

Intermolecular bonding

Answer the questions below then check your answers.

1. Explain how Van der Waals forces arise between atoms and molecules.
2. The noble gases are found in group 0 of the periodic table.
 - a. What forces exist between individual atoms in the noble gases?
 - b. Will helium at the top of group 0 or radon at the bottom have the most Van der Waals bonding between the atoms? Explain your answer.
3. The halogens are fluorine, chlorine, bromine and iodine. They consist of small diatomic molecules.

He

Ne

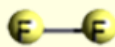
Ar

Kr

Xe

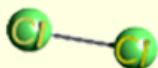
Rn

fluorine
gas



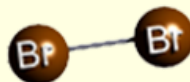
F_2

chlorine
gas



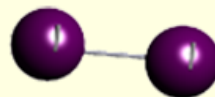
Cl_2

bromine
liquid



Br_2

iodine
solid



I_2

- a. What intermolecular forces exist between halogen molecules?

- b. Explain why iodine is a solid at room temperature but fluorine is a gas.
4. How is the shape of a molecule important when considering intermolecular forces?
5. Van der Waals forces are often called induced dipole-dipole interactions. What does this phrase mean?

Answers

1. Explain how Van der Waals forces arise between atoms and molecules.

Van der Waals forces arise due to random uneven movements of electrons within atoms and molecules. This creates areas of partial positive and partial negative charges within the atom/molecule. This is called an electric dipole or simply a dipole.

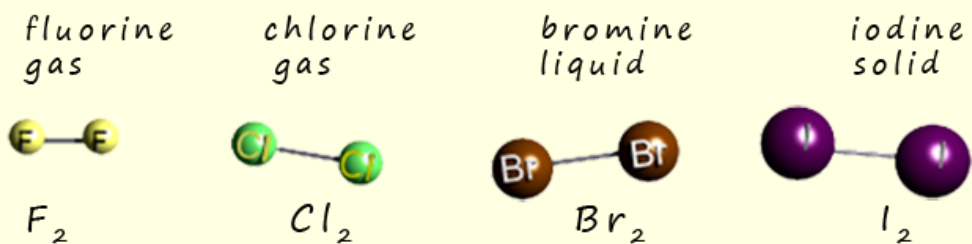
2. The noble gases are found in group 0 of the periodic table.
a. What forces exist between individual atoms in the noble gases?

Van der Waals forces exist between these neutral atoms.

- b. Will helium at the top of group 0 or radon at the bottom have the most Van der Waals bonding between the atoms? Explain your answer.

Van der Waals forces increase as the number of electrons increases, so there will be more Van der Waals bonding in large atoms such as radon than in small atoms such as helium.

3. The halogens are fluorine, chlorine, bromine and iodine. They consist of small diatomic molecules.



a. What intermolecular forces exist between halogen molecules?

Van der Waals forces exist between these neutral molecules.

b. Explain why iodine is a solid at room temperature but fluorine is a gas.

Iodine atoms are large atoms with lots more electrons than fluorine, so more Van der Waals bonding will occur.

4. How is the shape of a molecule important when considering intermolecular forces?

Van der Waals forces rely on the atoms/molecules being able to alter the electron distribution in neighbouring atoms/molecules. Molecules with large surface areas will allow this to happen more than molecules with smaller surface areas.

5. Van der Waals forces are often called induced dipole-dipole interactions. What does this phrase mean?

Random movements of electrons in one atom/molecule can cause dipoles to form. These dipoles can then alter the electron distribution in neighbouring atoms/molecules, that is they can cause them to form or be induced.