

Solutions

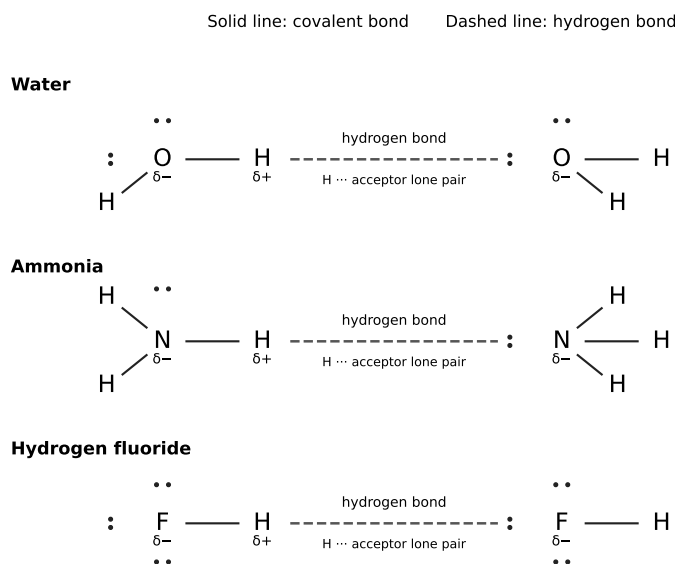
Original marking guidance: B1 for each stated earning point.

2.1 Both have London forces; propanal also has permanent dipole–dipole attractions from its polar carbonyl. Propane lacks a suitable donor/acceptor pair; propanal has an oxygen acceptor but no H bonded to N/O/F to donate.

2.2 Methanamide can form intermolecular hydrogen bonds: N–H is a donor and the carbonyl oxygen lone pair is an acceptor. Propanone lacks an N/O/F–H donor for its own network but its oxygen can accept from water.

2.3 More electrons/more polarisable clouds in longer chains strengthen London attractions. The alcohol also hydrogen-bonds. Boiling mainly overcomes intermolecular attractions, preserving the molecules and their covalent bonds.

3.1



Original marking guidance: for each pair, B1 for complete molecules/acceptor lone pairs and B1 for donor $\text{H}\delta+ \cdots \text{acceptor } \delta-$ attraction distinguished from covalent bonds (six marks total).

3.2 From HCl to HI, more electrons/more polarisable clouds give stronger London attractions and higher boiling temperatures. HF has H bonded to F and F lone pairs, enabling hydrogen bonds. Water also hydrogen-bonds whereas H_2S does not form the same strong network. More energy is needed to disrupt water's hydrogen-bonded intermolecular network during melting or boiling. Ice has an open hydrogen-bonded structure with molecules further apart, so lower density.

3.3 NaCl: water, which hydrates its ions. $\text{O}\delta-$ faces Na^+ and $\text{H}\delta+$ faces Cl^- . Ethanol: water, with new $\text{O}-\text{H} \cdots \text{O}$ hydrogen bonds. Iodine: hexane, with compatible London attractions. A halogenoalkane cannot replace disrupted water hydrogen bonding effectively; favourable new attractions must compensate for attractions broken, so a polar bond alone does not guarantee high solubility.