

Intermolecular Forces

Practice Worksheet: Detailed Solutions

Part A — Knowledge and Understanding

1. London dispersion forces arise from temporary fluctuations in electron distribution, creating instantaneous dipoles that induce dipoles in neighbouring molecules. Larger molecules are more polarizable, so these forces are stronger.
2. Boiling point depends on intermolecular forces, not only mass. A smaller molecule with hydrogen bonding can have a higher boiling point than a larger molecule with only dispersion forces.
3. Hydrogen bonding is stronger because it involves highly electronegative atoms (N, O, F), creating a strong dipole and strong attraction to lone pairs.
4. $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se}$ because hydrogen bonding occurs only in water, while the others rely on weaker forces.

Part B — Application

5. Boiling point increases down the group due to an increase in electron number and stronger dispersion forces.
6. CO_2 is non-polar (linear), so only dispersion forces exist.
 SO_2 is bent and polar, so dipole–dipole forces are present → stronger IMF.
7. Molecular geometry affects surface area. Linear molecules allow more interaction between electron clouds → stronger forces.
8. Linear isomers have higher boiling points because they have greater surface contact and stronger dispersion forces.

9. n-pentane has a higher boiling point than neopentane due to its linear shape and greater surface area

Part C — Thinking

10. A high boiling point without hydrogen bonding suggests strong dispersion forces (large molecules) or dipole–dipole interactions.

11. Water has strong hydrogen bonding, creating strong cohesion and high surface tension.

12. HF forms hydrogen bonds, making it much stronger than expected.
HCl, HBr, and HI follow dispersion trends.

13. Stronger intermolecular forces increase resistance to flow, resulting in higher viscosity.

14. Strong IMF hold particles close together (solid/liquid), while weak IMF allow particles to move freely (gas).

Part D — Extension

15. Hydrogen bonding may be reduced due to molecular structure, steric hindrance, or internal bonding.

16. Substances dissolve when their intermolecular forces are similar in type and strength (“like dissolves like”).

17. NH_3 forms hydrogen bonds, while PH_3 does not due to lower electronegativity → NH_3 has stronger IMF.

18. Greater surface area increases contact between molecules, strengthening dispersion forces.

19. Large non-polar molecules can have stronger dispersion forces than smaller polar molecules.

20. At low temperatures, kinetic energy decreases, allowing weak dispersion forces to hold noble gas atoms together.