What Are Intermolecular Forces?

Worksheet

Intermolecular forces are weak attractions between molecules caused by electrostatic interactions. They are much weaker than covalent or ionic bonds but determine bulk physical properties.

Questions

1. Which type of intermolecular force occurs in all molecules, regardless of polarity?

A) Hydrogen bonding
B) Dipole-dipole
C) London dispersion
D) Ionic

2. Why is the boiling point of HF (19.5@deg C) much higher than HCl (85@deg C)?

A) HF is denser
B) HF forms hydrogen bonds; HCl does not strongly
C) F is more massive
D) HCl is a gas

3. Which of these molecules can exhibit hydrogen bonding?

A) CH@sub{4}
B) C@sub{2}H@sub{6}
C) H@sub{2}O
D) C@sub{6}H@sub{14}

4. London dispersion forces are stronger in

A) He
B) Ne
C) Ar
D) Kr

5. Why is the boiling point of Br@sub{2} (79@deg C) higher than F@sub{2} (188@deg C), even though both are diatomic?

6. Why is HF a liquid (boiling point 19.5@deg C) while HCl is a gas (boiling point 85@deg C)?

7. Compare the water solubility of hexane (C@sub{6}H@sub{14}) and methanol (CH@sub{3}OH).

8. Define: What are intermolecular forces?

9. Define: Name the three main types of intermolecular forces.

10. Define: Which intermolecular force is present in all molecules?

Answer Key

1. C) London dispersion - London dispersion forces arise from temporary induced dipoles in all molecules.

2. B) HF forms hydrogen bonds; HCl does not strongly - HF can form strong hydrogen bonds; HCl's dipole-dipole forces are weaker.

3. C) H@sub{2}O - Only H@sub{2}O has O-H groups that can form hydrogen bonds.

4. D) Kr - Kr has more electrons, a larger electron cloud, and stronger London forces.

5. Br@sub{2} has more electrons than F@sub{2} (molar mass Br@sub{2} = 160 g/mol vs. F@sub{2} = 38 g/mol) More electrons = larger, more polarisable electron cloud London dispersion forces are stronger in Br@sub{2} Stronger intermolecular forces require more energy to overcome Result: Br@sub{2} has a much higher boiling point

6. HF is highly polar (H-F bond very electronegative) More importantly, HF molecules form hydrogen bonds with each other HCl is polar but cannot form strong hydrogen bonds (Cl is less electronegative) Hydrogen bonds are much stronger than dipole-dipole forces Result: HF has a much higher boiling point

7. Hexane is nonpolar; water is polar and forms hydrogen bonds Hexane-water intermolecular forces are very weak (London dispersion only) 'Like dissolves like': hexane does not dissolve well Methanol is polar and can form hydrogen bonds with water Methanol dissolves readily in water Result: methanol >> hexane in water solubility

8. Weak attractive forces between separate molecules, caused by electrostatic interactions.

9. London dispersion forces, dipole-dipole interactions and hydrogen bonding.

10. London dispersion forces - caused by temporary induced dipoles in electron clouds.