Answer the questions below then check your answers.

1. What are intermolecular forces.

2. List the types of intermolecular forces in order from weakest to strongest.

3. Briefly explain how London dispersion (Van der Waals) forces arise.

4. What conditions are necessary for a molecule to exhibit dipole-dipole forces?

5. Describe hydrogen bonding and the elements involved.

6. How do intermolecular forces differ from intramolecular bonds (chemical bonds)?

7. Explain how intermolecular forces influence boiling point.

8. Why do substances with hydrogen bonding often have unusually high melting points?

9. How does the shape of a molecule affect the strength of London Dispersion Forces?

10. Define viscosity.

11. How does hydrogen bonding influence the viscosity of a substance?

12. Explain the relationship between surface tension and intermolecular forces.

13. Why does branching in a molecule tend to decrease its boiling point?

14. Describe how dipole-dipole forces differ from hydrogen bonds.

15. A substance has very weak intermolecular forces. What can you predict about its melting and boiling points?

Answers

1. Intermolecular forces are attractive forces between molecules, distinct from the chemical bonds that hold atoms together within a molecule.

2. Weakest to strongest: London dispersion forces (Van der Waals), dipole-dipole forces, hydrogen bonding (a special, strong type of dipole-dipole).

3. London dispersion forces (Van der Waals forces) arise from temporary, fluctuating dipoles due to the random motion of electrons in an atom or molecule.
4. A molecule must be polar, meaning it has a permanent dipole moment due to an uneven distribution of electron density.

5. Hydrogen bonding is a particularly strong dipole-dipole attraction involving a hydrogen atom bonded to a highly electronegative atom (N, O, or F) and a lone pair on another nearby N, O, or F atom.

6. Intermolecular forces are much weaker than the ionic or covalent bonds that hold atoms together within a molecule.

7. Stronger intermolecular forces require more energy (heat) to overcome, leading to higher boiling points.

8. Hydrogen bonds require significant energy to break, leading to unusually high melting points for substances exhibiting them.

9. Longer, more linear molecules have a greater surface area, leading to increased London dispersion forces (Van der Waals forces).

10. Viscosity is a measure of a liquid's resistance to flow.

11. Hydrogen bonding increases viscosity as the strong attractions between molecules make flow more difficult.

12. Surface tension results from the cohesive forces between molecules at the surface of a liquid. Stronger intermolecular forces lead to higher surface tension.

13. Branching decreases surface area and reduces the strength of London dispersion forces (Van der Waals), leading to a lower boiling point.

14. Both involve polar molecules, but hydrogen bonding is significantly stronger and occurs specifically when hydrogen is bonded to N, O, or F.

15. The substance will likely have low melting and boiling points due to the ease of overcoming the weak attractions between molecules.