

Boiling Point Comparisons of Molecules

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Response: The correct statement is **(3) Xe has a higher boiling point than Kr.**

Analysis of the Options:

- **(1) Incorrect:** NO is a polar molecule with dipole-dipole forces in addition to dispersion forces, whereas N₂ is non-polar and relies only on London dispersion forces. Therefore, NO has a higher boiling point than N₂.
 - **(2) Incorrect:** NH₃ forms strong intermolecular **hydrogen bonds**, whereas PH₃ cannot. Thus, NH₃ has a significantly higher boiling point than PH₃.
 - **(3) Correct:** Both Xe and Kr are noble gases held together by London dispersion forces. Moving down Group 18, atomic size and electron cloud polarizability increase, leading to stronger dispersion forces. Thus, **Xe has a higher boiling point than Kr.**
 - **(4) Incorrect:** As the carbon chain length increases in primary alcohols, London dispersion forces increase. Propan-1-ol (CH₃CH₂CH₂OH) has a higher boiling point than ethanol (CH₃CH₂OH).
 - **(5) Incorrect:** Branching in alkanes reduces the surface area available for intermolecular contacts, lowering London dispersion forces. Therefore, straight-chain *n*-butane (CH₃CH₂CH₂CH₃) has a higher boiling point than branched isobutane (CH₃CH(CH₃)CH₃).
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