

- Name the two intermolecular forces, which best explain the difference in boiling points of 1-propanol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ ; bp = 97.2 °C) and 1-propanethiol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$ ; bp = 67.8 °C).

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- Consider the boiling points of the compounds 1-propanol, 1-propanethiol and 1-propaneselenol shown in the table below?

Compound	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{SeH}$
Boiling point ( $^\circ\text{C}$ )	97.2	67.8	147.0

With reference to intermolecular forces, explain briefly why the boiling points increase in the order  $\text{CH}_3\text{CH}_2\text{CH}_2\text{SH} < \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} < \text{CH}_3\text{CH}_2\text{CH}_2\text{SeH}$ .

- Hydrogen bond strength increases in the order  $\text{N-H}\cdots\text{N} < \text{O-H}\cdots\text{O} < \text{F-H}\cdots\text{F}$ . Use this information and the data given in the table to explain the differences in boiling point of ammonia, water and hydrogen fluoride.

Compound	$\text{NH}_3$	$\text{H}_2\text{O}$	HF
Boiling point / $^\circ\text{C}$	-33	100	20

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