it is given a special name - a hydrogen bond. This causes HF to have an anomalously high melting point, which just happens to lie between that of HBr and HI .