

Exercises 9

Exercise 9.1

Among the following pairs, which substance has the highest melting (or boiling) point? Justify your answer.

- | | |
|--------------------|-------------------------------|
| b) HF | HCl |
| c) CH ₄ | C ₂ H ₆ |
| d) NH ₃ | H ₂ O |
| e) NH ₃ | PH ₃ |

Exercise 9.2

For molecules of type AH_x , with A being an element from groups V (15) to VII (17), what distinguishes the second period from the following periods in terms of intermolecular interactions? Why does this distinction not exist for group IV (14)?

Exercise 9.3

What interaction(s) can be expected between molecules of:

- a) Benzene
- b) CH₃CH₂OH
- c) CH₃CH₂OCH₂CH₃

Exercise 9.4

What interaction(s) can be expected between C₂F₄Br₂ molecules? First, draw the two possible Lewis structures for this molecule.

In the same way, predict the interactions between C₂F₂Br₂ molecules using the different possible Lewis structures.

Exercise 9.5

Describe three types of hybrid orbitals that can form in a carbon atom. Include an energy level diagram for each type, and provide illustrations showing the shape and orientation of each resulting hybrid orbital.

Exercise 9.7

Draw a schematic molecular orbital (MO) energy level diagram for the interaction between two helium atoms, including illustrations of the resulting MOs. Label each atomic orbital (AO) and MO, adding electrons to each. Define the terms 'bonding' and 'antibonding' molecular orbitals, and explain why He₂ is unstable compared to two isolated helium atoms.